EXTRACTION OF DIETARY FIBER FROM SOUR CHERRY (*Prunus cerasus L.*) POMACE AND UTILIZATION IN LOW-FAT BISCUIT

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

DUYGU BAŞKAYA SEZER

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
FOOD ENGINEERING

FEBRUARY 2022

Approval of the thesis:

EXTRACTION OF DIETARY FIBER FROM SOUR CHERRY (*Prunus cerasus L.*) POMACE AND UTILIZATION IN LOW-FAT BISCUIT

submitted by **DUYGU BAŞKAYA SEZER** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Food Engineering, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences** _____

Prof. Dr. Serpil Şahin
Head of the Department, **Food Engineering** _____

Prof. Dr. Servet Gülüm Şumnu
Supervisor, **Food Engineering, METU** _____

Prof. Dr. Serpil Şahin
Co-Supervisor, **Food Engineering, METU** _____

Examining Committee Members:

Prof. Dr. Behiç Mert
Department of Food Engineering, METU _____

Prof. Dr. Servet Gülüm Şumnu
Department of Food Engineering, METU _____

Assoc. Prof. Dr. Mecit Halil Öztop
Department of Food Engineering, METU _____

Assist. Prof. Dr. Elif Yolaçaner
Department of Food Engineering, Hacettepe University _____

Assist. Prof. Dr. Semin Özge Keskin
İzmit Vocational School-Food Processing, Kocaeli University _____

Date:01.02.2022

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Surname: Duygu, Başkaya Sezer

Signature :

ABSTRACT

EXTRACTION OF DIETARY FIBER FROM SOUR CHERRY (*Prunus cerasus* L.) POMACE AND UTILIZATION IN LOW-FAT BISCUIT

Başkaya Sezer, Duygu
Doctor of Philosophy, Food Engineering
Supervisor: Prof. Dr. Servet Gülüm Şumnu
Co-Supervisor: Prof. Dr. Serpil Şahin

February 2022, 232 pages

There is a recent trend to decrease intake of saturated lipid by the consumers. The reduction of fat in dough and interactions of added fat replacer (sour cherry pomace) with wheat flour macromolecules influence biscuit characteristics adversely. The purpose of this study is to increase soluble dietary fiber (SDF) content in powdered sour cherry pomace (PSCP) by using different treatments and to investigate fat replacing properties of PSCP with examining the impact of its dietary fiber fractions on the quality, texture, color and technological properties of reduced-fat biscuits. Modification of dietary fibers was implemented by different combinations of microwave (850 W/60 s), high pressure (300 or 600 MPa/15 min), enzymatic hydrolysis (60ºC/60 min), and conventional heating (60ºC/60 min). The maximum SDF content was between 20.12% and 23.16% in the PSCP treated with microwave, microwave-assisted high pressure, or microwave-assisted high pressure combined with enzymatic hydrolysis. Accordingly, the elevated swelling power (7.11 g/g) was determined in microwave-treated PSCP and the highest solubility index (49.67%) was found in PSCP which was treated with microwave-assisted high pressure combined with enzymatic hydrolysis. Total phenolic content was augmented 98% and antioxidant capacity was enhanced 2.5 times in the PSCP treated with microwave-assisted high pressure (600 MPa/15 min). After modification processes, the treated PSCPs involving maximum SDF were incorporated into the reduced-fat (10% fat) biscuit. Incorporation of SDF (2% w/w) isolated from microwave-assisted high pressure treated PSCP into 10% fat dough ensured similar hardness, adhesiveness, and cohesiveness of 30% fat containing dough. In addition,

comparable moisture content, thickness, spread ratio, hardness, and color values were observed in reduced fat (10%) and 30% fat containing biscuits. Incorporation of insoluble dietary fiber (IDF) isolate deteriorated the textural and physical properties of the reduced-fat dough and biscuit more than the PSCP enrichment. The most significant difference was observed between biscuits containing 10% fat with untreated PSCP or its IDF isolate and 30% fat containing biscuit in terms of moisture content, spread ratio, and hardness. The sample enriched with untreated PSCP had 9 and 1.4-fold more hardness scores than the 30% fat containing dough and biscuit (control), respectively. Consequently, SDF was the most convenient fraction for replacing fat compared to PSCP and IDF isolate. Microwave-assisted high pressure (600 MPa/15 min) was the best combination to achieve the dietary fiber with effective properties to be used in the reduced-fat biscuit.

Keywords: Sour cherry pomace, dietary fibre, cellulase, antioxidant, microwave, high pressure.

ÖZ

VİŞNE (*Prunus cerasus* L.) POSASINDAN BESİNSEL LİF EKSTRAKSİYONU VE DÜŞÜK YAĞLI BİSKÜVİ YAPIMINDA KULLANIMI

Başkaya Sezer, Duygu
Doktora, Gıda Mühendisliği
Tez Yöneticisi: Prof. Dr. Servet Gülüm Şumnu
Ortak Tez Yöneticisi: Prof. Dr. Serpil Şahin

Şubat 2022, 232 sayfa

Son zamanlarda tüketicilerde doymuş lipid alımını azaltmaya yönelik bir eğilim görülmektedir. Hamurdaki yağın azalması ve eklenen yağ ikamesinin buğday unu makro molekülleri ile etkileşimi bisküvi özelliklerini olumsuz etkilemektedir. Bu çalışmanın amacı, toz vişne posasındaki (PSCP) çözünür diyet lif (SDF) içeriğinin farklı işlemler kullanılarak arttırılması ve PSCP'nin diyet lif fraksiyonlarının yağı azaltılmış bisküvilerin kalite, doku, renk ve teknolojik özelliklerine olan etkilerinin belirlenmesidir. Diyet liflerinin modifikasyonu, mikrodalga (850 W/60 s), yüksek basınç (300 veya 600 MPa/15dk), enzimatik hidroliz (60°C/60 dk), konvansiyonel ısıtma (60°C/60dk) ve bu işlemlerin farklı kombinasyonları ile gerçekleştirilmiştir. Maksimum SDF içeriği, mikrodalga, mikrodalga destekli yüksek basınç veya enzimatik hidroliz ile mikrodalga destekli yüksek basınca tabi tutulan PSCP'de bulunmuş ve %20,12 ile %23,16 arasında olmuştur. Buna göre, mikrodalga ile muamele edilmiş PSCP'de yüksek şişme gücü (7.11 g/g) belirlenirken en yüksek çözünürlük indeksi (%49,67) ise, enzimatik hidroliz ile kombine mikrodalga destekli yüksek basınç ile muamele edilen PSCP'de bulunmuştur. Mikrodalga destekli yüksek basınç (600 MPa/15 dk) ile PSCP'nin toplam fenolik içeriği %98, antioksidan kapasitesi ise 2,5 kat artmıştır. Modifikasyon işlemlerinden sonra, maksimum SDF içeren PSCP, yağı azaltılmış (%10 yağ) bisküviye eklenmiştir. Mikrodalga destekli yüksek basınç uygulanmış PSCP'den izole edilen SDF'nin (%2 w/w), %10 yağ içeren hamura eklenmesi %30 yağlı hamura ait sonuçlar ile kıyaslanabilir sertlik, yüzey ve iç yapışkanlığın elde edilmesini sağlamıştır. Ayrıca az yağlı (%10 yağ) ve %30 yağ

içeren bisküviler benzer nem içeriği, kalınlık, yayılma oranı, sertlik ve renk değerine sahip olmuştur. Çözünmeyen diyet lifi (IDF) izolatının eklenmesi ise, yağı azaltılmış hamur ve bisküvinin tekstürel ve fiziksel özelliklerini PSCP'ye göre daha çok düşürmüştür. Nem içeriği, yayılma oranı ve sertlik açısından %30 yağlı bisküviden (kontrol) en farklı örnekler, işlem görmemiş PSCP veya onun IDF izolatı eklenmiş %10 yağ içeren bisküviler olmuştur. İşlem görmemiş PSCP ile zenginleştirilmiş örneklerin, %30 yağlı hamur ve bisküvide ölçülenden sırasıyla 9 ve 1,4 kat daha fazla sertlik skoruna sahip olduğu bulunmuştur. Sonuç olarak SDF; IDF izolatı ve PSCP ile karşılaştırıldığında yağ ikamesi için en uygun fraksiyon olarak belirlenmiştir. Mikrodalga destekli yüksek basınç (600 MPa/15 dak), yağı azaltılmış bisküvide kullanılmak üzere en etkili özelliklere sahip diyet lif elde etmede en iyi kombinasyon olarak bulunmuştur.

Anahtar kelimeler: Vişne posası, diyet lifi, selülaz, antioksidan, mikrodalga, yüksek basınç.

To my family

ACKNOWLEDGMENTS

First of all, I wish to express my deepest gratitude to my advisor Prof. Dr. S. Gülüm Şumnu and co-advisor Prof. Dr. Serpil Şahin for their patience, guidance, advice, criticism, encouragements and insight throughout the research. Moreover, I would like to present many thanks to ANKOM Technology for providing product supply and especially to George Thomas who is from Kuwait Al Khaznah technical service of ANKOM, for his personal effort in addition to the technical support for maintenance of Dietary Fiber Analyzer. Furthermore, I would also like to express my endless gratitude to Selen Güner PhD., Research Assistant of Department of Food Engineeering in Middle East Technical University, for her valuable support by ensuring preparation of the research material for treatments.

This research project was funded by Middle East Technical University, Turkey (DKT-314-2018-3589). The authors would like to express sincere gratitude to the Scientific and Technological Research Council of Turkey for financial support (TUBITAK-2214A/1059B141800169), the Kuwait Institute for Scientific Research (KISR) and also my supervisor in KISR, Jasim Ahmed PhD., for conducting the research. I would like to present my special thank ANKOM Technology and Orba Biochemistry Inc. which provided the material support for realization of this research.

TABLE OF CONTENTS

ABSTRACT v

ÖZ vii

ACKNOWLEDGMENTS x

TABLE OF CONTENTS xi

LIST OF ABBREVIATIONS xvii

LIST OF SYMBOLS xix

CHAPTERS

1 INTRODUCTION 1

1.1 Agricultural Waste and By-products 1

1.2 Sour Cherry Pomace 4

1.3 Dietary Fiber 6

1.3.1 Insoluble dietary fiber 9

1.3.2 Soluble dietary fiber 11

1.4 Modification of DF 12

1.4.1 Physical modification 13

1.4.1.1 Microwave treatment 17

1.4.1.2 High pressure processing 18

1.4.2 Chemical treatments 21

1.4.3 Biological treatment 22

1.4.4 Combination of modification treatments 24

1.5 Incorporation of Dietary Fiber into Bakery Products 26

1.5.1 Bread 26

1.5.2 Cake 28

1.5.3 Biscuit 31
1.6 Objective of the Study 33
2 MATERIAL AND METHODS 35
2.1 Materials 35
2.2 Methods 35
2.2.1 Preparations of PSCP, SDF, and IDF 35
2.2.1.1 Pretreatment of PSCP 35
2.2.1.2 Microwave treatment 36
2.2.1.3 High hydrostatic pressure treatment 36
2.2.1.4 Enzymatic treatment 36
2.2.1.5 Conventional heating 36
2.2.1.6 Combinations of the treatments 37
2.2.1.7 Isolation of SDF and IDF 37
2.2.2 Analysis of the treated PSCP, SDF, and IDF 37
2.2.2.1 Dielectric properties measurement 37
2.2.2.2 DF assay 39
2.2.2.3 Microstructure 40
2.2.2.4 Functional properties 40
2.2.2.5 Determination of total phenolic content 41
2.2.2.6 Total antioxidant capacity 42
2.2.2.7 Color 42
2.2.3 Biscuit preparation and enrichment 42
2.2.4 Analysis of biscuit dough and biscuit 44
2.2.4.1 Textural properties of the dough and biscuits 44

2.2.4.2 Physical properties of the biscuits 45
2.2.5 Statistical Analysis 45
3 RESULTS AND DISCUSSION 47
3.1 Physical Properties of the Treated PSCP, SDF, and IDF 47
3.1.1 Dielectric properties 47
3.1.2 TDF, IDF, and SDF contents 50
3.1.3 Microstructures 53
3.1.4 Functional properties 56
3.1.5 Total phenolic content 59
3.1.6 Total antioxidant capacity 61
3.2 Physical Properties of the Enriched Dough and Biscuits 61
3.2.1 Textural properties of the dough 62
3.2.2 Physical properties of the biscuits 66
3.2.3 Spread ratio of the biscuits 66
3.2.4 Hardness of the biscuits 67
3.2.5 Color of the biscuits 69
4 CONCLUSION 73
REFERENCES 75
APPENDICES 97
A.Variance Analysis Outputs of Dielectric Properties 97
B.Variance Analysis Outputs of IDF 99
C.Variance Analysis Outputs of SDF 108
D.Variance Analysis Outputs of TDF 118
E.Variance Analysis Outputs of SP 129

F.Variance Analysis Outputs of WHC 140
G.Variance Analysis Outputs of SI 147
H.Variance Analysis Outputs of SVF 154
İ.Variance Analysis Outputs of OHC 161
I. Variance Analysis Outputs of Dough Hardness 168
M. Variance Analysis Outputs of Biscuit Moisture 192
N. Variance Analysis Outputs of Color (L*) 198
P. Variance Analysis Outputs of Color (a*) 204
R. Variance Analysis Outputs of Color (b*) 210
S. Variance Analysis Outputs of Color (ΔE*) 216
T. Variance Analysis Outputs of Spread Ratio 222
U. The Enriched Biscuits 228
CURRICULUM VITAE 229

LIST OF TABLES

TABLES

Table 1 The selected individual and combination treatments applied to PSCP 38
Table 2 Biscuit dough formulation 43
Table 3 The particle size and concentration dependent dielectric properties of the untreated PSCP 49
Table 4 The effects of different treatments on dietary fiber contents of the PSCPs51
Table 5 The effects of different treatments on functional properties of the PSCPs 58
Table 6 The effects of different treatments on total phenolic content and total antioxidant capacity of the PSCPs 60
Table 7 Textural properties of the dough..... 63
Table 8 Physical properties of the biscuits..... 68
Table 9 Color of the biscuits 71

LIST OF FIGURES

FIGURES

Figure 1 Waste components of fruit and vegetable processing industry.....2
Figure 2 Dietary fiber analyzer.....40
Figure 3 SEM images of untreated and treated SDF using different methods.....55
Figure 4 SEM images of untreated and treated IDF using different methods.....55
Figure 5 SEM images of untreated and treated PSCP using different methods.....55

LIST OF ABBREVIATIONS

DF Dietary fiber

$DPPH^{\cdot}$ 1,1-diphenyl-2-picrylhydrazyl

E- Enzyme (cellulase) addition

EH Enzymatic hydrolysis

HP High hydrostatic pressure

HP300 High hydrostatic pressure at 300 MPa

HP600 High hydrostatic pressure at 600 MPa

IDF Insoluble dietary fiber

MW Microwave treatment

OHC Oil holding capacity

PSCP Powder sour cherry pomace

SC Swelling capacity

SCP Sour cherry pomace

SDF Soluble dietary fiber

SI Solubility index

SP Swelling power

SVF Sediment volume fraction

TDF Total dietary fiber

TPC Total phenolic content

TT Thermal treatment

WHC Water holding capacity

U- Untreated sample

LIST OF SYMBOLS

ε' Dielectric constant

ε'' Dielectric loss factor

Dp Penetration depth

CHAPTER 1

INTRODUCTION

1.1 Agricultural Waste and By-products

The United Nations Food and Agriculture Organization (FAO) has estimated that at least one-third of the food produced in the world (estimated as 1.3 billion metric tonnes) is lost and wasted every year (FAO, 2014). FAO has declared that waste and losses in fruits and vegetables are the highest among all types of foods possibly reaching up to 60%. Loss of food materials occurs mostly in agricultural processes, post-harvesting, in food-supply chain, during transportation, in industrial processing, storage and at the table. A number of individual and collective efforts are being carried out worldwide to alleviate the grave situation of food wastage. The Food Loss & Waste Protocol is a multi-stakeholder effort led by the World Resources Institute to develop the global accounting and reporting standard for food as well as associated inedible parts removed from the food supply chain. In addition, several food rescue programs collect perishable food, including fruit and vegetable surplus, and donate them to hungry people (Tostivint et al., 2017).

Food processing industries produce the maximum wastes that are dangerous for environment. Food processing waste is composed mainly of peel, pulp, pomace, seed, kernel, husk, leaves, and stem (Figure 1) containing good sources of potentially valuable bioactive compounds, such as carotenoids, polyphenols, dietary fibers, vitamins, enzymes, and oils, among others. The waste by-products are heterogeneous in their composition due to the nature of the diverse processing activities on the complex raw materials. In the past, most of the waste of the food processing industry has been used as landfill, or as feed for farm animals. Disposal of food processing wastes induce significant environmental, nutritional, and economical issues.

Keeping all this in view; prevention, minimization, and treatment of food processing waste need to be considered seriously (Otles, Despoudi, Bucatariu, & Kartal, 2015).

It is possible to minimize wastage of food during processing by use of several emerging efficient food processing technologies. However, significant amounts of valuable and unexploited components need treatment or re-utilization of process wastes to obtain other benefits. For example, the phytochemicals containing different nutrients and micronutrients can be utilized in the health industry for preparation of health supplements and development of functional or enriched foods (F. Ahmad, Zaidi, & Ahmad, 2020; Pattnaik, Pandey, Martin, Mishra, & Ashokkumar, 2021). Other wastes capable of undergoing anaerobic or aerobic decomposition can be used in energy industry for generation of heat and electricity.

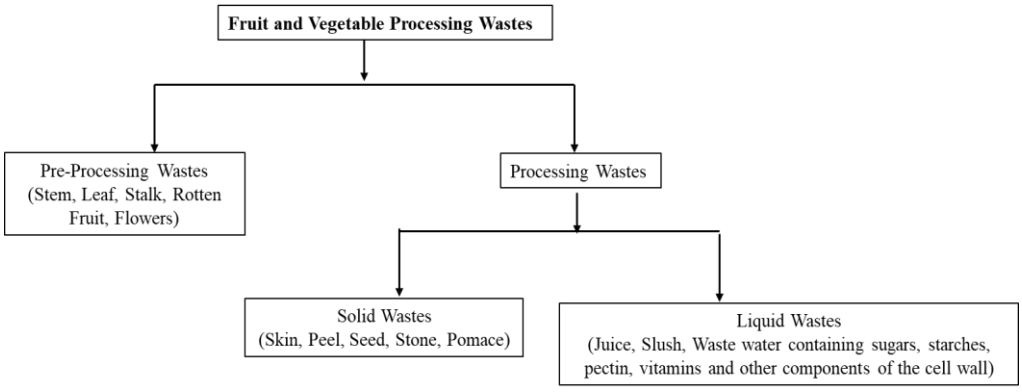

Figure 1 Waste components of fruit and vegetable processing industry

Profits of the fruit processing industry can be increased by reducing the disposal cost of fruit and vegetable processing wastes and utilizing the wastes in production of value-added products. Waste processing is important for contributing the recycling economy and the sustainability in the food industry in addition to potential benefits for health (Sharma et al., 2021).

By-products left after plant processing contain lignocellulosic substances composed of three components: hemicellulose, cellulose, and lignin. In addition, the leftover biomass contains a plethora of valuable bioactive phytochemicals. Isolation of these

bioactive components and their suitable use are much required for maintaining a circular economy and producing lesser wastes. Moreover, it is well known that agroindustrial by-products are also rich in colorants, antioxidant and phenolic compounds in addition to dietary fiber. These neutralize the free radicals in the body, thus by-products could be a source of bioaccessible phenols and antioxidant structures boosting overall health (Raiola, Rigano, Calafiore, Frusciante, & Barone, 2014).

Extraction step includes wet and dry processing, gravimetric, chemical, physical, enzymatic, and microbial methods, or a combination of these treatments. Different methods have varied impacts on the process and the structure of dietary fiber. For example, the enzyme usage might result in incomplete extraction, however; the utilization of acid and alkali could damage the molecular structure of the fiber (B. Wang, Sain, & Oksman, 2007).

The thermal and chemical methods are frequently used methods; it has high extraction efficiency, but it requires high time, high temperatures, and high solvent consumption. High-pressure (HP) processing and ultrasound, microwave (MW) are used to increase the functional properties of DF with optimum-minimum processing conditions in order to provide high efficiency in a short time. Despite these indicators, more research is needed to improve actual conditions. The functional properties and efficiency of DF depend on many criteria. These criteria are extraction methods and time, pH, solvents, temperature. (Tejada-Ortigoza, Garcia-Amezquita, Serna-Saldívar, & Welti-Chanes, 2016).

Enzymatic, biological, or physical treatments (HP, high temperature, and ultrasound) improves the extraction rate of arabinoxylan (A. Ahmad, Anjum, Zahoor, Nawaz, & Din, 2009; Ayala-Soto, Serna-Saldívar, & Welti-Chanes, 2016; Ebringerová, Kardošová, Hromadkova, Malovíková, & Hříbalová, 2002; Khaleghipour et al., 2021; Persson, Dinh, & Jönsson, 2009; J. Wang, Sun, Liu, & Zhang, 2014; Zheng et al., 2019). Alkaline, water, enzymatic, and ultrasound-assisted treatment can be

performed to extract β-glucan (A. Ahmad et al., 2009; Moczkowska, Karp, Niu, & Kurek, 2019; Pan, Luo, Liu, & Luo, 2018; Zheng et al., 2019).

More recently, the utilization of ball milling, jet milling, and HP-assisted micronization technology has been found to improve the physicochemical properties of insoluble dietary fiber (IDF) extracted from vegetables and fruits (Chau, Wen & Wang, 2006a, b; Chau,Wang, &Wen, 2007). This micron technology is mainly based on particle size reduction, thus improving the hydration properties of DF. It has been found that HP-assisted micronization, which is one of the micronization methods, is more effective than jet or ball milling in reducing the size of commercial cellulose particles and industrial residues obtained from star fruits, orange juice, and carrots (Mateos-Aparicio, Mateos-Peinado, & Rupérez, 2010). The combination of HP and conventional heating was used to change the physicochemical properties of DF in white cabbage and it was observed that the amount of soluble dietary fiber (SDF) increased. Thus, it was determined that HP caused a change in the ratio of SDF and IDF (Wennberg and Nyman, 2004).

Furthermore, MW could increase intracellular pressure in fresh tissue rupturing the cell wall and release active ingredients (Wei et al., 2019). The functional properties were improved by MW-assisted SDF extraction, wherein the water retention and swelling capacities were increased more than the oil retention capacity (Li et al., 2014). The treatments combined with MWmore improved functional properties, especially the ultrasound assisted-MW showed the highest binding capacity for the water, oil, cholesterol, glucose and nitrite ion of the grapefruit peel SDF (Gan et al., 2020).

1.2 Sour Cherry Pomace

Sour cherry pomace (SCP) is one of the important by-products after the juice is extracted. All over the world, 40-50% of fresh sour cherry is wasted as SCP which accounts for approximately 0.6 million tonnes (FAOSTAT, 2018). SCP incorporates

7.6% protein, 6.9% fat, 24.4% total dietary fiber, 3.2% sucrose, 14% glucose, 18.5% fructose in dry basis (Górnaś et al., 2016). It is also rich in bioactive compounds such as polyphenols, anthocyanins and flavonoids (Wang et al., 1997). Total phenolic content of SCP powder was determined as 91.29 mg GAE/g dry weight (Cilek, Luca, Hasirci, Sahin, & Sumnu, 2012). Moreover, sour cherry with an average of 5.53 mmol/100 g (FRAP) antioxidant activity was declared to be one of the most powerful products in terms of radical scavenging. In literature, SCP was investigated in terms of phenolic contents, and their antioxidant and antimicrobial activities, also sugar components (Górnaś et al., 2016; Šaponjac et al., 2016). In the study of Górnaś et al. (2016), providing the neochlorogenic acid in muffins enriched by SCP. The most unstable compounds were anthocyanins and 3-64% was recovered after baking of muffin with SCP, in contrast the flavonol glycosides,which were the most stable (0-5% lost). Almost 100% recovery was observed for neochlorogenic acid (92-99%) in SCP-incorporated muffin. Šaponjac et al. (2016) stated that total polyphenols of the enriched cookies with 10% SCP encapsulated in whey (WE10) and soy proteins (SE10) increased approximately 23% and 42%, respectively. Total anthocyanin contents of WE10 and SE10 samples were 67.92% and 64.33%, respectively and antioxidant activities of WE10 and SE10 samples 9.31% and 24.30% decreased after baking. Therefore, the encapsulated SCP bioactive compounds affected functional properties of the enriched cookies. In addition to characteristics of the product fortified with SCP, novel technologies for enhancing the shelf life and stability of the SCP incorporated products which were explored (Cilek et al., 2012; Luca, Cilek, Hasirci, Sahin, & Sumnu, 2012). Microencapsulation is one of the techniques that is used for enhancing stability and the shelf life of phenolics. Microencapsulation contributed preserving phenolic compounds which are extracted from vegetables and fruits. On the other hand, it was reported that SCP contributed to a delay in crumb hardening during bread storage, thus increasing the shelf life of the product due to its phenolic content and antioxidant capacity. For this purpose, SCP was used for the enrichment of muffins (Bajerska, Mildner- Szkudlarz, Górnaś, & Seglina, 2016) and gluten-free breads (Gumul, Korus, & Ziobro, 2020). In contrast to such abundant

researches, literature is scarce in physicochemical alterations of sour cherry fiber structures.

1.3 Dietary Fiber

Dietary fiber (DF) is known as the seventh nutrient which is indigestible carbohydrates of plant foods. The definition of DFs has been debated and has evolved in the past. Previously these are known as the edible parts of plants or analogous carbohydrates that is resistant to digestion and absorption in the small human intestine (Mongeau, 2003). A global DF definition was accepted in November of 2008. In the Codex Alimentarius, DF is defined as carbohydrate polymers with ten or more monomeric units, which are not hydrolyzed by the endogenous enzymes in the small intestine of humans (Sivam et. al., 2010).

DF is classified as IDF and SDF. Previous studies had indicated that SDF was superior to IDF in terms of controlling blood glucose level of diabetic patients, protecting against breast, colorectal, and prostatic cancers, in addition to reducing blood pressure, preventing gastrointestinal problems by its anti-inflammatory activity, and exhibiting higher cholesterol-binding capacity. DF has glycoside-bound phenolic compounds (Elleuch et al., 2011). Under the mechanism of intestinal enzyme, only soluble fractions of DF facilitate to be utilized these phenolic compounds for body health. From technical aspect, SDF is employed for water absorption (Nassar, AbdEl-Hamied, & El-Naggar, 2008), calorie reduction depend on mimicking fat ingredient (Mansour & Khalil, 1997), anti-caking, anti-sticking (Hou, Kruk, & Center, 1998), dimensional stabilization (Dreher, 1999), texturing, thickening, gelling, enhancing viscosity and improving appearance due to possessing better physicochemical and functional properties than IDF (Marangoni, Van Duynhoven, Acevedo, Nicholson, & Patel, 2020; Sudha, Baskaran, & Leelavathi, 2007; Sudha, Srivastava, Vetrimani, & Leelavathi, 2007; E. Zoulias, Oreopoulou, & Tzia, 2000, 2002).

In the study of Nassar et al. (2008), orange peel and pulphad high amount of DF (78.87 and 70.64%, respectively) with more proportion of IDF, high level ofoil and water binding capacity. Incorporation of orange peeland pulp in biscuit dough demonstrated an increase in waterholding whereas dough development time and stability, while mixing tolerance was decreased.

DF might also be incorporated into meat products as fat replacer to decrease the caloric content and to improve the stability and the texture of meat products. Surplus red and white beeswing, and DF from wheat bran, might be added to replace the fat of the beef burgers, decreasing levels of cholesterol and improving diameter, their cooking yield, and texture (Mansour & Khalil, 1997).

For pasta, the anti-sticking characteristics of certain DFs of oats, soybean, barley, and ricebran etc. contribute to facilitate extrusion and improves steam table life of the cooked pasta in addition to strengthen dough (Hou et al., 1998).

It is known that cellulose minimizes shrinkage in cakes with the effect of cooling after baking. For this reason, it can be said that cellulose in powder form provides dimensional stability to baked products (Dreher, 1999).

SDF and IDF are both used in food processing to improve appearance of the product, to give crispiness and replacing fat ingredient to reduce energy of food. Moreover, DF modifies texture with increasing viscosity. Carbohydrate-based fat replacers ensure that mechanism with gel formation (Marangoni et al., 2020). DF decreased breaking strength and formed short texture as desired in cookie compared to other fat reduced cookies (Sudha, Srivastava, et al., 2007; E. Zoulias et al., 2000; E. I. Zoulias, Oreopoulou, & Kounalaki, 2002).

Contrarily, in most plant-based food, IDF comprises 70–88% of TDF. This limits the utilization of DF during processing (Okur, Baltacıoğlu, Ağçam, Baltacıoğlu, & Alpas, 2019). For this reason, modifying the DF structure and increasing the SDF/IDF ratio by converting IDF to SDF have become a hot topic.

DF plays an important role in both prevention and treatment of obesity, atherosclerosis, coronary heart diseases, intestine cancer and diabetes. Additionally, it binds excess hydrochloric acid in the stomach and cholesterol, mineral components

and heavy metals. A recent meta-analysis pointed out towards the protective effects of DF against colorectal cancer suggesting about 10% reduction in risk of colorectal-cancer (Masrul & Nindrea, 2019).

DF which is the storage and cell wall polysaccharide of plant cells could be classified into soluble and IDF depending on the solubility in water. The examples of SDF are inulin, β-glucans, pectins, gums, oligosaccharides, and other nonstarch polysaccharides (Khan, Alam, Ali, Bibi, & Khalil, 2007; Yangilar, 2013) and IDF includes cellulose, lignin, and some type of hemicelluloses (Prakongpan, Nitithamyong, & Luangpituksa, 2010). Soluble and insoluble parts of DF are both utilized in food industry for functional properties such as improving texture and appearance of the product, giving crispiness and substituting fat addition to reduce energy of food, and to help feeling of satiety.

DF is used to enrich food products due to its health benefits. Due to its reported protective effect against cardiovascular disease, certain forms of cancers and DF incorporated foods might have a wide consumer appeal. It is also used for calorie reduction. DF is regarded as noncaloric, DF added food could show reduction in calorie compared to a reference product. In addition, due to noncaloric characteristic of DF, It could be utilized as a bulking agent in combination with high-intensity sweeteners to replace large quantities of caloric sweeteners (sugar) in reduced calorie food products. DF has also high water-holding capacity. This attribute provides retardation of staling and controling moisture migration. On the other hand, fat contributes several functional properties to a food system and it is difficult to replace it with a single ingredient, but DF might fulfill vital functions associated with fat. Lubricity, thickening, emulsion, opacity, and gel texture simulation characteristics of DF might successfully replace fat with DF (Tapia-Salazar et al., 2019). Moreover, anticaking attribute of DF supports to prevent caking and clumping and improves flowability. Antisticking characteristic of DF regulates textural properties of dough with reducing stickiness, thus facilitating some processes such as extrusion. DF might be employed as a dimensional stabilizer due to its fibrous nature. This structure stabilizes the physical structure of the food, thus minimizing shrinkage of the DF-

enriched product. DF is also a texturizing agent. The particulate nature of many fiber ingredients can contribute into mouthfeel (Tejada-Ortigoza, García-Amezquita, Serna-Saldívar, & Welti-Chanes, 2017). In addition, varying particle sizes can result in differences in water-holding capabilities. This factor also contributes into mouthfeel. Thickening property of DF improves water-holding and forms gel which contributes an increase in the thickness or viscosity of a food product (Pareyt et al., 2009).

DF is abundant in agricultural wastes and by-products and DFs are potential sources for food industry (Garcia-Amezquita et al., 2018). Stem, pomace, husk, peels, skinare the varieties of DF found in vegetable and fruits. It comprises 52–84 g/100 g (dry basis) of the plants.

Whether the backbone or side chains of the polysaccharides are regular (insoluble) or irregular (soluble) is a criterion for determining DF characteristics. In addition to these, having functional groups such as -COOH, affected by ionic strength and temperature are other parameters (Elleuch et al., 2011). When the content of DF is examined, the molecules found in fruits and vegetables can dissolve more quickly than DF in cereal grains, and this has an essential place in terms of a healthy diet (Tejada, 2016). The physiological effects of DFs and IDFs depend on their structural and physical properties, resulting in behaviors such as hydration, swelling, and enzymatic attack (López, et al., 1996).

1.3.1 Insoluble dietary fiber

IDF is inert to digestive enzymes in the upper gastrointestinal tract and it does not dissolve in water. It consists of DF sources that is rich in cell wall content such as purified cellulose, most cereal brans (corn and wheat bran etc.) and oilseed hulls (soybean hulls and sunflower seed etc.). IDFs are a consequence of inter-chain linkage of numerous polymer chains (McCleary, 2001). IDF typically contains lignin, cellulose, and some hemicelluloses (Prakongpan, Nitithamyong, & Luangpituksa, 2010).

Annual plant cell walls contain lignin and the same polysaccharide categories, namely, cellulose and hemicelluloses (arabinoxylans, arabinogalactans, xylans, xyloglucans, etc.). Cellulose is the basic structural component of plant cell walls, and it comprises about 33% of all plant materials. Hemicellulose, which might be present in greater amounts in annual plants constitutes 20%-30% of cell walls;. Hemicelluloses may be roughly defined as land-plant cell-wall polysaccharides other than cellulose and pectin. All the IDF are part of the structures that give vegetable and fruits the crisp, chewy, fibrous characteristics even after cooking process. IDF regulates the function of the gastrointestinal tract with increasing fecal bulk, providing laxation, reducing transit time, controlling body weight and supporting to decrease obesity and diabetes (Bemiller, 2019).

From the technological aspect, construction of networks by hydrated cellulose and hemicellulose, in which growth in total solids and three-dimensional conformation is affected, increases IDF's intensity and pseudoplastic behavior. Several functionalities of IDF have hydration and water-binding, viscosity building properties, incompatibility with hydrocolloids added for another purpose due to phase separation, gel formation, changes in sensory attributes, and changes in shelf life (Bemiller, 2019). Other ingredients (gums) hold the insoluble microcrystals together in a network which gives a creamy mouthfeel and body similar to that found in full-fat products. Different forms of cellulose such as powdered cellulose, methylcellulose and hydroxypropylmethylcellulose also have application as fat replacer in baked goods (O'Connor et al., 2016). The behaviour of these materials change according to the treatments. Coarsely ground IDF triggers the secretion of mucus in the large intestine, providing bulking. Finely ground IDF does not have this effect and can actually have a constipating effect. Some forms of IDF, such as resistant starches, can be fermented in the colon (Lockyer & Nugent, 2017).

IDF is utilized in food products. However, the effect of IDF on the product characteristics is discussed with the addition of by-products containing high IDF due to the fact that the use of IDF fractions by isolating them is limited.

IDF is more available in many by-products of vegetables and fruits than SDF. The results showed that microfluidization could effectively reduce IDF particle sizes to submicron scales, trigger a redistribution of some fiber composition from insoluble to soluble fractions and improve the physicochemical properties such as hydration characteristics (Chen et al., 2013). Using high amounts of IDF in bread increases product firmness during storage.

1.3.2 Soluble dietary fiber

SDF which dissolves in water, is generally fermented in the colon into gases and physiologically active by-products, such as short-chain fatty acids produced in the colon by gut bacteria. The examples of SDF can be arrayed as curdlan, hydroxypropylcelluloses, hydroxypropylmethylcelluloses, methylcelluloses which are soluble in water at room temperature. Alginates, amylopectins, carboxymethylcelluloses, kappa-, iota- high-methoxyl- and lambda-typecarrageenans, furcellarans, guar gum, gum arabic, gum tragacanth, pectins, polydextrose, xanthan which are dissolved in cold and hot water.

SCP, which is rich in IDF, mainly consists of lignin, cellulose, and hemicellulose (Wang et al., 2016). The limited amount of SDF is degraded during clarification of fruit juice. Several intervention studies have shown that SDF was more beneficial to human health than IDF (Huang, He, Zou, & Liu, 2015; Zhang, Wang, Yu, & Wu, 2013). Regular intake of SDF helps to prevent from cardiovascular diseases, lowers LDL and serum cholesterol levels, slows gastric emptying by increasing viscosity, increases satiety, and provides anti-inflammatory effect (Bemiller, 2019).

SDF has a colloidal and complex structure. Thereby, it is generally used as a thickening and stabilizing agent in food, pharmaceutical, chemical, and textile industries. For bakery products, an increase in SDF has not changed the rheology of SDF enriched-products (Jia et al., 2020). Improvement of health properties and a decrease of glycemic index have been reported in the biscuits prepared using SDF

(pectin) extracted from watermelon rind powder along with wheat flour (Naknaen et al., 2016). Soluble fibers reduced the thickness of the biscuit and increased its width, therefore increasing the spread factor in biscuits. On the other hand, IDFs had the opposite effect, reducing the final width of the biscuit and the spread factor (Mancebo et al., 2018). Therefore, it is better to modify DF for using them in food industry.

1.4 Modification of DF

DF is modified to increase the utilization of plant and its by-products in functional food processing, and to improve the yield and technological properties of DFs. The modification improves the physical properties of DF by breaking the intermolecular bonds and changing the crystal structure (Ma & Mu, 2016a). Modification treatments which are applied on DFs, could be gathered into four group such as physical, chemical, biological, and combined methods (J. Gan et al., 2021). Most of the fiber containing foods generally contains approximately one-third soluble and two-third IDF, but compared with IDF, more SDF is needed. Currently, there are no standards for the modification of dietary fiber (Mudgil, 2007).

Physical methods utilize high temperature, HP, instantaneous pressure reduction, explosion, high-speed impact and shearing to melt or break the glycosidic bond of DF, thereby achieving the purpose of modification, such as steam processing, HP homogenization, dynamic high-pressure micro-fluidization, ultrafine comminution, high hydrostatic pressure, extrusion, ultrasound, MW and cavitation jet processing. On the other hand, chemical method uses the chemical reactions to change the structural and functional properties of DFs, such as alkaline hydrogen peroxide, alkali, acid, disodiumphosphate, carboxymethylation, hydroxypropylation, and cross-linking treatment. Moreover, biological method is the way that utilizes specific enzymes or microorganisms for enzymatic hydrolysis or fermenting raw materials. As the last one, combined modification methods refer to two or more methods used together or alternatively to modify the DFs (J. Gan et al., 2021). Chemical methods

are time consuming and contaminant for reacting with strong acids, alkali or solvents (Mateos-Aparicio, Mateos-Peinado, & Rupérez, 2010). Additionally, biological methods are expensive for requiring purified enzymes .

1.4.1 Physical modification

Physical methods are widely performed methods to modify dietary fiber, including micronization, ultrafine comminution, HP homogenization, dynamic high-pressure microfluidization, ultrasound, extrusion, MW, and HP processing (J. Gan et al., 2021; Ma & Mu, 2016a). Micronization is one of the physical methods used in the modification of DF structure. The water holding capacity changes because of the automatic operation. It is mainly based on particle size reduction. The use of the micronization technology (i.e. ballmilling, jet-milling, cavitation jet processing, high-pressure micronization) improves the characteristics and physicochemical properties of IDFs from vegetables and fruits (C.-F. Chau, Wang, & Wen, 2007; C. F. Chau, Wen, & Wang, 2006). For example, high-pressure micronization seems to be more efficient in reducing particle size of commercial cellulose and industrial residues from orange juice, star fruit and carrots, than ballmilling and jet-milling (Tejada-Ortigoza, Garcia-Amezquita, Serna-Saldívar, & Welti-Chanes, 2015). The effect of different micronization methods (ball milling, jet milling and HP) had also improved the functionality of carrot IDF (Yu, Bei, Zhao, Li, & Cheng, 2018). The results of microfluidization on IDF showed a reduction in particle sizes from peach and oat to redistribution in the formation of SDF and PDF to submicron balance (C.-F. Chau et al., 2007). As particle size decreased, the bulk density of the IDF decreased influencing hydrating properties and oil holding as well. Water binding was mainly linked to structural parameters, such as porosity (Tejada-Ortigoza et al., 2016). In widespread, a drop in the academic cover area, the total pore volume, and the structural transformation due to the particles size lowering improved the capacity to ensnare water resulting in boosted hydration possessions. sometimes, the size reduction may lead to harm in the fiber and the defeat of the pores resulting in a

reduction in the hydration possessions. Micronization by HP was shown to increase water holding capacity (WHC), swelling capacity (SC), and oil holding capacity (OHC) which changed from 12.5 mL/g, 18 mL/g and 1.92 g/g in samples without micronization to 42.5 mL/g, 62.2 mL/g and 56 g/g in samples treated (Tejada-Ortigoza et al., 2015). In addition, after microfluidization treatments to DF of peach, this one improved solubility, WHC, SC and OHC 2.1, 1.5, 2.2, and 3.1 times, respectively, whereas in the caseof oat these values increased 3.6, 2.1, 1.3, and 3.7 times, respectively (Tejada-Ortigoza, Garcia-Amezquita, Serna-Saldivar, & Welti-Chanes, 2017).

Also, one of the reasons why DF-enriched products are of poor quality is the competition of DF and starch molecules for water. It is possible to regulate this behavior by reducing particle size of DF. Studies have shown that grain materials with smaller particle sizes such as barley, whole-grain flour, cornflour, lentil flour, cornmeal, and sorghum can increase the expansion of extrudates compared to flours with larger particle sizes (Oliveira et al. 2015; Al-Rabadiet al. 2011; Lazou and Krokida 2010; Carvalho et al. 2010). Decreasing the spall size of cornbran from 250 μm to less than 50 μm (Blake, 2006) or wheat bran from 1500 to 150 μm (Guy & Horne, 1988) significantly increases the sectional expansion of extruded fiber-containing flours. The structure of the extruded wheat bran changes due to disruptions of glucosidic linkages in the protein and carbohydrate fractions, it leads to lesser and more dissolved molecular detritus, thus enhancing SDF content (Yan et al., 2015). It shows that a more extensive water absorption index and gas bubble formation of smaller particle size fibers are required for more nucleation sites (Robin et al. 2012b; Lue & Huff 1991). Lue & Huff (1991) also reported that reducing to the fleck stature of sugar beet fiber from 10 to 200 mesh (2 mm to 0.074 mm) improved the radial, longitudinal, and volumetric expansion of extruded corn meal. Coarse fiber causes an increase in water vapor retention because of high water equity capability, thus increasing the nucleation area of water. Simultaneously, the expansion of the gas pockets is limited. This makes it difficult for the baked food to come out of the mold (Lue &Huff, 1991). However, according to the literature in

this field, it has been noticed that a sustainable solution for DF modification cannot be reached to solve such technological problems in DF added products. HP homogenization which is one of the physical treatment, is also known as dynamic HP homogenization. The homogenization valve of the positive displacement pump affects the modification of the HP homogenization. As the pressure drops, the liquid mixture passing through the narrow gap will encounter a sudden stopping force. Effects observed during flow such as cavitation, shock waves, turbulence will change the molecular structure of DF and change its physical and chemical properties. Xie et al. (2017) used HP homogenization was also used, and it was observed that the content of DF in purple-fleshed potatoes increased total α-glucosidase inhibition, phenol, and antioxidant activities. In the study of He, Zhang, et al. (2020), HP homogenization promoted stability, water holding capacity, interface properties and emulsification performance of DF. In addition, HP homogenization also improved the thermal stability of citrus DF (Zhang, Qi, Zeng, Huang, & Yang, 2020). As a result, this process, which is becoming increasingly common, improves desired changes in food products. (Leite, Augusto, & Cristianini, 2016). Nonetheless, emulsification stability and higher emulsification ability are the most important features of HP homogenization.

Dynamic high-pressure microfluidization is used to change DF's physical and chemical properties. In addition, the combined forces of cavitation, high-speed impact, and HP-shear troops are used (Wang, Huang, Tu, Ruan,& Lin, 2016). In this way, the system's pressure increases suddenly and is cut off. With the dynamic HP microfluidization, the part becomes large-pored, and a reduction in particle size is observed (Luo et al., 2018). Wang et al. (2018) used dynamic high-pressure micro-fluidization to treat the IDF from rice bran. It has been observed in the analysis that IDF has a significant effect on the adhesion of cholesterol molecules with its SDF, OHC, and total negative charge properties.

In addition, dynamic high-pressure micro-fluidization is easily prevented by DFs compared to other methods.

Cavitation jet processing is used in various sectors, including engine fuel injectors and water jet cutting machines (Mitroglou, Stamboliyski, Karathanassis, Nikas, & Gavaises, 2017). As it passes through the nozzle, the fluid particle grows rapidly and naturally creates a vacuum, resulting in local temperature and pressure (Peng, Shimizu, & Fujikawa, 2011). Thanks to these forces, large molecules in the liquid turn into small particles. Wu et al. (2020) utilized the cavitation jet processing to modify the okara DF, andfound that after 10 min modification the okara DF's WHC, OHC and SC were increased from 7.14 g/g, 2.46 g/g, and 9.37mL/g to 10.0 g/g, 5.04 g/g, and 13.9 mL/g, respectively. After the cavitation jet process, SDF increased fivefold while TDF mainly remained the same. Therefore, shear viscosity caused a significant increase. Although it is an advanced process, few studies on cavitation jet processing modify DFs.

The ultrasound system is more accessible in terms of sustainability than other methods. Analyzing the substance with an ultrasound generator at room temperature and pressure is the only requirement.

Ultrasound is used to break down the bonds of polysaccharides in the cell walls of plant cells and cause cavitation. The chemical structure of the complex compound of carbohydrate changes thanks to vacuolation, and its water retention feature changes so that bioactive substances are converted into smaller fragments more easily. Huang, Ding, Zhao, Li, and Ma (2018) detected that when the garlic straw is subjected to ultrasonic treatment, the IDF microstructures are damaged, and therefore new hydrophilic groups can be added, thus providing better physical and chemical functions with the new honeycomb network structure formed. In addition, due to the cavitation capacity of ultrasound, ultrasonic treatment can also improve the glucose adsorption capacities and SDF content of defatted rice bran DF (Daou & Zhang, 2012), and WHC, OHC of quinoa seed DF (Kurek, Karp, Wyrwisz, & Niu, 2018).

1.4.1.1 Microwave treatment

MW treatment is a physical modification method. MW energy could form dipole rotation of the solvent and raise the solvent temperature quickly, leading to the increase of compound solubility (Ahmad & Langrish, 2012). In addition, MW energy can directly penetrate the wall material to reach the center of the sample, making the sample heated more evenly and quickly, thus saving time and energy (Jamaluddin et al., 2013; Marra, Bonis, & Ruocco, 2010). More importantly, MW could increase intracellular pressure in fresh tissue rupturing the cell wall and release active ingredients (Wei et al., 2019).These characteristics of MW make it more and more widely utilized in the modification of DFs. MW extraction takes maksimum 20 min to receive a heightened quantity of pectic substances, being existing better applicable on the product than the conventional heating (boiling water) method. The use of MWs might transform molecular structure of plant cells physically and chemically (Tejada-Ortigoza, Garcia-Amezquita, Serna-Saldívar, & Welti-Chanes, 2016).

Modifications produced by conventional heat treatment (thermal processing) happen because the warmth displayed inside the biomass (resulting from the radiation of the bipolar juncture process) assembles a heating power inside the non-homogenous fabric that results in an incendiary result of particles, accordingly pushing the fracture of the lignocellulose configuration. This break rules to acid conditions by the firing of acetic acid, which delivers hydrolysis reactions existing better fitting on the outcome (Sarkar, Ghosh, Bannerjee, & Aikat, 2012). The high-energy radiations could likewise alter the cellulose biomass, boosting the surface space, and reducing the polymerization rate and crystallinity; in reserve, it could deliver hemicellulose hydrolysis and partial polysaccharides depolymerization (Lu, Xi, Zhang, & Angelidaki, 2011; Sarkar et al., 2012). Eventually, the compartment fracture induced by MWs eases the mass transfer, which improves the extraction of considerable combinations (Tejada-Ortigoza et al., 2016).

MW treatment was reported to have broken the weak bonds that existed in polysaccharide chains and rip apart glycosidic linkages in the polysaccharides

(Nyman & Nilsson, 1994). The consequence could lead to a modification of the matrix its architecture and caused IDF to solubilized (Zia-ur-Rehman et al., 2003). According to previous studies, MW treatment improved the cholesterol adsorption capacity, glucose adsorption capacities and SDF content of grapefruit peel SDF (Gan et al., 2020), glucose dialysis retardation index of defatted rice bran DF (Daou & Zhang, 2012), and the thermal stability of okara DF (Lin et al., 2020). Guo et al. (2020) obtained a yield of 18.13% when extracting pectin from orange peel after a 21 min treatment and an output power of 500 W. Likewise, Liu et al. (2019) used a MW treatment for 15 min to obtain a pectin yield of 0.8 and 1.6 % of dried orange albedo and peel, respectively. Ahmed, Almusallam, and Al-Hooti (2013) isolated IDF from date by using a MW treatment (1000 W/7 min) obtaining 5.6–5.9 g/100 g on dry matter content. In another research pectin extraction was compared thermal treatment (TT) with MW processing, and yields of 24.2 % were achieved for MW treatment method with 500 W and 3 min treatment, while 18.32 % was obtained with the conventional boiling-water method with an extended (120 min) heat exposure (Boukroufa, Boutekedjiret, Petigny, Rakotomanomana, & Chemat, 2015). According to the presented studies, MW processing technology is applicable to DF for improving extraction yield and increasing the SDF content.

1.4.1.2 High pressure processing

HP processing is one of the physical methods and it is a nontermal process as an alternative to thermal treatment used for extending shelf life of foods. In fact, high-pressure processing has been a topic of interest for several reasons. HP processing is effective modification of DF in vegetables and fruits (Bermúdez-Aguirre & Barbosa-Cánovas, 2010).

HP processing is also known as high hydrostatic pressure. In this process, oil or water medium used to transmit pressure to change the structure and functionality of high molecular weight molecules or biopolymers. HP treatment was shown to convert IDF into SDF and to improve the bioactivity of the material (Kim & Han, 2012). It

causes breaking of the hydrogen bonds between macromolecules without heat. HP has been widely used in the processes of DFs, meat, vegetables, fruits, seafood and other products (Bermúdez-Aguirre & Barbosa-Cánovas, 2010). HP changes the DF structure. Mateos-Aparicio, Mateos-Peinado, and Rupérez (2010) found that HP increased the hydration properties of DF because it caused relaxation in the DF structure, as a result, the physicochemical properties of okara changed and the SDF:IDF ratio increased. HP can greatly improve the ability of carrot IDF on water retention, water swelling, oil retention, cation exchange and glucose adsorption (Yu et al., 2018). Moreover, HP is able to change the monosaccharide composition of purple-fleshed potato DF (Xie et al., 2017) and pear pomace SDF (Yan et al., 2019).

Although it has a destructive effect on hydrophobic and electrostatic interactions within the molecule, it is known to have the least possible impact on covalent bonds, and this feature of HP is the most suitable tool for regulating non-covalent interactions. With HP, protein molecules can be broken down into smaller units. (Aertsen et al., 2009). The causes for pressure-induced dissociation of oligomeric proteins are imperfect van der Waals contacts between monomers, solvent electrostriction at the level of salt linkages at the interfaces of monomer subunits, and solvation of the nonpolar groups at the boundaries of contact in the oligomers (Balny, 2002).

HP affects micro- and macro- structure in addition to inter- and intra- molecular interactions of molecules. HP, which is an auspicious process for the future, to alter (bio) ease of access and subtraction of worthy composites (aroma, essential oils, antioxidants, colors) difficult to release from matrices (Rastogi et al., 2007).

One advantage of HP is that, generally, for low molecular weight, covalently bonded compounds, the biological functions of the molecules are not impaired during processing. In addition, studies show that HP can directly correlate with many criteria. A few of them are subtraction temperature, speed, bioactive material, energy requirement, and these criteria are positively affected by the HP process (Balasubramaniam, Barbosa-Cánovas, & Lelieveld, 2016).

HP micronization seems to be more efficient in reducing particle size of commercial cellulose and industrial residues from orange juice, star fruit and carrots, than ball or jet-milling. However, these works were mainly focused on the reduction of particle size and hydration properties of vegetable samples, more than on the evaluation of DF, HP has been successfully used to extract anthocyanidin from grape skin, ginsenoside from ginseng root, and triterpenes from cinnamon (Huang, Hsu, Yang, & Wang, 2013).

Regarding the effect of HP on polysaccharides and DF, as HP can stimulate dissociations between protein-oligomers and modify functional properties of proteins and starch, an effect on these macromolecules may also be expected. In this sense, HP did not have much effect on TDF in cabbage; however, the relation between SDF and IDF changed. Following, SDF decreased while IDF increased after HP treatments at 400 MPa, 20°C. Okara (soybean residue) was treated with 200 and 400 MPa at 30 and 60°C (Wennberg & Nyman, 2004). The amount of SDF increased by more than eight times (Mateos-Aparicio et al., 2010). Yu et al. (2018) reported that the overall functional and physicochemical properties due to the impact of HP treatment are more comprehensive; especially, 500 MPa application causes the outstanding effect and more stable impact on the product than other pressure magnitudes. The peels of orange, mango, and prickly pear were treated at 600 MPa for 10 min. Constant amount of TDF were found but the conversion of IDF into SDF was determined in orange (49.0%–50.8% dw) and mango (38.9%–40.5% dw) peels. Moreover, the higher WHC and water retention capacity of mango and prickly pear peels were related to their higher SDF content (Viridiana Tejada-Ortigoza, Luis Eduardo García-Amezquita, et al., 2017). DFs treated with HP homogenization showed the increased antioxidant activities (0.89 for DPPH, 2.65 for ABTS, 3.39 for FRAP mg Trolox/g DF), content of total phenol, and α-glucosidase inhibition (98.3%).HP homogenization treated dietary fiber showed a higher ratio of soluble fraction, increased physicochemical and functional properties than HP at 200 MPa (Fan Xie et al., 2017). Consequently, HP has shown encouraging potential to manipulate the extractability, functionality of bioactive compounds in addition to

macronutrients and micronutrients thereby it is a beneficial technology for providing healthier foods (Houška & da Silva, 2017).

1.4.2 Chemical treatments

Chemical treatments are the most popular conventional methods. DF structure is disintegrated and its physicochemical properties are modified through alkaline, acid, oxidant/bleach, disodium phosphate, solvent, chelating mechanism, and cross linking treatments. The conversion of IDF into SDF is an essential reason in chemical methods due to requirement for more SDF content. Moreover, in several treatments some DF are also lost such as hemicellulose and lignin. Chemical treatments degrade DFs depending on the parameters. IDF can break down into its monosaccharides when conditions are not set optimally (S. Li et al., 2019; Olson, Gray, Chiu, Betschart, & Turnlund, 1988). As alkali treatment for modifying DF structure is generally used sodium hydroxide, and as acid treatment; hydrochloric acid, citric acid, and sulfuric acid are utilized. Alkaline hydrogen peroxide might degrade cellulose, thereby changing the composition of DFs. Many studies have shown that alkaline hydrogen peroxide is able to significantly improve the functional properties of DFs. Solubility of corn DF was increased by using sodium hydroxide (Pai et al. 2009). In the study of Meng et al. (2019), the content of flavonoids, hydroxybenzoic and hydroxycinnamic acid derivatives in addition to the antioxidant capacity of hydrogen peroxide-modified IDF which is extracted from buckwheat straw decreased deleteriously. However, the WHC, α-amylase inhibitory activity, and glucose adsorption capacities of buckwheat straw IDFwere significantly enhanced by alkaline hydrogen peroxide. In addition, the alkaline hydrogen peroxide improved the bile acid binding capacity of tomato peel SDF (Niu, Li, Xia, Hou, & Xu, 2018), absorption capacity of IDF extracted from yam peel (Wang et al., 2019), and the properties of the thermal stability, SC, WHC of DF found in citrus fruits (Zhang, Qi, et al., 2020). Hydrogen peroxide also improved the okara SDF ratio by more than 600%, SC and WHC by 26% (Yoshida & Prudencio, 2020). Wang, Li, Wang, Liu,

and Ni (2021) compared the influences of citric acid and sodium hydroxide on IDF in kiwi fruit. Therefore, sodium hydroxide applied IDF possessed a higher thermal stability than that of the untreated. Moreover, in the study of Karraet al. (2020) on date palm flowers DF, sodium hydroxide enhanced the antioxidant activity, extraction yield and OHC. Additionally, in many researches, the acid-treated effect on DF properties is poorer than the alkaline treatments, however; compared with the untreated form of DF, it has significant effect. Zheng and Li (2018) found that hydrochloric acid treatment reduced the WHC, SC, and glucose dialysis retardation index, but improved the color, cation exchange capacity, emulsion stability and OHC of coconut cake DF.

1.4.3 Biological treatment

Cellulases were converted IDF into SDF to increase the water solubility of the DF, while xylanases acted primarily on hemicellulose, increasing holding water, SP, and oil absorption (Raghavendra et al., 2006). According to the study of Wen, Niu, Zhang, Zhao, and Xiong (2017), structural characteristics and functional properties of rice bran DF were modified by enzymatic hydrolysis (EH) and enzyme-assisted micronization. Degradation of IDF of rice bran with cellulase, xylanase, combination of cellulase and xylanase, micronization, and enzyme-assisted micronization treatments increased the SDF content by 3.8, 4.7, 3.5, 10, and 11.4 fold, respectively.

EH is one of the biological methods applied on DF. This process can destroy the chemical chains of lignin, cellulose and hemicellulose in the cell wall (Santala, Kiran, Sozer, Poutanen, & Nordlund, 2014). With accelerating interactions between cellulase and substrates (cellulose and hemicellulose) (Bourbonnais & Paice, 1990), DF network with porous structure, and declined the contact rate between amylase and starch molecules, which reduced-amylase activity (Chau et al., 2007). Therefore, increasing hydrophilic groups, surface area, water-binding sites, improving the conversion of IDF to SDF, and reducing particle sizes in addition to bulk density,

which were improved swelling and water retention capacity (Chau, Wang, & Wen, 2007).

Different treatment methods have different effects on DF structure. The use of acid and alkali treatment will damage the molecular structure of the fiber, but EH extract DF in mild conditions (de Moraes Crizel, Jablonski, de Oliveira Rios, Rech, & Flôres, 2013; De Vries, Pustjens, Schols, Hendriks, & Gerrits, 2012).
Commonly used enzymes in DF treatments are cellulase, xylanase and Viscozyme L (including xylanase, cellulase and hemicellulase). Cellulase is the general name of a group of enzymes which degrade cellulose. This biological material is employed for modifying DF structure and improving functional properties of these substances in addition to increasing SDF extraction yield (Elleuch et al., 2011; Tejada-Ortigoza et al., 2015). Wang et al. (2020) used cellulase to modify the ginger residue IDF, and found that water retention capacity, SP, oil retention capacity of modified ginger residue IDF increased by 22.45%, 33.85%, and 36.26%, respectively. Meanwhile, the modified ginger residue IDF exposes more hydrophilic groups and specific surface area, thus significantly reduces total cholesterol, triglyceride and atherosclerosis index, but increases the high density lipoprotein cholesterol. Furthermore, cellulase enhanced the sodium cholate binding capacity and hydroxyl radical scavenging activity of potato pulp SDF (Cheng et al., 2017), the SDF content, WHC, SC of tartary buckwheat bran DF (Zhou, Qian, Zhou, & Zhang, 2011), and the WHC, SC, cation exchange capacity, α-amylase inhibition activity, glucose dialysis retardation index of coconut cake DF (Zheng & Li, 2018).

Xylanase is a commonly called as a class of enzymes that degrade xylan. It is widely distributed in nature and could be obtained from animals, plants, and microorganisms which including β-1,4-endoxylanase, α-D-glucuronidase, α-L-arabinosidase, β-xylosidase etc. Zhu et al. (2019) claimed that DF in foxtail millet bran was extracted 2.23-fold more than the untreated material by xylanase hydrolysis for 2h at 50°C. In the work of Cheng et al. (2017), after extraction by xylanase hydrolysis on the potato pulp it was found that better functional properties in SDF for pancreatic lipase inhibitory activity, amylase inhibitory effect and glucose dialysis retardation index.

Viscozyme L was used for modifying tomato peels SDF by Gu et al. (2020). In the end of the treatment, SDF in the tomato peels enhanced lycopene content and glucose adsorption capacities (Gu et al., 2020).

After complex enzyme application for DF modification, the structure of carrot IDF modified by enzymes became loose and porous, and it was easy to form a network structure with water molecules and glucose molecules, so that the water retention capacity, oil retention capacity and glucose adsorption capacities of carrot IDF modified by enzymes became stronger. Particle size of untreated carrot IDF was greatly reduced and the specific surface area was increased after ultrafine comminution (Yu et al., 2018).

To sum up, chemical treatments cause contaminant releasing after reacting with strong alkali, acids, or solvents in addition to time-consuming (Mateos-Aparicio, Mateos-Peinado, & Rupérez, 2010). On the other hand, biological methods are generally expensive due to requiring purified enzymes (Ma & Mu, 2016b). Moreover, physical treatments are prominent methods for providing DF modification such as HP homogenization, HP hydrostatic, ultrafine grinding, micro-fluidization, and blasting extrusion (Ma & Mu, 2016b). Therefore, it is better to employ physical methods and to optimize the extraction parameters or combine them in mild conditions.

1.4.4 Combination of modification treatments

Considering the previous studies, mild thermal and non-thermal methods were mostly used together for DF extraction. One of them is the combination of pressure and heat applications. High hydrostatic pressure together with thermal treatment was employed to modify the physicochemical properties of DF in white cabbage (Wennberg & Nyman, 2004), okara (soybean residue) (Pérez-López, Mateos-Aparicio, & Rupérez, 2017), orange peel (Tejada-Ortigoza, Garcia-Amezquita,

Serna-Saldívar, Martín-Belloso, & Welti-Chanes, 2017), sugar beet pulp (Huang et al., 2020), cactus and ginseng (Hoon et al., 2013; Kim, Park, Yu, Imm, & Suh, 2014).

In addition, the combined effect of HP and degrading enzymes could be even more effective for SDF maximization and preserving foods and agrofood by-products. Additionally, the HP–enzyme treatment contributed to small fragments and cell wall disintegration. The particle size reduction and structural changes after HP–enzyme treatment decreased bulk density, increased surface areas, and capillary attraction of fiber, therefore would theoretically be able to hold more oil (Chau et al., 2007). SDF content increased by hydrolysing cell wall polysaccharides and carbohydrates from matrix releases (San Martín et al., 2002). In the study of Wennberg & Nyman (2004), not only SDF content, but also TDF increased by combined effect of HP and EH. Pérez-López et al. (2017) stated that Viscozyme L (including xylanase, cellulase and hemicellulase) activity improved under HP and IDF of okara was hydrolyzed more than solely the enzyme treated samples. When Viscozyme L (0.025% w/w) assisted by HP at 600 MPa for 30 min was applied to okara, total carbohydrate and polysaccharide content increased 2.50 and 3.20 times, thus content was 13.53% and 4.27%, respectively. HP at 600 MPa aided by Ultraflo L (containing xylanase and cellulase) was applied on okara and SDF increased twice compared to the measured in the untreated sample (Pérez-López, Mateos-Aparicio, & Rupérez, 2016a). Moreover, in the study on the deoiled cumin, it was found that SDF content increased from 10% to 30.37% by HP aided by laccase and cellulase (Ma & Mu, 2016b).

Another combined treatment is the MW-assisted chemical application. M. Li et al. (2014) reported that size of the cellulose fibers reduced after MW-aided alkaline treatment. Similarly, when grapefruit peel was subjected to 1% (w/w) sodium hydroxide with 500 W and 80ºC combination for 40 min, SDF content increased (J. Gan et al., 2021).

Ultrasound is an emerging technology and could be performed together with heating. Xu et al. (2014) explored the influence of ultrasound and heat treatment on the yield pectin extraction from grapefruit peel. It was reported that the combined heat (at

60ºC) and ultrasound increased the extraction rate of pectinin the first 20 min of process as compared to the sample treated with either heating or ultrasound.

When citrus peel DF was treated with sodium hydroxide (0.5 M) and HP homogenization (at 7000 rpm), SDF content increased with improving WHC, SC, and oil adsorption capacity, but decreasing hemicellulose content (Zhang, Liao, and Qi (2020). Consequently, the combined processes could increase the amount of SDF more than a single process.

1.5 Incorporation of Dietary Fiber into Bakery Products

DF extracted from different sources is utilized in the production of high fiber breads, biscuits, and cakes. The effect of DFs on the product quality depends on the form and components of DFs, and the concentration in formulation in addition to the structure of DF (Foschia, Peressini, Sensidoni, & Brennan, 2013). It is evident in the literature that DF influences the dough properties such as improving water absorption of dough, increasing development time, decreasing mixing stability, changing extensional properties, viscous and elastic moduli of dough significantly. It also affects the physical properties of baked products. In bakery products, DF incorporation results in decreased loaf volume of bread, height of cake or muffin, and spreading of biscuit. In addition it alters texture (especially hardness and crispiness) appearance and taste. To eliminate these problems, it is required to modify DFs structure (Quiles, Campbell, Struck, Rohm, & Hernando, 2018).

1.5.1 Bread

Bread is a baked product whose ingredients are flour, water, salt, and yeast. During bread making, biochemical and chemical-physical changes occur, which affect various constituents. Among the ingredients, flour and water are the main ingredients in a bread recipe and they affect texture and crumb the most. Other ingredients

contribute sensory attributes and technological functions of the product (Barbarisi et al., 2019).

With incorporation of DF, rheological defects might occur in bread dough and some quality problems in the final product. The addition of DFs usually results in a physical interfering effect and water competition between DFs and gluten (Bock & Damodaran, 2013), which collectively weakens the glutenin network and redistributed the water molecules in the system. The change in gluten (as a skeleton component) directly influences the quality of the dough (Feng et al., 2020). Stojceska and Ainsworth (2008) observed a decrease in loaf volume and an increase in crumb firmness when wheat flour was substituted with brewer's spent grain at levels of up to 30%, and similar results have been reported by Katina, Salmenkallio-Marttila, Partanen, Forssell, & Autio (2006); Salmenkallio-Marttila, Katina, & Autio (2001); Wang & Rosell et al. (2002). The addition of β-glucan could lead to an increase in mixing time and decrease in extensibility of the bread dough (Ahmed & Thomas, 2015). Dough with 1%–5% β-glucan extracted from oat had a higher farinograph water absorption, dough development time, and resistance to deformation, but a lower dough weakening degree, extensibility, viscosity, and retrogradation value.

One of the reasons explaining the negative effects of DF incorporation into the bread dough is the dilution of the gluten forming proteins. The development of a gluten network during bread baking is essential, as this will affect the properties responsible for gas retention and dough development then consequently loaf volume, crumb structure and texture. However, this is not the unique reason. Available water for gluten development is another factor (Autio, 2006). On the other hand, the components such as epicarp hair, bran and aleuroneepericarp particles disrupt the starch-gluten matrix and act as points of weakness in an expanding dough system causing the gas cells to expand in a particular direction. This greatly influences the ability of dough to expand and retain gas and hence affect the volume and the crumb structure of the baked product (Z. Gan, Ellis, Vaughan, & Galliard, 1989; Z. Gan, Galliard, Ellis, Angold, & Vaughan, 1992). M Wang et al. (2003) and M. Wang, Oudgenoeg, van Vliet, and Hamer (2003) reported that non-starch polysaccharides

decrease gluten yield (up to 20%) thus resulting in less extensible gluten due to restricting the water available for gluten development through interfering with gluten formation. However, it is possible to improve the quality of the product by modifying the DF. The alternatives in DF modifications provides to increase quality of the DF enriched bread.

Micronization is one of the modification methods before DF is incorporated into bread formulation. Chau, Wang, and Wen (2007), demonstrated that physicochemical properties of carrot IDF depend not only on the extent of grinding (DF particle size) but also on the grinding method DFs are incorporated into bakery products to prolong freshness, thanks to their capacity to retain water, thereby reducing economic losses. Therefore, it is possible to improve bread loaf volume, its springiness, the softness of the bread crumb and the firmness of the loaf (Sangnark & Noomhorm, 2004; Wang, Rosell, & Barber, 2002). Bread prepared with smaller sized fibers from sugarcane, was more tender and elastic than with coarser fibers (Sangnark & Noomhorm, 2004).

Moreover, a well-structured polysaccharide network formation leads dough to hold gas bubbles, constructing an open cellular crumb structure in bread. Some DF concentrates (mango, potato peel) have been utilized for this purpose making them a suitable ingredient (Kaack, Pedersen, Laerke, & Meyer, 2006; Mills, Wilde, Salt, & Skeggs, 2003; Vergara-Valencia et al., 2007).

1.5.2 Cake

Similar to bread, some DF resources are also utilized in cake formulation such as different cereal bran (Shafer and Zabik, 1978); sunflower hull flour (Dreher and Padmanaban, 1983); apple pomace (Wang and Thomas, 1989); and potato peel (Arora and Camire, 1994). Sharoba et al. (2013) used potato peel, green pea peel, orange waste, and carrot pomace as an ingredient of cake. The volume and extensibility decreased whereas dough stability, dough development, and water

absorption increased with increasing orange waste, carrot pomace, potato peel, and green pea peel content in cake from 0 to 20% of (Sharoba, Farrag, & Abd El-Salam, 2013). Textural attributes were affected by replacement levels of DF. All the DF enrichments caused an increase in hardness compared to the texture of the control sample (Sharoba et al., 2013). Especially, the hardness increased in cake by 56% with 20% green pea peel addition. DF changed the texture of the product due to improving water and oil adsorption as reported by Sowmya, Jeyarani, Jyotsna, and Indrani (2009). It is showed that 20% of potato peel, or green pea peel addition into cake formulation weakened the sensory characteristics (tenderness, softness, flavor, overall acceptability) regarding the score of the control cake. However, cakes with 5% or 10% of orange waste and carrot pomace were rated similar with the control (p>0.05) (Sharoba et al., 2013). In the study of Sudha et al. (2007), the volume of cakes decreased from 850 to 620 cm^3 with increase in apple pomace ingredient of the cake from 0% to 30%. The sensory attributes of the cake batter enriched at most with 5% of peach or prickly pear were deemed as compatible with the properties of the control (Ayadi, Abdelmaksoud, Ennouri, & Hamadi, 2009; Grigelmo-Miguel, Carreras-Boladeras, & Martín-Belloso, 1999). In the cakes enriched with guava pomace, water absorption decreased and dough stability increased (Khalifa, Barakat, El-Mansy, & Soliman, 2016). Decreasing water absorption might depend on protein content and interaction of DF with the protein and starch molecules, in addition to particles size specification (Milan & Cameron Smith, 2015; Park & Baik, 2002; Rosell et al., 2001; Simmonds,1989). The impact of by-products on extensibility, resistance to deformation, elastic resistance and extensibility balance, and deformation energy changed. Resistance to deformation raised after potato peel incorporation into cake batter whereas it decreased with grape pomace enrichment (Ben Jeddou et al., 2017; Bender et al., 2016). Cake with potato peels and grape pomace decreased deformation energy (Ben Jeddou et al., 2017; Bender et al., 2016). Belghith Fendri, Chaari, Kallel et al. (2016) reported that the enrichment of cake with broad bean pod and pea pod increased deformation energy. Enrichment of cake with banana pomace, specific volume decreased depending on gluten network and

gas retention (Chen, Rubenthaler, & Schanus, 1988; Martins, Pinho, & Ferreira, 2017). In addition, moisture loss decreased, subsequently height of the product increased due to higher content of DF with strong water binding properties (Sudha et al., 2007). By-products containing high SDF used as a substitute for wheat flour positively affect the textural and rheological properties of the cake. (Sudha, Baskaran, et al., 2007). According to Martins et al. (2017) hardness and chewiness improved consistently, but cohesiveness decreased with DF addition into cake. Alteration in hardness could result from amylose and amylopectin matrix as well as from interactions between gluten and TDF (Gomez et al., 2003; Hoseney, 1994; Schiraldi & Fessas, 2000). In addition, interactions between gelatinized starch and gluten batter influence cohesiveness, springiness, and chewiness (Hoseney, 1994; Plyer, 1988).

A darker colour is observed during crust formation of cake (wheat) with addition of by-products (Bender et al., 2016; Bitencourt et al., 2014; Majzoobi et al., 2013; Noor Aziah et al.,2011; Rupasinghe et al., 2009; Walker et al., 2014). It was determined that the lightness scores of the crust of the cakes enriched with DF decreased. It could be attributed to Maillard and caramelization reactions in addition to original colour of by-product such as mango peel and pulp (Noor Aziah, Lee Min, & Bhat, 2011), pumpkin seed (Bitencourt, Dutra, Pinto, Helbig, & Borges, 2014), rice bran (Majzoobi, Sharifi, Imani, & Farahnaky, 2013), apple skin (Vasantha Rupasinghe, Wang, Pitts, & Astatkie, 2009), grape pomace (Walker, Tseng, Cavender, Ross, & Zhao, 2014). The original colour of the additives increased redness score of the crumb of the cakes as well (Martins et al., 2017).

Sudha, Baskaran, et al. (2007) also added apple pomace into a cake batter and found that as the level of substitution increased, the volume of the cakes decreased and the density and hardness increased. Similar results were observed by Vasantha Rupasinghe et al. (2009), but in contrast to this, Gómez, Moraleja, Oliete, Ruiz, and Caballero (2010) reported a significant increase in volume of cakes with oat DF enrichment due to coarse size of the particles. Cakes with up to 24% DF addition had higher volume (626 mL) than the control (508 mL). When 36% of the flour was

substituted with DF, the volume decreased to 569 mL but it was still higher than the control. With the addition of 12% DF, the firmness, elasticity, cohesiveness, and resilince of the cake did not differ statistically compared to the control, but the chewness decreased. Especially with 20% wheat bran, large-sized DF caused the most firm, chewy and yellow cakes (Gómez et al., 2010).

1.5.3 Biscuit

The term 'cookie', or 'biscuit' refers to a baked product generally containing three major ingredients, flour, sugar, and fat. Compared with bread and cake, biscuits contain a very low amount of water, which in turn results in crispy texture. If products are low in moisture, it is difficult to prepare them without fat, which is very important for tenderness and mechanical handling. Fat (shortening) ingredient lubricates, coats, and segregates the flour particles during mixing of the biscuit dough, interrupting the formation of a cohesive gluten network, which leads to the formation of soft texture. It also has a critical role in enhancing the shelf life of products by delaying the transport of water into the starch granule. However, it causes substantial health problems, such as obesity, high blood cholesterol, and coronary heart disease (Manley, 2000).

Negative effects on biscuit characteristics have been detected when flour was substituted with DF such as orange pulp (Larrea et al., 2005), brewer's spent grain (Ozturk, Ozboy, Cavidoglu, & Koksel, 2002), wheat bran (Gujral, Mehta, Samra, & Goyal, 2003), lemon, apple, and mango fibers (Ajila et al., 2008; Uysal et al., 2007). The adverse effects generally refer to increased hardness, loss of crispiness and reduced spread ratio. On the other hand, less negative impacts were determined in the study of Brennan & Samyue (2004), for example non-significant effects on the textural and physical characteristics of biscuits supplemented with inulin, potato DF, resistant starch and β-glucan enriched flour. Laguna et al. (2011) substituted wheat flour with resistant starch-rich ingredients in biscuits. The results depended on the source and the composition of the DF nature.

Except for pomaces from blackcurrant, elderberry, rosehip, rowanberry, and cakes from ground nut and soybean, the addition of by-products functional components affects the physical features of biscuits such as thickness and diameter, and spread ratio (Behera et al., 2013; Tanska et al., 2016). The proportion between width and thickness determines the spread ratio, inversely related to consistency and diameter. These changes can be linked to gluten and TDF concentration and structure (Ajila et al., 2008; Leon, Rubiolo, & Anon, 1996; McWatters, 1978; Srivastava et al., 2014). As stated by Miller, Hoseney, and Morris (1997), Creating a continuous gluten network increases viscosity and inhibits the flow of biscuit dough, resulting in biscuits that are thicker, smaller in diameter, and have a larger spread ratio. Using by-products as functional ingredients dilutes the gluten network, lowering dough viscosity, increasing diameter, and spreading the balance. In addition, the preferred water uptake of TDF increases the number of hydrophilic sites available to compete for the limited amount of free water in the biscuit dough (McWatters, 1978). This causes a rapid dispersion of free water over these hydrophilic areas during dough kneading, which increases the dough's viscosity. As a result, the spread of the biscuits during baking is limited, which leads to an increase in the thickness of the biscuits and a consequent decrease in the diameter and spreading coefficient (McWatters, 1978). Sponge cake texture parameters such as breaking strength / breaking force / breaking force, and hardness are influenced by the addition of DF. A decrease in the breaking strength and hardness of plantain peels, grape seeds, corrugated pumpkin seeds, and corrugated seeds (defatted) is found (Aksoylu, Çağindi, & Köse, 2015; Arun et al., 2015; S. Giami & Barber, 2004; S. Y. Giami, 2005). In the case of biscuits with elderberry pomace, peanut cakes, and soybean cakes, no significant influence on the texture parameters was observed (Behera, Indumathi, Mahadevamma, & Sudha, 2013; Tańska et al., 2016). The breaking strength and hardness of biscuits are influenced by the interaction between proteins and hydrogen bonds between proteins and starch (Kumar, Sharma, Khan, Govindaraj, & Semwal, 2015). If total protein content increases but gluten is reduced, or if TDF causes a

dilution of gluten, there can be an increase in breaking strength and hardness (Pineli et al., 2015).

1.6 Objective of the Study

Sour cherry is a popular product because of its fruity flavor, intense color, and refreshing taste and appearance. Recently, the consumption and production of this fruithas increased due to consumer awareness of its health benefits which are derived from high content of various antioxidative compounds (melatonin, anthocyanins, hydroxycinnamic acids etc.). However, sour cherry is usually not consumed fresh due to its acidulous taste. It is used in juice, jam, dried and frozen fruit production. It is known that among these products, a high amount of by-product is obtained, especially in the juice industry.

Worldwide, the Republic of Turkey is the second country in sour cherry production. A total of 0.5 million tonnes/year sour cherry pomace (SCP) is generated worldwide, 0.2 million tonnes of which is in Turkey. The pomace is rendered as an animal feed or dumped in landfills which leads to substantial economic loss. In fact, SCP which is the main carrier of bioactive compounds in the fruit. This by-product was characterized by high polyphenol contents including anthocyanins, hydroxycinnamic acids and flavonoids and high antioxidant capacity. Moreover, TDF content in the SCP accounted for 71.44%. The amounts of lignin and cellulose accounted for 87% of this rate. These molecules might mimic conventional fats with some modifications due to its hydrating properties.

DFs have physiological health effects. These compounds interact with the other food components and can potentially interfere with metabolism and absorption. DF also provides numerous benefits to health including reduced cardiovascular diseases, risks of cancer, diabetes, and asthma. On the other hand, several intervention studies have demonstrated that SDF was more beneficial to human health than IDF. For this reason, it is required to extract as much SDF as possible.

Novel technologies in modification and extraction of DF become commercially available to the food industry. There is significant interest not only in their capacity to produce superior quality products, but also in their energy saving potentials within a short processing time. One of them, MW treatment facilitates the release of DF with bioactive compounds. It is declared that this technology can improve SDF content up to three times compared to conventional heating. HP processing has potential for food preservation purposes due to the fact that the elevated pressure inactivates microorganisms and enzymes. HP can also effectively promote the physical, chemical, and functional properties of DF. Additionally, the impacts of this treatment are provided with low operating cost and robust sustainability.

Gentle extraction methods assisted with emerging technologies were performed to valorize pomace obtained from olive, chokeberry, pear apple, carrot, and pineapple. However, these studies include neither the characterization of the product, which was enriched with both DF powder (PSCP) and its isolates (IDF and SDF) nor the comparison of the effects of DF fractions on the product properties.

Therefore, the objective of this work is to increase SDF content and also to improve physicochemical, morphological and antioxidant properties of the PSCP through the combination effect of MW, HP and EH treatments. In addition, it was aimed to investigate the effects of incorporation of PSCP and its isolates (IDF and SDF) into biscuit dough on physical properties of dough and quality of biscuits.

CHAPTER 2

MATERIAL AND METHODS

2.1 Materials

SCP was obtained from a juice processing company (Dimes Fruit Juice Company, Tokat, Turkey). Firstly; stones, stems, and leaves were removed from the sample manually. Then the remaining portion was dried in a hot-air tray-dryer (Harvest Saver, USA) at 60°C for 48 h with a relative humidity of 30%. The dried samples were ground and passed through 200-mesh (74-μm) sieve (Endecotts, London, England). It was denoted as PSCP. The samples were sealed in a food grade plastic bottle and stored in refrigerator. The proximate composition of the PSCP consisted of 5.11% moisture, 3.31% ash, 12.95% crude protein, 4.85% crude fat, and 73.89% total carbohydrates (dry basis).

2.2 Methods

2.2.1 Preparations of PSCP, SDF, and IDF

2.2.1.1 Pretreatment of PSCP

Firstly, the PSCP samples (20 g) were dispersed in 50 Mm citrate buffer solution (100 mL) at pH 5.0 in low-density polyethylene pouches (Whirl-Pak, USA) and placed in a refrigerator for 24 h for a complete hydration. Then, these samples sealed and stored in food grade plastic bottles under 0-4 °C until they were used for measurements.

2.2.1.2 Microwave treatment

Primarily, IMPI 2- liter test was used to determine the power of the MW oven (Panasonic Inverter, NN-ST651W, Osaka, Japan) (Uygun, Yildiz, Sumnu, & Sahin, 2020). Then, the samples were treated with MW at 850 W for 60 s

2.2.1.3 High hydrostatic pressure treatment

HP equipment (QFP 2L-700 Avure Technologies, Ohio, US) with 100 mm diameter and 254 mm height pressure vessel at 27±2°C.The samples were subjected to 300 MPa for 15 min, or 600 MPa for 15 min. Non-pressurized samples were assumed to be at atmosphere pressure (0.1 MPa). After processing, the alteration of temperature were negligible. The compression and decompression rates were 4.2 MPa/s and 40 MPa/s, respectively.

2.2.1.4 Enzymatic treatment

Lyophilized endogenous cellulase enzyme (from *Trichoderma reesei* -fungus-, standard activity is 6000 U/g) was provided from Orba Biochemistry Corp. (İstanbul, Turkey). PSCP sample of 20 g was wetted in 200 mL of 50 mM citrate buffer solution, 20 mg of cellulase powder was added in ratio of enzyme/sample 0.1% (w/w). Subsequently, the samples were subjected to HP at two different pressures (300 or 600 MPa) and TT.

2.2.1.5 Conventional heating

In conventional heating (thermal treatment), samples were heated in water-bath at 60℃ for 60 min. It was followed by denaturating the enzyme in boiling water-bath for 5 min.

2.2.1.6 Combinations of the treatments

The PSCP samples were subjected to individual or the combination of MW, HP, EH, and TT. All the treatments were listed and explained in detail in Table 1.

2.2.1.7 Isolation of SDF and IDF

To remove sugar moieties, PSCP was washed out four times with 85% ethanol in 1:10 (v/w) ratio. Then, the samples were centrifuged, supernatants were discarded and the precipitates, containing TDF, were dried at 40°C in a hot-air drier until 5% moisture content. SDF and IDF were isolated from the dried precipitate by following AOAC 991.43 procedure using an automated DF analyzer (Ankom, NewYork, USA) (Lee, Prosky, & Vries, 1992).

2.2.2 Analysis of the treated PSCP, SDF, and IDF

2.2.2.1 Dielectric properties measurement

The dielectric properties of the untreated PSCP samples were measured by the MW network analyzer (N5234A PNA-L, Keysight Technologies, Santa Rosa, California, US) with an open-ended coaxial cable connected to a dielectric probe (N1501A, Keysight Technologies). For accurate results, network analyzer was switched on 1h prior to the calibration. The calibration steps follow measuring the properties of air, short-circuit block, and water at 25°C. Particularly, the open-ended coaxial probe requires cable stability along with absence of air bubbles on the interface of probe and samples, to obtain correct results. Values of the dielectric constant ε' and the loss factor ε'' were determined to be 78 and 12.5 respectively for water, as control data. Noise cancellation was done in the response curve of dielectric properties. The measurements were taken for approximately 30 mL of slurries prepared with distilled water (10% [w/v]) by using different particle-sized (298-595, 150-297, 149-106, 75-

105, and <74 μm) PSCP samples in polypropylene centrifuge tubes. All experiments were carried out in the frequency range of 500 to 3500 MHz at 20 °C. Results were recorded 915 and 2450 MHz frequency values. The penetration depth (*Dp*) was calculated via Equation [1] and declared as "cm" (Von Hippel, 1954).

$$D_p = \frac{\lambda_o}{2\pi\sqrt{2\varepsilon'\left(\sqrt{1+\left(\frac{\varepsilon''}{\varepsilon'}\right)^2}-1\right)}} \quad [1]$$

Table 1 The selected individual and combination treatments applied to PSCP

Number	Treatment details
1	Control (no treatment)
2	Thermal treatment (TT) at 60°C/60 min followed by heating at 100°C for 5 min
3	Enzymatic hydrolysis (EH) at 60°C/60 min followed by heating at 100°C for 5 min for the enzyme inactivation
4	High-pressure (HP) at 300 MPa/15 min (HP300)
5	HP at 600 MPa/15 min (HP600)
6	TT at 60°C/60 min followed by heating at 100°C for 5 min followed by HP at 300 MPa/15 min (TT-HP300)
7	TT at 60°C/60 min followed by heating at 100°C for 5 min followed by HP at 600 MPa/15 min (TT-HP600)
8	Enzyme addition (E) followed by HP at 300 MPa/15 min (E-HP300)
9	Enzyme addition (E) followed by HP at 600 MPa/15 min (E-HP600)
10	Microwave (MW) heating at 850 W for 60 s
11	MW heating followed by EH at 60°C/60 min and heating at 100°C/5 min for the enzyme inactivation (MW-EH)
12	MW heating followed by HP at 300 MPa/15 min (MW-HP300)
13	MW heating followed by HP at 600 MPa/15 min (MW-HP600)
14	EH at 60°C/60 min and heating at 100°C/5 min followed by HP at 300 MPa/15 min (EH-HP300)
15	EH at 60°C/60 min and heating at 100°C/5 min followed by HP at 600 MPa/15 min (EH-HP600)
16	MW heating followed by HP at 300 MPa/15 min with E (MW-E-HP300)
17	MW heating followed by HP at 600 MPa/15 min with E (MW-E-HP600)
18	MW heating followed by EH at 60°C/60 min and heating at 100°C/5 min followed by HP at 600 MPa/15 min (MW-EH-HP600)

where π is a constant with approximate value 3.14, $\lambda_{\circ} = \frac{c}{f}$ refers to the wavelength in free space, c is the velocity of light in free space (3×108 m/s), and f is the frequency.

2.2.2.2 DF assay

Firstly, to remove sugar moieties, PSCP samples were washed out four times with 85% ethanol in 1:10 (v/w) ratio. Then, the samples were centrifuged, supernatants were discarded and the precipitates, containing TDF, were dried at 40°C in a hot-air drier until a constant weight was achieved. After that, the automated IDF/SDF procedure (AOAC 991.43) (Lee & Prosky, 1992) was applied by using Dietary Fiber Analyzer (ANKOM, NewYork, US) as illustrated in Figure 2. This method determines high molecular weight dietary fibers (HMWDF) including water and alcohol insoluble DF (IDF), also water soluble but alcohol insoluble DF (SDFP). SDFP was referred to as SDF in this paper. The DF results were corrected by ash and protein content (AOAC, 1990).

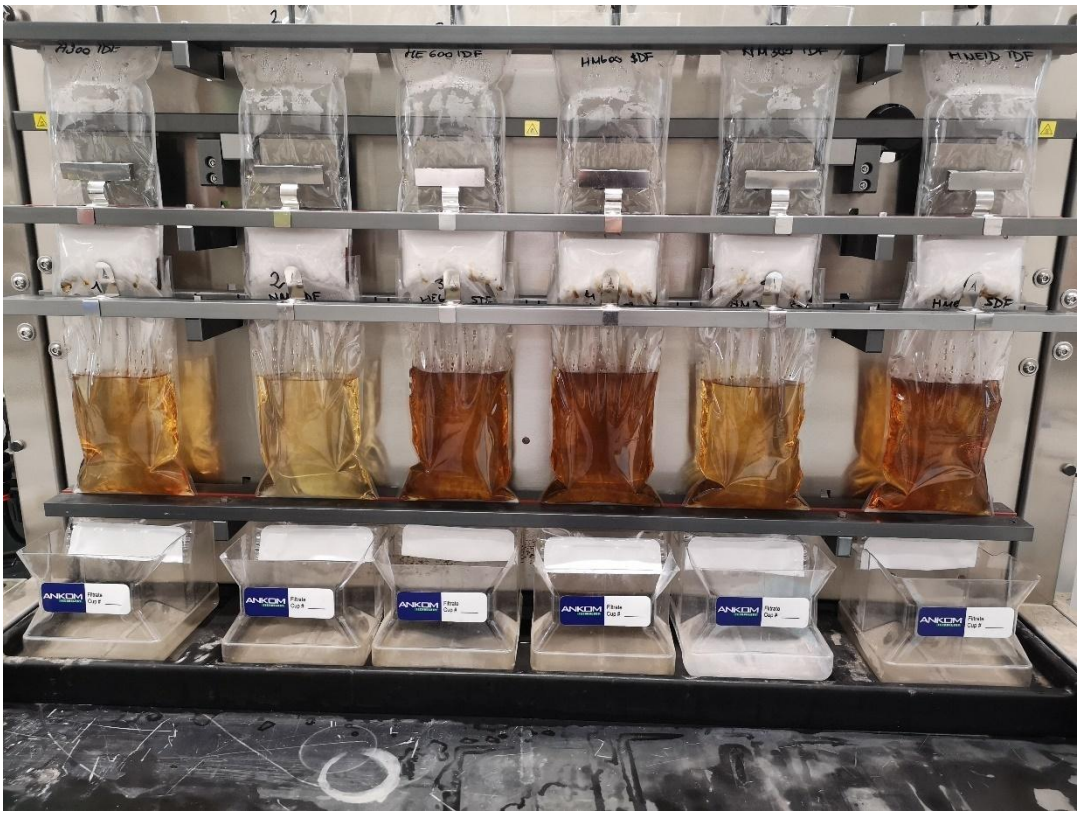

Figure 2 Dietary fiber analyzer

2.2.2.3 Microstructure

The microstructure and morphology of the samples (SDF, IDF and PSCP) were examined through a scanning electron microscope (JEOL, JSM-5410LV, Tokyo, Japan). Each sample was coated with gold in a sputter coater (Structure Probe, West Chester, PA) for 4 min before being scanned and photographed at the ×1500 magnifications. An accelerating potential of 5 kV was used during micrography.

2.2.2.4 Functional properties

The functional properties such as SP, WHC, solubility index (SI), sediment volume fraction (SVF), and OHC of the PSCP samples were measured at 25°C by using the centrifugal technique (J. Gan et al., 2020) with some modifications. Samples of 0.5 g of were dispersed in 20 mL of deionized water and vortexed for 1 min. The

dispersion was incubated at 25°C overnight. Then, it was centrifuged (Beckman GS-6R, CA, US) at 2500×g for 30 min. The supernatant was decanted to pre-weighted beaker and kept at 105°C until evaporated. SP, WHC, SI, SVF of the PSCP samples were calculated according to Equations [2-5]. In order to determine OHC, 10 mL of sunflower oil was transferred to 100 mg sample in a 50 mL centrifuge tube and stirred well. The resultant mixture was centrifuged (Beckman GS-6R, CA, US) at 1500 g for 30 min and OHC was calculated according to Equation [6].

$$\text{SP [g/g]} = \frac{\text{sediment weight}}{\text{dry sample weight}} \quad [2]$$

$$\text{WHC [g/g]} = \frac{\text{water absorbed by sample}}{\text{dry sample weight}} \quad [3]$$

$$\text{SI [\%]} = \frac{\text{dried supernatant weight}}{\text{sample weight}} \text{x100} \quad [4]$$

$$\text{SVF [\%]} = \frac{\text{sediment height}}{\text{total dispersion height}} \text{x100} \quad [5]$$

$$\text{OHC [g/g]} = \frac{\text{oil absorbed by sample}}{\text{sample weight}} \quad [6]$$

2.2.2.5 Determination of total phenolic content

Total phenolic content measurement on PSCP samples was performed by Folin Ciocalteu method. To extract phenolic compounds, 1 mL of solvent, ethanol:acetic acid: water (50:8:42), was added to 100 mg of sample (Cilek Tatar, Sumnu, & Oztop, 2019). Then, it was vortexed for 1 min. The extract was filtered through 0.45 μm filter and 2.5 mL of 0.2 N Folin–Ciocalteau reagent (Merck, Mumbai, India) was added to 500 μL of the filtered solution and vortexed. Then, the solutions were kept in dark at 25°C for 5 min. After 2 mL of 75 g/L sodium carbonate (SD Fine-Chem Limited, India) solution was added, the sample and buffer solutions were stored in the dark place for 1 h. The absorbance values of the solutions were measured at 760

nm by using UV-Vis spectrophotometer (Thermo Scientific, Madison, WI, US). Results were reported as gallic acid equivalents.

2.2.2.6 Total antioxidant capacity

Antioxidant capacity of PSCP samples was evaluated following the DPPH˙ (2,2-Diphenyl-1-picrylhydrazyl) method (Cilek Tatar et al., 2019). The samples were accurately weighed as 100 mg and dissolved in 1 mL ethanol:acetic acid:water mixture (50:8:42 v/v). This suspension was vortexed for 60 s. The liquid part was filtered with 0.45 µm syringe filter (Thermo Fisher Scientific, US). Then, 3.9 mL of 25 ppm DPPH˙ radical solution was added to 100 µL of methanol and the absorbance of blank (methanol) was measured at 517 nm by using UV-Vis spectrophotometer (Thermo Scientific, Madison, WI, US). Following the measurement, the sample solutions of 100 µL were mixed with 3.9 mL of 25 ppm DPPH˙ solution and stored in the dark place at 25°C for 1 h. The absorbances of the sample solutions were measured. The results were expressed as mmol DPPH/100 g.

2.2.2.7 Color

The color values of the biscuits were detected in a Color Flex colorimeter (Hunter, Reston, VA) according to the method described by Canadian Grain Commission (2012). The instrument was calibrated with the standard tiles (white and black). Then, the color value of white tile was taken as a reference (L_o = 93.77, a_o = -1.02, and b_o = -0.42) and color difference *(ΔE^*)* was calculated using the Equation [7]:

$$\Delta E^* = \sqrt{(L_o - L)^2 + (a_o - a)^2 + (b_o - b)^2} \quad [7]$$

2.2.3 Biscuit preparation and enrichment

The full-fat biscuit (C30) was prepared using 100% all-purpose wheat flour (with 28.71% wet gluten, KFM, Kuwait), 60% sucrose (SIS, Singapore), 30% shortening

(Crisco, US), 21.75% water, 3% non-fat milk powder (Regilait, France), 2.5% sodium hydrogen carbonate (LobaChemie, India), and 0.47% sodium chloride (LobaChemie, India) on flour basis according to the AACC Method 10-52 Sugar Snap Cookies Micro Method.

Table 2 Biscuit dough formulation

Sample ID	Wheat flour (g)	Shortening (g)	PSCP (g)	IDF (g)	SDF (g)	Water (mL)
C30	100	30				21.75
C20	100	20				21.75
C10	100	10				21.75
C10+U-SDF	100	10			2	32.63
C10+MW-SDF	100	10			2	32.63
C10+MW-HP600-SDF	100	10			2	32.63
C10+MW-EH-HP600-SDF	100	10			2	32.63
C10+U-IDF	100	10		2		32.63
C10+MW-IDF	100	10		2		32.63
C10+MW-HP600-IDF	100	10		2		32.63
C10+MW-EH-HP600-IDF	100	10		2		32.63
C10+U-PSCP	100	10	2			32.63
C10+MW-PSCP	100	10	2			32.63
C10+MW-HP600-PSCP	100	10	2			32.63
C10+MW-EH-HP600-PSCP	100	10	2			32.63

Other ingredients for each cookie dough formulation: 60 g sugar, 3 g skim milk powder, 2.5 g sodium hydrogen carbonate and 0.47 g salt.

To investigate the effects of the fat reduction, shortening ratio in the biscuits decreased from 30% to 20% and 10%, respectively (C20 and C10). In biscuits containing 10 % shortening the effects of fortifying with 2% (w/w) untreated or the

treated SDF, IDF, or PSCP were studied. In the SDF, IDF, or PSCP incorporated biscuit formulations, in order for DF to mix homogeneously with other ingredients, the amount of water was increased 1.5 times. Biscuit dough formulations were explained in detail in Table 2. Dough of 20 g was placed in a circular cutter of 60 mm diameter and spread on the surface homogeneously using a mold with a plug. Each run ten pieces of the dough were baked on a perforated tray at 205℃ for 10 min in a real baking oven (NationalMFG., Nebraska, US). The biscuits cooled down at room temperature for 30 min then subjected to the measurement.

2.2.4 Analysis of biscuit dough and biscuit

2.2.4.1 Textural properties of the dough and biscuits

The two-bite test (TPA) of the biscuit dough was performed using the penetration test mode of TA-XT Plus Texture Analyzer (Stable Micro Systems, Surrey, England). Sample of 110 g was filled in a cylindrical sample holder of the dough preparation set (A/DP). The aeration plunger was pressed into the dough cell to remove the air trapped. Then, the surface of the dough was flattened utilizing the flattening plunger and the sample was covered against moisture loss until measurement. After 15 min for relaxation of the dough, a 6 mm cylindrical probe (P/6) was used to deform the sample at 20 mm from the original height, employing a load cell of 5 kg and trigger force of 5 g at a test speed of 2 mm/sec. Hardness (N), adhesiveness (N.mm), and cohesiveness of the biscuit dough were determined. The baked products were tested for hardness (N) after cooling for 30 min at room temperature through penetration mode using (P/2) probe moving at 3 mm/sec. The maximum force of penetration was reported as the hardness of biscuits.

2.2.4.2 Physical properties of the biscuits

To determine moisture content of the biscuits, they were weighed in 0.0001 g precision balance before and after drying at 105°C until the sample reaches constant weight. The quality parameters (diameter, thickness, spread ratio) of each group of biscuits were also determined according to AACC method 10–52 (Hoseney, 1994). After any three biscuits were laid edge to edge and rotated by 90°, the diameter (D) was measured. These three biscuits were arranged as putting one over another then the thickness (T) was measured on different three points using a digital micrometer (Mitutoyo Corp., Japan). Spread ratio (D/T) was represented as a physical quality attribute which was declared in Hoseney (1994).

2.2.5 Statistical Analysis

The statistical analysis of the experimental data was performed using SPSS Statistics version 23 (IBM Corp., New York, U.S.). The results were subjected to analysis of variance (ANOVA) and the values were presented as mean ± SD (n=3). The significance level was defined as of $p< 0.05$. When a significant treatment effect was detected, a Tukey's HSD test was carried out to compare the means. The correlation between the hardness of dough and biscuit was determined by using Pearson correlation method.

CHAPTER 3

RESULTS AND DISCUSSION

3.1 Physical Properties of the Treated PSCP, SDF, and IDF

3.1.1 Dielectric properties

The frequency-dependent dielectric properties of the untreated PSCP sample were determined in terms of differences in particle size and concentration. According to the results in Table 3, at 915 MHz, the ε' values of the samples were found in the range of 65.28-76.06 and the ε'' values were between 6.71-9.99. At 2450 MHz ε' values were measured as 63.47-74.64, the ε'' values ranged from 10.86 to 12.76. According to the variation in the particle size, if the particle size were lower than 150 μm, the ε' decreased significantly in all the concentrations (5%, 7.5%, and 10%) in 915 and 2450 MHz as well.

The main reason of the differences in ε' values could be related to the water content of the suspension. Water absorption of fine particles was higher than that of course-ground samples due to surface enlargement. Therefore, free water of the medium decreased and then ε' decreased with dielectric polarization (Calay et al., 1994). In addition, water molecules are bound to proteins and starch in finer particles easily, resulting in low ε' (Singh, Kumar, Manohar, & Shukla, 2006). Here, the mechanism is about the decrease in MWenergy absorption because of poor dipolar rotation (Datta, Sumnu, & Raghavan, 2014).

On the other hand, there was no significant difference among the ε'' results of different particle-sized PSCPs. The ε'' is influenced by free and bound water. The reason of that is relaxation of bound water, this contributes into ε'' results slightly in MW frequencies (Datta et al., 2014). Due to the fact that the dielectric properties of the samples were measured in the MW frequencies (915 and 2450 MHz), the ε'' values did not change significantly with decreasing particle sizes. Similar alteration

depending on water content was also observed in macadamia nut kernels (Wang, Zhang, Gao, Tang, & Wang, 2013), wheat (Nelson & Trabelsi, 2006), and some legumes (Jiao, Johnson, Tang, Tiwari, & Wang, 2011) in MW frequency range.

Moreover, the *Dp* was similar in all the particle-sized samples for each concentration in both frequencies. The differences in the *Dp* results were attributed to the variation in ratio of the ε' to the ε'' values.

The purpose of the results in the dielectric properties could be represented as the less available water which is a charge carrier in the suspensions and the field sees fewer polarizable dipole moments per unit volume of sample in the solution could cause to not to change in the ε' of inulin solution (Roebuck, Goldblith, & Westphal, 1972) as resulted in this study.

The influence of the solid concentration on the ε'' parameters was obviously showed in the results of the 10% concentration suspensions. The maximum increase (46%) in the ε'' value at 915 MHz was found in the 10% concentration with respect to the 5% concentration suspension of the 75-105 μm particle-sized sample (details in Appendix A).

In the study of Liao, Raghavan, Dai, and Yaylayan (2003) about the dielectric properties depending on glucose concentration, the ε'' values increased linearly with concentration. Guo, Zhu, Liu, Yue, & Wang (2010) also reported that the highest linear coefficient of determination, 0.995, between the milk concentration and the loss factor at 915 MHz was observed. The increase in the ε'' values was explained with increasing ionic concentration in the sample (Guo, Zhu, Liu, Yue, & Wang, 2010).

Table 3 The particle size and concentration dependent dielectric properties of the untreated PSCP

Sample (µm)	**5%**			**7.5%**			**10%**		
915 MHz[1]	ε'	ε''	D_p	ε'	ε''	D_p	ε'	ε''	D_p
298-595	76.06 ± 1.5^{Aa}	6.88 ± 1.7^{bB}	6.46 ± 1.8^{bE}	69.92 ± 4.2^{Aa}	8.17 ± 0.3^{cC}	5.22 ± 1.6^{cF}	74.82 ± 3.3^{Aa}	9.54 ± 1.0^{dD}	4.63 ± 2.2^{dG}
150-297	72.25 ± 3.6^{Aa}	7.19 ± 1.9^{bB}	6.03 ± 1.7^{bE}	72.48 ± 4.5^{aA}	8.39 ± 1.7^{cC}	5.18 ± 1.9^{cF}	72.14 ± 3.7^{aA}	9.99 ± 1.2^{dD}	4.34 ± 2.0^{dG}
106-149	66.19 ± 4.2^{bA}	6.92 ± 0.9^{bB}	6 ± 1.3^{bE}	67.99 ± 4.0^{bA}	7.79 ± 1.4^{cC}	5.4 ± 0.3^{cF}	70.19 ± 2.3^{bA}	9.69 ± 1.3^{dD}	4.42 ± 0.9^{dG}
75-105	65.28 ± 3.2^{bA}	6.71 ± 1.0^{bB}	6.14 ± 1.1^{bE}	71.1 ± 0.0^{bA}	8.51 ± 2.0^{cC}	5.06 ± 1.1^{cF}	71.89 ± 4.8^{bA}	9.8 ± 0.2^{dD}	4.42 ± 1.7^{dG}
<74	71.21 ± 2.8^{bA}	7.09 ± 1.2^{bB}	6.07 ± 1.1^{bE}	67.22 ± 4.3^{bA}	8.13 ± 1.3^{cC}	5.15 ± 1.5^{cF}	68.69 ± 3.0^{bA}	9.52 ± 0.3^{dD}	4.45 ± 1.2^{dG}
2450 MHz[2]	ε'	ε''	D_p	ε'	ε''	D_p	ε'	ε''	D_p
298-595	74.64 ± 4.3^{Aa}	10.86 ± 1.2^{bB}	1.52 ± 0.7^{bE}	68.07 ± 1.9^{aA}	11.74 ± 1.3^{cC}	1.35 ± 0.0^{cF}	73.01 ± 5.3^{aA}	12.24 ± 0.8^{dD}	1.34 ± 0.0^{dG}
150-297	70.64 ± 3.2^{aA}	11.41 ± 1.2^{bB}	1.41 ± 0.6^{bE}	70.67 ± 4.0^{aA}	12.11 ± 1.2^{cC}	1.33 ± 0.7^{cF}	70.13 ± 3.2^{aA}	12.76 ± 0.1^{dD}	1.26 ± 0.1^{dG}
106-149	64.24 ± 2.8^{Ba}	11.26 ± 0.7^{bB}	1.37 ± 0.7^{bE}	66.19 ± 3.5^{bA}	11.66 ± 1.8^{cC}	1.34 ± 0.0^{cF}	68.23 ± 4.0^{bA}	12.53 ± 0.1^{dD}	1.26 ± 0.1^{dG}
75-105	63.47 ± 3.7^{bA}	11.3 ± 0.5^{bB}	1.35 ± 0.9^{bE}	69.33 ± 4.5^{bA}	11.91 ± 1.9^{cC}	1.34 ± 0.1^{cF}	69.99 ± 3.3^{bA}	12.52 ± 0.1^{dD}	1.28 ± 0.1^{dG}
<74	69.59 ± 3.2^{bA}	11.27 ± 0.9^{bB}	1.42 ± 0.2^{bE}	65.32 ± 2.3^{bA}	11.81 ± 0.8^{cC}	1.31 ± 0.1^{cF}	66.54 ± 4.8^{bA}	12.61 ± 0.1^{dD}	1.24 ± 0.0^{dG}

[1, 2] show the difference in the frequencies.

The lettering was executed for each dielectric properties, different dielectric properties were not compared with each other. Lower cases indicate the variations according to the particle size whereas upper cases demonstrate the differences among the concentration statistically.

3.1.2 TDF, IDF, and SDF contents

Table 4 summarized DF fraction (TDF, IDF, and SDF) contents of the treated and untreated PSCPs. The TDF, IDF, and SDF ratio in the untreated sample was found as 79.84, 65.62%, and 14.22%, respectively. These results were higher than the values found in the pear and kiwi pomace as reported by Yan, Li, Liu, & Zheng (2019); Wang, Li, Wanga, Liu, & Ni (2021). It could be seen that the DF contents were affected by the type of the extraction methods performed, whether it was either a combined or individual application. Among the individual applications, HP and MW markedly decreased the IDF ratioas compared with the untreated PSCP (p<0.05), however, they did not affect the TDF ratios significantly (p>0.05) (details in Appendix D and B, respectively). The IDF ratios of MW, HP300 and HP600 were measured 55.46, 60.83 and 61.99%, respectively, which lowered by 5.53, 7.30 and 15.48%, respectively according to the found in untreated sample. Additionally, both EH and TT lowered the IDF (41.92% and 37.65%) and TDF (59.08% and 54.28%) significantly (p<0.05).

As comparison among individual treatments, the MW treatment yielded the highest SDF (20.56%) with an increase by 44.6%, while compared with the untreated sample followed by HP600 as 17.33%, TT with 17.16% ratio, EH with 16.63%, and HP300 with 15.47%. Individual HP300 treatment barely raised the SDF ratio by 9% approximately, whereas with 600 MPa application this difference increased to ≈22% regarding the untreated sample SDF content. HP applications in the presence of enzymes such as E-HP300, E-HP600, EH-HP300, and EH-HP600 caused the substantial reduction in IDF and TDF contents (p<0.05) though the difference between E-HP and EH-HP treated samples was detected only in TDF content (p<0.05). Both application diminished the initial IDF content by more than 50% and the IDF content varied insignificantly (p>0.05). On the other hand, the conversion of IDF into SDF was provided by enzyme addition before HP treatment. The EH-HP treatment increased the SDF ratio with the EH-HP300 and the EH-HP600,

respectively by decreasing their IDF contents (p<0.05). A combination of the pressurization and thermal treatments (TT-HP) decreased the IDF content statistically (34.91 to 38.94%) whereas the conversion of IDF to SDF was reflected in the values from 12% to 24% (Table 4).

Table 4 The effects of different treatments on dietary fiber contents of the PSCPs

Treatments	Dietary fiber contents (%)		
	TDF (%)	IDF (%)	SDF (%)
Untreated	79.84±1.04^{a}	65.62±1.20^{a}	14.22±0.23^{fgh}
TT	59.08±3.32^{e}	41.92±1.21^{e}	17.16±1.33^{def}
EH	54.28±1.01^{fg}	37.65±1.11^{fg}	16.63±0.11^{efg}
HP300	76.30±0.42^{bc}	60.83±1.62^{b}	15.47±1.24^{efgh}
HP600	79.32±0.22^{ab}	61.99±0.13^{b}	17.33±0.43^{de}
TT-HP300	50.85±0.22^{h}	34.91±0.10^{ghij}	15.94±0.12^{efg}
TT-HP600	56.57±0.42^{ef}	38.94±0.20^{ef}	17.67±0.60^{cde}
E-HP300	44.57±0.21^{i}	32.15±0.60^{jkl}	12.42±0.51^{h}
E-HP600	45.00±0.61^{i}	31.42±1.34^{kl}	13.64±0.62^{gh}
MW	76.02±2.12^{c}	55.46±2.30^{c}	20.56±0.20^{abc}
MW-EH	56.39±0.72^{ef}	36.42±1.11^{fgh}	19.97±1.72^{bcd}
MW-HP300	72.95±0.42^{d}	50.82±1.31^{d}	22.13±1.70^{ab}
MW-HP600	80.63±1.80^{a}	56.47±2.06^{c}	23.16±0.14^{a}
EH-HP300	50.99±0.30^{h}	32.66±0.14^{ijkl}	18.33±0.42^{cde}
EH-HP600	51.28±0.81^{gh}	30.58±1.21^{l}	20.70±0.31^{abc}
MW-E-HP300	47.59±0.33^{i}	31.92±0.14^{jkl}	15.67±0.24^{efg}
MW-E-HP600	51.27±0.54^{gh}	33.83±1.32^{hijk}	17.44±1.82^{de}
MW-EH-HP600	55.77±2.40^{f}	35.65±1.92^{ghi}	20.12±1.13^{abcd}

Columns having different letters are significantly different (p< 0.05).

When the combination of MW with HP treatment was applied on the samples, a significant decrease in the IDF ratio from 50.82 to 56.47%, but an increase in the SDF content attained the highest values from 22.13 until 23.16%. The TDF did not vary so much after treatment as from 72.95 to 79.63% (p>0.05). The MW assisted

EH decreased the TDF and IDF significantly to 56.39% and 36.42%, respectively, but the SDF (19.97%) content increased after the treatment (p<0.05) (details in Appendix C). Hybrid application of three extraction methods such as MW-E-HP and MW-EH-HP caused reduction in the IDF contents to approximately the half of its original value (31.92 to 35.65%) and simultaneously improved the SDF contents. MW-EH-HP resulted in the maximum extraction of SDF as 20.12% with an increment of 41.5%, when the minimum value (15.67%) was reported for the MW-E-HP300 sample with an increment of only 10.2%.

Overall, it was detected that the individual treatment was not much effective for increasing the SDF or decreasing the IDF content with an exception such as MW. The hybrid method, but, demonstrated the best result either for the SDF or IDF. The lowering the IDF was more obvious for the HP treatment, but, not individual, rather hybrid methods. Yan et al. (2019) detected in a pear pomace a decrease of 8.1% in the IDF due to HP treatment at 300 MPa for 15 min. Likewise, Wang et al. (2021) performed EH on kiwi pomace and determined that the treatment caused a significantly lower IDF yield and about 7% SDF yield. In this study, EH assisted HP treatment (at 600 MPa) drastically decreased the IDF content by 53.3% as compared with the untreated sample. Unfortunately, no correlation was available systematically between the increase in SDF and the reduce in IDF. The specified extraction methods resulted in a wide range of SDF values from 12.42 to 23.16% and most of the treatments increased the SDF yield with exception of the E-HP600 and the E-HP300. The HP treatment at 300 and 600 MPa for 15 min, independently, increased the SDF ratios in the range of 9 to 22%, in contrast to a drastic improvement of 60% as declared in Yan et al. (2019) work for pear pomace. The reason for such a large variation in the yield could be depended on the alterations in the cellular structure of two DFs, the influence of pressure on the DFs and the conversion yield from insoluble to soluble form.

Moreover, MW treatment contributed the extraction of SDF statistically (≈45%), moreover, all the techniques involving MW yielded higher values than other techniques. Gan et al. (2020) reported that a two-fold increase in SDF content after

grapefruit peel was treated with MW due to the fact that MW energy may increase intracellular pressure, rupture the cell wall and release more active ingredients. In MW treatment, the heat is volumetric generated during the MW heating resulting in a sharp increase in the sample temperature that causes partial decomposition of components into small molecules, and decreasing particle size of the material (Tejada-Ortigoza et al., 2015). Furthermore, citrate buffer ensures rapid heating by interacting with MWs due to its ionic character and enhancement of the loss factor (*ε"*). MW-EH hybrid treatment transformed IDF into soluble form. The 44.5% decrease in the IDF content was successfully converted to SDF by an increment of >40%. A three fold increase in SDF was reported for grapefruit peel while the sample was treated with a combination of MW and EH (Gan et al. 2020).

Among all treatments, the MW-HP600 produced the maximum yield of the SDF (23.16%) from the pomace ($p<0.05$) followed by MW-HP300 (22.13%) and EH-HP600 (20.70%). IDF content decreased partially due to the transformation of cellulose and insoluble hemicellulose into SDF by effect of pressure (Kokorevics & Gravitis, 1997; Tejada-Ortigoza, Garcia-Amezquita, Serna-Saldívar, Martín-Belloso, & Welti-Chanes, 2017). In addition, the presence of the enzyme further facilitates the degradation of the DF cell structure and cell membrane as well. Likewise, the cell wall was also influenced by the MW assisted HP or enzymatic hydrolysis, thus providing more reactive sites releasing, and partially dissolving hemicellulose then converted them soluble form. This alteration results in an increase in SDF ratio.

3.1.3 Microstructures

The microstructures of the untreated (U) and treated SDF, IDF, and PSCP were illustrated in Figure 3, 4, and 5, respectively. SDF isolate had a clean-cut structure. After hemicellulose and lignin get depolymerized, the chemicals washed out their bioactive compounds and pigments throughout the isolation process. This alteration also induced removal of the flakes on the DF structure and the adhesion of fiber-

matrix decreased (Rahman, Ahmed, Hossain, Saha, & Noor, 2017). The treated PSCP was shown as solid-like fibers, which were superimposed due to the presence of protein and fat globules (Figure 5).

There were lots of block-shaped and spherical substances on the PSCP surface, which were probably the residual protein polymers and small starch granules after treatments. As illustrated in Figure 3b, the blocks of DF were transformed into a sheet-like structure with internal pressure of MW. Similar results were also obtained in the study of J. Gan et al. (2020) for grapefruit peel. According to Figure 4b and 5b; the weak bonds of IDF and PSCP could also be broken as reported by J. Gan et al. (2020); Nyman, Nylander, and Asp (1993). It might arise from rapid heating mechanism of MW. Fast internal heating during MW baking resulted in increased steam generation inside the material, thus occuring pressure gradient. This internal evaporation swelled the DF structure. Afterwards, this expansion formed looser structure and shrinkage on the surface (Marconi, Graziano, & Cubadda, 2000). HP impact was illustrated in Figure 4c and 5c. The deep grooves were developed in IDF and PSCP as a result of the major effect of pressure. Similar images were obtained for cherry tomato (Tangwongchai, Ledward, & Ames, 2000) and deoiled cumin DF (Ma & Mu, 2016a).

In Figure 4d and 5d; it was shown that cellulase treatment destroyed the holes formed by HP, and spreaded flakes onto the surface. These alterations were also observed in both cellulase and HP treated rice bran (Fengying Xie et al., 2019). After EH treatment, the DF lamellar structure was destroyed, and the block-shaped structures disappeared on the DF surface. This enzymatic disintegration depended on the non-crystalline region dissociations and the cell wall corrugation (Fengying Xie et al., 2019).

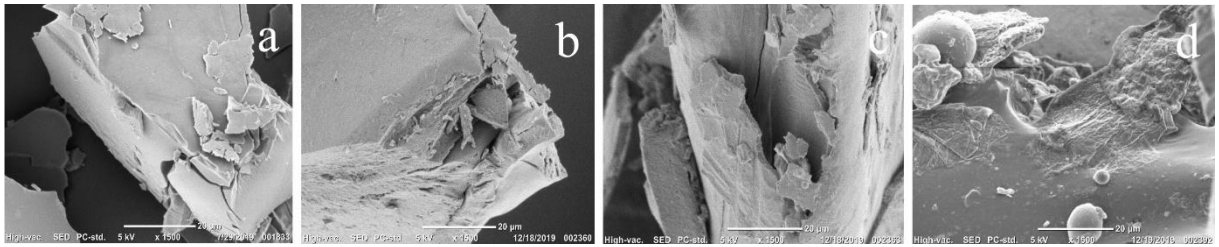

Figure 3 SEM images of untreated and treated SDF using different methods
a. U-SDF, b. MW-SDF, c. MW-HP600-SDF, d. MW-EH-HP600-SDF

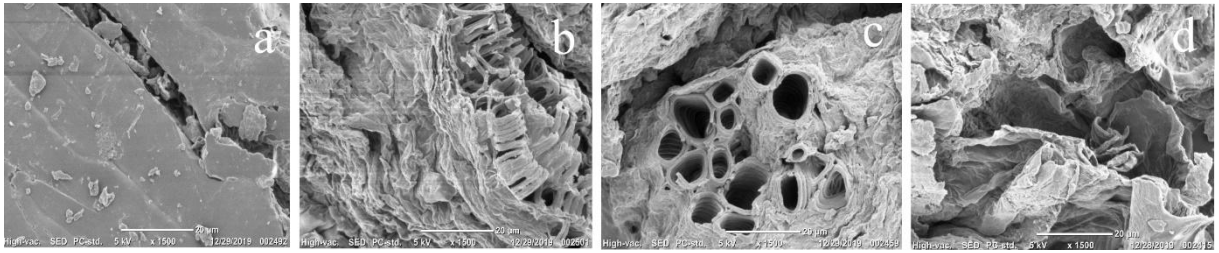

Figure 4 SEM images of untreated and treated IDF using different methods
a. U-IDF, b. MW-IDF, c. MW-HP600-IDF, d. MW-EH-HP600-IDF

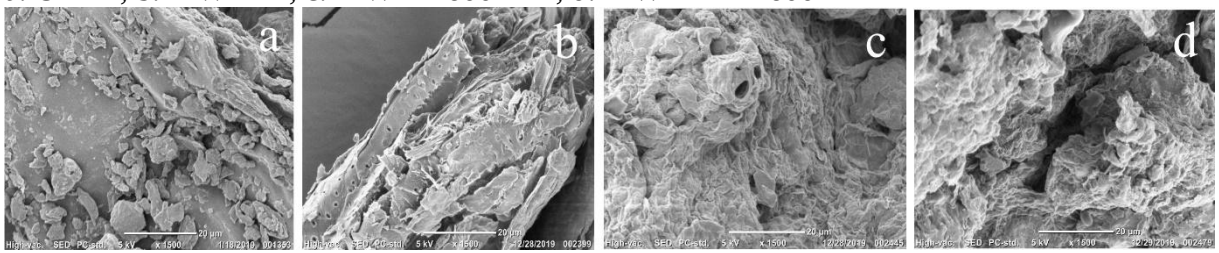

Figure 5 SEM images of untreated and treated PSCP using different methods
a. U-PSCP, b. MW-PSCP, c. MW-HP600-PSCP, d. MW-EH-HP600-PSCP

3.1.4 Functional properties

The effect of selected applications on hydration properties (SP, WHC, SI, and SVF) and OHC of PSCP are presented in Table 5. Water absorption resulted in swelling of DFs. The untreated sample had the highest SP (8.5 g/g), which reduced insignificantly (p>0.05) only in the HP treated samples (8 to 8.3 g/g) except the others (details in Appendix E). The minimum SP result (4.1 g/g) was measured in the MW-E-HP600 sample followed by MW-E-HP300 (4.6 g/g). Overall, it was indicated that the SP was related with the TDF content since the more TDF amount enables the larger surface area, thus facilitating water absorption that leads to increase volume of the material by swelling (Elleuch et al., 2011). Due to harsh treatment parameters, the cell matrix can be ruptured, thus can not entrap water molecules into the cell network (Tejada-Ortigoza et al., 2017), resulting in poor SP after the MW-E-HP treatment.

Among all the treatments performed in the PSCP, the pressure application enhanced WHC from 10.12 g/g to 10.90 g/g and to 11.71 g/g after 300 and 600 MPa treatment, respectively. The reason of that might be formation of capillary structure inside the DF molecules, extending surface area. The formed branching network constitutes void spaces inside the DF molecule, supporting to hold more water (Boulos, Greenfield, & Wills, 2000). Consistently, 500 MPa and above pressures were investigated to promote hydration capacity of carrot pomace (Yu et al., 2018). The WHC of the HP-assisted treatments such as MW-HP600, MW-E-HP300 considerably dropped to 7.4 and to 6.3 g/g, respectively as compared to the result found in the untreated PSCP (details in Appendix F). The reason might be the consecutive applications and their rupture effect on DF network (Robertson et al., 2000). Water is entrapped in the hydrophilic sites of the DF and within the cavities in the molecular structure, however, the gaps inside the DF network contract and water binding sidesmay be deteoriated by consecutive applications, thus reducing WHC dramatically (Robertson et al., 2000). These findings indicate that the

conformation of the structure and the textural characteristics could have a more pronounced effect on the water uptake than SDF/IDF ratio of the material (Boulos et al., 2000).

High degradation rates lead to the liberation of low molecular weight compounds readily and improving SI of the sample (Pérez-López et al., 2016). The highest SI results (46.9 to 49.6%) were attained in the sample with maximum SDF content (MW-HP300, MW-HP600, MW-EH-HP600) (details in Appendix G). Likewise, SI of the samples dropped with increasing IDF ratio according to the correlation ($p<0.05$) whereas the p value demonstrated the correlation between SI and SDF ratio was insignificant. This can be attributed to the transformation of IDF partially into low molecular weight compounds (monosaccharides, disaccharides, and oligosaccharides). These compounds cannot be measured with DF assay. Additionally, this deviation might stem from the variation in sensibility between automatically assayed SDF content and manually detected SI.

SVF represents the occupancy between before and after the centrifugated particles. The SVF was measured in the range of 28.6 and 37.5%, while the highest values were observed in the untreated (36%), HP600 (37.5%) and MW (32%) samples, respectively (details in Appendix H).

High SVF presents the information about the presence of the elevated IDF content. It is expected that the SVF value increases with reducing the particle size. On the other hand, the larger pores helps to absorb more water, decreasing SVF.

OHC is an indicator of fat loss during the processing and permits to remove excess fat. The OHC values ranged between 1.1 and 1.3 g/g. By means of the treatments, the OHC decreased almost 50% of the untreated sample result (2.3 g/g).

Table 5 The effects of different treatments on functional properties of the PSCPs

Treatments	Functional properties				
	SP (g/g)	WHC (g/g)	SI (%)	SVF (%)	OHC (g/g)
Untreated	8.51±0.21^{a}	10.12±0.02^{bcd}	23.03±0.04^{j}	36.03±0.12^{a}	2.32±0.02^{a}
TT	6.58±0.10^{bcd}	9.96±0.16^{bcde}	41.23±0.12^{fg}	33.10±0.19^{bc}	1.13±0.05^{a}
EH	5.93±0.20^{cde}	9.13±0.13^{cde}	43.22±0.90^{e}	31.32±0.11^{de}	1.10±0.05^{a}
HP300	8.02±0.11^{ab}	11.01±0.02^{ab}	35.96±0.12^{i}	32.03±0.20^{cd}	1.20±0.03^{a}
HP600	8.37±0.10^{a}	11.76±0.16^{a}	36.63±0.42^{hi}	37.53±0.25^{a}	1.21±0.05^{a}
TT-HP300	6.08±0.07^{cde}	9.12±0.08^{cde}	42.72±0.09^{ef}	32.30±1.07^{c}	1.14±0.15^{d}
TT-HP600	5.72±0.14^{cde}	9.25±0.05^{cde}	43.12±0.08^{e}	31.33±0.12^{e}	1.12±0.16^{c}
E-HP300	6.40±0.10^{cd}	9.06±0.03^{cde}	37.52±1.16^{h}	32.04±0.11^{cd}	1.20±0.09^{a}
E-HP600	6.25±0.03^{cd}	9.27±0.16^{cde}	41.22±1.11^{fg}	36.72±0.24^{a}	1.21±0.05^{a}
MW	7.11±0.10^{abc}	10.23±0.04^{abc}	38.12±0.04^{h}	32.04±0.22^{cd}	1.32±0.04^{a}
MW-EH	6.27±0.10^{cd}	9.21±0.04^{cde}	40.91±0.04^{g}	32.13±1.07^{cd}	1.10±0.07^{a}
MW-HP300	5.32±0.41^{def}	7.35±0.07^{fg}	46.91±1.16^{bc}	29.02±0.03^{f}	1.23±0.03^{a}
MW-HP600	5.05±0.03^{def}	7.43±0.08^{fg}	47.71±2.30^{b}	30.08±0.12^{ef}	1.22±0.03^{a}
EH-HP300	5.42±0.11^{def}	9.02±0.08^{cde}	44.77±0.09^{d}	28.61±0.13^{f}	1.12±0.04^{a}
EH-HP600	5.11±0.11^{def}	8.62±0.11^{def}	45.93±1.24^{cd}	29.22±0.13^{f}	1.12±0.02^{a}
MW-E-HP300	4.64±0.11^{ef}	6.31±0.05^{g}	40.22±0.39^{g}	31.07±0.15^{de}	1.20±0.03^{a}
MW-E-HP600	4.12±0.12^{f}	6.58±0.13^{g}	42.70±0.07^{ef}	29.04±0.21^{f}	1.21±0.14^{a}
MW-EH-HP600	5.55±0.14^{def}	8.44±0.25^{ef}	49.67±1.43^{a}	34.20±1.21^{b}	1.21±0.15^{a}

SP: Swelling power, WHC: Water holding capacity, SI: Solubility index, SVF: Sediment volume fraction, OHC: Oil holding capacity.
Columns having different letters are significantly different ($p< 0.05$).

The OHC was obtained an almost constant value (1.2-11.1g/g) for all the treated samples (details in Appendix İ). It was attributed that the applied treatments influenced the OHC at a low level. After transformation of IDF into SDF, DF network was transformed into a porous characteristic with a loose structure which make DF open to hydrophilic groups. With the exposure of hydrophilic groups, the hydrophobic impact weakenes, thereby OHC diminishes (Xie et al., 2019).

3.1.5 Total phenolic content

Table 6 presents the total phenolic content of the PSCP samples. The total phenolic contents (TPC) of the untreated PSCP was 2.72 mg GAE/g on dry basis, which improved significantly after the applied treatments (3.09 to 5.39 GAE/g). The MW-HP600 treated sample exhibited the largest increase, by 98%, which was followed by E-HP-600 (≈94%) and MW (≈90%), respectively. The obtained results were much lower than the result (3.94-11.33%) recorded by Hosseini, Parastouei, & Khodaiyan, (2020) for cherry pomace, but, higher than the value (2.7-5 mg of GAE /g) obtained by Bonerz, Würth, Dietrich, & Will (2006). Since, the antioxidant capacity of a phenolic extract is substantially related to its TPC and phenolic concentration profile, and therefore, the increase in TPC after the treatment shows the maximum antioxidant capacity of the resultant samples.

It has been reported that the TPC of the PSCP was improved by 150% when the MW treated was performed (Okur et al., 2019), in contrast to the current study, where 90% improvement was recorded. During MW heating, the internal volumetric heat generation produces high internal pressure within the cell wall that causes the rupture of the cells. Moreover, liberates the bound phenolics from the network cell that converts insoluble-type of phenolic compounds into partial soluble form. Because of the short heating time of MW improves the extraction yield and protects phenolic compounds from the disruption (Simsek, Sumnu, & Sahin, 2012). However, EH treatment which was combined with MW improved the TPC extraction yield as reported in Table 6.

TPC of MW-EH was measured 54% higher than EH-treated PSCP significantly (p<0.05). Additionally, the extracted TPC from EH-HP600 treated PSCP was greater than found in only subjected to EH sample by 50%.

Table 6 The effects of different treatments on total phenolic content and total antioxidant capacity of the PSCPs

Treatments	Total phenolic content (mg GAE/g d.b.)	Total antioxidant content (mmol DPPH/100g d.b.)
Untreated	2.72±0.11^{c}	2.83±0.01^{j}
TT	3.12±0.01^{bc}	5.48±0.02^{fgh}
EH	3.22±0.20^{bc}	3.89±0.03^{ij}
HP300	3.92±0.20^{abc}	4.51±0.12^{ghi}
HP600	4.04±0.13^{abc}	6.76±0.12^{def}
TT-HP300	4.44±0.14^{ab}	7.53±0.12^{cde}
TT-HP600	4.51±0.11^{ab}	8.16±0.14^{bcd}
E-HP300	4.82±0.24^{a}	5.23±0.20^{fghi}
E-HP600	5.27±0.24^{a}	6.09±0.22^{ef}
MW	5.18±0.21^{a}	9.51±0.31^{ab}
MW-EH	4.97±0.21^{a}	5.77±0.22^{fg}
MW-HP300	5.05±0.11^{a}	8.61±0.31^{abc}
MW-HP600	5.39±0.21^{a}	9.94±0.41^{a}
EH-HP300	4.12±0.03^{abc}	3.89±0.10^{ij}
EH-HP600	4.84±0.24^{a}	4.19±0.02^{hij}
MW-E-HP300	4.23±0.10^{abc}	6.69±0.40^{def}
MW-E-HP600	4.89±0.21^{a}	4.54±0.22^{ghi}
MW-EH-HP600	3.09±0.23^{bc}	2.78±0.14^{j}

TPC: Total phenolic content
Columns having different letters are significantly different ($p< 0.05$).

On the other hand, a combination of MW and HP600 resulted in the extraction of the highest TPC (5.39 GAE/g). Pressure treatment at 600 MPa was determined to be more effective than the treatment at 300 MPa and this observation is supported by previous work researched by Adil, Yener, & Bayındırlı (2008). These authors reported that the HP treatment allows the disruption of the solute-matrix interaction resulting in the liberate of the matrix-embedded phenolic compounds in addition extraction rate improves.

HP accompanying with enzymatic hydrolysis improves the TPC. Cellulase treatment acts a critical factor in liberating the TPC by hydrolyzing the polymers (i.e. cellulose,

hemicellulose) into their smaller fragments. This attempt provides releasing of the DF-bound phenolics in soluble form also eases the extraction procedure by means of diminishing viscosity of the extraction-medium (Yu et al., 2018). The inclusion of EH step in the MW-EH-HP sample might be the purpose of the least value of the TPC extraction (3.09 GAE/g). The extracted phenolic compounds by MW application could be influenced at the elevated temperatures applied during EH treatment, which further did not contribute in the last step of HP treatment.

3.1.6 Total antioxidant capacity

The total antioxidant capacity of the PSCP were presented in Table 6 based on DPPH scavenging activity. The results were in the range of 2.78 to 9.94 mmol DPPH/100g (db). The obtained values are in accordance with the reported values (3.39 to 7.14 mmol DPPH/100 g) (Halvorsen et al., 2002). MW-HP600 and MW showed about 251 and 236% more antioxidant capacity against to radical agent (DPPH), respectively than the found in other treatments. Though HP application improved antioxidant capacity by 59 to 139%, whereas these results changed dramatically after the EH treatment (37 to 48%). Among the subjected treatments, MW-EH-HP600 showed the minimum antioxidant activity with a loss of about 2% DPPH. It can be attributed to SDF content. Similarly, a correlation was found between SDF and antioxidant capacity as supported by the earlier report (Ma & Mu, 2016b). Overall, the reported resultsof this research corresponding with the findings, TPC and total antioxidant capacity are promoted with liberating soluble fractions of DF.

3.2 Physical Properties of the Enriched Dough and Biscuits

In the previous section, the physicochemical, functional, and microstructural properties of the treated PSCP and its isolates (SDF and IDF) subjected to MW, HP, EH, and the combination of these treatments have been reported. In this section; fat replacer properties of the modified PSCP and the isolates, which are DF sources,

were tried to be determined by measuring the textural, physical, diameter, thickness, spread ratio, and color properties of the enriched dough and biscuits.

3.2.1 Textural properties of the dough

As illustrated in Table 7, the dough hardness was found to be in the range of 1.06 and 14.36 N (details in Appendix I). The hardness of the dough increased more than three times with decreasing fat content from 30% to 10% since more gluten network developed due to increasing water-gluten interaction in the dough by reduction in fat (Manley, 2000).

Addition of U-SDF to the biscuit dough containing 10% fat (C10) softened texture but using U-IDF did not have a significant effect on hardness of biscuit dough. It might be explained by the low WHC of SDF than the others; hence, increasing free water in the dough (Mancebo, Rodríguez, Martínez, & Gómez, 2018). The highest hardness was observed in dough with U-PSCP. Considering the physical properties of 30% fat containing biscuit (C30) as ideal, similar hardness value could be obtained with MW-HP600-SDF, MW-EH-HP600-SDF, and MW-EH-HP600-PSCP incorporation into the dough with lower fat content.

As reported by Pérez-López, Mateos-Aparicio, and Rupérez (2016), HP effect of reduction in DF particle size decreased water binding ability due to damage to hydrogen bonds by mechanical force, which results in decreasing hardness in the biscuit dough. In fact, although similar reduction in particle size was observed by the cellulase in EH, the thermal effect during hydrolysis might increase the hardness of dough. Even if their hardness were similar to that of the C30, hardness of MW-EH-HP600-SDF dough was higher than that of MW-HP600-SDF dough.

It could be attributed to the stronger gel-like structures developed by heat treatment in MW-EH-HP600-SDF. Similar result was also obtained from the study of Talens et al. (2007).

Table 7 Textural properties of the dough

Biscuit formulation	Hardness (N)	Adhesiveness (N.mm)	Cohesiveness
C30	1.39±0.0^{jk}	5.11±0.7^{bc}	3.67±0.5^{c}
C20	2.13±0.1^{hi}	3.27±0.4^{d}	1.53±0.1^{ef}
C10	4.72±0.1^{c}	4.06±0.5^{cd}	0.67±0.1^{gh}
U-SDF	3.69±0.2^{ef}	4.50±0.3^{cd}	1.68±0.1^{e}
MW-SDF	3.01±0.1^{fg}	13.19±0.0^{a}	4.38±0.1^{b}
MW-HP600-SDF	1.06±0.1^{k}	4.37±0.4^{cd}	4.10±0.2^{bc}
MW-EH-HP600-SDF	2.02±0.1^{hij}	12.86±0.6^{a}	4.51±0.3^{b}
U-IDF	4.39±0.1^{cd}	4.90±0.7^{bcd}	0.76±0.1^{gh}
MW-IDF	3.74±0.6^{de}	4.84±0.4^{bcd}	1.02±0.1^{fg}
MW-HP600-IDF	2.69±0.2^{gh}	4.63±0.0^{cd}	1.68±0.1^{e}
MW-EH-HP600-IDF	3.00±0.1^{g}	4.60±0.3^{cd}	1.70±0.1^{e}
U-PSCP	14.36±0.4^{a}	6.46±1.5^{b}	0.45±0.1^{h}
MW-PSCP	6.43±0.2^{b}	4.57±0.1^{cd}	0.93±0.2^{gh}
MW-HP600-PSCP	4.12±0.0^{cde}	3.49±0.4^{cd}	8.34±0.2^{a}
MW-EH-HP600-PSCP	1.56±0.1^{ijk}	4.04±0.2^{cd}	2.98±0.1^{d}

$^{a.b.}$statistically significant difference shown levels ($p<0.05$); data are means ± SD (n=3)
Columns having different letters are significantly different ($p< 0.05$).

Similar hardness value with C30 dough could not be obtained by enriched with the treated or untreated IDF. IDF had higher adsorption capacity of water and oil than SDF therefore the hardness increased after enrichment of the product (Sharoba et al., 2013). Addition of MW-IDF could decrease hardness values of C10 dough slightly. MW energy might have transformed high molecular weight DF into lower molecule fragments. Therefore, loose structure was formed (Nyman et al., 1993). In the presence of HP, hardness value decreased further. This was explained by the formation of a porous structure (Tangwongchai et al., 2000).

Addition of MW-PSCP decreased hardness of dough significantly as compared to U-PSCP enrichment. Xiang, Zou, Liu, and Ruan (2020) reported that MW heating changed the secondary structure of protein. The secondary structure of protein transformed to β-turn. During the MW processing, the bound water increased then, the small molecular substances were aggregated with one another under the action

of noncovalent bonds, increasing the β-sheet form. Reduction in α-helix structure decreased elasticity and hardness of dough. The random coil content in dough expanded, the secondary structures transformed from order (α-helix) into unorderconformation (β-turn), thus decreasing hardness of the dough. Although MW provides softer structure, the hardness of biscuit dough prepared with MW-SDF, MW-IDF, and MW-PSCP, MW-HP600-PSCP dough was still higher than that of C30 dough.

In fact, MW-HP600-PSCP addition gave better result than MW-PSCP incorporation due to hardness reduction. It might be arisen from the fact that HP induced alterations on the tertiary and secondary structure of proteins. Modification in the tertiary structure could be observed at higher than 200 MPa whereas differentiation of the secondary structure might be expected between 300–700 MPa (Ahmed, Ramaswamy, Kasapis, & Boye, 2010). The binding ability of water might have been weakened by HP effect on the tertiary structure. Moreover, HP could also dissociate the protein subunits. The reasons for pressure-induced dissociation of oligomeric proteins could be imperfect van der Waals forces between monomers, solvent electrostriction at the level of salt linkages at the interfaces of monomer subunits, and solvation of the nonpolar groups at the boundaries of contact in the oligomers (Balny, 2002). Application of HP had a disruptive effect on intramolecular hydrophobic and electrostatic interactions, but its effect on covalent bonds was minimum.

According to Table 7, the added MW-EH-HP600-PSCP into the dough provided similar hardness value to found in C30 dough. It might be attributed to the degradation effect of MW, HP, and EH on macromolecules (e.g. DF) resulting into the smaller but highly functional fragments (J. Gan et al., 2020; Pérez-López et al., 2016). This alteration might be contributed to the formation of weaker matrix in biscuits, thus obtaining a softer texture.

The factor affecting hardness was probably the heating which was accompanied with EH. The thermal degradation of DF and the loss of some water-soluble molecules resulted in poor water absorption ability. Therefore, free water increased in the

dough, which decreased the hardness (Petrović et al., 2017). Moreover, the larger spaces which were formed due to degradation of compounds, were filled with air. This rearrangement created a crumbly structure and resulted a decrease in hardness value. The alteration in the composition enabled the texture softening with a decrease in dough consistency. Similarly, protein denaturation which was applied as the last step of the EH impaired water binding ability (Hoseney, 1994). Furthermore, the phenolics which gave hardness characteristic, might be another factor (Rastogi, Raghavarao, Balasubramaniam, Niranjan, & Knorr, 2007). During protein denaturation, the linkage between protein and phenolics was also destroyed (Balny, 2002). The liberated phenolic compounds stayed unprotected against the thermal effect and readily degraded. This phenomenon might have contributed to the softening of the product as well.

Adhesiveness is of great significance during the sheeting and forming process. According to Table 7, the adhesiveness of the biscuit dough decreased slightly after the reduction of fat ratio from 30% to 20%. Reduction of fat content from 30% to 10% did not have significant effect on adhesiveness (details in Appendix J). Therefore, there is no need to fortify fat reduction with fibers in terms of adhesiveness. Among the enriched dough, the higher adhesiveness values were observed in MW-SDF, MW-EH-HP600-SDF or U-PSCP containing ones. Smooth surface and nonporous structure of SDF as shown in Figure 3 may lead to weak hydration capacity. Therefore, excess amount of free water existed in the formulation might have increased the adhesiveness of the dough (Petrović et al., 2017).

Cohesiveness shows the strength of internal bonds in the dough (Gujral, Mehta, Samra, & Goyal, 2003). It decreased with decrease in fat content. The addition of MW-HP600-SDF provided similar cohesiveness value with found in C30 (details in Appendix K). This may be due to thermal effect of MW (H. Li & McCarthy, 2003). Similarly reported in the study of Pathera, Riar, Yadav, and Sharma (2017), cohesiveness of the MW-cooked nuggets was found higher than the oven cooked sample ($p<0.05$). In fact, the results of TPA demonstrated higher (two times more) cohesiveness in MW-baked soy-added flat dough than conventionally baked product

(Mandala, 2005). Here, the rapid water loss occurred during MW treatment resulted in tough texture (Mandala, 2005). In addition to MW treatment, HP influenced non-covalent bonds such as electrostatic and hydrophobic bonds. Especially, HP strengthened O-O and O-N linkages (Kieffer, 2007). Moreover, HP develops re-formation of intra- and inter-molecular bonds within or among the molecules. Therefore, with combination of heating, HP led to increase inloss of cohesivity (Kieffer, Schurer, Köhler, & Wieser, 2007) similar to the found in MW-HP600-SDF-added dough.

3.2.2 Physical properties of the biscuits

According to the Table 8, the moisture content of the C30, C20, C10 and SDF enriched biscuits was determined to be not significantly different from each other (details in Appendix M). The moisture content was found higher in all the IDF enriched biscuits. It might be derived from the reason that IDF was a bulking agent, thus not allowing moisture loss during baking due to high WHC (Sudha, Srivastava, et al., 2007). The combination of MW and HP improved water holding of the material as declared by Fengying Xie et al. (2019). Notably, increase in moisture content was noticed in MW-HP600-PSCP and MW-EH-HP600-PSCP added biscuit clearly.

3.2.3 Spread ratio of the biscuits

IDF and PSCP influenced spread ratio adversely (details in Appendix T). This might have arisen from the reason that IDF and PSCP increased dough consistency and the hardness values, thus restricting spreading property of the product (Mancebo et al., 2018). It was found that spreading of biscuit dough was correlated to consistency ($r= -0.73$, $p<0.01$) and hardness ($r= -0.68$, $p<0.01$) negatively. Moreover, a correlation was observed for adhesiveness with spreading. These can be attributed to greater gluten development influencing consistency,

hardness, and adhesiveness (Manohar & Rao, 2002). Furthermore, protein level influenced dimensions negatively (Manley, 2000). MW and HP treatments applied on IDF and PSCP did not contribute to dough spreading. However, all the treated SDFs were found to be effective on spreading due to the lubrication effect of nonviscous characteristic of SDF (Filipčev, Šimurina, & Bodroža-Solarov, 2014). SDF was transformed into fat replacer attribute with HP assistance to MW treatment.

3.2.4 Hardness of the biscuits

Hardness of the biscuit dough (Table 7) was found to be in correlation (r=0.739 and *p*=0.01) with the hardness of freshly baked biscuits (Table 8). The baked product became harder by 38% with reducing fat content from 30% to 10% (details in Appendix L). It might be related to the decrease in porosity.

Biscuit porosity decreased with reducing fat. In a previous study, it was shown that biscuit mean cell size decreased linearly (R^2= 0.78) from 14.5% to 8.7% with decreasing fat content (Pareyt et al., 2009). The fat level were shown to influence the expansion of cell size during baking (Pareyt et al., 2009). On the other hand, the increasing protein ratio due to fat reduction, might have improved the hardness of biscuit (Sudha, Srivastava, et al., 2007). Additionally, if the fat was present in insufficient amounts, it could not coat the surface of the flour particles developing gluten matrix, resulting in a harder texture (Menjivar & Faridi, 1994). MW was the dominant factor on SDF properties in terms of reducing hardness of the biscuit. This might be attributed to the fact that MW decreased molecular weight of the polysaccharides (Nyman et al., 1993). HP might decrease the particle size with mechanical force which resulted in softer biscuits. Thus, the hardness scores of MW-SDF and MW-HP600-SDF biscuits were lower than that of C30 biscuit.

Table 8 Physical properties of the biscuits

Biscuit formulation	Moisture content (%db)	D (mm)	T (mm)	Spread ratio*	Hardness (N)
C30	7.37±0.2^{c}	68.37±0.6^{b}	8.75±0.0^{ef}	7.81±0.1^{bc}	27.17±0.48^{f}
C20	7.27±0.1^{c}	65.73±0.6^{cde}	8.89±0.2^{e}	7.28±0.1^{c}	32.90±1.65^{cde}
C10	7.26±0.3^{c}	63.43±0.6^{fg}	9.65±0.1^{d}	6.35±0.3^{cd}	37.60±1.26^{c}
U-SDF	7.28±0.3^{c}	65.05±0.5^{ef}	12.62±0.1^{a}	5.16±0.0^{ghi}	35.42±4.41^{cde}
MW-SDF	7.41±0.2^{c}	62.00±0.1^{ghi}	9.94±0.2^{d}	6.24±0.1^{cde}	22.22±0.67^{g}
MW-HP600-SDF	7.47±0.2^{c}	67.33±0.8^{c}	8.41±0.3^{ef}	8.01±0.3^{ab}	20.18±1.14^{g}
MW-EH-HP600-SDF	7.61±0.1^{c}	70.81±0.4^{a}	8.35±0.3^{f}	8.49±0.3^{a}	37.91±0.67^{c}
U-IDF	9.81±0.8^{a}	61.8±0.3^{hi}	11.89±0.1^{b}	5.28±0.1^{fgh}	61.90±0.45^{a}
MW-IDF	8.87±0.1^{b}	66.07±0.2^{cd}	13.07±0.2^{a}	5.07±0.2^{i}	52.13±0.11^{b}
MW-HP600-IDF	8.94±0.1^{b}	62.37±0.6^{gh}	13.04±0.1^{a}	4.85±0.2^{hi}	31.50±0.79^{e}
MW-EH-HP600-IDF	8.79±0.2^{b}	63.5±0.5^{fg}	11.93±0.2^{b}	5.41±0.1^{fgh}	31.88±0.74^{e}
U-PSCP	7.18±0.2^{c}	60.69±0.6^{i}	12.9±0.1^{a}	4.71±0.0^{i}	64.67±0.65^{a}
MW-PSCP	7.61±0.1^{c}	66.03±0.2^{cd}	12.95±0.1^{a}	5.17±0.1^{ghi}	52.16±0.08^{b}
MW-HP600-PSCP	9.09±0.4^{ab}	64.8±0.2^{def}	11.2±0.1^{c}	5.77±0.2^{ef}	36.29±1.42^{cd}
MW-EH-HP600-PSCP	8.81±0.2^{b}	62.67±0.4^{gh}	11.7±0.1^{bc}	4.96±0.1^{ghi}	33.77±0.16^{de}

*Spread ratio represented D/T. D: Diameter, T: Thickness of the biscuits.
Columns having different letters are significantly different (p< 0.05).

The highest value of hardness was measured in the biscuit with either U-IDF or U-PSCP. This might arise from the reason that IDF and PSCP increased dough viscosity, thus developing harder texture (Mancebo et al., 2018). To correct the textural attributes, MW was found to be an effective treatment, but MW-HP600 seemed to be preferable for SDF additives according to Table 8. HP modified regularly structured polysaccharides as porous form (Tangwongchai et al., 2000). The density of the biscuit decreased with increasing porosity which was probably due to the impact of higher levels of air incorporation. Therefore, hardness value decreased as reported by Pareyt et al. (2009).

Both the thermal and non-thermal mechanisms might break non-covalent bonds. Accordingly, most of their hydrophilic fragments might be washed away due to

solvent effect after liberation of the molecules as stated by Mancebo et al. (2018). When IDF addition was considered, MW-HP600-IDF and MW-EH-HP600-IDF biscuits got the best scores according to the hardness results of the fresh C30 biscuit. One of the most hardness degree was also detected in the U-PSCP biscuit. PSCP consisted of a high ratio of IDF which might be the reason of high hardness value. Nevertheless, to get closer to the texture of C30 biscuit, EH-aided treatments could be a better alternative. As mentioned before, EH degraded macromolecules with enzyme addition followed by thermal processing. Due to the fact that PSCP comprised many other compounds than DF structure, EH was required for treating PSCP. Macromolecules could be hydrolyzed by EH and thermal mechanisms in the EH step. After this micronization process, surface area increased and then DF absorbed water. Absorbed water was not allowed to evaporate during baking due to the water binding power of DF, thus hardness decreased (Petrović et al., 2017).

3.2.5 Color of the biscuits

According to Table 9, C30, C20, and C10 biscuits possessed similar lightness (L^*) of the color and color differences (ΔE^*), but redness (a^*) index of C10 decreased as compared to C30 (details in Appendix N, S, and P, respectively). Additionally, the yellowness (b^*) values of C20 and C10 biscuits were measured to be similar, but C30 was higher (details in Appendix R). It might be derived from fat content improving a^* and b^* value of the material. High a^* value was observed due to higher baking degree of fatty products whereas high b^* of color came from using fat ingredient more as reported by Manohar and Rao (1999).

L^* value also did not change in the U-SDF and U-IDF biscuits significantly. However, it was affected by treatments. Since, the treatments damaged cell wall thus, liberating color pigments outside of cell and darken color of the products. However, the extracted pigments might be degraded thereby, L^* value increased due to the overtreatment as shown in the MW-EH-HP600-SDF biscuit. Nevertheless, similar results could not be seen in the IDF and PSCP added samples. That could be

explained by the fact that IDF or PSCP incorporated biscuits had more compact structure as compared to SDF.

The limited redness in the biscuit attracts the consumers, but DF enrichment decreased *a** value according to the color of C30 biscuit except MW-IDF and MW-HP600-SDF biscuits. MW ensured similar *a** index in the IDF enriched product. It might have been arisen from a devastating effect of MW energy on the cell structure due to internal pressure gradient, thus providing extraction of compounds which can change the color values such as anthocyanins. Similar results were also found in blueberry powder (Liu et al., 2019).

Even though no significant difference was reported in color after HP treatment by Ahmed, Ramaswamy, and Hiremath (2005), to protect the redness of the SDF, the combination of thermal and non-thermal mechanisms was required in this study.

HP could damage cell membrane, increase permeability, and accelerate the mass transfer. It had been successfully used for anthocyanins from grape skins (Corrales, García, Butz, & Tauscher, 2009). According to Kouniaki, Kajda, and Zabetakis (2004), anthocyanins are located in the vacuoles in plants, and HP affects the cell and vacuole membranes. It enhances cell permeability owing to its aptitude to deprotonate charged groups and disrupt salt bridges and hydrophobic bonds in cell membranes. Thus, HP following the MW treatment could facilitate the extraction of anthocyanins from the SDF. All the *b** values of the enriched biscuits were lower than measured in C30 biscuit. It could be attributed to fat content as above mentioned (for qualitative assessment, please see Appendix U).

Color difference is an important parameter in comparison the enriched sample with the C30, C20 and C10 biscuits. According to the MW treated DFs enriched biscuit results, MW was found to be an effective factor on ΔE^* as compared to the result of the untreated DF added samples.

Table 9 Color of the biscuits

Biscuit formulation	*L**	*a**	*b**	Δ*E**
C30	63.22±0.9^{a}	12.10±0.6^{a}	34.41±0.8^{a}	48.20±1.3^{ab}
C20	64.15±0.5^{a}	11.32±0.1^{ab}	32.63±0.5^{bc}	46.11±0.1^{abc}
C10	64.58±0.8^{a}	10.66±0.1^{bc}	32.25±0.1^{bcd}	45.39±0.5^{bc}
U-SDF	63.12±2.0^{a}	9.34±0.9^{de}	29.11±0.8^{e}	43.80±2.1^{c}
MW-SDF	58.88±0.7^{c}	9.78±0.6^{bcde}	29.60±0.9^{e}	47.44±0.8^{ab}
MW-HP600-SDF	59.99±0.7^{bc}	11.36±0.2^{ab}	32.37±0.1^{bc}	48.68±0.5^{ab}
MW-EH-HP600-SDF	62.09±0.5^{ab}	10.61±0.1^{bcd}	32.03±1.0^{bcd}	46.82±0.4^{ab}
U-IDF	63.50±1.0^{a}	7.33±0.5^{f}	30.59±0.8^{de}	40.37±1.5^{d}
MW-IDF	60.30±1.1^{bc}	10.89±0.3^{abc}	30.61±0.1^{cde}	47.25±0.8^{ab}
MW-HP600-IDF	59.24±0.8^{bc}	9.66±0.4^{bcde}	30.64±0.1^{cde}	47.66±0.6^{ab}
MW-EH-HP600-IDF	58.52±0.1^{c}	9.30±0.1^{e}	29.07±0.1^{e}	47.11±0.2^{ab}
U-PSCP	46.67±0.6^{d}	4.84±0.8^{g}	26.83±1.0^{f}	33.61±1.8^{e}
MW-PSCP	60.41±0.6^{bc}	10.33±0.1^{bcde}	30.58±0.1^{de}	46.58±0.4^{abc}
MW-HP600-PSCP	59.55±0.9^{bc}	10.47±0.2^{bcde}	30.61±0.1^{cde}	46.92±0.5^{ab}
MW-EH-HP600-PSCP	59.71±0.6^{bc}	10.15±0.2^{bcde}	30.49±0.2^{de}	47.34±0.6^{ab}

Columns having different letters are significantly different ($p< 0.05$).

However, all the MW treated DF enrichment provided similar color difference with C30 biscuit statistically. Identically, no color differences were also observed after HP treatments in the study of Ahmed et al. (2005).

CHAPTER 4

CONCLUSION

This study helps to clarify the underlying mechanisms of a combined biological and physical treatment for structural modification of SCP then, to create an opportunity to investigate the effects of different DF fractions modified by different treatments on the quality of biscuits. In terms of DF portions, it should be stated that the increase in IDF increased TDF percentage significantly. Hence, TDF content was influenced by the similar treatments affecting IDF. Both the thermal and non-thermal mechanisms influenced the DF characteristics. MW caused smooth surface with nonporous structure by reducing particle size and molecular weight of the DF. The hybrid treatments were found to be advantageous for improving SDF content, SDF/IDF ratio, and functional properties of the SCP. HP600 and MW were determined as the best combination to maximize SDF and TDF contents and, to enhance hydrating properties, total phenolic content, and antioxidant capacity. From time saving point of a view, MW-EH-HP600 treatment took an application time of nearly 80 min. On the other hand, it takes 16 min and 1 min for treatments of MW-HP600 and MW, respectively. All these demostrate that MW is an energy-saving and cost-effective application. In this study, it was determined that MW treatment was sufficient to increase SDF content, but for increasing the functional properties of the PSCP in addition to SDF ratio, HP600 assisted with MW could be recommended.

In terms of DF incorporation into biscuit dough, among the treatments, HP changed the textural properties of biscuits. SDF improved textural properties and quality of the dough and biscuit. SDF showed better performance to act as a fat replacer with minimum processing requirements. MW was found to be as the critical treatment for SDF modification. MW-SDF addition resulted in an acceptable dough hardness,

biscuit hardness and spread ratio. MW-HP600-SDF and MW-EH-HP600-PSCP dough presented similar hardness, adhesiveness, and cohesiveness values with the properties of C30. Further processing was required for PSCP to improve biscuit quality. In IDF-enriched dough; hardness, cohesiveness, and spreading were poor. The characteristics of the DF fractions were also supported by microstructure images.

To modify SDF, IDF and PSCP, the combination of MW and HP was found to be the best treatment for the enrichment of a low fat biscuit. Moreover, usage of MW-HP600-SDF was the prominent alternative to the C30 with similar dough hardness, adhesiveness, cohesiveness, and spread ratio. The hybrid processes with isolation step could present a methodological approach allowing DF to upgrade its performance to replace fat. This present study will ensure insight to researches about green utilization of byproduct-derived DF and offer a theoretical basis for the functional food additive.

According to all the findings obtained from this study, it is possible to convert IDF into soluble form by using different combinations of EH, MW, and HP from PSCP. This allows the utilization of SDF, which reasonably change the physicochemical and textural properties of the product, as fat replacer, instead of saturated fats in the formulation of bakery products.

In future studies, it may be useful to rheologically examine the high-temperature behavior of DF obtained by these methods and to compare the in vitro and in vivo digestibility of the enriched products.

REFERENCES

Adil, İ. H., Yener, M. E., & Bayındırlı, A. (2008). Extraction of Total Phenolics of Sour Cherry Pomace by High Pressure Solvent and Subcritical Fluid and Determination of the Antioxidant Activities of the Extracts. *Separation Science and Technology, 43*(5), 1091-1110. doi: 10.1080/01496390801888243

Ahmad, A., Anjum, F. M., Zahoor, T., Nawaz, H., & Din, A. (2009). Physicochemical and functional properties of barley β- glucan as affected by different extraction procedures. *International journal of food science & technology, 44*(1), 181-187.

Ahmad, F., Zaidi, S., & Ahmad, S. (2020). Role of By-products of Fruits and Vegetables in Functional Foods. In *Functional Food Products and Sustainable Health* (pp. 199-218): Springer.

Ahmad, F., Zaidi, S., & Ahmad, S. (2020). Role of By-products of Fruits and Vegetables in Functional Foods *Functional Food Products and Sustainable Health* (pp. 199-218): Springer.

Ahmed, J., Almusallam, A., & Al-Hooti, S. N. (2013). Isolation and characterization of insoluble date (Phoenix dactylifera L.) fibers. *LWT-Food Science and Technology, 50*(2), 414-419.

Ahmed, J., Almusallam, A., & Al-Hooti, S. N. (2013). Isolation and characterization of insoluble date (Phoenix dactylifera L.) fibers. *LWT-Food Science and Technology, 50*(2), 414-419.

Ahmed, J., Mulla, M., Al- Ruwaih, N., & Arfat, Y. A. (2019). Effect of high-pressure treatment prior to enzymatic hydrolysis on rheological, thermal, and antioxidant properties of lentil protein isolate. Legume Science, 1(1), e10.

Ahmed, J., Ramaswamy, H. S., & Hiremath, N. (2005). The effect of high pressure treatment on rheological characteristics and colour of mango pulp. *International journal of food science & technology, 40*(8), 885-895.

Ahmed, J., Ramaswamy, H. S., & Hiremath, N. (2005). The effect of high pressure treatment on rheological characteristics and colour of mango pulp. *International Journal of Food Science & Technology, 40*(8), 885-895.

Ahmed, J., Ramaswamy, H. S., Kasapis, S., & Boye, J. I. (2016). *Novel food processing: effects on rheological and functional properties*: CRC Press.

Aksoylu, Z., Çağindi, Ö., & Köse, E. (2015). Effects of blueberry, grape seed powder and poppy seed incorporation on physicochemical and sensory properties of biscuit. *Journal of Food Quality, 38*(3), 164-174.

Aksoylu, Z., Çağindi, Ö., & Köse, E. (2015). Effects of blueberry, grape seed powder and poppy seed incorporation on physicochemical and sensory properties of biscuit. *Journal of food quality, 38*(3), 164-174.

AOAC. (1990). Association of official analytical chemists. Official methods of analysis. In: AOAC Arlington, VA.

AOAC. (1990). Association of official analytical chemists. Official methods of analysis: AOAC Arlington, VA.

Aravind, N., Sissons, M. J., Fellows, C. M., Blazek, J., & Gilbert, E. P. (2012). Effect of inulin soluble dietary fiber addition on technological, sensory, and structural properties of durum wheat spaghetti. Food Chem, 132(2), 993-1002.

Arun, K., Persia, F., Aswathy, P., Chandran, J., Sajeev, M., Jayamurthy, P., & Nisha, P. (2015). Plantain peel-a potential source of antioxidant dietary fibre for developing functional cookies. *Journal of Food Science and Technology, 52*(10), 6355-6364.

Arun, K., Persia, F., Aswathy, P., Chandran, J., Sajeev, M., Jayamurthy, P., & Nisha, P. (2015). Plantain peel-a potential source of antioxidant dietary fibre for developing functional cookies. *J Food Sci Technol, 52*(10), 6355-6364.

Ayala-Soto, F. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2016). Effect of processing time, temperature and alkali concentration on yield extraction, structure and gelling properties of corn fiber arabinoxylans. *Food hydrocolloids, 60*, 21-28.

Bajerska, J., Mildner- Szkudlarz, S., Górnaś, P., & Seglina, D. (2016). The effects of muffins enriched with sour cherry pomace on acceptability, glycemic response, satiety and energy intake: a randomized crossover trial. *J Sci Food Agric, 96*(7), 2486-2493.

Balasubramaniam, V., Barbosa-Cánovas, G. V., & Lelieveld, H. (2016). *High pressure processing of food: Principles, technology and applications*: Springer.

Balasubramaniam, V., Barbosa-Cánovas, G. V., & Lelieveld, H. (2016). *High pressure processing of food: Principles, technology and applications*: Springer.

Balny, C. (2002). High pressure and protein oligomeric dissociation. *International Journal of High Pressure Research, 22*(3-4), 737-741.

Balny, C. (2002). High pressure and protein oligomeric dissociation. *International Journal of High Pressure Research, 22*(3-4), 737-741.

Barbarisi, C., De Vito, V., Pellicano, M. P., Boscaino, F., Balsamo, S., Laurino, C., . . . Volpe, M. G. (2019). Bread chemical and nutritional characteristics as influenced by food grade sea water. *International Journal of Food Properties, 22*(1), 280-289. doi:10.1080/10942912.2019.1579837

Barbarisi, C., De Vito, V., Pellicano, M. P., Boscaino, F., Balsamo, S., Laurino, C., . . . Volpe, M. G. (2019). Bread chemical and nutritional characteristics as influenced by food grade sea water. *International Journal of Food Properties, 22*(1), 280-289. doi: 10.1080/10942912.2019.1579837

Behera, S., Indumathi, K., Mahadevamma, S., & Sudha, M. (2013). Oil cakes–a by-product of agriculture industry as a fortificant in bakery products. *International journal of food sciences and nutrition, 64*(7), 806-814.

Behera, S., Indumathi, K., Mahadevamma, S., & Sudha, M. (2013). Oil cakes–a by-product of agriculture industry as a fortificant in bakery products. *International journal of food sciences and nutrition*, *64*(7), 806-814.

Bender, A. B. B., Speroni, C. S., Moro, K. I. B., Morisso, F. D. P., dos Santos, D. R., da Silva, L. P., & Penna, N. G. (2020). Effects of micronization on dietary fiber composition, physicochemical properties, phenolic compounds, and antioxidant capacity of grape pomace and its dietary fiber concentrate. *Lwt*, *117*, 108652.

Bermúdez-Aguirre, D., & Barbosa-Cánovas, G. V. (2010). Recent advances in emerging nonthermal technologies. *Food engineering interfaces*, 285-323.

Bermúdez-Aguirre, D., & Barbosa-Cánovas, G. V. (2010). Recent advances in emerging nonthermal technologies. *Food engineering interfaces*, 285-323.

Bitencourt, C., Dutra, F., Pinto, V., Helbig, E., & Borges, L. (2014). Elaboration of cakes enriched by pumpkin seeds: chemical, physical and sensory assessment. *Boletim do CEPPA*, *32*(1), 19-32.

Bitencourt, C., Dutra, F., Pinto, V., Helbig, E., & Borges, L. (2014). Elaboration of cakes enriched by pumpkin seeds: chemical, physical and sensory assessment. *Boletim do CEPPA, 32*(1), 19-32.

Blake, O. A. (2006). Effect of molecular and supramolecular characteristics of select dietary fibers on extrusion expansion.

Blake, O. A. (2006). Effect of molecular and supramolecular characteristics of select dietary fibers on extrusion expansion.

Bock, J. E., & Damodaran, S. (2013). Bran-induced changes in water structure and gluten conformation in model gluten dough studied by Fourier transform infrared spectroscopy. *Food hydrocolloids*, *31*(2), 146-155.

Bock, J. E., & Damodaran, S. (2013). Bran-induced changes in water structure and gluten conformation in model gluten dough studied by Fourier transform infrared spectroscopy. *Food Hydrocolloids*, *31*(2), 146-155.

Bonerz, D., Würth, K., Dietrich, H., & Will, F. (2006). Analytical characterization and the impact of ageing on anthocyanin composition and degradation in juices from five sour cherry cultivars. *European Food Research and Technology*, *224*(3), 355-364. doi: 10.1007/s00217-006-0328-7

Boukroufa, M., Boutekedjiret, C., Petigny, L., Rakotomanomana, N., & Chemat, F. (2015). Bio-refinery of orange peels waste: A new concept based on integrated green and solvent free extraction processes using ultrasound and microwave techniques to obtain essential oil, polyphenols and pectin. *Ultrasonics Sonochemistry*, *24*, 72-79.

Boukroufa, M., Boutekedjiret, C., Petigny, L., Rakotomanomana, N., & Chemat, F. (2015). Bio-refinery of orange peels waste: A new concept based on integrated green and solvent free extraction processes using ultrasound and microwave techniques to obtain essential oil, polyphenols and pectin. *Ultrasonics Sonochemistry, 24*, 72-79.

Boulos, N. N., Greenfield, H., & Wills, R. B. H. (2000). Water holding capacity of selected soluble and insoluble dietary fibre. *International Journal of Food Properties*, *3*(2), 217-231. doi: 10.1080/10942910009524629

Bourbonnais, R., & Paice, M. G. (1990). Oxidation of non- phenolic substrates: an expanded role for laccase in lignin biodegradation. *FEBS letters, 267*(1), 99-102.

Brennan, C. S., & Tudorica, C. M. (2008). Evaluation of potential mechanisms by which dietary fiber additions reduce the predicted glycaemic index of fresh pastas. International Journal of Food Science & Technology, 43(12), 2151-2162.

Chau, C. F., Wen, Y. L., & Wang, Y. T. (2006). Improvement of the functionality of a potential fruit insoluble fibre by micron technology. *International journal of food science & technology, 41*(9), 1054-1060.

Chau, C. F., Wen, Y. L., & Wang, Y. T. (2006a). Effects of micronisation on the characteristics and physicochemical properties of insoluble fibres. *J Sci Food Agric, 86*(14), 2380-2386.

Chau, C. F., Wen, Y. L., & Wang, Y. T. (2006b). Improvement of the functionality of a potential fruit insoluble fibre by micron technology. *International Journal of Food Science & Technology, 41*(9), 1054-1060.

Chau, C.-F., Wang, Y.-T., & Wen, Y.-L. (2007). Different micronization methods significantly improve the functionality of carrot insoluble fibre. *Food chemistry, 100*(4), 1402-1408.

Chau, C.-F., Wang, Y.-T., & Wen, Y.-L. (2007). Different micronization methods significantly improve the functionality of carrot insoluble fiber. Food Chem, 100(4), 1402-1408. doi: 10.1016/j.foodchem.2005.11.034

Chemat, F., Rombaut, N., Meullemiestre, A., Turk, M., Perino, S., Fabiano- Tixier, A.S., & Abert-Vian, M. (2017). Review of green food processing techniques. Preservation, transformation, and extraction, Innov Food Sci Emerg Technol, 41 , pp. 357-377

Chen, H., Rubenthaler, G., & Schanus, E. (1988). Effect of apple fiber and cellulose on the physical properties of wheat flour. *Journal of food science, 53*(1), 304-305.

Chen, H., Rubenthaler, G., & Schanus, E. (1988). Effect of apple fiber and cellulose on the physical properties of wheat flour. *Journal of Food Science, 53*(1), 304-305.

Cilek Tatar, B., Sumnu, G., & Oztop, M. (2019). Microcapsule characterization of phenolic powder obtained from strawberry pomace. *Journal of Food Processing and Preservation, 43*(6), e13892.

Cilek Tatar, B., Sumnu, G., & Oztop, M. (2019). Microcapsule characterization of phenolic powder obtained from strawberry pomace. *Journal of Food Processing and Preservation, 43*(6), e13892.

Cilek, B., Luca, A., Hasirci, V., Sahin, S., & Sumnu, G. (2012). Microencapsulation of phenolic compounds extracted from sour cherry pomace: effect of formulation, ultrasonication time and core to coating ratio. European Food Research and Technology, 235(4), 587-596. doi: 10.1007/s00217-012-1786-8

Coimbra, M. A., Waldron, K. W., & Selvendran, R. R. (1994). Isolation and characterisation of cell wall polymers from olive pulp (Olea europaea L.). Carbohydrate Research, 252, 245-262.

Corrales, M., García, A. F., Butz, P., & Tauscher, B. (2009). Extraction of anthocyanins from grape skins assisted by high hydrostatic pressure. *Journal of food engineering, 90*(4), 415-421.

Corrales, M., García, A. F., Butz, P., & Tauscher, B. (2009). Extraction of anthocyanins from grape skins assisted by high hydrostatic pressure. Journal of Food Engineering, 90(4), 415-421.

Datta, A. K., Sumnu, G., & Raghavan, G. (2014). Dielectric properties of foods. In *Engineering properties of foods* (pp. 523-588): CRC Press.

Datta, A. K., Sumnu, G., & Raghavan, G. (2014). Dielectric properties of foods *Engineering properties of foods* (pp. 523-588): CRC Press.

de Moraes Crizel, T., Jablonski, A., de Oliveira Rios, A., Rech, R., & Flôres, S. H. (2013). Dietary fiber from orange byproducts as a potential fat replacer. *LWT-Food Science and Technology, 53*(1), 9-14.

de Moraes Crizel, T., Jablonski, A., de Oliveira Rios, A., Rech, R., & Flôres, S. H. (2013). Dietary fiber from orange byproducts as a potential fat replacer. *LWT-Food Science and Technology, 53*(1), 9-14.

De Vries, S., Pustjens, A., Schols, H., Hendriks, W., & Gerrits, W. (2012). Improving digestive utilization of fiber-rich feedstuffs in pigs and poultry by processing and enzyme technologies: A review. *Animal Feed Science and Technology, 178*(3-4), 123-138.

De Vries, S., Pustjens, A., Schols, H., Hendriks, W., & Gerrits, W. (2012). Improving digestive utilization of fiber-rich feedstuffs in pigs and poultry by processing and enzyme technologies: A review. *Animal Feed Science and Technology, 178*(3-4), 123-138.

Dreher, M. (1999). Food sources and uses of dietary fiber. In *Complex carbohydrates in foods* (pp. 330-377): CRC Press.

Dreher, M. L. (2018). Whole fruits and fruit fiber emerging health effects. Nutrients, 10(12), 1833.

Ebringerová, A., Kardošová, A., Hromadkova, Z., Malovíková, A., & Hříbalová, V. (2002). Immunomodulatory activity of acidic xylans in relation to their structural and molecular properties. *International Journal of Biological Macromolecules, 30*(1), 1-6.

Elizondo-Montemayor, L., Ramos-Parra, P. A., Jacobo-Velázquez, D. A., Treviño-Saldaña, N., Marín-Obispo, L. M., Ibarra-Garza, I. P., . . . Hernández-Brenes, C. (2020). High hydrostatic pressure stabilized micronutrients and shifted dietary fibers, from insoluble to soluble, producing a low-glycemic index mango pulp. CyTA - Journal of Food, 18(1), 203-215. doi: 10.1080/19476337.2020.1731610

Elleuch, M., Bedigian, D., Roiseux, O., Besbes, S., Blecker, C., & Attia, H. (2011). Dietary fibre and fibre-rich by-products of food processing: Characterisation, technological functionality and commercial applications: A review. *Food chemistry, 124*(2), 411-421.

Elleuch, M., Bedigian, D., Roiseux, O., Besbes, S., Blecker, C., & Attia, H. (2011). Dietary fiber and fiber-rich by-products of food processing: Characterisation, technological functionality and commercial applications: A review. Food Chem, 124(2), 411-421. doi: 10.1016/j.foodchem.2010.06.077

Faostat, F. (2019). FAOSTAT statistical database. Available from FAO Retrieved September 1, 2020, from FAO http://www.fao.org/faostat/en/#data/QC

FAOSTAT. (2018). FAO statistical database. Retrieved September 10, 2019, from http://www.fao.org/faostat/en/#data/QC

Filipčev, B., Šimurina, O., & Bodroža-Solarov, M. (2014). Quality of gingernut type biscuits as affected by varying fat content and partial replacement of honey with molasses. *Journal of Food Science and Technology, 51*(11), 3163-3171.

Filipčev, B., Šimurina, O., & Bodroža-Solarov, M. (2014). Quality of gingernut type biscuits as affected by varying fat content and partial replacement of honey with molasses. *J Food Sci Technol, 51*(11), 3163-3171.

Foschia, M., Peressini, D., Sensidoni, A., & Brennan, C. S. J. J. o. c. s. (2013). The effects of dietary fibre addition on the quality of common cereal products. *58*(2), 216-227.

Fu, J.-J., Shen, S., Duan, J.-L., Tang, C., Du, X.-Y., Wang, H.-B., & Gao, W.-D. (2017). Microwave heating: A potential pretreating method for bamboo fiber extraction. *Thermal Science, 21*(4), 1695-1699.

Gan, J., Huang, Z., Yu, Q., Peng, G., Chen, Y., Xie, J., . . . Xie, M. (2020). Microwave assisted extraction with three modifications on structural and functional properties of soluble dietary fibers from grapefruit peel. *Food hydrocolloids, 101*, 105549.

Gan, J., Huang, Z., Yu, Q., Peng, G., Chen, Y., Xie, J., . . . Xie, M. (2020). Microwave assisted extraction with three modifications on structural and functional properties of soluble dietary fibers from grapefruit peel. Food Hydrocolloids, 101, 105549. doi: 10.1016/j.foodhyd.2019.105549

Gan, J., Xie, L., Peng, G., Xie, J., Chen, Y., & Yu, Q. (2021). Systematic review on modification methods of dietary fiber. *Food hydrocolloids, 119*, 106872. doi:https://doi.org/10.1016/j.foodhyd.2021.106872

Gan, J., Xie, L., Peng, G., Xie, J., Chen, Y., & Yu, Q. (2021). Systematic review on modification methods of dietary fiber. *Food Hydrocolloids, 119*, 106872. doi: https://doi.org/10.1016/j.foodhyd.2021.106872

Gan, Z., Ellis, P., Vaughan, J., & Galliard, T. (1989). Some effects of non-endosperm components of wheat and of added gluten on wholemeal bread microstructure. *Journal of Cereal Science, 10*(2), 81-91.

Gan, Z., Ellis, P., Vaughan, J., & Galliard, T. (1989). Some effects of non-endosperm components of wheat and of added gluten on wholemeal bread microstructure. *Journal of Cereal Science, 10*(2), 81-91.

Gan, Z., Galliard, T., Ellis, P., Angold, R., & Vaughan, J. (1992). Effect of the outer bran layers on the loaf volume of wheat bread. *Journal of Cereal Science, 15*(2), 151-163.

Gan, Z., Galliard, T., Ellis, P., Angold, R., & Vaughan, J. (1992). Effect of the outer bran layers on the loaf volume of wheat bread. *Journal of Cereal Science, 15*(2), 151-163.

Giami, S. Y. (2005). Compositional and nutritional properties of selected newly developed lines of cowpea (Vigna unguiculata L. Walp). *Journal of Food Composition and Analysis, 18*(7), 665-673.

Giami, S. Y. (2005). Compositional and nutritional properties of selected newly developed lines of cowpea (Vigna unguiculata L. Walp). *Journal of Food Composition and Analysis, 18*(7), 665-673.

Giami, S., & Barber, L. (2004). Utilization of protein concentrates from ungerminated and germinated fluted pumpkin (Telfairia occidentalis Hook) seeds in cookie formulations. *Journal of the Science of Food and Agriculture, 84*(14), 1901-1907.

Giami, S., & Barber, L. (2004). Utilization of protein concentrates from ungerminated and germinated fluted pumpkin (Telfairia occidentalis Hook) seeds in cookie formulations. *J Sci Food Agric, 84*(14), 1901-1907.

Gómez, M., Moraleja, A., Oliete, B., Ruiz, E., & Caballero, P. A. (2010). Effect of fibre size on the quality of fibre-enriched layer cakes. *LWT-Food Science and Technology, 43*(1), 33-38.

Gómez, M., Moraleja, A., Oliete, B., Ruiz, E., & Caballero, P. A. (2010). Effect of fibre size on the quality of fibre-enriched layer cakes. *LWT-Food Science and Technology, 43*(1), 33-38.

Górnaś, P., Juhņeviča-Radenkova, K., Radenkovs, V., Mišina, I., Pugajeva, I., Soliven, A., & Segliņa, D. (2016). The impact of different baking conditions on the stability of the extractable polyphenols in muffins enriched by strawberry, sour cherry, raspberry or black currant pomace. *LWT-Food Science and Technology, 65*, 946-953.

Górnaś, P., Juhņeviča-Radenkova, K., Radenkovs, V., Mišina, I., Pugajeva, I., Soliven, A., & Segliņa, D. (2016). The impact of different baking conditions on the stability of the extractable polyphenols in muffins enriched by strawberry, sour cherry, raspberry or black currant pomace. LWT - Food Science and Technology, 65, 946-953. doi: 10.1016/j.lwt.2015.09.029

Gu, M., Fang, H., Gao, Y., Su, T., Niu, Y., & Yu, L. L. (2020). Characterization of enzymatic modified soluble dietary fiber from tomato peels with high release of lycopene. *Food hydrocolloids, 99*, 105321.

Gu, M., Fang, H., Gao, Y., Su, T., Niu, Y., & Yu, L. L. (2020). Characterization of enzymatic modified soluble dietary fiber from tomato peels with high release of lycopene. *Food Hydrocolloids, 99*, 105321.

Guillon, F. Champ M. (2000). Food Research International, 33 , pp. 233-245

Gujral, H. S., Mehta, S., Samra, I. S., & Goyal, P. (2003). Effect of wheat bran, coarse wheat flour, and rice flour on the instrumental texture of cookies. *International Journal of Food Properties, 6*(2), 329-340.

Gujral, H. S., Mehta, S., Samra, I. S., & Goyal, P. (2003). Effect of wheat bran, coarse wheat flour, and rice flour on the instrumental texture of cookies. *International Journal of Food Properties, 6*(2), 329-340.

Gumul, D., Korus, A., & Ziobro, R. (2020). Extruded Preparations with Sour Cherry Pomace Influence Quality and Increase the Level of Bioactive Components in Gluten-Free Breads. *International Journal of Food Science, 2020*.

Guo, W., Zhu, X., Liu, H., Yue, R., & Wang, S. (2010). Effects of milk concentration and freshness on microwave dielectric properties. *Journal of food engineering, 99*(3), 344-350.

Guo, W., Zhu, X., Liu, H., Yue, R., & Wang, S. (2010). Effects of milk concentration and freshness on microwave dielectric properties. *Journal of Food Engineering, 99*(3), 344-350.

Halvorsen, B. L., Holte, K., Myhrstad, M. C., Barikmo, I., Hvattum, E., Remberg, S. F., . . . Andersen, L. F. (2002). A systematic screening of total antioxidants in dietary plants. The Journal of nutrition, 132(3), 461-471.

Hoseney, R. C. (1994). *Principles of cereal science and technology*: American Association of Cereal Chemists (AACC).

Hoseney, R. C. (1994). Principles of cereal science and technology: American Association of Cereal Chemists (AACC).

Hou, G., Kruk, M., & Center, W. M. (1998). Asian noodle technology. *Technical Bulletin, 20*(12), 1-10.

Houška, M., & da Silva, F. V. M. (2017). *High pressure processing of fruit and vegetable products*: CRC Press.

Houška, M., & da Silva, F. V. M. (2017). *High pressure processing of fruit and vegetable products*: CRC Press.

Huang, Z., Wang, J. J., Chen, Y., Wei, N., Hou, Y., Bai, W., & Hu, S.-Q. (2020). Effect of water-soluble dietary fiber resistant dextrin on flour and bread qualities. *Food chemistry, 317*, 126452. doi:https://doi.org/10.1016/j.foodchem.2020.126452

Huang, Z., Wang, J. J., Chen, Y., Wei, N., Hou, Y., Bai, W., & Hu, S.-Q. (2020). Effect of water-soluble dietary fiber resistant dextrin on flour and bread qualities. *Food Chem, 317*, 126452. doi: https://doi.org/10.1016/j.foodchem.2020.126452

Ince, A. E., Sahin, S., & Sumnu, G. (2014). Comparison of microwave and ultrasound-assisted extraction techniques for leaching of phenolic compounds from nettle. J Food Sci Technol, 51(10), 2776-2782.

Jia, M., Yu, Q., Chen, J., He, Z., Chen, Y., Xie, J., . . . Xie, M. (2020). Physical quality and in vitro starch digestibility of biscuits as affected by addition of soluble dietary fiber from defatted rice bran. *Food hydrocolloids, 99*, 105349.

Jia, M., Yu, Q., Chen, J., He, Z., Chen, Y., Xie, J., . . . Xie, M. (2020). Physical quality and in vitro starch digestibility of biscuits as affected by addition of soluble dietary fiber from defatted rice bran. *Food Hydrocolloids, 99*, 105349.

Kaack, K., Pedersen, L., Laerke, H. N., & Meyer, A. (2006). New potato fibre for improvement of texture and colour of wheat bread. *European Food Research and Technology, 224*(2), 199-207.

Kaack, K., Pedersen, L., Laerke, H. N., & Meyer, A. (2006). New potato fibre for improvement of texture and colour of wheat bread. *European Food Research and Technology, 224*(2), 199-207.

Khaleghipour, L., Linares-Pastén, J. A., Rashedi, H., Ranaei Siadat, S. O., Jasilionis, A., Al-Hamimi, S., . . . Karlsson, E. N. (2021). Extraction of sugarcane bagasse arabinoxylan, integrated with enzymatic production of xylo-oligosaccharides and separation of cellulose. *Biotechnology for biofuels, 14*(1), 1-19.

Khattak, K., & Rahman, T. (2017). Analysis of vegetable's peels as a natural source of vitamins and minerals. *International Food Research Journal, 24*(1), 292.

Kieffer, R. (2007). Modification of gluten by emulsifiers and effects on dough stabilization. *Gluten proteins 2006*, 279-283.

Kieffer, R. (2007). Modification of gluten by emulsifiers and effects on dough stabilization. *Gluten proteins 2006*, 279-283.

Kieffer, R., Schurer, F., Köhler, P., & Wieser, H. J. J. o. C. S. (2007). Effect of hydrostatic pressure and temperature on the chemical and functional properties of wheat gluten: Studies on gluten, gliadin and glutenin. *45*(3), 285-292.

Kouniaki, S., Kajda, P., & Zabetakis, I. (2004). The effect of high hydrostatic pressure on anthocyanins and ascorbic acid in blackcurrants (Ribes nigrum). *Flavour and Fragrance Journal, 19*(4), 281-286.

Kouniaki, S., Kajda, P., & Zabetakis, I. (2004). The effect of high hydrostatic pressure on anthocyanins and ascorbic acid in blackcurrants (Ribes nigrum). Flavour and Fragrance Journal, 19(4), 281-286.

Kumar, K. A., Sharma, G., Khan, M., Govindaraj, T., & Semwal, A. (2015). Development of multigrain premixes—its effect on rheological, textural and micro-structural characteristics of dough and quality of biscuits. *Journal of Food Science and Technology, 52*(12), 7759-7770.

Kumar, K. A., Sharma, G., Khan, M., Govindaraj, T., & Semwal, A. (2015). Development of multigrain premixes—its effect on rheological, textural and micro-structural characteristics of dough and quality of biscuits. *J Food Sci Technol, 52*(12), 7759-7770.

Lee, S. C., & Prosky, L. (1992). Dietary fiber analysis. *Cereal Foods World, 37*, 765.

Lee, S. C., Prosky, L., & Vries, J. W. D. (1992). Determination of total, soluble, and insoluble dietary fiber in foods—Enzymatic-gravimetric method, MES-TRIS buffer: Collaborative study. Journal of AOAC international, 75(3), 395-416.

Li, H., & McCarthy, J. (2003). Controlling cohesive particle mixing and segregation. *Physical review letters, 90*(18), 184301.

Li, H., & McCarthy, J. (2003). Controlling cohesive particle mixing and segregation. *Physical review letters, 90*(18), 184301.

Li, M., Cheng, Y.-L., Fu, N., Li, D., Adhikari, B., & Chen, X. D. (2014). Isolation and characterization of corncob cellulose fibers using microwave-assisted chemical treatments. *International Journal of Food Engineering, 10*(3), 427-436.

Li, M., Cheng, Y.-L., Fu, N., Li, D., Adhikari, B., & Chen, X. D. (2014). Isolation and characterization of corncob cellulose fibers using microwave-assisted chemical treatments. *International Journal of Food Engineering, 10*(3), 427-436.

Li, M.-F., Sun, S.-N., Xu, F., & Sun, R.-C. (2012). Microwave-assisted organic acid extraction of lignin from bamboo: Structure and antioxidant activity investigation. Food Chem, 134(3), 1392-1398.

Li, S., Chen, G., Qiang, S., Tang, D., Chen, Y., Zhang, Z., . . . Chen, Y. (2019). Intensifying soluble dietary fiber production and properties of soybean curd residue via autoclaving treatment. *Bioresource technology reports, 7*, 100203.

Li, X., He, X., Lv, Y., & He, Q. (2014). Extraction and functional properties of water- soluble dietary fiber from apple pomace. Journal of Food Process Engineering, 37(3), 293-298.

Liao, X., Raghavan, G., Dai, J., & Yaylayan, V. (2003). Dielectric properties of α-D-glucose aqueous solutions at 2450 MHz. *Food Research International, 36*(5), 485-490.

Liao, X., Raghavan, G., Dai, J., & Yaylayan, V. (2003). Dielectric properties of α-D-glucose aqueous solutions at 2450 MHz. *Food Research International, 36*(5), 485-490.

Lin, D., Long, X., Huang, Y., Yang, Y., Wu, Z., Chen, H., . . . Tu, Z. (2020). Effects of microbial fermentation and microwave treatment on the composition, structural characteristics, and functional properties of modified okara dietary fiber. Lwt, 123, 109059.

Liu, C., Xue, H., Shen, L., Liu, C., Zheng, X., Shi, J., & Xue, S. (2019). Improvement of anthocyanins rate of blueberry powder under variable power of microwave extraction. *Separation and Purification Technology, 226*, 286-298.

Liu, C., Xue, H., Shen, L., Liu, C., Zheng, X., Shi, J., & Xue, S. (2019). Improvement of anthocyanins rate of blueberry powder under variable power of microwave extraction. Separation and Purification Technology, 226, 286-298.

Lockyer, S., & Nugent, A. P. (2017). Health effects of resistant starch. *Nutrition Bulletin, 42*(1), 10-41. doi:https://doi.org/10.1111/nbu.12244

Lockyer, S., & Nugent, A. P. (2017). Health effects of resistant starch. *Nutrition Bulletin, 42*(1), 10-41. doi: https://doi.org/10.1111/nbu.12244

Lu, X., Xi, B., Zhang, Y., & Angelidaki, I. (2011). Microwave pretreatment of rape straw for bioethanol production: focus on energy efficiency. *Bioresource technology, 102*(17), 7937-7940.

Lu, X., Xi, B., Zhang, Y., & Angelidaki, I. (2011). Microwave pretreatment of rape straw for bioethanol production: focus on energy efficiency. *Bioresource technology, 102*(17), 7937-7940.

Luca, A., Cilek, B., Hasirci, V., Sahin, S., & Sumnu, G. (2012). Effect of Degritting of Phenolic Extract from Sour Cherry Pomace on Encapsulation Efficiency—Production of Nano-suspension. Food and Bioprocess Technology, 6(9), 2494-2502. doi: 10.1007/s11947-012-0880-z

Ma, M., & Mu, T. (2016). Modification of deoiled cumin dietary fiber with laccase and cellulase under high hydrostatic pressure. Carbohydr Polym, 136, 87-94. doi: 10.1016/j.carbpol.2015.09.030

Ma, M., & Mu, T. (2016a). Effects of extraction methods and particle size distribution on the structural, physicochemical, and functional properties of dietary fiber from deoiled cumin. *Food chemistry*, *194*, 237-246.

Ma, M., & Mu, T. (2016b). Modification of deoiled cumin dietary fiber with laccase and cellulase under high hydrostatic pressure. *Carbohydr Polym*, *136*, 87-94. doi:10.1016/j.carbpol.2015.09.030

Ma, M.-m., & Mu, T.-h. (2016). Effects of extraction methods and particle size distribution on the structural, physicochemical, and functional properties of dietary fiber from deoiled cumin. Food Chem, 194, 237-246.

Mahmoud, K. (2015). Statistical optimization of cultural conditions of an halophilic alpha-amylase production by halophilic Streptomyces sp. grown on orange waste powder. *Biocatalysis and Agricultural Biotechnology, 4*(4), 685-693.

Majzoobi, M., Sharifi, S., Imani, B., & Farahnaky, A. (2013). The effect of particle size and level of rice bran on the batter and sponge cake properties.

Majzoobi, M., Sharifi, S., Imani, B., & Farahnaky, A. (2013). The effect of particle size and level of rice bran on the batter and sponge cake properties.

Mancebo, C. M., Rodríguez, P., Martínez, M. M., & Gómez, M. (2018). Effect of the addition of soluble (nutriose, inulin and polydextrose) and insoluble (bamboo, potato and pea) fibres on the quality of sugar- snap cookies. *International journal of food science & technology, 53*(1), 129-136.

Mancebo, C. M., Rodríguez, P., Martínez, M. M., & Gómez, M. (2018). Effect of the addition of soluble (nutriose, inulin and polydextrose) and insoluble (bamboo, potato and pea) fibers on the quality of sugar- snap cookies. International Journal of Food Science & Technology, 53(1), 129-136.

Mandala, I. (2005). Physical properties of fresh and frozen stored, microwave-reheated breads, containing hydrocolloids. *Journal of food Engineering, 66*(3), 291-300.

Manley, D. (2000). *Technology of biscuits, crackers and cookies* (Third ed.). Cambridge, UK: Woodhead Publishing Limited.

Manley, D. (2000). Technology of biscuits, crackers and cookies (Third ed.). Cambridge, UK: Woodhead Publishing Limited.

Manohar, R. S., & Rao, P. H. (1999). Effect of mixing method on the rheological characteristics of biscuit dough and the quality of biscuits. *European Food Research and Technology, 210*(1), 43-48.

Manohar, R. S., & Rao, P. H. (1999). Effect of mixing method on the rheological characteristics of biscuit dough and the quality of biscuits. European Food Research and Technology, 210(1), 43-48.

Mansour, E. H., & Khalil, A. H. (1997). Characteristics of low-fat beefburger as influenced by various types of wheat fibers. *Food Research International, 30*(3-4), 199-205.

Marangoni, A. G., Van Duynhoven, J. P., Acevedo, N. C., Nicholson, R. A., & Patel, A. R. (2020). Advances in our understanding of the structure and functionality of edible fats and fat mimetics. *Soft Matter, 16*(2), 289-306.

Marconi, E., Graziano, M., & Cubadda, R. (2000). Composition and utilization of barley pearling by- products for making functional pastas rich in dietary fiber and β- glucans. *Cereal Chemistry, 77*(2), 133-139.

Marconi, E., Graziano, M., & Cubadda, R. (2000). Composition and utilization of barley pearling by- products for making functional pastas rich in dietary fiber and β- glucans. Cereal Chemistry, 77(2), 133-139.

Martínez, M. M., Díaz, Á., & Gómez, M. (2014). Effect of different microstructural features of soluble and insoluble fibers on gluten-free dough rheology and bread-making. Journal of Food Engineering, 142, 49-56.

Martins, Z., Pinho, O., & Ferreira, I. (2017). Food industry by-products used as functional ingredients of bakery products. *Trends in Food Science & Technology, 67*, 106-128.

Martins, Z., Pinho, O., & Ferreira, I. (2017). Food industry by-products used as functional ingredients of bakery products. *Trends in Food Science & Technology, 67*, 106-128.

Mateos-Aparicio, I., Mateos-Peinado, C., & Rupérez, P. (2010). High hydrostatic pressure improves the functionality of dietary fibre in okara by-product from soybean. *Innovative Food Science & Emerging Technologies, 11*(3), 445-450.

Mateos-Aparicio, I., Mateos-Peinado, C., & Rupérez, P. (2010). High hydrostatic pressure improves the functionality of dietary fiber in okara by-product from soybean. Innovative Food Science & Emerging Technologies, 11(3), 445-450. doi: 10.1016/j.ifset.2010.02.003

Matthee, V., & Appledorf, H. (1978). Effect of cooking on vegetable fiber. Journal of Food Science, 43(4), 1344-1345.

Menjivar, J., & Faridi, H. (1994). Rheological properties of cookie and cracker doughs. *The Science of Cookie and Cracker Production H Faridi, ed Chapman and Hall: New York*, 283-322.

Menjivar, J., & Faridi, H. (1994). Rheological properties of cookie and cracker doughs. The Science of Cookie and Cracker Production H Faridi, ed Chapman and Hall: New York, 283-322.

Mildner- Szkudlarz, S., Bajerska, J., Zawirska- Wojtasiak, R., & Górecka, D. (2013). White grape pomace as a source of dietary fiber and polyphenols and its effect on physical and nutraceutical characteristics of wheat biscuits. J Sci Food Agric, 93(2), 389-395.

Mills, E., Wilde, P., Salt, L., & Skeggs, P. (2003). Bubble formation and stabilization in bread dough. *Food and bioproducts processing, 81*(3), 189-193.

Mills, E., Wilde, P., Salt, L., & Skeggs, P. (2003). Bubble formation and stabilization in bread dough. *Food and Bioproducts Processing, 81*(3), 189-193.

Moczkowska, M., Karp, S., Niu, Y., & Kurek, M. A. (2019). Enzymatic, enzymatic-ultrasonic and alkaline extraction of soluble dietary fibre from flaxseed–A physicochemical approach. *Food hydrocolloids*, *90*, 105-112.

Nandeesh, K., Jyotsna, R., & Venkateswara Rao, G. (2011). Effect of differently treated wheat bran on rheology, microstructure and quality characteristics of soft dough biscuits. Journal of Food Processing and Preservation, 35(2), 179-200.

Nassar, A., AbdEl-Hamied, A., & El-Naggar, E. (2008). Effect of citrus by-products flour incorporation on chemical, rheological and organolepic characteristics of biscuits. *World Journal of Agricultural Sciences*, *4*(5), 612-616.

Neupane, K., & Khadka, R. (2019). Production of garbage enzyme from different fruit and vegetable wastes and evaluation of its enzymatic and antimicrobial efficacy. *Tribhuvan University Journal of Microbiology*, *6*, 113-118.

Noor Aziah, A., Lee Min, W., & Bhat, R. (2011). Nutritional and sensory quality evaluation of sponge cake prepared by incorporation of high dietary fiber containing mango (Mangifera indica var. Chokanan) pulp and peel flours. *International journal of food sciences and nutrition*, *62*(6), 559-567.

Noor Aziah, A., Lee Min, W., & Bhat, R. (2011). Nutritional and sensory quality evaluation of sponge cake prepared by incorporation of high dietary fiber containing mango (Mangifera indica var. Chokanan) pulp and peel flours. *International journal of food sciences and nutrition*, *62*(6), 559-567.

Nyman, M., Nylander, T., & Asp, N.-G. (1993). Degradation of water-soluble fibre polysaccharides in carrots after different types of processing. *Food chemistry*, *47*(2), 169-176. doi:https://doi.org/10.1016/0308-8146(93)90239-C

Nyman, M., Nylander, T., & Asp, N.-G. (1993). Degradation of water-soluble fibre polysaccharides in carrots after different types of processing. *Food Chem*, *47*(2), 169-176. doi: https://doi.org/10.1016/0308-8146(93)90239-C

Okino-Delgado, C. H., Prado, D. Z., & Fleuri, L. F. (2018). Brazilian fruit processing, wastes as a source of lipase and other biotechnological products: a review. *Anais da Academia Brasileira de Ciências, 90*, 2927-2943.

Okur, İ., Baltacıoğlu, C., Ağçam, E., Baltacıoğlu, H., & Alpas, H. (2019). Evaluation of the Effect of Different Extraction Techniques on Sour Cherry Pomace Phenolic Content and Antioxidant Activity and Determination of Phenolic Compounds by FTIR and HPLC. Waste and Biomass Valorization, 10(12), 3545-3555. doi: 10.1007/s12649-019-00771-1

Olson, A. C., Gray, G. M., Chiu, M. C., Betschart, A. A., & Turnlund, J. R. (1988). Monosaccharides produced by acid hydrolysis of selected foods, dietary fibers, and fecal residues from white and whole wheat bread consumed by humans. *Journal of agricultural and food chemistry*, *36*(2), 300-304.

Otles, S., Despoudi, S., Bucatariu, C., & Kartal, C. (2015). Food waste management, valorization, and sustainability in the food industry. In *Food waste recovery* (pp. 3-23): Elsevier.

Pan, L. H., Luo, S. Z., Liu, F., & Luo, J. p. (2018). Comparison of rheological properties of dough and antistaling characteristics of Chinese Steamed Bread containing β- glucan from yeast or oat. *Cereal Chemistry*, *95*(1), 149-157.

Pareyt, B., Talhaoui, F., Kerckhofs, G., Brijs, K., Goesaert, H., Wevers, M., & Delcour, J. A. (2009). The role of sugar and fat in sugar-snap cookies: Structural and textural properties. *Journal of food engineering*, *90*(3), 400-408. doi:https://doi.org/10.1016/j.jfoodeng.2008.07.010

Pareyt, B., Talhaoui, F., Kerckhofs, G., Brijs, K., Goesaert, H., Wevers, M., & Delcour, J. A. (2009). The role of sugar and fat in sugar-snap cookies: Structural and textural properties. *Journal of Food Engineering*, *90*(3), 400-408. doi: https://doi.org/10.1016/j.jfoodeng.2008.07.010

Pathera, A. K., Riar, C., Yadav, S., & Sharma, D. J. K. j. f. f. s. o. a. r. (2017). Effect of dietary fiber enrichment and different cooking methods on quality of chicken nuggets. *37*(3), 410.

Pattnaik, M., Pandey, P., Martin, G. J., Mishra, H. N., & Ashokkumar, M. (2021). Innovative technologies for extraction and microencapsulation of bioactives from plant-based food waste and their applications in functional food development. *Foods*, *10*(2), 279.

Pattnaik, M., Pandey, P., Martin, G. J., Mishra, H. N., & Ashokkumar, M. (2021). Innovative technologies for extraction and microencapsulation of bioactives from plant-based food waste and their applications in functional food development. *Foods*, *10*(2), 279.

Pérez-López, E., Mateos-Aparicio, I., & Rupérez, P. (2016). Low molecular weight carbohydrates released from Okara by enzymatic treatment under high hydrostatic pressure. *Innovative Food Science & Emerging Technologies*, *38*, 76-82.

Pérez-López, E., Mateos-Aparicio, I., & Rupérez, P. (2016). Low molecular weight carbohydrates released from Okara by enzymatic treatment under high hydrostatic pressure. Innovative Food Science & Emerging Technologies, 38, 76-82. doi: 10.1016/j.ifset.2016.09.014

Pérez-López, E., Mateos-Aparicio, I., & Rupérez, P. (2017). High hydrostatic pressure aided by food-grade enzymes as a novel approach for Okara valorization. *Innovative Food Science & Emerging Technologies*, *42*, 197-203.

Pérez-López, E., Mateos-Aparicio, I., & Rupérez, P. (2017). High hydrostatic pressure aided by food-grade enzymes as a novel approach for Okara valorization. *Innovative Food Science & Emerging Technologies*, *42*, 197-203.

Periago, M.J. Ros, G. López, G., Martínez, M.C. Rincón F. (1993). Revista Española de Ciencia y Tecnologia de Alimentos, 33 , pp. 229-246

Persson, T., Dinh, E., & Jönsson, A.-S. (2009). Improvement of arabinoxylan isolation from barley husks. *Food and bioproducts processing*, *87*(3), 228-233.

Petrović, J., Rakić, D., Fišteš, A., Pajin, B., Lončarević, I., Tomović, V., & Zarić, D. (2017). Defatted wheat germ application: Influence on cookies' properties with regard to its particle size and dough moisture content. *Food Science and Technology International, 23*(7), 597-607.

Petrović, J., Rakić, D., Fišteš, A., Pajin, B., Lončarević, I., Tomović, V., & Zarić, D. (2017). Defatted wheat germ application: Influence on cookies' properties with regard to its particle size and dough moisture content. Food Science and Technology International, 23(7), 597-607.

Pineli, L. d. L., de Aguiar, L. A., de Oliveira, G. T., BOLTELHO, R., Ibiapina, M., de Lima, H. C., & Costa, A. M. (2015). Use of baru (Brazilian Almond) waste from physical extraction of oil to produce gluten free cakes. *Embrapa Cerrados-Artigo em periódico indexado (ALICE)*.

Pineli, L. d. L., de Aguiar, L. A., de Oliveira, G. T., BOLTELHO, R., Ibiapina, M., de Lima, H. C., & Costa, A. M. (2015). Use of baru (Brazilian Almond) waste from physical extraction of oil to produce gluten free cakes. *Embrapa Cerrados-Artigo em periódico indexado (ALICE)*.

Prestamo, G., & Arroyo, G. (1998). High hydrostatic pressure effects on vegetable structure. *Journal of Food Science, 63*(5), 878-881.

Quiles, A., Campbell, G. M., Struck, S., Rohm, H., & Hernando, I. J. F. R. I. (2018). Fiber from fruit pomace: A review of applications in cereal-based products. *34*(2), 162-181.

Rahman, M., Ahmed, K., Hossain, M., Saha, M., & Noor, M. (2017). Proximate composition of oilcake and ash of some rapeseed cultivars available in bangladsh.

Rahman, M., Ahmed, K., Hossain, M., Saha, M., & Noor, M. (2017). Proximate composition of oilcake and ash of some rapeseed cultivars available in bangladsh.

Raiola, A., Rigano, M. M., Calafiore, R., Frusciante, L., & Barone, A. J. M. o. i. (2014). Enhancing the health-promoting effects of tomato fruit for biofortified food. *2014*.

Rastogi, N., Raghavarao, K., Balasubramaniam, V., Niranjan, K., & Knorr, D. (2007). Opportunities and challenges in high pressure processing of foods. *Critical reviews in food science and nutrition, 47*(1), 69-112.

Rastogi, N., Raghavarao, K., Balasubramaniam, V., Niranjan, K., & Knorr, D. (2007). Opportunities and challenges in high pressure processing of foods. Crit Rev Food Sci Nutr, 47(1), 69-112.

Robertson, J. A., de Monredon, F. D., Dysseler, P., Guillon, F., Amado, R., & Thibault, J.-F. (2000). Hydration Properties of Dietary Fiber and Resistant Starch: a European Collaborative Study. LWT - Food Science and Technology, 33(2), 72-79. doi: 10.1006/fstl.1999.0595

Saeed, M. A., Ma, H., Yue, S., Wang, Q., & Tu, M. (2018). Concise review on ethanol production from food waste: development and sustainability. *Environmental Science and Pollution Research, 25*(29), 28851-28863.

Šaponjac, V. T., Ćetković, G., Čanadanović-Brunet, J., Pajin, B., Djilas, S., Petrović, J., . . . Vulić, J. (2016). Sour cherry pomace extract encapsulated

in whey and soy proteins: Incorporation in cookies. *Food chemistry, 207*, 27-33.

Sarkar, N., Ghosh, S. K., Bannerjee, S., & Aikat, K. (2012). Bioethanol production from agricultural wastes: an overview. *Renewable energy, 37*(1), 19-27.

Sarkar, N., Ghosh, S. K., Bannerjee, S., & Aikat, K. (2012). Bioethanol production from agricultural wastes: an overview. *Renewable Energy, 37*(1), 19-27.

Schiffmann, R. F. (2001). Microwave Processes for the Food. In A. K. Datta & C. A. Ramaswamy (Eds.), Handbook of microwave technology for food application (pp. 299). NewYork: Marcel Dekker Inc.

Schmid, V., Steck, J., Mayer-Miebach, E., Behsnilian, D., Briviba, K., Bunzel, M., . . . Emin, M. A. (2020). Impact of defined thermomechanical treatment on the structure and content of dietary fiber and the stability and bioaccessibility of polyphenols of chokeberry (Aronia melanocarpa) pomace. Food Research International, 134, 109232.

Selani, M. M., Brazaca, S. G. C., dos Santos Dias, C. T., Ratnayake, W. S., Flores, R. A., & Bianchini, A. (2014). Characterisation and potential application of pineapple pomace in an extruded product for fiber enhancement. Food Chem, 163, 23-30.

Sharma, P., Gaur, V. K., Sirohi, R., Varjani, S., Kim, S. H., & Wong, J. W. J. B. T. (2021). Sustainable processing of food waste for production of bio-based products for circular bioeconomy. *325*, 124684.

Sharoba, A. M., Farrag, M., & Abd El-Salam, A. (2013). Utilization of some fruits and vegetables waste as a source of dietary fiber and its effect on the cake making and its quality attributes. *Journal of Agroalimentary Processes and Technologies, 19*(4), 429-444.

Sharoba, A. M., Farrag, M., & Abd El-Salam, A. (2013). Utilization of some fruits and vegetables waste as a source of dietary fiber and its effect on the cake making and its quality attributes. Journal of Agroalimentary Processes and Technologies, 19(4), 429-444.

Simsek, M., Sumnu, G., & Sahin, S. (2012). Microwave Assisted Extraction of Phenolic Compounds from Sour Cherry Pomace. Separation Science and Technology, 47(8), 1248-1254. doi: 10.1080/01496395.2011.644616

Sowmya, M., Jeyarani, T., Jyotsna, R., & Indrani, D. (2009). Effect of replacement of fat with sesame oil and additives on rheological, microstructural, quality characteristics and fatty acid profile of cakes. *Food hydrocolloids, 23*(7), 1827-1836.

Sowmya, M., Jeyarani, T., Jyotsna, R., & Indrani, D. (2009). Effect of replacement of fat with sesame oil and additives on rheological, microstructural, quality characteristics and fatty acid profile of cakes. *Food Hydrocolloids, 23*(7), 1827-1836.

Speroni, C. S., Bender, A. B. B., Stiebe, J., Ballus, C. A., Ávila, P. F., Goldbeck, R., . . . Emanuelli, T. (2020). Granulometric fractionation and micronization: A process for increasing soluble dietary fiber content and improving technological and functional properties of olive pomace. Lwt, 130, 109526.

Sudha, M., Baskaran, V., & Leelavathi, K. (2007). Apple pomace as a source of dietary fiber and polyphenols and its effect on the rheological characteristics and cake making. *Food chemistry, 104*(2), 686-692.

Sudha, M., Baskaran, V., & Leelavathi, K. (2007). Apple pomace as a source of dietary fiber and polyphenols and its effect on the rheological characteristics and cake making. *Food Chem, 104*(2), 686-692.

Sudha, M., Srivastava, A., Vetrimani, R., & Leelavathi, K. (2007). Fat replacement in soft dough biscuits: Its implications on dough rheology and biscuit quality. *Journal of food engineering, 80*(3), 922-930.

Sudha, M., Srivastava, A., Vetrimani, R., & Leelavathi, K. (2007). Fat replacement in soft dough biscuits: Its implications on dough rheology and biscuit quality. Journal of Food Engineering, 80(3), 922-930.

Sumnu, G. (2001). A review on microwave baking of foods. *International Journal of Food Science & Technology, 36*(2), 117-127.

Sumnu, G., Turabi, E., & Oztop, M. (2005). Drying of carrots in microwave and halogen lamp–microwave combination ovens. LWT - Food Science and Technology, 38(5), 549-553. doi: 10.1016/j.lwt.2004.07.006

Sun, Y., Wu, X., Wang, Y., Luo, Y., Liu, B., & Xu, W. (2009). Preparation of soluble dietary fiber from soybean residue. Food Ferment. Ind, 35(11), 92-95.

Tangwongchai, R., Ledward, D. A., & Ames, J. M. (2000). Effect of high-pressure treatment on the texture of cherry tomato. *Journal of agricultural and food chemistry, 48*(5), 1434-1441.

Tangwongchai, R., Ledward, D. A., & Ames, J. M. (2000). Effect of high-pressure treatment on the texture of cherry tomato. Journal of Agricultural and Food Chemistry, 48(5), 1434-1441.

Tańska, M., Roszkowska, B., Czaplicki, S., Borowska, E. J., Bojarska, J., & Dąbrowska, A. (2016). Effect of fruit pomace addition on shortbread cookies to improve their physical and nutritional values. *Plant Foods for Human Nutrition, 71*(3), 307-313.

Tańska, M., Roszkowska, B., Czaplicki, S., Borowska, E. J., Bojarska, J., & Dąbrowska, A. (2016). Effect of fruit pomace addition on shortbread cookies to improve their physical and nutritional values. *Plant Foods Hum Nutr, 71*(3), 307-313.

Tapia-Salazar, M., Arévalo-Rivera, I. G., Maldonado-Muñiz, M., Garcia-Amezquita, L. E., Nieto-López, M. G., Ricque-Marie, D., . . . Welti-Chanes, J. (2019). The dietary fiber profile, total polyphenol content, functionality of Silvetia compressa and Ecklonia arborea, and modifications induced by high hydrostatic pressure treatments. *Food and Bioprocess Technology, 12*(3), 512-523.

Tapia-Salazar, M., Arévalo-Rivera, I. G., Maldonado-Muñiz, M., Garcia-Amezquita, L. E., Nieto-López, M. G., Ricque-Marie, D., . . . Welti-Chanes, J. (2019). The Dietary Fiber Profile, Total Polyphenol Content, Functionality of Silvetia compressa and Ecklonia arborea, and Modifications Induced by High Hydrostatic Pressure Treatments. Food and Bioprocess Technology, 12(3), 512-523. doi: 10.1007/s11947-018-2229-8

Tapia-Salazar, M., Arévalo-Rivera, I. G., Maldonado-Muñiz, M., Garcia-Amezquita, L. E., Nieto-López, M. G., Ricque-Marie, D., . . . Welti-Chanes, J. (2019). The dietary fiber profile, total polyphenol content, functionality of Silvetia compressa and Ecklonia arborea, and modifications induced by high hydrostatic pressure treatments. *Food and Bioprocess Technology, 12*(3), 512-523.

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldivar, S. O., & Welti-Chanes, J. (2017). The dietary fiber profile of fruit peels and functionality modifications induced by high hydrostatic pressure treatments. *Food Sci Technol Int, 23*(5), 396-402. doi:10.1177/1082013217694301

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldívar, S. O., Martín-Belloso, O., & Welti-Chanes, J. (2017). High Hydrostatic Pressure and Mild Heat Treatments for the Modification of Orange Peel Dietary Fiber: Effects on Hygroscopic Properties and Functionality. *Food and Bioprocess Technology, 11*(1), 110-121. doi:10.1007/s11947-017-1998-9

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2015). Advances in the Functional Characterization and Extraction Processes of Dietary Fiber. *Food Engineering Reviews, 8*(3), 251-271. doi:10.1007/s12393-015-9134-y

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2016). Advances in the functional characterization and extraction processes of dietary fiber. *Food Engineering Reviews, 8*(3), 251-271.

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2015). Advances in the Functional Characterization and Extraction Processes of Dietary Fiber. Food Engineering Reviews, 8(3), 251-271. doi: 10.1007/s12393-015-9134-y

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldívar, S. O., Martín-Belloso, O., & Welti-Chanes, J. (2017). High Hydrostatic Pressure and Mild Heat Treatments for the Modification of Orange Peel Dietary Fiber: Effects on Hygroscopic Properties and Functionality. *Food and Bioprocess Technology, 11*(1), 110-121. doi: 10.1007/s11947-017-1998-9

Tejada-Ortigoza, V., Garcia-Amezquita, L. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2016). Advances in the functional characterization and extraction processes of dietary fiber. *Food Engineering Reviews, 8*(3), 251-271.

Tejada-Ortigoza, V., García-Amezquita, L. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2017). The dietary fiber profile of fruit peels and functionality modifications induced by high hydrostatic pressure treatments. *Food Science and Technology International, 23*(5), 396-402.

Tejada-Ortigoza, V., García-Amezquita, L. E., Serna-Saldívar, S. O., & Welti-Chanes, J. (2017). The dietary fiber profile of fruit peels and functionality modifications induced by high hydrostatic pressure treatments. Food Science and Technology International, 23(5), 396-402.

Tostivint, C., de Veron, S., Jan, O., Lanctuit, H., Hutton, Z. V., & Loubière, M. J. J. o. C. P. (2017). Measuring food waste in a dairy supply chain in Pakistan. *145*, 221-231.

Tumbas Saponjac, V., Cetkovic, G., Canadanovic-Brunet, J., Pajin, B., Djilas, S., Petrovic, J., . . . Vulic, J. (2016). Sour cherry pomace extract encapsulated in whey and soy proteins: Incorporation in cookies. Food Chem, 207, 27-33. doi: 10.1016/j.foodchem.2016.03.082

Ullah, I., Yin, T., Xiong, S., Huang, Q., Zhang, J., & Javaid, A. B. (2018). Effects of thermal pre-treatment on physicochemical properties of nano-sized okara (soybean residue) insoluble dietary fiber prepared by wet media milling. Journal of Food Engineering, 237, 18-26.

Uygun, E., Yildiz, E., Sumnu, G., & Sahin, S. (2020). Microwave Pretreatment for the Improvement of Physicochemical Properties of Carob Flour and Rice Starch–Based Electrospun Nanofilms. *Food and Bioprocess Technology, 13*(5), 838-850. doi:10.1007/s11947-020-02440-x

Uygun, E., Yildiz, E., Sumnu, G., & Sahin, S. (2020). Microwave Pretreatment for the Improvement of Physicochemical Properties of Carob Flour and Rice Starch–Based Electrospun Nanofilms. Food and Bioprocess Technology, 13(5), 838-850. doi: 10.1007/s11947-020-02440-x

Vasantha Rupasinghe, H., Wang, L., Pitts, N. L., & Astatkie, T. (2009). Baking and sensory characteristics of muffins incorporated with apple skin powder. *Journal of Food Quality, 32*(6), 685-694.

Vasantha Rupasinghe, H., Wang, L., Pitts, N. L., & Astatkie, T. (2009). Baking and sensory characteristics of muffins incorporated with apple skin powder. *Journal of food quality, 32*(6), 685-694.

Vergara-Valencia, N., Granados-Pérez, E., Agama-Acevedo, E., Tovar, J., Ruales, J., & Bello-Pérez, L. A. (2007). Fibre concentrate from mango fruit: Characterization, associated antioxidant capacity and application as a bakery product ingredient. *LWT-Food Science and Technology, 40*(4), 722-729.

Vergara-Valencia, N., Granados-Pérez, E., Agama-Acevedo, E., Tovar, J., Ruales, J., & Bello-Pérez, L. A. (2007). Fibre concentrate from mango fruit: Characterization, associated antioxidant capacity and application as a bakery product ingredient. *LWT-Food Science and Technology, 40*(4), 722-729.

Walker, R., Tseng, A., Cavender, G., Ross, A., & Zhao, Y. (2014). Physicochemical, nutritional, and sensory qualities of wine grape pomace fortified baked goods. *Journal of food science, 79*(9), S1811-S1822.

Walker, R., Tseng, A., Cavender, G., Ross, A., & Zhao, Y. (2014). Physicochemical, nutritional, and sensory qualities of wine grape pomace fortified baked goods. *Journal of Food Science, 79*(9), S1811-S1822.

Wang, B., Sain, M., & Oksman, K. (2007). Study of structural morphology of hemp fiber from the micro to the nanoscale. *Applied Composite Materials, 14*(2), 89-103.

Wang, H., Nair, M. G., Iezzoni, A. F., Strasburg, G. M., Booren, A. M., & Gray, J. I. (1997). Quantification and characterization of anthocyanins in Balaton tart cherries. Journal of Agricultural and Food Chemistry, 45(7), 2556-2560.

Wang, J., Sun, B., Liu, Y., & Zhang, H. (2014). Optimisation of ultrasound-assisted enzymatic extraction of arabinoxylan from wheat bran. *Food chemistry*, *150*, 482-488.

Wang, K., Li, M., Wang Y. , Liu, Z., & Ni, Y. (2021). Effects of extraction methods on the structural characteristics and functional properties of dietary fiber extracted from kiwifruit (Actinidia deliciosa) Food Hydrocolloids, 110, 106162.

Wang, L., Xu, H., Yuan, F., Fan, R., & Gao, Y. (2015). Preparation and physicochemical properties of soluble dietary fiber from orange peel assisted by steam explosion and dilute acid soaking. *Food Chem*, *185*, 90-98.

Wang, M., Hamer, R., Van Vliet, T., Gruppen, H., Marseille, H., & Weegels, P. (2003). Effect of water unextractable solids on gluten formation and properties: mechanistic considerations. *Journal of Cereal Science*, *37*(1), 55-64.

Wang, M., Hamer, R., Van Vliet, T., Gruppen, H., Marseille, H., & Weegels, P. (2003). Effect of water unextractable solids on gluten formation and properties: mechanistic considerations. *Journal of Cereal Science*, *37*(1), 55-64.

Wang, M., Oudgenoeg, G., van Vliet, T., & Hamer, R. J. (2003). Interaction of water unextractable solids with gluten protein: effect on dough properties and gluten quality. *Journal of Cereal Science*, *38*(1), 95-104.

Wang, M., Oudgenoeg, G., van Vliet, T., & Hamer, R. J. (2003). Interaction of water unextractable solids with gluten protein: effect on dough properties and gluten quality. *Journal of Cereal Science, 38*(1), 95-104.

Wang, S., Kowalski, R. J., Kang, Y., Kiszonas, A. M., Zhu, M.-J., & Ganjyal, G. M. (2016). Impacts of the Particle Sizes and Levels of Inclusions of Cherry Pomace on the Physical and Structural Properties of Direct Expanded Corn Starch. Food and Bioprocess Technology, 10(2), 394-406. doi: 10.1007/s11947-016-1824-9

Wang, W., Ma, X., Xu, Y., Cao, Y., Jiang, Z., Ding, T., . . . Liu, D. (2015). Ultrasound-assisted heating extraction of pectin from grapefruit peel: Optimization and comparison with the conventional method. *Food Chem*, *178*, 106-114.

Wen, L., Zhang, Z., Zhao, M., Senthamaraikannan, R., Padamati, R. B., Sun, D. W., & Tiwari, B. K. (2020). Green extraction of soluble dietary fiber from coffee silverskin: impact of ultrasound/microwave- assisted extraction. International Journal of Food Science & Technology, 55(5), 2242-2250. doi: 10.1111/ijfs.14477

Wen, Y., Niu, M., Zhang, B., Zhao, S., & Xiong, S. (2017). Structural characteristics and functional properties of rice bran dietary fiber modified by enzymatic and enzyme-micronization treatments. Lwt, 75, 344-351. doi: 10.1016/j.lwt.2016.09.012

Xiang, S., Zou, H., Liu, Y., & Ruan, R. (2020). Effects of microwave heating on the protein structure, digestion properties and Maillard products of gluten. *Journal of Food Science and Technology*, 1-11.

Xiang, S., Zou, H., Liu, Y., & Ruan, R. (2020). Effects of microwave heating on the protein structure, digestion properties and Maillard products of gluten. J Food Sci Technol, 1-11.

Xie, F., Li, M., Lan, X., Zhang, W., Gong, S., Wu, J., & Wang, Z. (2017). Modification of dietary fibers from purple-fleshed potatoes (Heimeiren) with high hydrostatic pressure and high pressure homogenization processing: A comparative study. *Innovative Food Science & Emerging Technologies, 42*, 157-164.

Xie, F., Li, M., Lan, X., Zhang, W., Gong, S., Wu, J., & Wang, Z. (2017). Modification of dietary fibers from purple-fleshed potatoes (Heimeiren) with high hydrostatic pressure and high pressure homogenization processing: A comparative study. *Innovative Food Science & Emerging Technologies, 42*, 157-164.

Xie, F., Zhao, T., Wan, H., Li, M., Sun, L., Wang, Z., & Zhang, S. (2019). Structural and physicochemical characteristics of rice bran dietary fiber by cellulase and high-pressure homogenization. *Applied Sciences, 9*(7), 1270.

Xie, F., Zhao, T., Wan, H., Li, M., Sun, L., Wang, Z., & Zhang, S. (2019). Structural and Physicochemical Characteristics of Rice Bran Dietary Fiber by Cellulase and High-Pressure Homogenization. *Applied Sciences, 9*(7), 1270. doi: 10.3390/app9071270

Xu, Y., Zhang, L., Bailina, Y., Ge, Z., Ding, T., Ye, X., & Liu, D. (2014). Effects of ultrasound and/or heating on the extraction of pectin from grapefruit peel. *Journal of food engineering, 126*, 72-81.

Xu, Y., Zhang, L., Bailina, Y., Ge, Z., Ding, T., Ye, X., & Liu, D. (2014). Effects of ultrasound and/or heating on the extraction of pectin from grapefruit peel. *Journal of Food Engineering, 126*, 72-81.

Yan, L., Li, T., Liu, C., & Zheng, L. (2019). Effects of high hydrostatic pressure and superfine grinding treatment on physicochemical/functional properties of pear pomace and chemical composition of its soluble dietary fibre. *Lwt, 107*, 171-177.

Yoshida, B. Y., & Prudencio, S. H. (2020). Alkaline hydrogen peroxide improves physical, chemical, and techno-functional properties of okara. *Food chemistry, 323*, 126776.

Yoshida, B. Y., & Prudencio, S. H. (2020). Alkaline hydrogen peroxide improves physical, chemical, and techno-functional properties of okara. *Food Chem, 323*, 126776.

Yu, G., Bei, J., Zhao, J., Li, Q., & Cheng, C. (2018). Modification of carrot (Daucus carota Linn. var. Sativa Hoffm.) pomace insoluble dietary fiber with complex enzyme method, ultrafine comminution, and high hydrostatic pressure. *Food chemistry, 257*, 333-340.

Yu, G., Bei, J., Zhao, J., Li, Q., & Cheng, C. (2018). Modification of carrot (Daucus carota Linn. var. Sativa Hoffm.) pomace insoluble dietary fiber with complex

enzyme method, ultrafine comminution, and high hydrostatic pressure. Food Chem, 257, 333-340. doi: 10.1016/j.foodchem.2018.03.037

Zhang, Y., Liao, J., & Qi, J. (2020). Functional and structural properties of dietary fiber from citrus peel affected by the alkali combined with high-speed homogenization treatment. *LWT, 128*, 109397.

Zhang, Y., Liao, J., & Qi, J. (2020). Functional and structural properties of dietary fiber from citrus peel affected by the alkali combined with high-speed homogenization treatment. *Lwt, 128*, 109397.

Zhao, X., & Dong, C. (2016). Extracting xylooligosaccharides in wheat bran by screening and cellulase assisted enzymatic hydrolysis. *Int J Biol Macromol, 92*, 748-752.

Zheng, Y., & Li, Y. (2018). Physicochemical and functional properties of coconut (*Cocos nucifera* L) cake dietary fibers: Effects of cellulase hydrolysis, acid treatment and particle size distribution. Food Chem, 257, 135-142. doi: 10.1016/j.foodchem.2018.03.012.

Zheng, Z., Huang, Q., Luo, X., Xiao, Y., Cai, W., & Ma, H. (2019). Effects and mechanisms of ultrasound-and alkali-assisted enzymolysis on production of water-soluble yeast β-glucan. *Bioresource technology, 273*, 394-403.

Zoulias, E. I., Oreopoulou, V., & Kounalaki, E. (2002). Effect of fat and sugar replacement on cookie properties. *Journal of the Science of Food and Agriculture, 82*(14), 1637-1644.

Zoulias, E., Oreopoulou, V., & Tzia, C. (2000). Effect of fat mimetics on physical, textural and sensory properties of cookies. *International Journal of Food Properties, 3*(3), 385-397.

Zoulias, E., Oreopoulou, V., & Tzia, C. (2002). Textural properties of low-fat cookies containing carbohydrate-or protein-based fat replacers. *Journal of food engineering, 55*(4), 337-342.

APPENDICES

A. Variance Analysis Outputs of Dielectric Properties

		Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Min	Max
Dielectric_constant_915MHz	298-595	76,0580	1,47021	,63781	74,1900	78,9260	75,92	76,50
	150-297	72,2500	3,63585	,47401	70,2433	74,2767	71,14	73,79
	106-149	66,1880	4,15908	,40255	63,7946	68,5214	65,04	67,19
	75-105	65,2840	3,18992	,66871	63,2098	66,0782	64,28	66,89
	<74	71,2100	2,77585	,45852	69,7866	73,7534	70,22	72,00
	Total	73,7780	3,37118	,38927	71,0024	75,5536	72,28	74,79
Loss_factor_915MHz	298-595	6,8810	1,70325	,49142	7,1540	9,2620	5,64	10,81
	150-297	7,1940	1,94262	,52740	7,3528	9,6152	5,64	11,21
	106-149	6,9200	,91867	,47991	7,1307	9,1893	5,74	10,66
	75-105	6,7080	1,01761	,45381	7,2547	9,2013	5,88	10,24
	<74	7,0916	1,20024	,46485	7,2610	9,2550	5,81	10,74
	Total	6,9922	1,71252	,21099	7,8472	8,6880	5,64	11,21
Penetration_depth_915MHz	298-595	6,4560	1,81618	,36566	4,8817	6,4503	4,11	7,91
	150-297	6,0340	1,71005	,38215	4,6544	6,2936	3,89	7,93
	106-149	5,9980	1,30136	,31019	4,7327	6,0633	3,95	7,22
	75-105	6,1401	1,14680	,29610	4,7289	5,9991	4,11	7,09
	<74	6,0680	1,08116	,33079	4,7085	6,1275	3,97	7,45
	Total	6,4640	1,67980	,14778	5,1695	5,7585	3,89	7,93
Dielectric_constant_2450MHz	298-595	74,6400	4,34949	,68409	71,4628	74,3972	68,07	75,33
	150-297	70,6380	3,17143	,56066	70,3195	72,7245	70,13	75,70
	106-149	64,2380	2,78161	,37919	64,9647	66,5913	64,24	68,23
	75-105	63,4740	3,72613	,67032	65,3063	68,1817	63,47	69,99
	<74	69,5920	3,19448	,50981	66,7886	68,9754	65,32	70,48
	Total	68,9712	3,52836	,40742	68,1594	69,7830	63,47	75,70
Loss_factor_2450MHz	298-595	10,8560	1,17887	,25274	11,0339	12,1181	10,20	12,84
	150-297	11,4100	1,19778	,28603	11,3465	12,5735	10,23	13,29

	106-149	11,2480	,68873	,22947	11,3618	12,3462	10,72	13,10
	75-105	11,2860	,49756	,18269	11,5942	12,3778	11,22	12,98
	<74	11,2740	,90135	,23273	11,4149	12,4131	10,74	13,14
	Total	11,8580	,91295	,10542	11,6479	12,0681	10,20	13,29
Penetration_depth_2450MHz	298-595	1,5240	,73490	,03483	1,3493	1,4987	1,28	1,63
	150-297	1,4080	,55247	,03937	1,2836	1,4524	1,21	1,63
	106-149	1,3700	,69000	,02324	1,2702	1,3698	1,19	1,44
	75-105	1,3521	,08612	,01707	1,2734	1,3466	1,20	1,38
	<74	1,4180	,15556	,02984	1,2700	1,3980	1,20	1,50
	Total	1,3912	,92025	,01388	1,3235	1,3789	1,19	1,63

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Dielectric_constant_915MHz	Between Groups	536,297	4	134,074	30,801	,000
	Within Groups	304,701	70	4,353		
	Total	840,998	74			
Loss_factor_915MHz	Between Groups	,954	4	,239	,068	,991
	Within Groups	246,118	70	3,516		
	Total	247,072	74			
Penetration_depth_915MHz	Between Groups	,861	4	,215	,125	,973
	Within Groups	120,342	70	1,719		
	Total	121,203	74			
Dielectric_constant_2450MHz	Between Groups	577,830	4	144,457	29,445	,000
	Within Groups	343,422	70	4,906		
	Total	921,252	74			
Loss_factor_2450MHz	Between Groups	1,642	4	,410	,479	,751
	Within Groups	60,036	70	,858		
	Total	61,678	74			
Penetration_depth_2450MHz	Between Groups	,128	4	,032	2,383	,060
	Within Groups	,942	70	,013		
	Total	1,070	74			

B. Variance Analysis Outputs of IDF

Descriptives

IDF

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	36,4200	1,11000	,63095	33,7052	39,1348	35,16	37,11
HP-600	3	61,9900	,13000	,08083	61,6422	62,3378	61,85	62,13
MW-HP-300	3	50,8200	1,31000	,73323	47,6651	53,9749	49,55	52,09
EH	3	37,6500	1,11000	,64086	34,8926	40,4074	36,54	38,76
E-HP-600	3	31,4200	1,34000	,73323	28,2451	34,5549	30,13	32,67
EH-HP-300	3	32,6600	,14000	,06351	32,3867	32,9333	32,55	32,77
EH-HP-600	3	30,5800	1,21000	,66395	27,7232	33,4368	29,43	31,73
MW-HP-600	3	56,4700	2,06000	1,13161	52,6011	62,3389	55,51	59,43
MW	3	55,4600	2,30000	1,33368	49,7216	61,1984	53,15	57,77
E-HP-300	3	32,1500	,60000	,36950	30,5602	33,7398	31,51	32,79
HP-300	3	60,8300	1,62000	,92953	56,8305	64,8295	59,22	62,44
TT	3	41,9200	1,21000	,68705	38,9639	44,8761	40,73	43,11
MW-E-HP-600	3	33,8300	1,32000	,73323	30,6751	36,9849	32,56	35,10
Control	3	65,6200	1,20000	,66973	62,7384	68,5016	64,46	66,78
MW-E-HP-300	3	31,9200	,14000	,04041	31,7461	32,0939	31,85	31,99
MW-EH-HP-600	3	35,6500	1,92000	,05196	35,1814	35,9344	35,16	36,04
TT-HP-300	3	34,9100	,10000	,05296	34,6864	35,1336	34,82	35,00
TT-HP-600	3	38,9400	,20000	,11547	38,4032	39,3968	38,70	39,10
Total	54	43,2076	12,26370	1,71726	39,7584	46,6569	29,43	66,78

ANOVA

IDF

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7472,696	16	467,043	336,239	,000
Within Groups	47,227	37	1,389		
Total	7519,922	53			

Multiple Comparisons

Dependent Variable: IDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	-25,57000*	,96230	,000	-29,1592	-21,9808
	MW-HP-300	-14,40000*	,96230	,000	-17,9892	-10,8108
	EH	-1,23000	,96230	,996	-4,8192	2,3592
	E-HP-600	5,02000*	,96230	,001	1,4308	8,6092
	EH-HP-300	3,76000*	,96230	,032	,1708	7,3492
	EH-HP-600	5,84000*	,96230	,000	2,2508	9,4292
	MW-HP-600	-21,05000*	,96230	,000	-24,6392	-17,4608
	MW	-19,04000*	,96230	,000	-22,6292	-15,4508
	E-HP-300	4,27000*	,96230	,008	,6808	7,8592
	HP-300	-24,41000*	,96230	,000	-27,9992	-20,8208
	TT	-5,50000*	,96230	,000	-9,0892	-1,9108
	MW-E-HP-600	2,59000	,96230	,399	-,9992	6,1792
	Control	-29,20000*	,96230	,000	-32,7892	-25,6108
	MW-E-HP-300	4,50000*	,96230	,004	,9108	8,0892
	TT-HP-300	1,51000	,96230	,971	-2,0792	5,0992
	TT-HP-600	-2,48000	,96230	,470	-6,0692	1,1092
HP-600	MW-EH	25,57000*	,96230	,000	21,9808	29,1592
	MW-HP-300	11,17000*	,96230	,000	7,5808	14,7592
	EH	24,34000*	,96230	,000	20,7508	27,9292
	E-HP-600	30,59000*	,96230	,000	27,0008	34,1792
	EH-HP-300	29,33000*	,96230	,000	25,7408	32,9192
	EH-HP-600	31,41000*	,96230	,000	27,8208	34,9992
	MW-HP-600	4,52000*	,96230	,004	,9308	8,1092
	MW	6,53000*	,96230	,000	2,9408	10,1192
	E-HP-300	29,84000*	,96230	,000	26,2508	33,4292
	HP-300	1,16000	,96230	,998	-2,4292	4,7492
	TT	20,07000*	,96230	,000	16,4808	23,6592
	MW-E-HP-600	28,16000*	,96230	,000	24,5708	31,7492
	Control	-3,63000*	,96230	,045	-7,2192	-,0408
	MW-E-HP-300	30,07000*	,96230	,000	26,4808	33,6592
	TT-HP-300	27,08000*	,96230	,000	23,4908	30,6692
	TT-HP-600	23,09000*	,96230	,000	19,5008	26,6792
MW-HP-300	MW-EH	14,40000*	,96230	,000	10,8108	17,9892
	HP-600	-11,17000*	,96230	,000	-14,7592	-7,5808
	EH	13,17000*	,96230	,000	9,5808	16,7592
	E-HP-600	19,42000*	,96230	,000	15,8308	23,0092
	EH-HP-300	18,16000*	,96230	,000	14,5708	21,7492
	EH-HP-600	20,24000*	,96230	,000	16,6508	23,8292
	MW-HP-600	-6,65000*	,96230	,000	-10,2392	-3,0608
	MW	-4,64000*	,96230	,003	-8,2292	-1,0508
	E-HP-300	18,67000*	,96230	,000	15,0808	22,2592
	HP-300	-10,01000*	,96230	,000	-13,5992	-6,4208
	TT	8,90000*	,96230	,000	5,3108	12,4892
	MW-E-HP-600	16,99000*	,96230	,000	13,4008	20,5792
	Control	-14,80000*	,96230	,000	-18,3892	-11,2108
	MW-E-HP-300	18,90000*	,96230	,000	15,3108	22,4892
	TT-HP-300	15,91000*	,96230	,000	12,3208	19,4992
	TT-HP-600	11,92000*	,96230	,000	8,3308	15,5092

Multiple Comparisons

Dependent Variable: IDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
EH	MW-EH	1,23000	,96230	,996	-2,3592	4,8192
	HP-600	-24,34000*	,96230	,000	-27,9292	-20,7508
	MW-HP-300	-13,17000*	,96230	,000	-16,7592	-9,5808
	E-HP-600	6,25000*	,96230	,000	2,6608	9,8392
	EH-HP-300	4,99000*	,96230	,001	1,4008	8,5792
	EH-HP-600	7,07000*	,96230	,000	3,4808	10,6592
	MW-HP-600	-19,82000*	,96230	,000	-23,4092	-16,2308
	MW	-17,81000*	,96230	,000	-21,3992	-14,2208
	E-HP-300	5,50000*	,96230	,000	1,9108	9,0892
	HP-300	-23,18000*	,96230	,000	-26,7692	-19,5908
	TT	-4,27000*	,96230	,008	-7,8592	-,6808
	MW-E-HP-600	3,82000*	,96230	,028	,2308	7,4092
	Control	-27,97000*	,96230	,000	-31,5592	-24,3808
	MW-E-HP-300	5,73000*	,96230	,000	2,1408	9,3192
	TT-HP-300	2,74000	,96230	,312	-,8492	6,3292
	TT-HP-600	-1,25000	,96230	,995	-4,8392	2,3392
E-HP-600	MW-EH	-5,02000*	,96230	,001	-8,6092	-1,4308
	HP-600	-30,59000*	,96230	,000	-34,1792	-27,0008
	MW-HP-300	-19,42000*	,96230	,000	-23,0092	-15,8308
	EH	-6,25000*	,96230	,000	-9,8392	-2,6608
	EH-HP-300	-1,26000	,96230	,995	-4,8492	2,3292
	EH-HP-600	,82000	,96230	1,000	-2,7692	4,4092
	MW-HP-600	-26,07000*	,96230	,000	-29,6592	-22,4808
	MW	-24,06000*	,96230	,000	-27,6492	-20,4708
	E-HP-300	-,75000	,96230	1,000	-4,3392	2,8392
	HP-300	-29,43000*	,96230	,000	-33,0192	-25,8408
	TT	-10,52000*	,96230	,000	-14,1092	-6,9308
	MW-E-HP-600	-2,43000	,96230	,504	-6,0192	1,1592
	Control	-34,22000*	,96230	,000	-37,8092	-30,6308
	MW-E-HP-300	-,52000	,96230	1,000	-4,1092	3,0692
	TT-HP-300	-3,51000	,96230	,061	-7,0992	,0792
	TT-HP-600	-7,50000*	,96230	,000	-11,0892	-3,9108
EH-HP-300	MW-EH	-3,76000*	,96230	,032	-7,3492	-,1708
	HP-600	-29,33000*	,96230	,000	-32,9192	-25,7408
	MW-HP-300	-18,16000*	,96230	,000	-21,7492	-14,5708
	EH	-4,99000*	,96230	,001	-8,5792	-1,4008
	E-HP-600	1,26000	,96230	,995	-2,3292	4,8492
	EH-HP-600	2,08000	,96230	,741	-1,5092	5,6692
	MW-HP-600	-24,81000*	,96230	,000	-28,3992	-21,2208
	MW	-22,80000*	,96230	,000	-26,3892	-19,2108
	E-HP-300	,51000	,96230	1,000	-3,0792	4,0992
	HP-300	-28,17000*	,96230	,000	-31,7592	-24,5808
	TT	-9,26000*	,96230	,000	-12,8492	-5,6708
	MW-E-HP-600	-1,17000	,96230	,998	-4,7592	2,4192
	Control	-32,96000*	,96230	,000	-36,5492	-29,3708
	MW-E-HP-300	,74000	,96230	1,000	-2,8492	4,3292
	TT-HP-300	-2,25000	,96230	,628	-5,8392	1,3392
	TT-HP-600	-6,24000*	,96230	,000	-9,8292	-2,6508

Multiple Comparisons

Dependent Variable: IDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
EH-HP-600	MW-EH	-5,84000*	,96230	,000	-9,4292	-2,2508
	HP-600	-31,41000*	,96230	,000	-34,9992	-27,8208
	MW-HP-300	-20,24000*	,96230	,000	-23,8292	-16,6508
	EH	-7,07000*	,96230	,000	-10,6592	-3,4808
	E-HP-600	-,82000	,96230	1,000	-4,4092	2,7692
	EH-HP-300	-2,08000	,96230	,741	-5,6692	1,5092
	MW-HP-600	-26,89000*	,96230	,000	-30,4792	-23,3008
	MW	-24,88000*	,96230	,000	-28,4692	-21,2908
	E-HP-300	-1,57000	,96230	,960	-5,1592	2,0192
	HP-300	-30,25000*	,96230	,000	-33,8392	-26,6608
	TT	-11,34000*	,96230	,000	-14,9292	-7,7508
	MW-E-HP-600	-3,25000	,96230	,112	-6,8392	,3392
	Control	-35,04000*	,96230	,000	-38,6292	-31,4508
	MW-E-HP-300	-1,34000	,96230	,990	-4,9292	2,2492
	TT-HP-300	-4,33000*	,96230	,007	-7,9192	-,7408
	TT-HP-600	-8,32000*	,96230	,000	-11,9092	-4,7308
MW-HP-600	MW-EH	21,05000*	,96230	,000	17,4608	24,6392
	HP-600	-4,52000*	,96230	,004	-8,1092	-,9308
	MW-HP-300	6,65000*	,96230	,000	3,0608	10,2392
	EH	19,82000*	,96230	,000	16,2308	23,4092
	E-HP-600	26,07000*	,96230	,000	22,4808	29,6592
	EH-HP-300	24,81000*	,96230	,000	21,2208	28,3992
	EH-HP-600	26,89000*	,96230	,000	23,3008	30,4792
	MW	2,01000	,96230	,783	-1,5792	5,5992
	E-HP-300	25,32000*	,96230	,000	21,7308	28,9092
	HP-300	-3,36000	,96230	,087	-6,9492	,2292
	TT	15,55000*	,96230	,000	11,9608	19,1392
	MW-E-HP-600	23,64000*	,96230	,000	20,0508	27,2292
	Control	-8,15000*	,96230	,000	-11,7392	-4,5608
	MW-E-HP-300	25,55000*	,96230	,000	21,9608	29,1392
	TT-HP-300	22,56000*	,96230	,000	18,9708	26,1492
	TT-HP-600	18,57000*	,96230	,000	14,9808	22,1592
MW	MW-EH	19,04000*	,96230	,000	15,4508	22,6292
	HP-600	-6,53000*	,96230	,000	-10,1192	-2,9408
	MW-HP-300	4,64000*	,96230	,003	1,0508	8,2292
	EH	17,81000*	,96230	,000	14,2208	21,3992
	E-HP-600	24,06000*	,96230	,000	20,4708	27,6492
	EH-HP-300	22,80000*	,96230	,000	19,2108	26,3892
	EH-HP-600	24,88000*	,96230	,000	21,2908	28,4692
	MW-HP-600	-2,01000	,96230	,783	-5,5992	1,5792
	E-HP-300	23,31000*	,96230	,000	19,7208	26,8992
	HP-300	-5,37000*	,96230	,000	-8,9592	-1,7808
	TT	13,54000*	,96230	,000	9,9508	17,1292
	MW-E-HP-600	21,63000*	,96230	,000	18,0408	25,2192
	Control	-10,16000*	,96230	,000	-13,7492	-6,5708
	MW-E-HP-300	23,54000*	,96230	,000	19,9508	27,1292
	TT-HP-300	20,55000*	,96230	,000	16,9608	24,1392
	TT-HP-600	16,56000*	,96230	,000	12,9708	20,1492

Multiple Comparisons

Dependent Variable: IDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
E-HP-300	MW-EH	-4,27000*	,96230	,008	-7,8592	-,6808
	HP-600	-29,84000*	,96230	,000	-33,4292	-26,2508
	MW-HP-300	-18,67000*	,96230	,000	-22,2592	-15,0808
	EH	-5,50000*	,96230	,000	-9,0892	-1,9108
	E-HP-600	,75000	,96230	1,000	-2,8392	4,3392
	EH-HP-300	-,51000	,96230	1,000	-4,0992	3,0792
	EH-HP-600	1,57000	,96230	,960	-2,0192	5,1592
	MW-HP-600	-25,32000*	,96230	,000	-28,9092	-21,7308
	MW	-23,31000*	,96230	,000	-26,8992	-19,7208
	HP-300	-28,68000*	,96230	,000	-32,2692	-25,0908
	TT	-9,77000*	,96230	,000	-13,3592	-6,1808
	MW-E-HP-600	-1,68000	,96230	,932	-5,2692	1,9092
	Control	-33,47000*	,96230	,000	-37,0592	-29,8808
	MW-E-HP-300	,23000	,96230	1,000	-3,3592	3,8192
	TT-HP-300	-2,76000	,96230	,301	-6,3492	,8292
	TT-HP-600	-6,75000*	,96230	,000	-10,3392	-3,1608
HP-300	MW-EH	24,41000*	,96230	,000	20,8208	27,9992
	HP-600	-1,16000	,96230	,998	-4,7492	2,4292
	MW-HP-300	10,01000*	,96230	,000	6,4208	13,5992
	EH	23,18000*	,96230	,000	19,5908	26,7692
	E-HP-600	29,43000*	,96230	,000	25,8408	33,0192
	EH-HP-300	28,17000*	,96230	,000	24,5808	31,7592
	EH-HP-600	30,25000*	,96230	,000	26,6608	33,8392
	MW-HP-600	3,36000	,96230	,087	-,2292	6,9492
	MW	5,37000*	,96230	,000	1,7808	8,9592
	E-HP-300	28,68000*	,96230	,000	25,0908	32,2692
	TT	18,91000*	,96230	,000	15,3208	22,4992
	MW-E-HP-600	27,00000*	,96230	,000	23,4108	30,5892
	Control	-4,79000*	,96230	,002	-8,3792	-1,2008
	MW-E-HP-300	28,91000*	,96230	,000	25,3208	32,4992
	TT-HP-300	25,92000*	,96230	,000	22,3308	29,5092
	TT-HP-600	21,93000*	,96230	,000	18,3408	25,5192
TT	MW-EH	5,50000*	,96230	,000	1,9108	9,0892
	HP-600	-20,07000*	,96230	,000	-23,6592	-16,4808
	MW-HP-300	-8,90000*	,96230	,000	-12,4892	-5,3108
	EH	4,27000*	,96230	,008	,6808	7,8592
	E-HP-600	10,52000*	,96230	,000	6,9308	14,1092
	EH-HP-300	9,26000*	,96230	,000	5,6708	12,8492
	EH-HP-600	11,34000*	,96230	,000	7,7508	14,9292
	MW-HP-600	-15,55000*	,96230	,000	-19,1392	-11,9608
	MW	-13,54000*	,96230	,000	-17,1292	-9,9508
	E-HP-300	9,77000*	,96230	,000	6,1808	13,3592
	HP-300	-18,91000*	,96230	,000	-22,4992	-15,3208
	MW-E-HP-600	8,09000*	,96230	,000	4,5008	11,6792
	Control	-23,70000*	,96230	,000	-27,2892	-20,1108
	MW-E-HP-300	10,00000*	,96230	,000	6,4108	13,5892
	TT-HP-300	7,01000*	,96230	,000	3,4208	10,5992
	TT-HP-600	3,02000	,96230	,183	-,5692	6,6092

Multiple Comparisons

Dependent Variable: IDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-E-HP-600	MW-EH	-2,59000	,96230	,399	-6,1792	,9992
	HP-600	-28,16000*	,96230	,000	-31,7492	-24,5708
	MW-HP-300	-16,99000*	,96230	,000	-20,5792	-13,4008
	EH	-3,82000*	,96230	,028	-7,4092	-,2308
	E-HP-600	2,43000	,96230	,504	-1,1592	6,0192
	EH-HP-300	1,17000	,96230	,998	-2,4192	4,7592
	EH-HP-600	3,25000	,96230	,112	-,3392	6,8392
	MW-HP-600	-23,64000*	,96230	,000	-27,2292	-20,0508
	MW	-21,63000*	,96230	,000	-25,2192	-18,0408
	E-HP-300	1,68000	,96230	,932	-1,9092	5,2692
	HP-300	-27,00000*	,96230	,000	-30,5892	-23,4108
	TT	-8,09000*	,96230	,000	-11,6792	-4,5008
	Control	-31,79000*	,96230	,000	-35,3792	-28,2008
	MW-E-HP-300	1,91000	,96230	,838	-1,6792	5,4992
	TT-HP-300	-1,08000	,96230	,999	-4,6692	2,5092
	TT-HP-600	-5,07000*	,96230	,001	-8,6592	-1,4808
Control	MW-EH	29,20000*	,96230	,000	25,6108	32,7892
	HP-600	3,63000*	,96230	,045	,0408	7,2192
	MW-HP-300	14,80000*	,96230	,000	11,2108	18,3892
	EH	27,97000*	,96230	,000	24,3808	31,5592
	E-HP-600	34,22000*	,96230	,000	30,6308	37,8092
	EH-HP-300	32,96000*	,96230	,000	29,3708	36,5492
	EH-HP-600	35,04000*	,96230	,000	31,4508	38,6292
	MW-HP-600	8,15000*	,96230	,000	4,5608	11,7392
	MW	10,16000*	,96230	,000	6,5708	13,7492
	E-HP-300	33,47000*	,96230	,000	29,8808	37,0592
	HP-300	4,79000*	,96230	,002	1,2008	8,3792
	TT	23,70000*	,96230	,000	20,1108	27,2892
	MW-E-HP-600	31,79000*	,96230	,000	28,2008	35,3792
	MW-E-HP-300	33,70000*	,96230	,000	30,1108	37,2892
	TT-HP-300	30,71000*	,96230	,000	27,1208	34,2992
	TT-HP-600	26,72000*	,96230	,000	23,1308	30,3092
MW-E-HP-300	MW-EH	-4,50000*	,96230	,004	-8,0892	-,9108
	HP-600	-30,07000*	,96230	,000	-33,6592	-26,4808
	MW-HP-300	-18,90000*	,96230	,000	-22,4892	-15,3108
	EH	-5,73000*	,96230	,000	-9,3192	-2,1408
	E-HP-600	,52000	,96230	1,000	-3,0692	4,1092
	EH-HP-300	-,74000	,96230	1,000	-4,3292	2,8492
	EH-HP-600	1,34000	,96230	,990	-2,2492	4,9292
	MW-HP-600	-25,55000*	,96230	,000	-29,1392	-21,9608
	MW	-23,54000*	,96230	,000	-27,1292	-19,9508
	E-HP-300	-,23000	,96230	1,000	-3,8192	3,3592
	HP-300	-28,91000*	,96230	,000	-32,4992	-25,3208
	TT	-10,00000*	,96230	,000	-13,5892	-6,4108
	MW-E-HP-600	-1,91000	,96230	,838	-5,4992	1,6792
	Control	-33,70000*	,96230	,000	-37,2892	-30,1108
	TT-HP-300	-2,99000	,96230	,195	-6,5792	,5992
	TT-HP-600	-6,98000*	,96230	,000	-10,5692	-3,3908

Multiple Comparisons

Dependent Variable: IDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
TT-HP-300	MW-EH	-1,51000	,96230	,971	-5,0992	2,0792
	HP-600	-27,08000*	,96230	,000	-30,6692	-23,4908
	MW-HP-300	-15,91000*	,96230	,000	-19,4992	-12,3208
	EH	-2,74000	,96230	,312	-6,3292	,8492
	E-HP-600	3,51000	,96230	,061	-,0792	7,0992
	EH-HP-300	2,25000	,96230	,628	-1,3392	5,8392
	EH-HP-600	4,33000*	,96230	,007	,7408	7,9192
	MW-HP-600	-22,56000*	,96230	,000	-26,1492	-18,9708
	MW	-20,55000*	,96230	,000	-24,1392	-16,9608
	E-HP-300	2,76000	,96230	,301	-,8292	6,3492
	HP-300	-25,92000*	,96230	,000	-29,5092	-22,3308
	TT	-7,01000*	,96230	,000	-10,5992	-3,4208
	MW-E-HP-600	1,08000	,96230	,999	-2,5092	4,6692
	Control	-30,71000*	,96230	,000	-34,2992	-27,1208
	MW-E-HP-300	2,99000	,96230	,195	-,5992	6,5792
	TT-HP-600	-3,99000*	,96230	,018	-7,5792	-,4008
TT-HP-600	MW-EH	2,48000	,96230	,470	-1,1092	6,0692
	HP-600	-23,09000*	,96230	,000	-26,6792	-19,5008
	MW-HP-300	-11,92000*	,96230	,000	-15,5092	-8,3308
	EH	1,25000	,96230	,995	-2,3392	4,8392
	E-HP-600	7,50000*	,96230	,000	3,9108	11,0892
	EH-HP-300	6,24000*	,96230	,000	2,6508	9,8292
	EH-HP-600	8,32000*	,96230	,000	4,7308	11,9092
	MW-HP-600	-18,57000*	,96230	,000	-22,1592	-14,9808
	MW	-16,56000*	,96230	,000	-20,1492	-12,9708
	E-HP-300	6,75000*	,96230	,000	3,1608	10,3392
	HP-300	-21,93000*	,96230	,000	-25,5192	-18,3408
	TT	-3,02000	,96230	,183	-6,6092	,5692
	MW-E-HP-600	5,07000*	,96230	,001	1,4808	8,6592
	Control	-26,72000*	,96230	,000	-30,3092	-23,1308
	MW-E-HP-300	6,98000*	,96230	,000	3,3908	10,5692
	TT-HP-300	3,99000*	,96230	,018	,4008	7,5792

*. The mean difference is significant at the 0.05 level.

IDF

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05										
		1	2	3	4	5	6	7	8	9	10	11
EH-HP-600	3	30,5800										
E-HP-600	3	31,4000	31,4000									
MW-EH-HP-300	3	31,9200	31,9200									
E-HP-300	3	32,1500	32,1500									
EH-HP-300	3	32,6600	32,6600									
MW-EH-HP-600	3	33,8300	33,8300	33,8300								
TT-HP-300	3		34,9100	34,9100	34,9100							
MW-EH	3			36,4200	36,4200	36,4200						
EH	3				37,6500	37,6500						
TT-HP-600	3					38,9000	38,9000					
TT	3						41,9200					
MW-HP-300	3							50,8200				
MW	3								55,4600			
MW-HP-600	3								57,4700	57,4700		
HP-300	3									60,8300	60,8300	
HP-600	3										61,9900	
C	3											65,6200
Sig.		,112	,061	,399	,312	,470	,183	1,000	,783	,087	,998	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

C. Variance Analysis Outputs of SDF

Descriptives

SDF

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	19,9700	1,72000	,96718	15,8086	24,1314	18,44	21,76
HP-600	3	17,3300	,43000	,20207	16,4606	18,1994	16,98	17,68
MW-HP-300	3	22,1300	1,70000	,96995	17,9566	26,3034	20,45	23,81
EH	3	16,6300	,09000	,05196	16,4064	16,8536	16,54	16,72
E-HP-600	3	13,6400	,62000	,36373	12,0350	15,1650	12,97	14,23
EH-HP-300	3	18,3300	,42000	,21939	17,3860	19,2740	17,95	18,71
EH-HP-600	3	20,7000	,31000	,19630	19,8554	21,5446	20,36	21,04
MW-HP-600	3	23,1600	,14000	,08660	22,7874	23,5326	23,01	23,31
MW	3	20,5600	,20000	,12702	20,0135	21,1065	20,34	20,78
E-HP-300	3	12,4200	,51000	,27135	11,2525	13,5875	11,95	12,89
HP-300	3	15,4700	1,19000	,68705	12,5139	18,4261	14,28	16,66
TT	3	21,5200	4,49000	2,59230	10,3662	32,6738	17,03	26,01
MW-E-HP-600	3	17,4400	1,82000	1,01036	13,0928	21,7872	15,69	19,19
Control	3	14,2200	,19000	,10970	13,7480	14,6920	14,03	14,41
MW-E-HP-300	3	15,6700	,24000	,12124	15,1483	16,1917	15,46	15,88
MW-EH-HP-600	3	20,1200	1,130000	,12432	20,0008	21,1017	20,21	20,71
TT-HP-300	3	15,9400	,12000	,04619	15,7413	16,1387	15,86	16,02
TT-HP-600	3	17,6700	,60000	,36373	16,1050	19,2350	17,04	18,30
Total	54	17,8094	3,26909	,45776	16,8900	18,7289	11,95	26,01

ANOVA

SDF

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	470,686	16	29,418	15,712	,000
Within Groups	63,660	37	1,872		
Total	534,346	53			

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	2,64000	1,11725	,611	-1,5271	6,8071
	MW-HP-300	-2,16000	1,11725	,862	-6,3271	2,0071
	EH	3,34000	1,11725	,243	-,8271	7,5071
	E-HP-600	6,37000*	1,11725	,000	2,2029	10,5371
	EH-HP-300	1,64000	1,11725	,984	-2,5271	5,8071
	EH-HP-600	-,73000	1,11725	1,000	-4,8971	3,4371
	MW-HP-600	-3,19000	1,11725	,307	-7,3571	,9771
	MW	-,59000	1,11725	1,000	-4,7571	3,5771
	E-HP-300	7,55000*	1,11725	,000	3,3829	11,7171
	HP-300	4,50000*	1,11725	,024	,3329	8,6671
	TT	-1,55000	1,11725	,991	-5,7171	2,6171
	MW-E-HP-600	2,53000	1,11725	,676	-1,6371	6,6971
	Control	5,75000*	1,11725	,001	1,5829	9,9171
	MW-E-HP-300	4,30000*	1,11725	,037	,1329	8,4671
	TT-HP-300	4,03000	1,11725	,067	-,1371	8,1971
	TT-HP-600	2,30000	1,11725	,800	-1,8671	6,4671
HP-600	MW-EH	-2,64000	1,11725	,611	-6,8071	1,5271
	MW-HP-300	-4,80000*	1,11725	,012	-8,9671	-,6329
	EH	,70000	1,11725	1,000	-3,4671	4,8671
	E-HP-600	3,73000	1,11725	,122	-,4371	7,8971
	EH-HP-300	-1,00000	1,11725	1,000	-5,1671	3,1671
	EH-HP-600	-3,37000	1,11725	,231	-7,5371	,7971
	MW-HP-600	-5,83000*	1,11725	,001	-9,9971	-1,6629
	MW	-3,23000	1,11725	,289	-7,3971	,9371
	E-HP-300	4,91000*	1,11725	,009	,7429	9,0771
	HP-300	1,86000	1,11725	,953	-2,3071	6,0271
	TT	-4,19000*	1,11725	,048	-8,3571	-,0229
	MW-E-HP-600	-,11000	1,11725	1,000	-4,2771	4,0571
	Control	3,11000	1,11725	,346	-1,0571	7,2771
	MW-E-HP-300	1,66000	1,11725	,982	-2,5071	5,8271
	TT-HP-300	1,39000	1,11725	,997	-2,7771	5,5571
	TT-HP-600	-,34000	1,11725	1,000	-4,5071	3,8271

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
	TT-HP-300	1,39000	1,11725	,997	-2,7771	5,5571
	TT-HP-600	-,34000	1,11725	1,000	-4,5071	3,8271
MW-HP-300	MW-EH	2,16000	1,11725	,862	-2,0071	6,3271
	HP-600	4,80000*	1,11725	,012	,6329	8,9671
	EH	5,50000*	1,11725	,002	1,3329	9,6671
	E-HP-600	8,53000*	1,11725	,000	4,3629	12,6971
	EH-HP-300	3,80000	1,11725	,106	-,3671	7,9671
	EH-HP-600	1,43000	1,11725	,996	-2,7371	5,5971
	MW-HP-600	-1,03000	1,11725	1,000	-5,1971	3,1371
	MW	1,57000	1,11725	,989	-2,5971	5,7371
	E-HP-300	9,71000*	1,11725	,000	5,5429	13,8771
	HP-300	6,66000*	1,11725	,000	2,4929	10,8271
	TT	,61000	1,11725	1,000	-3,5571	4,7771
	MW-E-HP-600	4,69000*	1,11725	,015	,5229	8,8571
	Control	7,91000*	1,11725	,000	3,7429	12,0771
	MW-E-HP-300	6,46000*	1,11725	,000	2,2929	10,6271
	TT-HP-300	6,19000*	1,11725	,000	2,0229	10,3571
	TT-HP-600	4,46000*	1,11725	,026	,2929	8,6271
EH	MW-EH	-3,34000	1,11725	,243	-7,5071	,8271
	HP-600	-,70000	1,11725	1,000	-4,8671	3,4671
	MW-HP-300	-5,50000*	1,11725	,002	-9,6671	-1,3329
	E-HP-600	3,03000	1,11725	,387	-1,1371	7,1971
	EH-HP-300	-1,70000	1,11725	,978	-5,8671	2,4671
	EH-HP-600	-4,07000	1,11725	,061	-8,2371	,0971
	MW-HP-600	-6,53000*	1,11725	,000	-10,6971	-2,3629
	MW	-3,93000	1,11725	,082	-8,0971	,2371
	E-HP-300	4,21000*	1,11725	,046	,0429	8,3771
	HP-300	1,16000	1,11725	1,000	-3,0071	5,3271
	TT	-4,89000*	1,11725	,010	-9,0571	-,7229
	MW-E-HP-600	-,81000	1,11725	1,000	-4,9771	3,3571
	Control	2,41000	1,11725	,743	-1,7571	6,5771
	MW-E-HP-300	,96000	1,11725	1,000	-3,2071	5,1271
	TT-HP-300	,69000	1,11725	1,000	-3,4771	4,8571
	TT-HP-600	-1,04000	1,11725	1,000	-5,2071	3,1271

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
E-HP-600	MW-EH	-6,37000*	1,11725	,000	-10,5371	-2,2029
	HP-600	-3,73000	1,11725	,122	-7,8971	,4371
	MW-HP-300	-8,53000*	1,11725	,000	-12,6971	-4,3629
	EH	-3,03000	1,11725	,387	-7,1971	1,1371
	EH-HP-300	-4,73000*	1,11725	,014	-8,8971	-,5629
	EH-HP-600	-7,10000*	1,11725	,000	-11,2671	-2,9329
	MW-HP-600	-9,56000*	1,11725	,000	-13,7271	-5,3929
	MW	-6,96000*	1,11725	,000	-11,1271	-2,7929
	E-HP-300	1,18000	1,11725	1,000	-2,9871	5,3471
	HP-300	-1,87000	1,11725	,951	-6,0371	2,2971
	TT	-7,92000*	1,11725	,000	-12,0871	-3,7529
	MW-E-HP-600	-3,84000	1,11725	,098	-8,0071	,3271
	Control	-,62000	1,11725	1,000	-4,7871	3,5471
	MW-E-HP-300	-2,07000	1,11725	,896	-6,2371	2,0971
	TT-HP-300	-2,34000	1,11725	,780	-6,5071	1,8271
	TT-HP-600	-4,07000	1,11725	,061	-8,2371	,0971
EH-HP-300	MW-EH	-1,64000	1,11725	,984	-5,8071	2,5271
	HP-600	1,00000	1,11725	1,000	-3,1671	5,1671
	MW-HP-300	-3,80000	1,11725	,106	-7,9671	,3671
	EH	1,70000	1,11725	,978	-2,4671	5,8671
	E-HP-600	4,73000*	1,11725	,014	,5629	8,8971
	EH-HP-600	-2,37000	1,11725	,765	-6,5371	1,7971
	MW-HP-600	-4,83000*	1,11725	,011	-8,9971	-,6629
	MW	-2,23000	1,11725	,833	-6,3971	1,9371
	E-HP-300	5,91000*	1,11725	,001	1,7429	10,0771
	HP-300	2,86000	1,11725	,481	-1,3071	7,0271
	TT	-3,19000	1,11725	,307	-7,3571	,9771
	MW-E-HP-600	,89000	1,11725	1,000	-3,2771	5,0571
	Control	4,11000	1,11725	,056	-,0571	8,2771
	MW-E-HP-300	2,66000	1,11725	,600	-1,5071	6,8271
	TT-HP-300	2,39000	1,11725	,754	-1,7771	6,5571
	TT-HP-600	,66000	1,11725	1,000	-3,5071	4,8271

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
EH-HP-600	MW-EH	,73000	1,11725	1,000	-3,4371	4,8971
	HP-600	3,37000	1,11725	,231	-,7971	7,5371
	MW-HP-300	-1,43000	1,11725	,996	-5,5971	2,7371
	EH	4,07000	1,11725	,061	-,0971	8,2371
	E-HP-600	7,10000*	1,11725	,000	2,9329	11,2671
	EH-HP-300	2,37000	1,11725	,765	-1,7971	6,5371
	MW-HP-600	-2,46000	1,11725	,716	-6,6271	1,7071
	MW	,14000	1,11725	1,000	-4,0271	4,3071
	E-HP-300	8,28000*	1,11725	,000	4,1129	12,4471
	HP-300	5,23000*	1,11725	,004	1,0629	9,3971
	TT	-,82000	1,11725	1,000	-4,9871	3,3471
	MW-E-HP-600	3,26000	1,11725	,276	-,9071	7,4271
	Control	6,48000*	1,11725	,000	2,3129	10,6471
	MW-E-HP-300	5,03000*	1,11725	,007	,8629	9,1971
	TT-HP-300	4,76000*	1,11725	,013	,5929	8,9271
	TT-HP-600	3,03000	1,11725	,387	-1,1371	7,1971
MW-HP-600	MW-EH	3,19000	1,11725	,307	-,9771	7,3571
	HP-600	5,83000*	1,11725	,001	1,6629	9,9971
	MW-HP-300	1,03000	1,11725	1,000	-3,1371	5,1971
	EH	6,53000*	1,11725	,000	2,3629	10,6971
	E-HP-600	9,56000*	1,11725	,000	5,3929	13,7271
	EH-HP-300	4,83000*	1,11725	,011	,6629	8,9971
	EH-HP-600	2,46000	1,11725	,716	-1,7071	6,6271
	MW	2,60000	1,11725	,635	-1,5671	6,7671
	E-HP-300	10,74000*	1,11725	,000	6,5729	14,9071
	HP-300	7,69000*	1,11725	,000	3,5229	11,8571
	TT	1,64000	1,11725	,984	-2,5271	5,8071
	MW-E-HP-600	5,72000*	1,11725	,001	1,5529	9,8871
	Control	8,94000*	1,11725	,000	4,7729	13,1071
	MW-E-HP-300	7,49000*	1,11725	,000	3,3229	11,6571
	TT-HP-300	7,22000*	1,11725	,000	3,0529	11,3871
	TT-HP-600	5,49000*	1,11725	,002	1,3229	9,6571

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW	MW-EH	,59000	1,11725	1,000	-3,5771	4,7571
	HP-600	3,23000	1,11725	,289	-,9371	7,3971
	MW-HP-300	-1,57000	1,11725	,989	-5,7371	2,5971
	EH	3,93000	1,11725	,082	-,2371	8,0971
	E-HP-600	6,96000*	1,11725	,000	2,7929	11,1271
	EH-HP-300	2,23000	1,11725	,833	-1,9371	6,3971
	EH-HP-600	-,14000	1,11725	1,000	-4,3071	4,0271
	MW-HP-600	-2,60000	1,11725	,635	-6,7671	1,5671
	E-HP-300	8,14000*	1,11725	,000	3,9729	12,3071
	HP-300	5,09000*	1,11725	,006	,9229	9,2571
	TT	-,96000	1,11725	1,000	-5,1271	3,2071
	MW-E-HP-600	3,12000	1,11725	,341	-1,0471	7,2871
	Control	6,34000*	1,11725	,000	2,1729	10,5071
	MW-E-HP-300	4,89000*	1,11725	,010	,7229	9,0571
	TT-HP-300	4,62000*	1,11725	,018	,4529	8,7871
	TT-HP-600	2,89000	1,11725	,464	-1,2771	7,0571
E-HP-300	MW-EH	-7,55000*	1,11725	,000	-11,7171	-3,3829
	HP-600	-4,91000*	1,11725	,009	-9,0771	-,7429
	MW-HP-300	-9,71000*	1,11725	,000	-13,8771	-5,5429
	EH	-4,21000*	1,11725	,046	-8,3771	-,0429
	E-HP-600	-1,18000	1,11725	1,000	-5,3471	2,9871
	EH-HP-300	-5,91000*	1,11725	,001	-10,0771	-1,7429
	EH-HP-600	-8,28000*	1,11725	,000	-12,4471	-4,1129
	MW-HP-600	-10,74000*	1,11725	,000	-14,9071	-6,5729
	MW	-8,14000*	1,11725	,000	-12,3071	-3,9729
	HP-300	-3,05000	1,11725	,377	-7,2171	1,1171
	TT	-9,10000*	1,11725	,000	-13,2671	-4,9329
	MW-E-HP-600	-5,02000*	1,11725	,007	-9,1871	-,8529
	Control	-1,80000	1,11725	,964	-5,9671	2,3671
	MW-E-HP-300	-3,25000	1,11725	,280	-7,4171	,9171
	TT-HP-300	-3,52000	1,11725	,179	-7,6871	,6471
	TT-HP-600	-5,25000*	1,11725	,004	-9,4171	-1,0829

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
HP-300	MW-EH	-4,50000*	1,11725	,024	-8,6671	-,3329
	HP-600	-1,86000	1,11725	,953	-6,0271	2,3071
	MW-HP-300	-6,66000*	1,11725	,000	-10,8271	-2,4929
	EH	-1,16000	1,11725	1,000	-5,3271	3,0071
	E-HP-600	1,87000	1,11725	,951	-2,2971	6,0371
	EH-HP-300	-2,86000	1,11725	,481	-7,0271	1,3071
	EH-HP-600	-5,23000*	1,11725	,004	-9,3971	-1,0629
	MW-HP-600	-7,69000*	1,11725	,000	-11,8571	-3,5229
	MW	-5,09000*	1,11725	,006	-9,2571	-,9229
	E-HP-300	3,05000	1,11725	,377	-1,1171	7,2171
	TT	-6,05000*	1,11725	,001	-10,2171	-1,8829
	MW-E-HP-600	-1,97000	1,11725	,926	-6,1371	2,1971
	Control	1,25000	1,11725	,999	-2,9171	5,4171
	MW-E-HP-300	-,20000	1,11725	1,000	-4,3671	3,9671
	TT-HP-300	-,47000	1,11725	1,000	-4,6371	3,6971
	TT-HP-600	-2,20000	1,11725	,846	-6,3671	1,9671
TT	MW-EH	1,55000	1,11725	,991	-2,6171	5,7171
	HP-600	4,19000*	1,11725	,048	,0229	8,3571
	MW-HP-300	-,61000	1,11725	1,000	-4,7771	3,5571
	EH	4,89000*	1,11725	,010	,7229	9,0571
	E-HP-600	7,92000*	1,11725	,000	3,7529	12,0871
	EH-HP-300	3,19000	1,11725	,307	-,9771	7,3571
	EH-HP-600	,82000	1,11725	1,000	-3,3471	4,9871
	MW-HP-600	-1,64000	1,11725	,984	-5,8071	2,5271
	MW	,96000	1,11725	1,000	-3,2071	5,1271
	E-HP-300	9,10000*	1,11725	,000	4,9329	13,2671
	HP-300	6,05000*	1,11725	,001	1,8829	10,2171
	MW-E-HP-600	4,08000	1,11725	,060	-,0871	8,2471
	Control	7,30000*	1,11725	,000	3,1329	11,4671
	MW-E-HP-300	5,85000*	1,11725	,001	1,6829	10,0171
	TT-HP-300	5,58000*	1,11725	,002	1,4129	9,7471
	TT-HP-600	3,85000	1,11725	,096	-,3171	8,0171

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-E-HP-600	MW-EH	-2,53000	1,11725	,676	-6,6971	1,6371
	HP-600	,11000	1,11725	1,000	-4,0571	4,2771
	MW-HP-300	-4,69000*	1,11725	,015	-8,8571	-,5229
	EH	,81000	1,11725	1,000	-3,3571	4,9771
	E-HP-600	3,84000	1,11725	,098	-,3271	8,0071
	EH-HP-300	-,89000	1,11725	1,000	-5,0571	3,2771
	EH-HP-600	-3,26000	1,11725	,276	-7,4271	,9071
	MW-HP-600	-5,72000*	1,11725	,001	-9,8871	-1,5529
	MW	-3,12000	1,11725	,341	-7,2871	1,0471
	E-HP-300	5,02000*	1,11725	,007	,8529	9,1871
	HP-300	1,97000	1,11725	,926	-2,1971	6,1371
	TT	-4,08000	1,11725	,060	-8,2471	,0871
	Control	3,22000	1,11725	,294	-,9471	7,3871
	MW-E-HP-300	1,77000	1,11725	,968	-2,3971	5,9371
	TT-HP-300	1,50000	1,11725	,993	-2,6671	5,6671
	TT-HP-600	-,23000	1,11725	1,000	-4,3971	3,9371
Control	MW-EH	-5,75000*	1,11725	,001	-9,9171	-1,5829
	HP-600	-3,11000	1,11725	,346	-7,2771	1,0571
	MW-HP-300	-7,91000*	1,11725	,000	-12,0771	-3,7429
	EH	-2,41000	1,11725	,743	-6,5771	1,7571
	E-HP-600	,62000	1,11725	1,000	-3,5471	4,7871
	EH-HP-300	-4,11000	1,11725	,056	-8,2771	,0571
	EH-HP-600	-6,48000*	1,11725	,000	-10,6471	-2,3129
	MW-HP-600	-8,94000*	1,11725	,000	-13,1071	-4,7729
	MW	-6,34000*	1,11725	,000	-10,5071	-2,1729
	E-HP-300	1,80000	1,11725	,964	-2,3671	5,9671
	HP-300	-1,25000	1,11725	,999	-5,4171	2,9171
	TT	-7,30000*	1,11725	,000	-11,4671	-3,1329
	MW-E-HP-600	-3,22000	1,11725	,294	-7,3871	,9471
	MW-E-HP-300	-1,45000	1,11725	,995	-5,6171	2,7171
	TT-HP-300	-1,72000	1,11725	,975	-5,8871	2,4471
	TT-HP-600	-3,45000	1,11725	,202	-7,6171	,7171

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: SDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-E-HP-300	MW-EH	-4,30000*	1,11725	,037	-8,4671	-,1329
	HP-600	-1,66000	1,11725	,982	-5,8271	2,5071
	MW-HP-300	-6,46000*	1,11725	,000	-10,6271	-2,2929
	EH	-,96000	1,11725	1,000	-5,1271	3,2071
	E-HP-600	2,07000	1,11725	,896	-2,0971	6,2371
	EH-HP-300	-2,66000	1,11725	,600	-6,8271	1,5071
	EH-HP-600	-5,03000*	1,11725	,007	-9,1971	-,8629
	MW-HP-600	-7,49000*	1,11725	,000	-11,6571	-3,3229
	MW	-4,89000*	1,11725	,010	-9,0571	-,7229
	E-HP-300	3,25000	1,11725	,280	-,9171	7,4171
	HP-300	,20000	1,11725	1,000	-3,9671	4,3671
	TT	-5,85000*	1,11725	,001	-10,0171	-1,6829
	MW-E-HP-600	-1,77000	1,11725	,968	-5,9371	2,3971
	Control	1,45000	1,11725	,995	-2,7171	5,6171
	TT-HP-300	-,27000	1,11725	1,000	-4,4371	3,8971
	TT-HP-600	-2,00000	1,11725	,918	-6,1671	2,1671
TT-HP-300	MW-EH	-4,03000	1,11725	,067	-8,1971	,1371
	HP-600	-1,39000	1,11725	,997	-5,5571	2,7771
	MW-HP-300	-6,19000*	1,11725	,000	-10,3571	-2,0229
	EH	-,69000	1,11725	1,000	-4,8571	3,4771
	E-HP-600	2,34000	1,11725	,780	-1,8271	6,5071
	EH-HP-300	-2,39000	1,11725	,754	-6,5571	1,7771
	EH-HP-600	-4,76000*	1,11725	,013	-8,9271	-,5929
	MW-HP-600	-7,22000*	1,11725	,000	-11,3871	-3,0529
	MW	-4,62000*	1,11725	,018	-8,7871	-,4529
	E-HP-300	3,52000	1,11725	,179	-,6471	7,6871
	HP-300	,47000	1,11725	1,000	-3,6971	4,6371
	TT	-5,58000*	1,11725	,002	-9,7471	-1,4129
	MW-E-HP-600	-1,50000	1,11725	,993	-5,6671	2,6671
	Control	1,72000	1,11725	,975	-2,4471	5,8871
	MW-E-HP-300	,27000	1,11725	1,000	-3,8971	4,4371
	TT-HP-600	-1,73000	1,11725	,974	-5,8971	2,4371
TT-HP-600	MW-EH	-2,30000	1,11725	,800	-6,4671	1,8671
	HP-600	,34000	1,11725	1,000	-3,8271	4,5071
	MW-HP-300	-4,46000*	1,11725	,026	-8,6271	-,2929
	EH	1,04000	1,11725	1,000	-3,1271	5,2071
	E-HP-600	4,07000	1,11725	,061	-,0971	8,2371
	EH-HP-300	-,66000	1,11725	1,000	-4,8271	3,5071
	EH-HP-600	-3,03000	1,11725	,387	-7,1971	1,1371
	MW-HP-600	-5,49000*	1,11725	,002	-9,6571	-1,3229
	MW	-2,89000	1,11725	,464	-7,0571	1,2771
	E-HP-300	5,25000*	1,11725	,004	1,0829	9,4171
	HP-300	2,20000	1,11725	,846	-1,9671	6,3671
	TT	-3,85000	1,11725	,096	-8,0171	,3171
	MW-E-HP-600	,23000	1,11725	1,000	-3,9371	4,3971
	Control	3,45000	1,11725	,202	-,7171	7,6171
	MW-E-HP-300	2,00000	1,11725	,918	-2,1671	6,1671
	TT-HP-300	1,73000	1,11725	,974	-2,4371	5,8971

*. The mean difference is significant at the 0.05 level.

SDF

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05							
		1	2	3	4	5	6	7	8
E-HP-300	3	12,4200							
E-HP-600	3	13,6000	13,6000						
Control	3	14,2200	14,2200	14,2200					
HP-300	3	15,4700	15,4700	15,4700					
MW-E-HP-300	3	15,6700	15,6700	15,6700					
TT-HP-300	3	15,9400	15,9400	15,9400	15,9400				
EH	3		16,6300	16,6300	16,6300	16,6300			
HP-600	3		17,3300	17,3300	17,3300	17,3300			
MW-E-HP-600	3		17,4400	17,4400	17,4400	17,4400	17,4400		
TT-HP-600	3		17,6700	17,6700	17,6700	17,6700	17,6700		
EH-HP-300	3			18,3300	18,3300	18,3300	18,3300	18,3300	
MW-EH	3				19,9700	19,9700	19,9700	19,9700	19,9700
MW	3					20,5600	20,5600	20,5600	20,5600
EH-HP-600	3					20,7000	20,7000	20,7000	20,7000
TT	3						21,5200	21,5200	21,5200
MW-HP-300	3							22,1300	22,1300
MW-HP-600	3								23,1600
Sig.		,179	,061	,056	,067	,061	,060	,106	,307

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

D. Variance Analysis Outputs of TDF

Descriptives

TDF

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	56,3900	,72133	,42477	54,5623	58,2177	55,55	56,92
HP-600	3	79,3200	,22100	,12124	78,7983	79,8417	79,11	79,53
MW-HP-300	3	72,9500	,41800	,23671	71,9315	73,9685	72,54	73,36
EH	3	54,2800	1,01200	,58890	51,7462	56,8138	53,26	55,30
E-HP-600	3	45,0000	,61400	,36950	43,4102	46,5898	44,36	45,64
EH-HP-300	3	50,9900	,30160	,15588	50,3193	51,6607	50,72	51,26
EH-HP-600	3	51,2800	,81000	,46765	49,2678	53,2922	50,47	52,09
MW-HP-600	3	80,6300	1,80100	1,04500	76,1337	85,1263	78,82	82,44
MW	3	76,0200	2,11900	1,20666	70,8282	81,2118	73,93	78,11
E-HP-300	3	44,5700	,21400	,09815	44,1477	44,9923	44,40	44,74
HP-300	3	76,3000	,42000	,24249	75,2567	77,3433	75,88	76,72
TT	3	59,0810	3,32100	1,90526	55,2423	71,6377	60,14	66,74
MW-E-HP-600	3	51,2700	,53800	,27713	50,0776	52,4624	50,79	51,75
Control	3	79,8400	,97000	,56003	77,4304	82,2496	78,87	80,81
MW-E-HP-300	3	47,5900	,32800	,16166	46,8944	48,2856	47,31	47,87
MW-EH-HP-600	3	55,7720	2,37660	,32166	53,3623	57,7154	54,62	56,28
TT-HP-300	3	50,8500	,22300	,09815	50,4277	51,2723	50,68	51,02
TT-HP-600	3	56,5700	,42300	,24826	55,5018	57,6382	56,14	57,00
Total	54	61,0171	13,15436	1,84198	57,3173	64,7168	44,36	82,44

ANOVA

TDF

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8605,586	16	537,849	395,212	,000
Within Groups	46,271	37	1,361		
Total	8651,857	53			

Multiple Comparisons

Dependent Variable: TDF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	-22,93000*	,95251	,000	-26,4827	-19,3773
	MW-HP-300	-16,56000*	,95251	,000	-20,1127	-13,0073
	EH	2,11000	,95251	,708	-1,4427	5,6627
	E-HP-600	11,39000*	,95251	,000	7,8373	14,9427
	EH-HP-300	5,40000*	,95251	,000	1,8473	8,9527
	EH-HP-600	5,11000*	,95251	,001	1,5573	8,6627
	MW-HP-600	-24,24000*	,95251	,000	-27,7927	-20,6873
	MW	-19,63000*	,95251	,000	-23,1827	-16,0773
	E-HP-300	11,82000*	,95251	,000	8,2673	15,3727
	HP-300	-19,91000*	,95251	,000	-23,4627	-16,3573
	TT	-7,05000*	,95251	,000	-10,6027	-3,4973
	MW-E-HP-600	5,12000*	,95251	,001	1,5673	8,6727
	Control	-23,45000*	,95251	,000	-27,0027	-19,8973
	MW-E-HP-300	8,80000*	,95251	,000	5,2473	12,3527
	TT-HP-300	5,54000*	,95251	,000	1,9873	9,0927
	TT-HP-600	-,18000	,95251	1,000	-3,7327	3,3727
HP-600	MW-EH	22,93000*	,95251	,000	19,3773	26,4827
	MW-HP-300	6,37000*	,95251	,000	2,8173	9,9227
	EH	25,04000*	,95251	,000	21,4873	28,5927
	E-HP-600	34,32000*	,95251	,000	30,7673	37,8727
	EH-HP-300	28,33000*	,95251	,000	24,7773	31,8827
	EH-HP-600	28,04000*	,95251	,000	24,4873	31,5927
	MW-HP-600	-1,31000	,95251	,991	-4,8627	2,2427
	MW	3,30000	,95251	,092	-,2527	6,8527
	E-HP-300	34,75000*	,95251	,000	31,1973	38,3027
	HP-300	3,02000	,95251	,172	-,5327	6,5727
	TT	15,88000*	,95251	,000	12,3273	19,4327
	MW-E-HP-600	28,05000*	,95251	,000	24,4973	31,6027
	Control	-,52000	,95251	1,000	-4,0727	3,0327
	MW-E-HP-300	31,73000*	,95251	,000	28,1773	35,2827
	TT-HP-300	28,47000*	,95251	,000	24,9173	32,0227
	TT-HP-600	22,75000*	,95251	,000	19,1973	26,3027

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-HP-300	MW-EH	16,56000*	,95251	,000	13,0073	20,1127
	HP-600	-6,37000*	,95251	,000	-9,9227	-2,8173
	EH	18,67000*	,95251	,000	15,1173	22,2227
	E-HP-600	27,95000*	,95251	,000	24,3973	31,5027
	EH-HP-300	21,96000*	,95251	,000	18,4073	25,5127
	EH-HP-600	21,67000*	,95251	,000	18,1173	25,2227
	MW-HP-600	-7,68000*	,95251	,000	-11,2327	-4,1273
	MW	-3,07000	,95251	,155	-6,6227	,4827
	E-HP-300	28,38000*	,95251	,000	24,8273	31,9327
	HP-300	-3,35000	,95251	,082	-6,9027	,2027
	TT	9,51000*	,95251	,000	5,9573	13,0627
	MW-E-HP-600	21,68000*	,95251	,000	18,1273	25,2327
	Control	-6,89000*	,95251	,000	-10,4427	-3,3373
	MW-E-HP-300	25,36000*	,95251	,000	21,8073	28,9127
	TT-HP-300	22,10000*	,95251	,000	18,5473	25,6527
	TT-HP-600	16,38000*	,95251	,000	12,8273	19,9327
EH	MW-EH	-2,11000	,95251	,708	-5,6627	1,4427
	HP-600	-25,04000*	,95251	,000	-28,5927	-21,4873
	MW-HP-300	-18,67000*	,95251	,000	-22,2227	-15,1173
	E-HP-600	9,28000*	,95251	,000	5,7273	12,8327
	EH-HP-300	3,29000	,95251	,095	-,2627	6,8427
	EH-HP-600	3,00000	,95251	,179	-,5527	6,5527
	MW-HP-600	-26,35000*	,95251	,000	-29,9027	-22,7973
	MW	-21,74000*	,95251	,000	-25,2927	-18,1873
	E-HP-300	9,71000*	,95251	,000	6,1573	13,2627
	HP-300	-22,02000*	,95251	,000	-25,5727	-18,4673
	TT	-9,16000*	,95251	,000	-12,7127	-5,6073
	MW-E-HP-600	3,01000	,95251	,175	-,5427	6,5627
	Control	-25,56000*	,95251	,000	-29,1127	-22,0073
	MW-E-HP-300	6,69000*	,95251	,000	3,1373	10,2427
	TT-HP-300	3,43000	,95251	,068	-,1227	6,9827
	TT-HP-600	-2,29000	,95251	,584	-5,8427	1,2627

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
E-HP-600	MW-EH	-11,39000*	,95251	,000	-14,9427	-7,8373
	HP-600	-34,32000*	,95251	,000	-37,8727	-30,7673
	MW-HP-300	-27,95000*	,95251	,000	-31,5027	-24,3973
	EH	-9,28000*	,95251	,000	-12,8327	-5,7273
	EH-HP-300	-5,99000*	,95251	,000	-9,5427	-2,4373
	EH-HP-600	-6,28000*	,95251	,000	-9,8327	-2,7273
	MW-HP-600	-35,63000*	,95251	,000	-39,1827	-32,0773
	MW	-31,02000*	,95251	,000	-34,5727	-27,4673
	E-HP-300	,43000	,95251	1,000	-3,1227	3,9827
	HP-300	-31,30000*	,95251	,000	-34,8527	-27,7473
	TT	-18,44000*	,95251	,000	-21,9927	-14,8873
	MW-E-HP-600	-6,27000*	,95251	,000	-9,8227	-2,7173
	Control	-34,84000*	,95251	,000	-38,3927	-31,2873
	MW-E-HP-300	-2,59000	,95251	,383	-6,1427	,9627
	TT-HP-300	-5,85000*	,95251	,000	-9,4027	-2,2973
	TT-HP-600	-11,57000*	,95251	,000	-15,1227	-8,0173
EH-HP-300	MW-EH	-5,40000*	,95251	,000	-8,9527	-1,8473
	HP-600	-28,33000*	,95251	,000	-31,8827	-24,7773
	MW-HP-300	-21,96000*	,95251	,000	-25,5127	-18,4073
	EH	-3,29000	,95251	,095	-6,8427	,2627
	E-HP-600	5,99000*	,95251	,000	2,4373	9,5427
	EH-HP-600	-,29000	,95251	1,000	-3,8427	3,2627
	MW-HP-600	-29,64000*	,95251	,000	-33,1927	-26,0873
	MW	-25,03000*	,95251	,000	-28,5827	-21,4773
	E-HP-300	6,42000*	,95251	,000	2,8673	9,9727
	HP-300	-25,31000*	,95251	,000	-28,8627	-21,7573
	TT	-12,45000*	,95251	,000	-16,0027	-8,8973
	MW-E-HP-600	-,28000	,95251	1,000	-3,8327	3,2727
	Control	-28,85000*	,95251	,000	-32,4027	-25,2973
	MW-E-HP-300	3,40000	,95251	,073	-,1527	6,9527
	TT-HP-300	,14000	,95251	1,000	-3,4127	3,6927
	TT-HP-600	-5,58000*	,95251	,000	-9,1327	-2,0273

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
EH-HP-600	MW-EH	-5,11000*	,95251	,001	-8,6627	-1,5573
	HP-600	-28,04000*	,95251	,000	-31,5927	-24,4873
	MW-HP-300	-21,67000*	,95251	,000	-25,2227	-18,1173
	EH	-3,00000	,95251	,179	-6,5527	,5527
	E-HP-600	6,28000*	,95251	,000	2,7273	9,8327
	EH-HP-300	,29000	,95251	1,000	-3,2627	3,8427
	MW-HP-600	-29,35000*	,95251	,000	-32,9027	-25,7973
	MW	-24,74000*	,95251	,000	-28,2927	-21,1873
	E-HP-300	6,71000*	,95251	,000	3,1573	10,2627
	HP-300	-25,02000*	,95251	,000	-28,5727	-21,4673
	TT	-12,16000*	,95251	,000	-15,7127	-8,6073
	MW-E-HP-600	,01000	,95251	1,000	-3,5427	3,5627
	Control	-28,56000*	,95251	,000	-32,1127	-25,0073
	MW-E-HP-300	3,69000*	,95251	,035	,1373	7,2427
	TT-HP-300	,43000	,95251	1,000	-3,1227	3,9827
	TT-HP-600	-5,29000*	,95251	,000	-8,8427	-1,7373
MW-HP-600	MW-EH	24,24000*	,95251	,000	20,6873	27,7927
	HP-600	1,31000	,95251	,991	-2,2427	4,8627
	MW-HP-300	7,68000*	,95251	,000	4,1273	11,2327
	EH	26,35000*	,95251	,000	22,7973	29,9027
	E-HP-600	35,63000*	,95251	,000	32,0773	39,1827
	EH-HP-300	29,64000*	,95251	,000	26,0873	33,1927
	EH-HP-600	29,35000*	,95251	,000	25,7973	32,9027
	MW	4,61000*	,95251	,003	1,0573	8,1627
	E-HP-300	36,06000*	,95251	,000	32,5073	39,6127
	HP-300	4,33000*	,95251	,006	,7773	7,8827
	TT	17,19000*	,95251	,000	13,6373	20,7427
	MW-E-HP-600	29,36000*	,95251	,000	25,8073	32,9127
	Control	,79000	,95251	1,000	-2,7627	4,3427
	MW-E-HP-300	33,04000*	,95251	,000	29,4873	36,5927
	TT-HP-300	29,78000*	,95251	,000	26,2273	33,3327
	TT-HP-600	24,06000*	,95251	,000	20,5073	27,6127

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW	MW-EH	19,63000*	,95251	,000	16,0773	23,1827
	HP-600	-3,30000	,95251	,092	-6,8527	,2527
	MW-HP-300	3,07000	,95251	,155	-,4827	6,6227
	EH	21,74000*	,95251	,000	18,1873	25,2927
	E-HP-600	31,02000*	,95251	,000	27,4673	34,5727
	EH-HP-300	25,03000*	,95251	,000	21,4773	28,5827
	EH-HP-600	24,74000*	,95251	,000	21,1873	28,2927
	MW-HP-600	-4,61000*	,95251	,003	-8,1627	-1,0573
	E-HP-300	31,45000*	,95251	,000	27,8973	35,0027
	HP-300	-,28000	,95251	1,000	-3,8327	3,2727
	TT	12,58000*	,95251	,000	9,0273	16,1327
	MW-E-HP-600	24,75000*	,95251	,000	21,1973	28,3027
	Control	-3,82000*	,95251	,025	-7,3727	-,2673
	MW-E-HP-300	28,43000*	,95251	,000	24,8773	31,9827
	TT-HP-300	25,17000*	,95251	,000	21,6173	28,7227
	TT-HP-600	19,45000*	,95251	,000	15,8973	23,0027
E-HP-300	MW-EH	-11,82000*	,95251	,000	-15,3727	-8,2673
	HP-600	-34,75000*	,95251	,000	-38,3027	-31,1973
	MW-HP-300	-28,38000*	,95251	,000	-31,9327	-24,8273
	EH	-9,71000*	,95251	,000	-13,2627	-6,1573
	E-HP-600	-,43000	,95251	1,000	-3,9827	3,1227
	EH-HP-300	-6,42000*	,95251	,000	-9,9727	-2,8673
	EH-HP-600	-6,71000*	,95251	,000	-10,2627	-3,1573
	MW-HP-600	-36,06000*	,95251	,000	-39,6127	-32,5073
	MW	-31,45000*	,95251	,000	-35,0027	-27,8973
	HP-300	-31,73000*	,95251	,000	-35,2827	-28,1773
	TT	-18,87000*	,95251	,000	-22,4227	-15,3173
	MW-E-HP-600	-6,70000*	,95251	,000	-10,2527	-3,1473
	Control	-35,27000*	,95251	,000	-38,8227	-31,7173
	MW-E-HP-300	-3,02000	,95251	,172	-6,5727	,5327
	TT-HP-300	-6,28000*	,95251	,000	-9,8327	-2,7273
	TT-HP-600	-12,00000*	,95251	,000	-15,5527	-8,4473

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
HP-300	MW-EH	19,91000*	,95251	,000	16,3573	23,4627
	HP-600	-3,02000	,95251	,172	-6,5727	,5327
	MW-HP-300	3,35000	,95251	,082	-,2027	6,9027
	EH	22,02000*	,95251	,000	18,4673	25,5727
	E-HP-600	31,30000*	,95251	,000	27,7473	34,8527
	EH-HP-300	25,31000*	,95251	,000	21,7573	28,8627
	EH-HP-600	25,02000*	,95251	,000	21,4673	28,5727
	MW-HP-600	-4,33000*	,95251	,006	-7,8827	-,7773
	MW	,28000	,95251	1,000	-3,2727	3,8327
	E-HP-300	31,73000*	,95251	,000	28,1773	35,2827
	TT	12,86000*	,95251	,000	9,3073	16,4127
	MW-E-HP-600	25,03000*	,95251	,000	21,4773	28,5827
	Control	-3,54000	,95251	,052	-7,0927	,0127
	MW-E-HP-300	28,71000*	,95251	,000	25,1573	32,2627
	TT-HP-300	25,45000*	,95251	,000	21,8973	29,0027
	TT-HP-600	19,73000*	,95251	,000	16,1773	23,2827
TT	MW-EH	7,05000*	,95251	,000	3,4973	10,6027
	HP-600	-15,88000*	,95251	,000	-19,4327	-12,3273
	MW-HP-300	-9,51000*	,95251	,000	-13,0627	-5,9573
	EH	9,16000*	,95251	,000	5,6073	12,7127
	E-HP-600	18,44000*	,95251	,000	14,8873	21,9927
	EH-HP-300	12,45000*	,95251	,000	8,8973	16,0027
	EH-HP-600	12,16000*	,95251	,000	8,6073	15,7127
	MW-HP-600	-17,19000*	,95251	,000	-20,7427	-13,6373
	MW	-12,58000*	,95251	,000	-16,1327	-9,0273
	E-HP-300	18,87000*	,95251	,000	15,3173	22,4227
	HP-300	-12,86000*	,95251	,000	-16,4127	-9,3073
	MW-E-HP-600	12,17000*	,95251	,000	8,6173	15,7227
	Control	-16,40000*	,95251	,000	-19,9527	-12,8473
	MW-E-HP-300	15,85000*	,95251	,000	12,2973	19,4027
	TT-HP-300	12,59000*	,95251	,000	9,0373	16,1427
	TT-HP-600	6,87000*	,95251	,000	3,3173	10,4227

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-E-HP-600	MW-EH	-5,12000*	,95251	,001	-8,6727	-1,5673
	HP-600	-28,05000*	,95251	,000	-31,6027	-24,4973
	MW-HP-300	-21,68000*	,95251	,000	-25,2327	-18,1273
	EH	-3,01000	,95251	,175	-6,5627	,5427
	E-HP-600	6,27000*	,95251	,000	2,7173	9,8227
	EH-HP-300	,28000	,95251	1,000	-3,2727	3,8327
	EH-HP-600	-,01000	,95251	1,000	-3,5627	3,5427
	MW-HP-600	-29,36000*	,95251	,000	-32,9127	-25,8073
	MW	-24,75000*	,95251	,000	-28,3027	-21,1973
	E-HP-300	6,70000*	,95251	,000	3,1473	10,2527
	HP-300	-25,03000*	,95251	,000	-28,5827	-21,4773
	TT	-12,17000*	,95251	,000	-15,7227	-8,6173
	Control	-28,57000*	,95251	,000	-32,1227	-25,0173
	MW-E-HP-300	3,68000*	,95251	,036	,1273	7,2327
	TT-HP-300	,42000	,95251	1,000	-3,1327	3,9727
	TT-HP-600	-5,30000*	,95251	,000	-8,8527	-1,7473
Control	MW-EH	23,45000*	,95251	,000	19,8973	27,0027
	HP-600	,52000	,95251	1,000	-3,0327	4,0727
	MW-HP-300	6,89000*	,95251	,000	3,3373	10,4427
	EH	25,56000*	,95251	,000	22,0073	29,1127
	E-HP-600	34,84000*	,95251	,000	31,2873	38,3927
	EH-HP-300	28,85000*	,95251	,000	25,2973	32,4027
	EH-HP-600	28,56000*	,95251	,000	25,0073	32,1127
	MW-HP-600	-,79000	,95251	1,000	-4,3427	2,7627
	MW	3,82000*	,95251	,025	,2673	7,3727
	E-HP-300	35,27000*	,95251	,000	31,7173	38,8227
	HP-300	3,54000	,95251	,052	-,0127	7,0927
	TT	16,40000*	,95251	,000	12,8473	19,9527
	MW-E-HP-600	28,57000*	,95251	,000	25,0173	32,1227
	MW-E-HP-300	32,25000*	,95251	,000	28,6973	35,8027
	TT-HP-300	28,99000*	,95251	,000	25,4373	32,5427
	TT-HP-600	23,27000*	,95251	,000	19,7173	26,8227

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-E-HP-300	MW-EH	-8,80000*	,95251	,000	-12,3527	-5,2473
	HP-600	-31,73000*	,95251	,000	-35,2827	-28,1773
	MW-HP-300	-25,36000*	,95251	,000	-28,9127	-21,8073
	EH	-6,69000*	,95251	,000	-10,2427	-3,1373
	E-HP-600	2,59000	,95251	,383	-,9627	6,1427
	EH-HP-300	-3,40000	,95251	,073	-6,9527	,1527
	EH-HP-600	-3,69000*	,95251	,035	-7,2427	-,1373
	MW-HP-600	-33,04000*	,95251	,000	-36,5927	-29,4873
	MW	-28,43000*	,95251	,000	-31,9827	-24,8773
	E-HP-300	3,02000	,95251	,172	-,5327	6,5727
	HP-300	-28,71000*	,95251	,000	-32,2627	-25,1573
	TT	-15,85000*	,95251	,000	-19,4027	-12,2973
	MW-E-HP-600	-3,68000*	,95251	,036	-7,2327	-,1273
	Control	-32,25000*	,95251	,000	-35,8027	-28,6973
	TT-HP-300	-3,26000	,95251	,101	-6,8127	,2927
	TT-HP-600	-8,98000*	,95251	,000	-12,5327	-5,4273
TT-HP-300	MW-EH	-5,54000*	,95251	,000	-9,0927	-1,9873
	HP-600	-28,47000*	,95251	,000	-32,0227	-24,9173
	MW-HP-300	-22,10000*	,95251	,000	-25,6527	-18,5473
	EH	-3,43000	,95251	,068	-6,9827	,1227
	E-HP-600	5,85000*	,95251	,000	2,2973	9,4027
	EH-HP-300	-,14000	,95251	1,000	-3,6927	3,4127
	EH-HP-600	-,43000	,95251	1,000	-3,9827	3,1227
	MW-HP-600	-29,78000*	,95251	,000	-33,3327	-26,2273
	MW	-25,17000*	,95251	,000	-28,7227	-21,6173
	E-HP-300	6,28000*	,95251	,000	2,7273	9,8327
	HP-300	-25,45000*	,95251	,000	-29,0027	-21,8973
	TT	-12,59000*	,95251	,000	-16,1427	-9,0373
	MW-E-HP-600	-,42000	,95251	1,000	-3,9727	3,1327
	Control	-28,99000*	,95251	,000	-32,5427	-25,4373
	MW-E-HP-300	3,26000	,95251	,101	-,2927	6,8127
	TT-HP-600	-5,72000*	,95251	,000	-9,2727	-2,1673

*. The mean difference is significant at the 0.05 level.

Multiple Comparisons

Dependent Variable: TDF

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
TT-HP-600	MW-EH	,18000	,95251	1,000	-3,3727	3,7327
	HP-600	-22,75000*	,95251	,000	-26,3027	-19,1973
	MW-HP-300	-16,38000*	,95251	,000	-19,9327	-12,8273
	EH	2,29000	,95251	,584	-1,2627	5,8427
	E-HP-600	11,57000*	,95251	,000	8,0173	15,1227
	EH-HP-300	5,58000*	,95251	,000	2,0273	9,1327
	EH-HP-600	5,29000*	,95251	,000	1,7373	8,8427
	MW-HP-600	-24,06000*	,95251	,000	-27,6127	-20,5073
	MW	-19,45000*	,95251	,000	-23,0027	-15,8973
	E-HP-300	12,00000*	,95251	,000	8,4473	15,5527
	HP-300	-19,73000*	,95251	,000	-23,2827	-16,1773
	TT	-6,87000*	,95251	,000	-10,4227	-3,3173
	MW-E-HP-600	5,30000*	,95251	,000	1,7473	8,8527
	Control	-23,27000*	,95251	,000	-26,8227	-19,7173
	MW-E-HP-300	8,98000*	,95251	,000	5,4273	12,5327
	TT-HP-300	5,72000*	,95251	,000	2,1673	9,2727

*. The mean difference is significant at the 0.05 level.

TDF

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05								
		1	2	3	4	5	6	7	8	9
E-HP-300	3	44,5700								
E-HP-600	3	45,0000								
MW-E-HP-300	3	47,5900	47,5900							
TT-HP-300	3		50,8500	50,8500						
EH-HP-300	3		50,9900	50,9900						
MW-E-HP-600	3			51,2700						
EH-HP-600	3			51,2800						
EH	3			54,2800	54,2800					
MW-EH	3				56,3900					
TT-HP-600	3				56,5700					
TT	3					63,4400				
MW-HP-300	3						72,9500			
MW	3						76,0200	76,0200		
HP-300	3						76,3000	76,3000	76,3000	
HP-600	3							79,3200	79,3200	79,3200
Control	3								79,8400	79,8400
MW-HP-600	3									80,6300
Sig.		,172	,073	,068	,584	1,000	,082	,092	,052	,991

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

E. Variance Analysis Outputs of SP

Descriptives

SP

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	6,1500	,04359	,02517	6,0417	6,2583	6,12	6,20
HP-600	3	8,2700	,07000	,04041	8,0961	8,4439	8,22	8,35
MW-HP-300	3	5,3100	,37041	,21385	4,3899	6,2301	4,93	5,67
EH	3	5,9200	,15716	,09074	5,5296	6,3104	5,74	6,03
E-HP-600	3	6,2100	,11000	,06351	5,9367	6,4833	6,10	6,32
EH-HP-300	3	5,4200	,13528	,07810	5,0840	5,7560	5,28	5,55
EH-HP-600	3	5,1100	,10149	,05859	4,8579	5,3621	5,00	5,20
MW-HP-600	3	5,0300	,04000	,02309	4,9306	5,1294	4,99	5,07
MW	3	7,0700	,06000	,03464	6,9210	7,2190	7,01	7,13
E-HP-300	3	6,4100	,11358	,06557	6,1279	6,6921	6,33	6,54
HP-300	3	8,0200	,08185	,04726	7,8167	8,2233	7,95	8,11
TT	3	6,4600	,07211	,04163	6,2809	6,6391	6,40	6,54
MW-E-HP-600	3	4,0700	,08718	,05033	3,8534	4,2866	3,97	4,13
Control	3	8,5400	,17578	,10149	8,1033	8,9767	8,34	8,67
MW-E-HP-300	3	4,6100	,05568	,03215	4,4717	4,7483	4,56	4,67
TT-HP-300	3	5,9800	,04359	,02517	5,8717	6,0883	5,95	6,03
TT-HP-600	3	5,6500	,05292	,03055	5,5186	5,7814	5,61	5,71
Total	51	6,1312	1,23707	,17322	5,7832	6,4791	3,97	8,67

ANOVA

SP

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	75,946	16	4,747	282,439	,000
Within Groups	,571	34	,017		
Total	76,518	50			

Multiple Comparisons

Dependent Variable: SP
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	-2,12000*	,10585	,000	-2,5148	-1,7252
	MW-HP-300	,84000*	,10585	,000	,4452	1,2348
	EH	,23000	,10585	,734	-,1648	,6248
	E-HP-600	-,06000	,10585	1,000	-,4548	,3348
	EH-HP-300	,73000*	,10585	,000	,3352	1,1248
	EH-HP-600	1,04000*	,10585	,000	,6452	1,4348
	MW-HP-600	1,12000*	,10585	,000	,7252	1,5148
	MW	-,92000*	,10585	,000	-1,3148	-,5252
	E-HP-300	-,26000	,10585	,549	-,6548	,1348
	HP-300	-1,87000*	,10585	,000	-2,2648	-1,4752
	TT	-,31000	,10585	,271	-,7048	,0848
	MW-E-HP-600	2,08000*	,10585	,000	1,6852	2,4748
	Control	-2,39000*	,10585	,000	-2,7848	-1,9952
	MW-E-HP-300	1,54000*	,10585	,000	1,1452	1,9348
	TT-HP-300	,17000	,10585	,965	-,2248	,5648
	TT-HP-600	,50000*	,10585	,004	,1052	,8948
HP-600	MW-EH	2,12000*	,10585	,000	1,7252	2,5148
	MW-HP-300	2,96000*	,10585	,000	2,5652	3,3548
	EH	2,35000*	,10585	,000	1,9552	2,7448
	E-HP-600	2,06000*	,10585	,000	1,6652	2,4548
	EH-HP-300	2,85000*	,10585	,000	2,4552	3,2448
	EH-HP-600	3,16000*	,10585	,000	2,7652	3,5548
	MW-HP-600	3,24000*	,10585	,000	2,8452	3,6348
	MW	1,20000*	,10585	,000	,8052	1,5948
	E-HP-300	1,86000*	,10585	,000	1,4652	2,2548
	HP-300	,25000	,10585	,612	-,1448	,6448
	TT	1,81000*	,10585	,000	1,4152	2,2048
	MW-E-HP-600	4,20000*	,10585	,000	3,8052	4,5948
	Control	-,27000	,10585	,487	-,6648	,1248
	MW-E-HP-300	3,66000*	,10585	,000	3,2652	4,0548
	TT-HP-300	2,29000*	,10585	,000	1,8952	2,6848
	TT-HP-600	2,62000*	,10585	,000	2,2252	3,0148

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-HP-300	MW-EH	-,84000*	,10585	,000	-1,2348	-,4452
	HP-600	-2,96000*	,10585	,000	-3,3548	-2,5652
	EH	-,61000*	,10585	,000	-1,0048	-,2152
	E-HP-600	-,90000*	,10585	,000	-1,2948	-,5052
	EH-HP-300	-,11000	,10585	1,000	-,5048	,2848
	EH-HP-600	,20000	,10585	,881	-,1948	,5948
	MW-HP-600	,28000	,10585	,427	-,1148	,6748
	MW	-1,76000*	,10585	,000	-2,1548	-1,3652
	E-HP-300	-1,10000*	,10585	,000	-1,4948	-,7052
	HP-300	-2,71000*	,10585	,000	-3,1048	-2,3152
	TT	-1,15000*	,10585	,000	-1,5448	-,7552
	MW-E-HP-600	1,24000*	,10585	,000	,8452	1,6348
	Control	-3,23000*	,10585	,000	-3,6248	-2,8352
	MW-E-HP-300	,70000*	,10585	,000	,3052	1,0948
	TT-HP-300	-,67000*	,10585	,000	-1,0648	-,2752
	TT-HP-600	-,34000	,10585	,158	-,7348	,0548
EH	MW-EH	-,23000	,10585	,734	-,6248	,1648
	HP-600	-2,35000*	,10585	,000	-2,7448	-1,9552
	MW-HP-300	,61000*	,10585	,000	,2152	1,0048
	E-HP-600	-,29000	,10585	,371	-,6848	,1048
	EH-HP-300	,50000*	,10585	,004	,1052	,8948
	EH-HP-600	,81000*	,10585	,000	,4152	1,2048
	MW-HP-600	,89000*	,10585	,000	,4952	1,2848
	MW	-1,15000*	,10585	,000	-1,5448	-,7552
	E-HP-300	-,49000*	,10585	,005	-,8848	-,0952
	HP-300	-2,10000*	,10585	,000	-2,4948	-1,7052
	TT	-,54000*	,10585	,001	-,9348	-,1452
	MW-E-HP-600	1,85000*	,10585	,000	1,4552	2,2448
	Control	-2,62000*	,10585	,000	-3,0148	-2,2252
	MW-E-HP-300	1,31000*	,10585	,000	,9152	1,7048
	TT-HP-300	-,06000	,10585	1,000	-,4548	,3348
	TT-HP-600	,27000	,10585	,487	-,1248	,6648

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
E-HP-600	MW-EH	,06000	,10585	1,000	-,3348	,4548
	HP-600	-2,06000*	,10585	,000	-2,4548	-1,6652
	MW-HP-300	,90000*	,10585	,000	,5052	1,2948
	EH	,29000	,10585	,371	-,1048	,6848
	EH-HP-300	,79000*	,10585	,000	,3952	1,1848
	EH-HP-600	1,10000*	,10585	,000	,7052	1,4948
	MW-HP-600	1,18000*	,10585	,000	,7852	1,5748
	MW	-,86000*	,10585	,000	-1,2548	-,4652
	E-HP-300	-,20000	,10585	,881	-,5948	,1948
	HP-300	-1,81000*	,10585	,000	-2,2048	-1,4152
	TT	-,25000	,10585	,612	-,6448	,1448
	MW-E-HP-600	2,14000*	,10585	,000	1,7452	2,5348
	Control	-2,33000*	,10585	,000	-2,7248	-1,9352
	MW-E-HP-300	1,60000*	,10585	,000	1,2052	1,9948
	TT-HP-300	,23000	,10585	,734	-,1648	,6248
	TT-HP-600	,56000*	,10585	,001	,1652	,9548
EH-HP-300	MW-EH	-,73000*	,10585	,000	-1,1248	-,3352
	HP-600	-2,85000*	,10585	,000	-3,2448	-2,4552
	MW-HP-300	,11000	,10585	1,000	-,2848	,5048
	EH	-,50000*	,10585	,004	-,8948	-,1052
	E-HP-600	-,79000*	,10585	,000	-1,1848	-,3952
	EH-HP-600	,31000	,10585	,271	-,0848	,7048
	MW-HP-600	,39000	,10585	,056	-,0048	,7848
	MW	-1,65000*	,10585	,000	-2,0448	-1,2552
	E-HP-300	-,99000*	,10585	,000	-1,3848	-,5952
	HP-300	-2,60000*	,10585	,000	-2,9948	-2,2052
	TT	-1,04000*	,10585	,000	-1,4348	-,6452
	MW-E-HP-600	1,35000*	,10585	,000	,9552	1,7448
	Control	-3,12000*	,10585	,000	-3,5148	-2,7252
	MW-E-HP-300	,81000*	,10585	,000	,4152	1,2048
	TT-HP-300	-,56000*	,10585	,001	-,9548	-,1652
	TT-HP-600	-,23000	,10585	,734	-,6248	,1648

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
EH-HP-600	MW-EH	-1,04000*	,10585	,000	-1,4348	-,6452
	HP-600	-3,16000*	,10585	,000	-3,5548	-2,7652
	MW-HP-300	-,20000	,10585	,881	-,5948	,1948
	EH	-,81000*	,10585	,000	-1,2048	-,4152
	E-HP-600	-1,10000*	,10585	,000	-1,4948	-,7052
	EH-HP-300	-,31000	,10585	,271	-,7048	,0848
	MW-HP-600	,08000	,10585	1,000	-,3148	,4748
	MW	-1,96000*	,10585	,000	-2,3548	-1,5652
	E-HP-300	-1,30000*	,10585	,000	-1,6948	-,9052
	HP-300	-2,91000*	,10585	,000	-3,3048	-2,5152
	TT	-1,35000*	,10585	,000	-1,7448	-,9552
	MW-E-HP-600	1,04000*	,10585	,000	,6452	1,4348
	Control	-3,43000*	,10585	,000	-3,8248	-3,0352
	MW-E-HP-300	,50000*	,10585	,004	,1052	,8948
	TT-HP-300	-,87000*	,10585	,000	-1,2648	-,4752
	TT-HP-600	-,54000*	,10585	,001	-,9348	-,1452
MW-HP-600	MW-EH	-1,12000*	,10585	,000	-1,5148	-,7252
	HP-600	-3,24000*	,10585	,000	-3,6348	-2,8452
	MW-HP-300	-,28000	,10585	,427	-,6748	,1148
	EH	-,89000*	,10585	,000	-1,2848	-,4952
	E-HP-600	-1,18000*	,10585	,000	-1,5748	-,7852
	EH-HP-300	-,39000	,10585	,056	-,7848	,0048
	EH-HP-600	-,08000	,10585	1,000	-,4748	,3148
	MW	-2,04000*	,10585	,000	-2,4348	-1,6452
	E-HP-300	-1,38000*	,10585	,000	-1,7748	-,9852
	HP-300	-2,99000*	,10585	,000	-3,3848	-2,5952
	TT	-1,43000*	,10585	,000	-1,8248	-1,0352
	MW-E-HP-600	,96000*	,10585	,000	,5652	1,3548
	Control	-3,51000*	,10585	,000	-3,9048	-3,1152
	MW-E-HP-300	,42000*	,10585	,028	,0252	,8148
	TT-HP-300	-,95000*	,10585	,000	-1,3448	-,5552
	TT-HP-600	-,62000*	,10585	,000	-1,0148	-,2252

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW	MW-EH	,92000*	,10585	,000	,5252	1,3148
	HP-600	-1,20000*	,10585	,000	-1,5948	-,8052
	MW-HP-300	1,76000*	,10585	,000	1,3652	2,1548
	EH	1,15000*	,10585	,000	,7552	1,5448
	E-HP-600	,86000*	,10585	,000	,4652	1,2548
	EH-HP-300	1,65000*	,10585	,000	1,2552	2,0448
	EH-HP-600	1,96000*	,10585	,000	1,5652	2,3548
	MW-HP-600	2,04000*	,10585	,000	1,6452	2,4348
	E-HP-300	,66000*	,10585	,000	,2652	1,0548
	HP-300	-,95000*	,10585	,000	-1,3448	-,5552
	TT	,61000*	,10585	,000	,2152	1,0048
	MW-E-HP-600	3,00000*	,10585	,000	2,6052	3,3948
	Control	-1,47000*	,10585	,000	-1,8648	-1,0752
	MW-E-HP-300	2,46000*	,10585	,000	2,0652	2,8548
	TT-HP-300	1,09000*	,10585	,000	,6952	1,4848
	TT-HP-600	1,42000*	,10585	,000	1,0252	1,8148
E-HP-300	MW-EH	,26000	,10585	,549	-,1348	,6548
	HP-600	-1,86000*	,10585	,000	-2,2548	-1,4652
	MW-HP-300	1,10000*	,10585	,000	,7052	1,4948
	EH	,49000*	,10585	,005	,0952	,8848
	E-HP-600	,20000	,10585	,881	-,1948	,5948
	EH-HP-300	,99000*	,10585	,000	,5952	1,3848
	EH-HP-600	1,30000*	,10585	,000	,9052	1,6948
	MW-HP-600	1,38000*	,10585	,000	,9852	1,7748
	MW	-,66000*	,10585	,000	-1,0548	-,2652
	HP-300	-1,61000*	,10585	,000	-2,0048	-1,2152
	TT	-,05000	,10585	1,000	-,4448	,3448
	MW-E-HP-600	2,34000*	,10585	,000	1,9452	2,7348
	Control	-2,13000*	,10585	,000	-2,5248	-1,7352
	MW-E-HP-300	1,80000*	,10585	,000	1,4052	2,1948
	TT-HP-300	,43000*	,10585	,022	,0352	,8248
	TT-HP-600	,76000*	,10585	,000	,3652	1,1548

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
HP-300	MW-EH	1,87000*	,10585	,000	1,4752	2,2648
	HP-600	-,25000	,10585	,612	-,6448	,1448
	MW-HP-300	2,71000*	,10585	,000	2,3152	3,1048
	EH	2,10000*	,10585	,000	1,7052	2,4948
	E-HP-600	1,81000*	,10585	,000	1,4152	2,2048
	EH-HP-300	2,60000*	,10585	,000	2,2052	2,9948
	EH-HP-600	2,91000*	,10585	,000	2,5152	3,3048
	MW-HP-600	2,99000*	,10585	,000	2,5952	3,3848
	MW	,95000*	,10585	,000	,5552	1,3448
	E-HP-300	1,61000*	,10585	,000	1,2152	2,0048
	TT	1,56000*	,10585	,000	1,1652	1,9548
	MW-E-HP-600	3,95000*	,10585	,000	3,5552	4,3448
	Control	-,52000*	,10585	,002	-,9148	-,1252
	MW-E-HP-300	3,41000*	,10585	,000	3,0152	3,8048
	TT-HP-300	2,04000*	,10585	,000	1,6452	2,4348
	TT-HP-600	2,37000*	,10585	,000	1,9752	2,7648
TT	MW-EH	,31000	,10585	,271	-,0848	,7048
	HP-600	-1,81000*	,10585	,000	-2,2048	-1,4152
	MW-HP-300	1,15000*	,10585	,000	,7552	1,5448
	EH	,54000*	,10585	,001	,1452	,9348
	E-HP-600	,25000	,10585	,612	-,1448	,6448
	EH-HP-300	1,04000*	,10585	,000	,6452	1,4348
	EH-HP-600	1,35000*	,10585	,000	,9552	1,7448
	MW-HP-600	1,43000*	,10585	,000	1,0352	1,8248
	MW	-,61000*	,10585	,000	-1,0048	-,2152
	E-HP-300	,05000	,10585	1,000	-,3448	,4448
	HP-300	-1,56000*	,10585	,000	-1,9548	-1,1652
	MW-E-HP-600	2,39000*	,10585	,000	1,9952	2,7848
	Control	-2,08000*	,10585	,000	-2,4748	-1,6852
	MW-E-HP-300	1,85000*	,10585	,000	1,4552	2,2448
	TT-HP-300	,48000*	,10585	,006	,0852	,8748
	TT-HP-600	,81000*	,10585	,000	,4152	1,2048

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
TT	MW-EH	,31000	,10585	,271	-,0848	,7048
	HP-600	-1,81000*	,10585	,000	-2,2048	-1,4152
	MW-HP-300	1,15000*	,10585	,000	,7552	1,5448
	EH	,54000*	,10585	,001	,1452	,9348
	E-HP-600	,25000	,10585	,612	-,1448	,6448
	EH-HP-300	1,04000*	,10585	,000	,6452	1,4348
	EH-HP-600	1,35000*	,10585	,000	,9552	1,7448
	MW-HP-600	1,43000*	,10585	,000	1,0352	1,8248
	MW	-,61000*	,10585	,000	-1,0048	-,2152
	E-HP-300	,05000	,10585	1,000	-,3448	,4448
	HP-300	-1,56000*	,10585	,000	-1,9548	-1,1652
	MW-E-HP-600	2,39000*	,10585	,000	1,9952	2,7848
	Control	-2,08000*	,10585	,000	-2,4748	-1,6852
	MW-E-HP-300	1,85000*	,10585	,000	1,4552	2,2448
	TT-HP-300	,48000*	,10585	,006	,0852	,8748
	TT-HP-600	,81000*	,10585	,000	,4152	1,2048
MW-E-HP-600	MW-EH	-2,08000*	,10585	,000	-2,4748	-1,6852
	HP-600	-4,20000*	,10585	,000	-4,5948	-3,8052
	MW-HP-300	-1,24000*	,10585	,000	-1,6348	-,8452
	EH	-1,85000*	,10585	,000	-2,2448	-1,4552
	E-HP-600	-2,14000*	,10585	,000	-2,5348	-1,7452
	EH-HP-300	-1,35000*	,10585	,000	-1,7448	-,9552
	EH-HP-600	-1,04000*	,10585	,000	-1,4348	-,6452
	MW-HP-600	-,96000*	,10585	,000	-1,3548	-,5652
	MW	-3,00000*	,10585	,000	-3,3948	-2,6052
	E-HP-300	-2,34000*	,10585	,000	-2,7348	-1,9452
	HP-300	-3,95000*	,10585	,000	-4,3448	-3,5552
	TT	-2,39000*	,10585	,000	-2,7848	-1,9952
	Control	-4,47000*	,10585	,000	-4,8648	-4,0752
	MW-E-HP-300	-,54000*	,10585	,001	-,9348	-,1452
	TT-HP-300	-1,91000*	,10585	,000	-2,3048	-1,5152
	TT-HP-600	-1,58000*	,10585	,000	-1,9748	-1,1852

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control	MW-EH	2,39000*	,10585	,000	1,9952	2,7848
	HP-600	,27000	,10585	,487	-,1248	,6648
	MW-HP-300	3,23000*	,10585	,000	2,8352	3,6248
	EH	2,62000*	,10585	,000	2,2252	3,0148
	E-HP-600	2,33000*	,10585	,000	1,9352	2,7248
	EH-HP-300	3,12000*	,10585	,000	2,7252	3,5148
	EH-HP-600	3,43000*	,10585	,000	3,0352	3,8248
	MW-HP-600	3,51000*	,10585	,000	3,1152	3,9048
	MW	1,47000*	,10585	,000	1,0752	1,8648
	E-HP-300	2,13000*	,10585	,000	1,7352	2,5248
	HP-300	,52000*	,10585	,002	,1252	,9148
	TT	2,08000*	,10585	,000	1,6852	2,4748
	MW-E-HP-600	4,47000*	,10585	,000	4,0752	4,8648
	MW-E-HP-300	3,93000*	,10585	,000	3,5352	4,3248
	TT-HP-300	2,56000*	,10585	,000	2,1652	2,9548
	TT-HP-600	2,89000*	,10585	,000	2,4952	3,2848
MW-E-HP-300	MW-EH	-1,54000*	,10585	,000	-1,9348	-1,1452
	HP-600	-3,66000*	,10585	,000	-4,0548	-3,2652
	MW-HP-300	-,70000*	,10585	,000	-1,0948	-,3052
	EH	-1,31000*	,10585	,000	-1,7048	-,9152
	E-HP-600	-1,60000*	,10585	,000	-1,9948	-1,2052
	EH-HP-300	-,81000*	,10585	,000	-1,2048	-,4152
	EH-HP-600	-,50000*	,10585	,004	-,8948	-,1052
	MW-HP-600	-,42000*	,10585	,028	-,8148	-,0252
	MW	-2,46000*	,10585	,000	-2,8548	-2,0652
	E-HP-300	-1,80000*	,10585	,000	-2,1948	-1,4052
	HP-300	-3,41000*	,10585	,000	-3,8048	-3,0152
	TT	-1,85000*	,10585	,000	-2,2448	-1,4552
	MW-E-HP-600	,54000*	,10585	,001	,1452	,9348
	Control	-3,93000*	,10585	,000	-4,3248	-3,5352
	TT-HP-300	-1,37000*	,10585	,000	-1,7648	-,9752
	TT-HP-600	-1,04000*	,10585	,000	-1,4348	-,6452

Multiple Comparisons

Dependent Variable: SP

Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
TT-HP-300	MW-EH	-,17000	,10585	,965	-,5648	,2248
	HP-600	-2,29000*	,10585	,000	-2,6848	-1,8952
	MW-HP-300	,67000*	,10585	,000	,2752	1,0648
	EH	,06000	,10585	1,000	-,3348	,4548
	E-HP-600	-,23000	,10585	,734	-,6248	,1648
	EH-HP-300	,56000*	,10585	,001	,1652	,9548
	EH-HP-600	,87000*	,10585	,000	,4752	1,2648
	MW-HP-600	,95000*	,10585	,000	,5552	1,3448
	MW	-1,09000*	,10585	,000	-1,4848	-,6952
	E-HP-300	-,43000*	,10585	,022	-,8248	-,0352
	HP-300	-2,04000*	,10585	,000	-2,4348	-1,6452
	TT	-,48000*	,10585	,006	-,8748	-,0852
	MW-E-HP-600	1,91000*	,10585	,000	1,5152	2,3048
	Control	-2,56000*	,10585	,000	-2,9548	-2,1652
	MW-E-HP-300	1,37000*	,10585	,000	,9752	1,7648
	TT-HP-600	,33000	,10585	,191	-,0648	,7248
TT-HP-600	MW-EH	-,50000*	,10585	,004	-,8948	-,1052
	HP-600	-2,62000*	,10585	,000	-3,0148	-2,2252
	MW-HP-300	,34000	,10585	,158	-,0548	,7348
	EH	-,27000	,10585	,487	-,6648	,1248
	E-HP-600	-,56000*	,10585	,001	-,9548	-,1652
	EH-HP-300	,23000	,10585	,734	-,1648	,6248
	EH-HP-600	,54000*	,10585	,001	,1452	,9348
	MW-HP-600	,62000*	,10585	,000	,2252	1,0148
	MW	-1,42000*	,10585	,000	-1,8148	-1,0252
	E-HP-300	-,76000*	,10585	,000	-1,1548	-,3652
	HP-300	-2,37000*	,10585	,000	-2,7648	-1,9752
	TT	-,81000*	,10585	,000	-1,2048	-,4152
	MW-E-HP-600	1,58000*	,10585	,000	1,1852	1,9748
	Control	-2,89000*	,10585	,000	-3,2848	-2,4952
	MW-E-HP-300	1,04000*	,10585	,000	,6452	1,4348
	TT-HP-300	-,33000	,10585	,191	-,7248	,0648

SP

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05									
		1	2	3	4	5	6	7	8	9	10
MW-E-HP-600	3	4,0700									
MW-E-HP-300	3		4,6100								
MW-HP-600	3			5,0300							
EH-HP-600	3			5,1100							
MW-HP-300	3			5,3100	5,3100						
EH-HP-300	3			5,4200	5,4200						
TT-HP-600	3				5,6500	5,6500					
EH	3					5,9200	5,9200				
TT-HP-300	3					5,9800	5,9800				
MW-EH	3						6,1500	6,1500			
E-HP-600	3						6,2100	6,2100			
E-HP-300	3							6,4100			
TT	3							6,4600			
MW	3								7,0700		
HP-300	3									8,0200	
HP-600	3									8,2700	8,2700
Control	3										8,5400
Sig.		1,000	1,000	,056	,158	,191	,371	,271	1,000	,612	,487

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

F. Variance Analysis Outputs of WHC

Descriptives

WHC

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	9,2100	,09165	,05292	8,9823	9,4377	9,11	9,29
HP-600	3	11,7100	,05568	,03215	11,5717	11,8483	11,66	11,77
MW-HP-300	3	7,3200	,01732	,01000	7,2770	7,3630	7,31	7,34
EH	3	9,1100	,07810	,04509	8,9160	9,3040	9,02	9,16
E-HP-600	3	9,2000	,02646	,01528	9,1343	9,2657	9,18	9,23
EH-HP-300	3	8,9700	,04583	,02646	8,8562	9,0838	8,93	9,02
EH-HP-600	3	8,5600	,04583	,02646	8,4462	8,6738	8,51	8,60
MW-HP-600	3	7,4100	,02646	,01528	7,3443	7,4757	7,39	7,44
MW	3	10,1700	,04359	,02517	10,0617	10,2783	10,14	10,22
E-HP-300	3	8,9800	,04583	,02646	8,8662	9,0938	8,93	9,02
HP-300	3	10,9000	,01732	,01000	10,8570	10,9430	10,88	10,91
TT	3	9,8700	,07937	,04583	9,6728	10,0672	9,78	9,93
MW-E-HP-600	3	6,5000	,05292	,03055	6,3686	6,6314	6,46	6,56
Control	3	10,1200	,03606	,02082	10,0304	10,2096	10,09	10,16
MW-E-HP-300	3	6,3400	,02646	,01528	6,2743	6,4057	6,31	6,36
TT-HP-300	3	9,1400	,02646	,01528	9,0743	9,2057	9,12	9,17
TT-HP-600	3	9,2300	,02000	,01155	9,1803	9,2797	9,21	9,25
Total	51	8,9847	1,41556	,19822	8,5866	9,3828	6,31	11,77

ANOVA

WHC

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	100,110	16	6,257	2659,174	,000
Within Groups	,080	34	,002		
Total	100,190	50			

Multiple Comparisons

Dependent Variable: WHC
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	-2,50000*	,03961	,000	-2,6477	-2,3523
	MW-HP-300	1,89000*	,03961	,000	1,7423	2,0377
	EH	,10000	,03961	,504	-,0477	,2477
	E-HP-600	,01000	,03961	1,000	-,1377	,1577
	EH-HP-300	,24000*	,03961	,000	,0923	,3877
	EH-HP-600	,65000*	,03961	,000	,5023	,7977
	MW-HP-600	1,80000*	,03961	,000	1,6523	1,9477
	MW	-,96000*	,03961	,000	-1,1077	-,8123
	E-HP-300	,23000*	,03961	,000	,0823	,3777
	HP-300	-1,69000*	,03961	,000	-1,8377	-1,5423
	TT	-,66000*	,03961	,000	-,8077	-,5123
	MW-E-HP-600	2,71000*	,03961	,000	2,5623	2,8577
	Control	-,91000*	,03961	,000	-1,0577	-,7623
	MW-E-HP-300	2,87000*	,03961	,000	2,7223	3,0177
	TT-HP-300	,07000	,03961	,925	-,0777	,2177
	TT-HP-600	-,02000	,03961	1,000	-,1677	,1277
HP-600	MW-EH	2,50000*	,03961	,000	2,3523	2,6477
	MW-HP-300	4,39000*	,03961	,000	4,2423	4,5377
	EH	2,60000*	,03961	,000	2,4523	2,7477
	E-HP-600	2,51000*	,03961	,000	2,3623	2,6577
	EH-HP-300	2,74000*	,03961	,000	2,5923	2,8877
	EH-HP-600	3,15000*	,03961	,000	3,0023	3,2977
	MW-HP-600	4,30000*	,03961	,000	4,1523	4,4477
	MW	1,54000*	,03961	,000	1,3923	1,6877
	E-HP-300	2,73000*	,03961	,000	2,5823	2,8777
	HP-300	,81000*	,03961	,000	,6623	,9577
	TT	1,84000*	,03961	,000	1,6923	1,9877
	MW-E-HP-600	5,21000*	,03961	,000	5,0623	5,3577
	Control	1,59000*	,03961	,000	1,4423	1,7377
	MW-E-HP-300	5,37000*	,03961	,000	5,2223	5,5177
	TT-HP-300	2,57000*	,03961	,000	2,4223	2,7177
	TT-HP-600	2,48000*	,03961	,000	2,3323	2,6277
MW-HP-300	MW-EH	-1,89000*	,03961	,000	-2,0377	-1,7423
	HP-600	-4,39000*	,03961	,000	-4,5377	-4,2423
	EH	-1,79000*	,03961	,000	-1,9377	-1,6423
	E-HP-600	-1,88000*	,03961	,000	-2,0277	-1,7323
	EH-HP-300	-1,65000*	,03961	,000	-1,7977	-1,5023
	EH-HP-600	-1,24000*	,03961	,000	-1,3877	-1,0923
	MW-HP-600	-,09000	,03961	,671	-,2377	,0577
	MW	-2,85000*	,03961	,000	-2,9977	-2,7023
	E-HP-300	-1,66000*	,03961	,000	-1,8077	-1,5123
	HP-300	-3,58000*	,03961	,000	-3,7277	-3,4323
	TT	-2,55000*	,03961	,000	-2,6977	-2,4023
	MW-E-HP-600	,82000*	,03961	,000	,6723	,9677
	Control	-2,80000*	,03961	,000	-2,9477	-2,6523
	MW-E-HP-300	,98000*	,03961	,000	,8323	1,1277
	TT-HP-300	-1,82000*	,03961	,000	-1,9677	-1,6723
	TT-HP-600	-1,91000*	,03961	,000	-2,0577	-1,7623
EH	MW-EH	-,10000	,03961	,504	-,2477	,0477
	HP-600	-2,60000*	,03961	,000	-2,7477	-2,4523
	MW-HP-300	1,79000*	,03961	,000	1,6423	1,9377
	E-HP-600	-,09000	,03961	,671	-,2377	,0577
	EH-HP-300	,14000	,03961	,079	-,0077	,2877

	EH-HP-600	,55000*	,03961	,000	,4023	,6977
	MW-HP-600	1,70000*	,03961	,000	1,5523	1,8477
	MW	-1,06000*	,03961	,000	-1,2077	-,9123
	E-HP-300	,13000	,03961	,137	-,0177	,2777
	HP-300	-1,79000*	,03961	,000	-1,9377	-1,6423
	TT	-,76000*	,03961	,000	-,9077	-,6123
	MW-E-HP-600	2,61000*	,03961	,000	2,4623	2,7577
	Control	-1,01000*	,03961	,000	-1,1577	-,8623
	MW-E-HP-300	2,77000*	,03961	,000	2,6223	2,9177
	TT-HP-300	-,03000	,03961	1,000	-,1777	,1177
	TT-HP-600	-,12000	,03961	,225	-,2677	,0277
E-HP-600	MW-EH	-,01000	,03961	1,000	-,1577	,1377
	HP-600	-2,51000*	,03961	,000	-2,6577	-2,3623
	MW-HP-300	1,88000*	,03961	,000	1,7323	2,0277
	EH	,09000	,03961	,671	-,0577	,2377
	EH-HP-300	,23000*	,03961	,000	,0823	,3777
	EH-HP-600	,64000*	,03961	,000	,4923	,7877
	MW-HP-600	1,79000*	,03961	,000	1,6423	1,9377
	MW	-,97000*	,03961	,000	-1,1177	-,8223
	E-HP-300	,22000*	,03961	,000	,0723	,3677
	HP-300	-1,70000*	,03961	,000	-1,8477	-1,5523
	TT	-,67000*	,03961	,000	-,8177	-,5223
	MW-E-HP-600	2,70000*	,03961	,000	2,5523	2,8477
	Control	-,92000*	,03961	,000	-1,0677	-,7723
	MW-E-HP-300	2,86000*	,03961	,000	2,7123	3,0077
	TT-HP-300	,06000	,03961	,979	-,0877	,2077
	TT-HP-600	-,03000	,03961	1,000	-,1777	,1177
EH-HP-300	MW-EH	-,24000*	,03961	,000	-,3877	-,0923
	HP-600	-2,74000*	,03961	,000	-2,8877	-2,5923
	MW-HP-300	1,65000*	,03961	,000	1,5023	1,7977
	EH	-,14000	,03961	,079	-,2877	,0077
	E-HP-600	-,23000*	,03961	,000	-,3777	-,0823
	EH-HP-600	,41000*	,03961	,000	,2623	,5577
	MW-HP-600	1,56000*	,03961	,000	1,4123	1,7077
	MW	-1,20000*	,03961	,000	-1,3477	-1,0523
	E-HP-300	-,01000	,03961	1,000	-,1577	,1377
	HP-300	-1,93000*	,03961	,000	-2,0777	-1,7823
	TT	-,90000*	,03961	,000	-1,0477	-,7523
	MW-E-HP-600	2,47000*	,03961	,000	2,3223	2,6177
	Control	-1,15000*	,03961	,000	-1,2977	-1,0023
	MW-E-HP-300	2,63000*	,03961	,000	2,4823	2,7777
	TT-HP-300	-,17000*	,03961	,012	-,3177	-,0223
	TT-HP-600	-,26000*	,03961	,000	-,4077	-,1123
EH-HP-600	MW-EH	-,65000*	,03961	,000	-,7977	-,5023
	HP-600	-3,15000*	,03961	,000	-3,2977	-3,0023
	MW-HP-300	1,24000*	,03961	,000	1,0923	1,3877
	EH	-,55000*	,03961	,000	-,6977	-,4023
	E-HP-600	-,64000*	,03961	,000	-,7877	-,4923
	EH-HP-300	-,41000*	,03961	,000	-,5577	-,2623
	MW-HP-600	1,15000*	,03961	,000	1,0023	1,2977
	MW	-1,61000*	,03961	,000	-1,7577	-1,4623
	E-HP-300	-,42000*	,03961	,000	-,5677	-,2723
	HP-300	-2,34000*	,03961	,000	-2,4877	-2,1923
	TT	-1,31000*	,03961	,000	-1,4577	-1,1623
	MW-E-HP-600	2,06000*	,03961	,000	1,9123	2,2077
	Control	-1,56000*	,03961	,000	-1,7077	-1,4123
	MW-E-HP-300	2,22000*	,03961	,000	2,0723	2,3677
	TT-HP-300	-,58000*	,03961	,000	-,7277	-,4323
	TT-HP-600	-,67000*	,03961	,000	-,8177	-,5223
MW-HP-600	MW-EH	-1,80000*	,03961	,000	-1,9477	-1,6523
	HP-600	-4,30000*	,03961	,000	-4,4477	-4,1523

	MW-HP-300	,09000	,03961	,671	-,0577	,2377
	EH	-1,70000*	,03961	,000	-1,8477	-1,5523
	E-HP-600	-1,79000*	,03961	,000	-1,9377	-1,6423
	EH-HP-300	-1,56000*	,03961	,000	-1,7077	-1,4123
	EH-HP-600	-1,15000*	,03961	,000	-1,2977	-1,0023
	MW	-2,76000*	,03961	,000	-2,9077	-2,6123
	E-HP-300	-1,57000*	,03961	,000	-1,7177	-1,4223
	HP-300	-3,49000*	,03961	,000	-3,6377	-3,3423
	TT	-2,46000*	,03961	,000	-2,6077	-2,3123
	MW-E-HP-600	,91000*	,03961	,000	,7623	1,0577
	Control	-2,71000*	,03961	,000	-2,8577	-2,5623
	MW-E-HP-300	1,07000*	,03961	,000	,9223	1,2177
	TT-HP-300	-1,73000*	,03961	,000	-1,8777	-1,5823
	TT-HP-600	-1,82000*	,03961	,000	-1,9677	-1,6723
MW	MW-EH	,96000*	,03961	,000	,8123	1,1077
	HP-600	-1,54000*	,03961	,000	-1,6877	-1,3923
	MW-HP-300	2,85000*	,03961	,000	2,7023	2,9977
	EH	1,06000*	,03961	,000	,9123	1,2077
	E-HP-600	,97000*	,03961	,000	,8223	1,1177
	EH-HP-300	1,20000*	,03961	,000	1,0523	1,3477
	EH-HP-600	1,61000*	,03961	,000	1,4623	1,7577
	MW-HP-600	2,76000*	,03961	,000	2,6123	2,9077
	E-HP-300	1,19000*	,03961	,000	1,0423	1,3377
	HP-300	-,73000*	,03961	,000	-,8777	-,5823
	TT	,30000*	,03961	,000	,1523	,4477
	MW-E-HP-600	3,67000*	,03961	,000	3,5223	3,8177
	Control	,05000	,03961	,996	-,0977	,1977
	MW-E-HP-300	3,83000*	,03961	,000	3,6823	3,9777
	TT-HP-300	1,03000*	,03961	,000	,8823	1,1777
	TT-HP-600	,94000*	,03961	,000	,7923	1,0877
E-HP-300	MW-EH	-,23000*	,03961	,000	-,3777	-,0823
	HP-600	-2,73000*	,03961	,000	-2,8777	-2,5823
	MW-HP-300	1,66000*	,03961	,000	1,5123	1,8077
	EH	-,13000	,03961	,137	-,2777	,0177
	E-HP-600	-,22000*	,03961	,000	-,3677	-,0723
	EH-HP-300	,01000	,03961	1,000	-,1377	,1577
	EH-HP-600	,42000*	,03961	,000	,2723	,5677
	MW-HP-600	1,57000*	,03961	,000	1,4223	1,7177
	MW	-1,19000*	,03961	,000	-1,3377	-1,0423
	HP-300	-1,92000*	,03961	,000	-2,0677	-1,7723
	TT	-,89000*	,03961	,000	-1,0377	-,7423
	MW-E-HP-600	2,48000*	,03961	,000	2,3323	2,6277
	Control	-1,14000*	,03961	,000	-1,2877	-,9923
	MW-E-HP-300	2,64000*	,03961	,000	2,4923	2,7877
	TT-HP-300	-,16000*	,03961	,023	-,3077	-,0123
	TT-HP-600	-,25000*	,03961	,000	-,3977	-,1023
HP-300	MW-EH	1,69000*	,03961	,000	1,5423	1,8377
	HP-600	-,81000*	,03961	,000	-,9577	-,6623
	MW-HP-300	3,58000*	,03961	,000	3,4323	3,7277
	EH	1,79000*	,03961	,000	1,6423	1,9377
	E-HP-600	1,70000*	,03961	,000	1,5523	1,8477
	EH-HP-300	1,93000*	,03961	,000	1,7823	2,0777
	EH-HP-600	2,34000*	,03961	,000	2,1923	2,4877
	MW-HP-600	3,49000*	,03961	,000	3,3423	3,6377
	MW	,73000*	,03961	,000	,5823	,8777
	E-HP-300	1,92000*	,03961	,000	1,7723	2,0677
	TT	1,03000*	,03961	,000	,8823	1,1777
	MW-E-HP-600	4,40000*	,03961	,000	4,2523	4,5477
	Control	,78000*	,03961	,000	,6323	,9277
	MW-E-HP-300	4,56000*	,03961	,000	4,4123	4,7077
	TT-HP-300	1,76000*	,03961	,000	1,6123	1,9077

	TT-HP-600	1,67000*	,03961	,000	1,5223	1,8177
TT	MW-EH	,66000*	,03961	,000	,5123	,8077
	HP-600	-1,84000*	,03961	,000	-1,9877	-1,6923
	MW-HP-300	2,55000*	,03961	,000	2,4023	2,6977
	EH	,76000*	,03961	,000	,6123	,9077
	E-HP-600	,67000*	,03961	,000	,5223	,8177
	EH-HP-300	,90000*	,03961	,000	,7523	1,0477
	EH-HP-600	1,31000*	,03961	,000	1,1623	1,4577
	MW-HP-600	2,46000*	,03961	,000	2,3123	2,6077
	MW	-,30000*	,03961	,000	-,4477	-,1523
	E-HP-300	,89000*	,03961	,000	,7423	1,0377
	HP-300	-1,03000*	,03961	,000	-1,1777	-,8823
	MW-E-HP-600	3,37000*	,03961	,000	3,2223	3,5177
	Control	-,25000*	,03961	,000	-,3977	-,1023
	MW-E-HP-300	3,53000*	,03961	,000	3,3823	3,6777
	TT-HP-300	,73000*	,03961	,000	,5823	,8777
	TT-HP-600	,64000*	,03961	,000	,4923	,7877
MW-E-HP-600	MW-EH	-2,71000*	,03961	,000	-2,8577	-2,5623
	HP-600	-5,21000*	,03961	,000	-5,3577	-5,0623
	MW-HP-300	-,82000*	,03961	,000	-,9677	-,6723
	EH	-2,61000*	,03961	,000	-2,7577	-2,4623
	E-HP-600	-2,70000*	,03961	,000	-2,8477	-2,5523
	EH-HP-300	-2,47000*	,03961	,000	-2,6177	-2,3223
	EH-HP-600	-2,06000*	,03961	,000	-2,2077	-1,9123
	MW-HP-600	-,91000*	,03961	,000	-1,0577	-,7623
	MW	-3,67000*	,03961	,000	-3,8177	-3,5223
	E-HP-300	-2,48000*	,03961	,000	-2,6277	-2,3323
	HP-300	-4,40000*	,03961	,000	-4,5477	-4,2523
	TT	-3,37000*	,03961	,000	-3,5177	-3,2223
	Control	-3,62000*	,03961	,000	-3,7677	-3,4723
	MW-E-HP-300	,16000*	,03961	,023	,0123	,3077
	TT-HP-300	-2,64000*	,03961	,000	-2,7877	-2,4923
	TT-HP-600	-2,73000*	,03961	,000	-2,8777	-2,5823
Control	MW-EH	,91000*	,03961	,000	,7623	1,0577
	HP-600	-1,59000*	,03961	,000	-1,7377	-1,4423
	MW-HP-300	2,80000*	,03961	,000	2,6523	2,9477
	EH	1,01000*	,03961	,000	,8623	1,1577
	E-HP-600	,92000*	,03961	,000	,7723	1,0677
	EH-HP-300	1,15000*	,03961	,000	1,0023	1,2977
	EH-HP-600	1,56000*	,03961	,000	1,4123	1,7077
	MW-HP-600	2,71000*	,03961	,000	2,5623	2,8577
	MW	-,05000	,03961	,996	-,1977	,0977
	E-HP-300	1,14000*	,03961	,000	,9923	1,2877
	HP-300	-,78000*	,03961	,000	-,9277	-,6323
	TT	,25000*	,03961	,000	,1023	,3977
	MW-E-HP-600	3,62000*	,03961	,000	3,4723	3,7677
	MW-E-HP-300	3,78000*	,03961	,000	3,6323	3,9277
	TT-HP-300	,98000*	,03961	,000	,8323	1,1277
	TT-HP-600	,89000*	,03961	,000	,7423	1,0377
MW-E-HP-300	MW-EH	-2,87000*	,03961	,000	-3,0177	-2,7223
	HP-600	-5,37000*	,03961	,000	-5,5177	-5,2223
	MW-HP-300	-,98000*	,03961	,000	-1,1277	-,8323
	EH	-2,77000*	,03961	,000	-2,9177	-2,6223
	E-HP-600	-2,86000*	,03961	,000	-3,0077	-2,7123
	EH-HP-300	-2,63000*	,03961	,000	-2,7777	-2,4823
	EH-HP-600	-2,22000*	,03961	,000	-2,3677	-2,0723
	MW-HP-600	-1,07000*	,03961	,000	-1,2177	-,9223
	MW	-3,83000*	,03961	,000	-3,9777	-3,6823
	E-HP-300	-2,64000*	,03961	,000	-2,7877	-2,4923
	HP-300	-4,56000*	,03961	,000	-4,7077	-4,4123
	TT	-3,53000*	,03961	,000	-3,6777	-3,3823

	MW-E-HP-600	-,16000*	,03961	,023	-,3077	-,0123
	Control	-3,78000*	,03961	,000	-3,9277	-3,6323
	TT-HP-300	-2,80000*	,03961	,000	-2,9477	-2,6523
	TT-HP-600	-2,89000*	,03961	,000	-3,0377	-2,7423
TT-HP-300	MW-EH	-,07000	,03961	,925	-,2177	,0777
	HP-600	-2,57000*	,03961	,000	-2,7177	-2,4223
	MW-HP-300	1,82000*	,03961	,000	1,6723	1,9677
	EH	,03000	,03961	1,000	-,1177	,1777
	E-HP-600	-,06000	,03961	,979	-,2077	,0877
	EH-HP-300	,17000*	,03961	,012	,0223	,3177
	EH-HP-600	,58000*	,03961	,000	,4323	,7277
	MW-HP-600	1,73000*	,03961	,000	1,5823	1,8777
	MW	-1,03000*	,03961	,000	-1,1777	-,8823
	E-HP-300	,16000*	,03961	,023	,0123	,3077
	HP-300	-1,76000*	,03961	,000	-1,9077	-1,6123
	TT	-,73000*	,03961	,000	-,8777	-,5823
	MW-E-HP-600	2,64000*	,03961	,000	2,4923	2,7877
	Control	-,98000*	,03961	,000	-1,1277	-,8323
	MW-E-HP-300	2,80000*	,03961	,000	2,6523	2,9477
	TT-HP-600	-,09000	,03961	,671	-,2377	,0577
TT-HP-600	MW-EH	,02000	,03961	1,000	-,1277	,1677
	HP-600	-2,48000*	,03961	,000	-2,6277	-2,3323
	MW-HP-300	1,91000*	,03961	,000	1,7623	2,0577
	EH	,12000	,03961	,225	-,0277	,2677
	E-HP-600	,03000	,03961	1,000	-,1177	,1777
	EH-HP-300	,26000*	,03961	,000	,1123	,4077
	EH-HP-600	,67000*	,03961	,000	,5223	,8177
	MW-HP-600	1,82000*	,03961	,000	1,6723	1,9677
	MW	-,94000*	,03961	,000	-1,0877	-,7923
	E-HP-300	,25000*	,03961	,000	,1023	,3977
	HP-300	-1,67000*	,03961	,000	-1,8177	-1,5223
	TT	-,64000*	,03961	,000	-,7877	-,4923
	MW-E-HP-600	2,73000*	,03961	,000	2,5823	2,8777
	Control	-,89000*	,03961	,000	-1,0377	-,7423
	MW-E-HP-300	2,89000*	,03961	,000	2,7423	3,0377
	TT-HP-300	,09000	,03961	,671	-,0577	,2377

*. The mean difference is significant at the 0.05 level.

WHC

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05									
		1	2	3	4	5	6	7	8	9	10
MW-E-HP-300	3	6,3400									
MW-E-HP-600	3		6,5000								
MW-HP-300	3			7,3200							
MW-HP-600	3			7,4100							
EH-HP-600	3				8,5600						
EH-HP-300	3					8,9700					
E-HP-300	3					8,9800					
EH	3					9,1100	9,1100				
TT-HP-300	3						9,1400				
E-HP-600	3						9,2000				
MW-EH	3						9,2100				
TT-HP-600	3						9,2300				
TT	3							9,8700			
Control	3								10,1200		
MW	3								10,1700		
HP-300	3									10,9000	
HP-600	3										11,7100
Sig.		1,000	1,000	,671	1,000	,079	,225	1,000	,996	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

G. Variance Analysis Outputs of SI

Descriptives

SI

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	41,1600	,06245	,03606	41,0049	41,3151	41,11	41,23
HP-600	3	36,5800	,42297	,24420	35,5293	37,6307	36,11	36,93
MW-HP-300	3	46,8900	,10817	,06245	46,6213	47,1587	46,80	47,01
EH	3	43,2000	,10000	,05774	42,9516	43,4484	43,10	43,30
E-HP-600	3	40,8700	,03606	,02082	40,7804	40,9596	40,83	40,90
EH-HP-300	3	44,7300	,02646	,01528	44,6643	44,7957	44,70	44,75
EH-HP-600	3	45,8700	,13454	,07767	45,5358	46,2042	45,76	46,02
MW-HP-600	3	47,6500	,04583	,02646	47,5362	47,7638	47,61	47,70
MW	3	38,1300	,01732	,01000	38,0870	38,1730	38,11	38,14
E-HP-300	3	37,5200	,07211	,04163	37,3409	37,6991	37,46	37,60
HP-300	3	35,8600	,09849	,05686	35,6153	36,1047	35,75	35,94
TT	3	41,1900	,08718	,05033	40,9734	41,4066	41,13	41,29
MW-E-HP-600	3	42,6500	,04359	,02517	42,5417	42,7583	42,60	42,68
Control	3	23,0000	,02646	,01528	22,9343	23,0657	22,97	23,02
MW-E-HP-300	3	40,1700	,05292	,03055	40,0386	40,3014	40,11	40,21
TT-HP-300	3	42,6900	,04583	,02646	42,5762	42,8038	42,65	42,74
TT-HP-600	3	43,1300	,04359	,02517	43,0217	43,2383	43,10	43,18
Total	51	40,6641	5,59013	,78277	39,0919	42,2364	22,97	47,70

ANOVA

SI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1561,958	16	97,622	6410,123	,000
Within Groups	,518	34	,015		
Total	1562,476	50			

Multiple Comparisons

Dependent Variable: SI
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	4,58000*	,10076	,000	4,2042	4,9558
	MW-HP-300	-5,73000*	,10076	,000	-6,1058	-5,3542
	EH	-2,04000*	,10076	,000	-2,4158	-1,6642
	E-HP-600	,29000	,10076	,296	-,0858	,6658
	EH-HP-300	-3,57000*	,10076	,000	-3,9458	-3,1942
	EH-HP-600	-4,71000*	,10076	,000	-5,0858	-4,3342
	MW-HP-600	-6,49000*	,10076	,000	-6,8658	-6,1142
	MW	3,03000*	,10076	,000	2,6542	3,4058
	E-HP-300	3,64000*	,10076	,000	3,2642	4,0158
	HP-300	5,30000*	,10076	,000	4,9242	5,6758
	TT	-,03000	,10076	1,000	-,4058	,3458
	MW-E-HP-600	-1,49000*	,10076	,000	-1,8658	-1,1142
	Control	18,16000*	,10076	,000	17,7842	18,5358
	MW-E-HP-300	,99000*	,10076	,000	,6142	1,3658
	TT-HP-300	-1,53000*	,10076	,000	-1,9058	-1,1542
	TT-HP-600	-1,97000*	,10076	,000	-2,3458	-1,5942
HP-600	MW-EH	-4,58000*	,10076	,000	-4,9558	-4,2042
	MW-HP-300	-10,31000*	,10076	,000	-10,6858	-9,9342
	EH	-6,62000*	,10076	,000	-6,9958	-6,2442
	E-HP-600	-4,29000*	,10076	,000	-4,6658	-3,9142
	EH-HP-300	-8,15000*	,10076	,000	-8,5258	-7,7742
	EH-HP-600	-9,29000*	,10076	,000	-9,6658	-8,9142
	MW-HP-600	-11,07000*	,10076	,000	-11,4458	-10,6942
	MW	-1,55000*	,10076	,000	-1,9258	-1,1742
	E-HP-300	-,94000*	,10076	,000	-1,3158	-,5642
	HP-300	,72000*	,10076	,000	,3442	1,0958
	TT	-4,61000*	,10076	,000	-4,9858	-4,2342
	MW-E-HP-600	-6,07000*	,10076	,000	-6,4458	-5,6942
	Control	13,58000*	,10076	,000	13,2042	13,9558
	MW-E-HP-300	-3,59000*	,10076	,000	-3,9658	-3,2142
	TT-HP-300	-6,11000*	,10076	,000	-6,4858	-5,7342
	TT-HP-600	-6,55000*	,10076	,000	-6,9258	-6,1742
MW-HP-300	MW-EH	5,73000*	,10076	,000	5,3542	6,1058
	HP-600	10,31000*	,10076	,000	9,9342	10,6858
	EH	3,69000*	,10076	,000	3,3142	4,0658
	E-HP-600	6,02000*	,10076	,000	5,6442	6,3958
	EH-HP-300	2,16000*	,10076	,000	1,7842	2,5358
	EH-HP-600	1,02000*	,10076	,000	,6442	1,3958
	MW-HP-600	-,76000*	,10076	,000	-1,1358	-,3842
	MW	8,76000*	,10076	,000	8,3842	9,1358
	E-HP-300	9,37000*	,10076	,000	8,9942	9,7458
	HP-300	11,03000*	,10076	,000	10,6542	11,4058
	TT	5,70000*	,10076	,000	5,3242	6,0758
	MW-E-HP-600	4,24000*	,10076	,000	3,8642	4,6158
	Control	23,89000*	,10076	,000	23,5142	24,2658
	MW-E-HP-300	6,72000*	,10076	,000	6,3442	7,0958
	TT-HP-300	4,20000*	,10076	,000	3,8242	4,5758
	TT-HP-600	3,76000*	,10076	,000	3,3842	4,1358
EH	MW-EH	2,04000*	,10076	,000	1,6642	2,4158
	HP-600	6,62000*	,10076	,000	6,2442	6,9958
	MW-HP-300	-3,69000*	,10076	,000	-4,0658	-3,3142
	E-HP-600	2,33000*	,10076	,000	1,9542	2,7058
	EH-HP-300	-1,53000*	,10076	,000	-1,9058	-1,1542
	EH-HP-600	-2,67000*	,10076	,000	-3,0458	-2,2942

	MW-HP-600	-4,45000*	,10076	,000	-4,8258	-4,0742
	MW	5,07000*	,10076	,000	4,6942	5,4458
	E-HP-300	5,68000*	,10076	,000	5,3042	6,0558
	HP-300	7,34000*	,10076	,000	6,9642	7,7158
	TT	2,01000*	,10076	,000	1,6342	2,3858
	MW-E-HP-600	,55000*	,10076	,000	,1742	,9258
	Control	20,20000*	,10076	,000	19,8242	20,5758
	MW-E-HP-300	3,03000*	,10076	,000	2,6542	3,4058
	TT-HP-300	,51000*	,10076	,001	,1342	,8858
	TT-HP-600	,07000	,10076	1,000	-,3058	,4458
E-HP-600	MW-EH	-,29000	,10076	,296	-,6658	,0858
	HP-600	4,29000*	,10076	,000	3,9142	4,6658
	MW-HP-300	-6,02000*	,10076	,000	-6,3958	-5,6442
	EH	-2,33000*	,10076	,000	-2,7058	-1,9542
	EH-HP-300	-3,86000*	,10076	,000	-4,2358	-3,4842
	EH-HP-600	-5,00000*	,10076	,000	-5,3758	-4,6242
	MW-HP-600	-6,78000*	,10076	,000	-7,1558	-6,4042
	MW	2,74000*	,10076	,000	2,3642	3,1158
	E-HP-300	3,35000*	,10076	,000	2,9742	3,7258
	HP-300	5,01000*	,10076	,000	4,6342	5,3858
	TT	-,32000	,10076	,170	-,6958	,0558
	MW-E-HP-600	-1,78000*	,10076	,000	-2,1558	-1,4042
	Control	17,87000*	,10076	,000	17,4942	18,2458
	MW-E-HP-300	,70000*	,10076	,000	,3242	1,0758
	TT-HP-300	-1,82000*	,10076	,000	-2,1958	-1,4442
	TT-HP-600	-2,26000*	,10076	,000	-2,6358	-1,8842
EH-HP-300	MW-EH	3,57000*	,10076	,000	3,1942	3,9458
	HP-600	8,15000*	,10076	,000	7,7742	8,5258
	MW-HP-300	-2,16000*	,10076	,000	-2,5358	-1,7842
	EH	1,53000*	,10076	,000	1,1542	1,9058
	E-HP-600	3,86000*	,10076	,000	3,4842	4,2358
	EH-HP-600	-1,14000*	,10076	,000	-1,5158	-,7642
	MW-HP-600	-2,92000*	,10076	,000	-3,2958	-2,5442
	MW	6,60000*	,10076	,000	6,2242	6,9758
	E-HP-300	7,21000*	,10076	,000	6,8342	7,5858
	HP-300	8,87000*	,10076	,000	8,4942	9,2458
	TT	3,54000*	,10076	,000	3,1642	3,9158
	MW-E-HP-600	2,08000*	,10076	,000	1,7042	2,4558
	Control	21,73000*	,10076	,000	21,3542	22,1058
	MW-E-HP-300	4,56000*	,10076	,000	4,1842	4,9358
	TT-HP-300	2,04000*	,10076	,000	1,6642	2,4158
	TT-HP-600	1,60000*	,10076	,000	1,2242	1,9758
EH-HP-600	MW-EH	4,71000*	,10076	,000	4,3342	5,0858
	HP-600	9,29000*	,10076	,000	8,9142	9,6658
	MW-HP-300	-1,02000*	,10076	,000	-1,3958	-,6442
	EH	2,67000*	,10076	,000	2,2942	3,0458
	E-HP-600	5,00000*	,10076	,000	4,6242	5,3758
	EH-HP-300	1,14000*	,10076	,000	,7642	1,5158
	MW-HP-600	-1,78000*	,10076	,000	-2,1558	-1,4042
	MW	7,74000*	,10076	,000	7,3642	8,1158
	E-HP-300	8,35000*	,10076	,000	7,9742	8,7258
	HP-300	10,01000*	,10076	,000	9,6342	10,3858
	TT	4,68000*	,10076	,000	4,3042	5,0558
	MW-E-HP-600	3,22000*	,10076	,000	2,8442	3,5958
	Control	22,87000*	,10076	,000	22,4942	23,2458
	MW-E-HP-300	5,70000*	,10076	,000	5,3242	6,0758
	TT-HP-300	3,18000*	,10076	,000	2,8042	3,5558
	TT-HP-600	2,74000*	,10076	,000	2,3642	3,1158
MW-HP-600	MW-EH	6,49000*	,10076	,000	6,1142	6,8658
	HP-600	11,07000*	,10076	,000	10,6942	11,4458
	MW-HP-300	,76000*	,10076	,000	,3842	1,1358

	EH	4,45000*	,10076	,000	4,0742	4,8258
	E-HP-600	6,78000*	,10076	,000	6,4042	7,1558
	EH-HP-300	2,92000*	,10076	,000	2,5442	3,2958
	EH-HP-600	1,78000*	,10076	,000	1,4042	2,1558
	MW	9,52000*	,10076	,000	9,1442	9,8958
	E-HP-300	10,13000*	,10076	,000	9,7542	10,5058
	HP-300	11,79000*	,10076	,000	11,4142	12,1658
	TT	6,46000*	,10076	,000	6,0842	6,8358
	MW-E-HP-600	5,00000*	,10076	,000	4,6242	5,3758
	Control	24,65000*	,10076	,000	24,2742	25,0258
	MW-E-HP-300	7,48000*	,10076	,000	7,1042	7,8558
	TT-HP-300	4,96000*	,10076	,000	4,5842	5,3358
	TT-HP-600	4,52000*	,10076	,000	4,1442	4,8958
MW	MW-EH	-3,03000*	,10076	,000	-3,4058	-2,6542
	HP-600	1,55000*	,10076	,000	1,1742	1,9258
	MW-HP-300	-8,76000*	,10076	,000	-9,1358	-8,3842
	EH	-5,07000*	,10076	,000	-5,4458	-4,6942
	E-HP-600	-2,74000*	,10076	,000	-3,1158	-2,3642
	EH-HP-300	-6,60000*	,10076	,000	-6,9758	-6,2242
	EH-HP-600	-7,74000*	,10076	,000	-8,1158	-7,3642
	MW-HP-600	-9,52000*	,10076	,000	-9,8958	-9,1442
	E-HP-300	,61000*	,10076	,000	,2342	,9858
	HP-300	2,27000*	,10076	,000	1,8942	2,6458
	TT	-3,06000*	,10076	,000	-3,4358	-2,6842
	MW-E-HP-600	-4,52000*	,10076	,000	-4,8958	-4,1442
	Control	15,13000*	,10076	,000	14,7542	15,5058
	MW-E-HP-300	-2,04000*	,10076	,000	-2,4158	-1,6642
	TT-HP-300	-4,56000*	,10076	,000	-4,9358	-4,1842
	TT-HP-600	-5,00000*	,10076	,000	-5,3758	-4,6242
E-HP-300	MW-EH	-3,64000*	,10076	,000	-4,0158	-3,2642
	HP-600	,94000*	,10076	,000	,5642	1,3158
	MW-HP-300	-9,37000*	,10076	,000	-9,7458	-8,9942
	EH	-5,68000*	,10076	,000	-6,0558	-5,3042
	E-HP-600	-3,35000*	,10076	,000	-3,7258	-2,9742
	EH-HP-300	-7,21000*	,10076	,000	-7,5858	-6,8342
	EH-HP-600	-8,35000*	,10076	,000	-8,7258	-7,9742
	MW-HP-600	-10,13000*	,10076	,000	-10,5058	-9,7542
	MW	-,61000*	,10076	,000	-,9858	-,2342
	HP-300	1,66000*	,10076	,000	1,2842	2,0358
	TT	-3,67000*	,10076	,000	-4,0458	-3,2942
	MW-E-HP-600	-5,13000*	,10076	,000	-5,5058	-4,7542
	Control	14,52000*	,10076	,000	14,1442	14,8958
	MW-E-HP-300	-2,65000*	,10076	,000	-3,0258	-2,2742
	TT-HP-300	-5,17000*	,10076	,000	-5,5458	-4,7942
	TT-HP-600	-5,61000*	,10076	,000	-5,9858	-5,2342
HP-300	MW-EH	-5,30000*	,10076	,000	-5,6758	-4,9242
	HP-600	-,72000*	,10076	,000	-1,0958	-,3442
	MW-HP-300	-11,03000*	,10076	,000	-11,4058	-10,6542
	EH	-7,34000*	,10076	,000	-7,7158	-6,9642
	E-HP-600	-5,01000*	,10076	,000	-5,3858	-4,6342
	EH-HP-300	-8,87000*	,10076	,000	-9,2458	-8,4942
	EH-HP-600	-10,01000*	,10076	,000	-10,3858	-9,6342
	MW-HP-600	-11,79000*	,10076	,000	-12,1658	-11,4142
	MW	-2,27000*	,10076	,000	-2,6458	-1,8942
	E-HP-300	-1,66000*	,10076	,000	-2,0358	-1,2842
	TT	-5,33000*	,10076	,000	-5,7058	-4,9542
	MW-E-HP-600	-6,79000*	,10076	,000	-7,1658	-6,4142
	Control	12,86000*	,10076	,000	12,4842	13,2358
	MW-E-HP-300	-4,31000*	,10076	,000	-4,6858	-3,9342
	TT-HP-300	-6,83000*	,10076	,000	-7,2058	-6,4542
	TT-HP-600	-7,27000*	,10076	,000	-7,6458	-6,8942

TT	MW-EH	,03000	,10076	1,000	-,3458	,4058
	HP-600	4,61000*	,10076	,000	4,2342	4,9858
	MW-HP-300	-5,70000*	,10076	,000	-6,0758	-5,3242
	EH	-2,01000*	,10076	,000	-2,3858	-1,6342
	E-HP-600	,32000	,10076	,170	-,0558	,6958
	EH-HP-300	-3,54000*	,10076	,000	-3,9158	-3,1642
	EH-HP-600	-4,68000*	,10076	,000	-5,0558	-4,3042
	MW-HP-600	-6,46000*	,10076	,000	-6,8358	-6,0842
	MW	3,06000*	,10076	,000	2,6842	3,4358
	E-HP-300	3,67000*	,10076	,000	3,2942	4,0458
	HP-300	5,33000*	,10076	,000	4,9542	5,7058
	MW-E-HP-600	-1,46000*	,10076	,000	-1,8358	-1,0842
	Control	18,19000*	,10076	,000	17,8142	18,5658
	MW-E-HP-300	1,02000*	,10076	,000	,6442	1,3958
	TT-HP-300	-1,50000*	,10076	,000	-1,8758	-1,1242
	TT-HP-600	-1,94000*	,10076	,000	-2,3158	-1,5642
MW-E-HP-600	MW-EH	1,49000*	,10076	,000	1,1142	1,8658
	HP-600	6,07000*	,10076	,000	5,6942	6,4458
	MW-HP-300	-4,24000*	,10076	,000	-4,6158	-3,8642
	EH	-,55000*	,10076	,000	-,9258	-,1742
	E-HP-600	1,78000*	,10076	,000	1,4042	2,1558
	EH-HP-300	-2,08000*	,10076	,000	-2,4558	-1,7042
	EH-HP-600	-3,22000*	,10076	,000	-3,5958	-2,8442
	MW-HP-600	-5,00000*	,10076	,000	-5,3758	-4,6242
	MW	4,52000*	,10076	,000	4,1442	4,8958
	E-HP-300	5,13000*	,10076	,000	4,7542	5,5058
	HP-300	6,79000*	,10076	,000	6,4142	7,1658
	TT	1,46000*	,10076	,000	1,0842	1,8358
	Control	19,65000*	,10076	,000	19,2742	20,0258
	MW-E-HP-300	2,48000*	,10076	,000	2,1042	2,8558
	TT-HP-300	-,04000	,10076	1,000	-,4158	,3358
	TT-HP-600	-,48000*	,10076	,003	-,8558	-,1042
Control	MW-EH	-18,16000*	,10076	,000	-18,5358	-17,7842
	HP-600	-13,58000*	,10076	,000	-13,9558	-13,2042
	MW-HP-300	-23,89000*	,10076	,000	-24,2658	-23,5142
	EH	-20,20000*	,10076	,000	-20,5758	-19,8242
	E-HP-600	-17,87000*	,10076	,000	-18,2458	-17,4942
	EH-HP-300	-21,73000*	,10076	,000	-22,1058	-21,3542
	EH-HP-600	-22,87000*	,10076	,000	-23,2458	-22,4942
	MW-HP-600	-24,65000*	,10076	,000	-25,0258	-24,2742
	MW	-15,13000*	,10076	,000	-15,5058	-14,7542
	E-HP-300	-14,52000*	,10076	,000	-14,8958	-14,1442
	HP-300	-12,86000*	,10076	,000	-13,2358	-12,4842
	TT	-18,19000*	,10076	,000	-18,5658	-17,8142
	MW-E-HP-600	-19,65000*	,10076	,000	-20,0258	-19,2742
	MW-E-HP-300	-17,17000*	,10076	,000	-17,5458	-16,7942
	TT-HP-300	-19,69000*	,10076	,000	-20,0658	-19,3142
	TT-HP-600	-20,13000*	,10076	,000	-20,5058	-19,7542
MW-E-HP-300	MW-EH	-,99000*	,10076	,000	-1,3658	-,6142
	HP-600	3,59000*	,10076	,000	3,2142	3,9658
	MW-HP-300	-6,72000*	,10076	,000	-7,0958	-6,3442
	EH	-3,03000*	,10076	,000	-3,4058	-2,6542
	E-HP-600	-,70000*	,10076	,000	-1,0758	-,3242
	EH-HP-300	-4,56000*	,10076	,000	-4,9358	-4,1842
	EH-HP-600	-5,70000*	,10076	,000	-6,0758	-5,3242
	MW-HP-600	-7,48000*	,10076	,000	-7,8558	-7,1042
	MW	2,04000*	,10076	,000	1,6642	2,4158
	E-HP-300	2,65000*	,10076	,000	2,2742	3,0258
	HP-300	4,31000*	,10076	,000	3,9342	4,6858
	TT	-1,02000*	,10076	,000	-1,3958	-,6442
	MW-E-HP-600	-2,48000*	,10076	,000	-2,8558	-2,1042

	Control	17,17000*	,10076	,000	16,7942	17,5458
	TT-HP-300	-2,52000*	,10076	,000	-2,8958	-2,1442
	TT-HP-600	-2,96000*	,10076	,000	-3,3358	-2,5842
TT-HP-300	MW-EH	1,53000*	,10076	,000	1,1542	1,9058
	HP-600	6,11000*	,10076	,000	5,7342	6,4858
	MW-HP-300	-4,20000*	,10076	,000	-4,5758	-3,8242
	EH	-,51000*	,10076	,001	-,8858	-,1342
	E-HP-600	1,82000*	,10076	,000	1,4442	2,1958
	EH-HP-300	-2,04000*	,10076	,000	-2,4158	-1,6642
	EH-HP-600	-3,18000*	,10076	,000	-3,5558	-2,8042
	MW-HP-600	-4,96000*	,10076	,000	-5,3358	-4,5842
	MW	4,56000*	,10076	,000	4,1842	4,9358
	E-HP-300	5,17000*	,10076	,000	4,7942	5,5458
	HP-300	6,83000*	,10076	,000	6,4542	7,2058
	TT	1,50000*	,10076	,000	1,1242	1,8758
	MW-E-HP-600	,04000	,10076	1,000	-,3358	,4158
	Control	19,69000*	,10076	,000	19,3142	20,0658
	MW-E-HP-300	2,52000*	,10076	,000	2,1442	2,8958
	TT-HP-600	-,44000*	,10076	,010	-,8158	-,0642
TT-HP-600	MW-EH	1,97000*	,10076	,000	1,5942	2,3458
	HP-600	6,55000*	,10076	,000	6,1742	6,9258
	MW-HP-300	-3,76000*	,10076	,000	-4,1358	-3,3842
	EH	-,07000	,10076	1,000	-,4458	,3058
	E-HP-600	2,26000*	,10076	,000	1,8842	2,6358
	EH-HP-300	-1,60000*	,10076	,000	-1,9758	-1,2242
	EH-HP-600	-2,74000*	,10076	,000	-3,1158	-2,3642
	MW-HP-600	-4,52000*	,10076	,000	-4,8958	-4,1442
	MW	5,00000*	,10076	,000	4,6242	5,3758
	E-HP-300	5,61000*	,10076	,000	5,2342	5,9858
	HP-300	7,27000*	,10076	,000	6,8942	7,6458
	TT	1,94000*	,10076	,000	1,5642	2,3158
	MW-E-HP-600	,48000*	,10076	,003	,1042	,8558
	Control	20,13000*	,10076	,000	19,7542	20,5058
	MW-E-HP-300	2,96000*	,10076	,000	2,5842	3,3358
	TT-HP-300	,44000*	,10076	,010	,0642	,8158

*. The mean difference is significant at the 0.05 level.

SI

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05												
		1	2	3	4	5	6	7	8	9	10	11	12	13
Control	3	23,000												
HP-300	3		35,800											
HP-600	3			36,800										
E-HP-300	3				37,200									
MW	3					38,300								
MW-E-HP-300	3						40,700							
E-HP-600	3							40,700						
MW-EH	3							41,600						
TT	3							41,900						
MW-E-HP-600	3								42,500					
TT-HP-300	3								42,900					
TT-HP-600	3									43,300				
EH	3									43,200				
EH-HP-300	3										44,700			
EH-HP-600	3											45,800		
MW-HP-300	3												46,900	
MW-HP-600	3													47,600
Sig.		1,000	1,000	1,000	1,000	1,000	1,000	,170	1,000	1,000	1,000	1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

H. Variance Analysis Outputs of SVF

Descriptives

SVF

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	36,7100	,17088	,09866	36,2855	37,1345	36,55	36,89
HP-600	3	37,5000	,18028	,10408	37,0522	37,9478	37,35	37,70
MW-HP-300	3	29,0200	,04583	,02646	28,9062	29,1338	28,98	29,07
EH	3	31,3400	,10583	,06110	31,0771	31,6029	31,22	31,42
E-HP-600	3	32,1300	,04583	,02646	32,0162	32,2438	32,08	32,17
EH-HP-300	3	28,5700	,10000	,05774	28,3216	28,8184	28,47	28,67
EH-HP-600	3	29,2200	,11000	,06351	28,9467	29,4933	29,11	29,33
MW-HP-600	3	30,0000	,11533	,06658	29,7135	30,2865	29,89	30,12
MW	3	32,0000	,19925	,11504	31,5050	32,4950	31,88	32,23
E-HP-300	3	32,0000	,13000	,07506	31,6771	32,3229	31,87	32,13
HP-300	3	32,0000	,19053	,11000	31,5267	32,4733	31,78	32,11
TT	3	33,1200	,09644	,05568	32,8804	33,3596	33,01	33,19
MW-E-HP-600	3	29,0000	,19672	,11358	28,5113	29,4887	28,79	29,18
Control	3	36,0000	,10583	,06110	35,7371	36,2629	35,92	36,12
MW-E-HP-300	3	31,0300	,07211	,04163	30,8509	31,2091	30,97	31,11
TT-HP-300	3	32,2900	1,03793	,59925	29,7116	34,8684	31,30	33,37
TT-HP-600	3	31,2700	,11136	,06429	30,9934	31,5466	31,17	31,39
Total	51	31,9529	2,61467	,36613	31,2176	32,6883	28,47	37,70

ANOVA

SVF

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	339,105	16	21,194	265,023	,000
Within Groups	2,719	34	,080		
Total	341,824	50			

Multiple Comparisons

Dependent Variable: SVF
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	-,79000	,23090	,102	-1,6512	,0712
	MW-HP-300	7,69000*	,23090	,000	6,8288	8,5512
	EH	5,37000*	,23090	,000	4,5088	6,2312
	E-HP-600	4,58000*	,23090	,000	3,7188	5,4412
	EH-HP-300	8,14000*	,23090	,000	7,2788	9,0012
	EH-HP-600	7,49000*	,23090	,000	6,6288	8,3512
	MW-HP-600	6,71000*	,23090	,000	5,8488	7,5712
	MW	4,71000*	,23090	,000	3,8488	5,5712
	E-HP-300	4,71000*	,23090	,000	3,8488	5,5712
	HP-300	4,71000*	,23090	,000	3,8488	5,5712
	TT	3,59000*	,23090	,000	2,7288	4,4512
	MW-E-HP-600	7,71000*	,23090	,000	6,8488	8,5712
	Control	,71000	,23090	,207	-,1512	1,5712
	MW-E-HP-300	5,68000*	,23090	,000	4,8188	6,5412
	TT-HP-300	4,42000*	,23090	,000	3,5588	5,2812
	TT-HP-600	5,44000*	,23090	,000	4,5788	6,3012
HP-600	MW-EH	,79000	,23090	,102	-,0712	1,6512
	MW-HP-300	8,48000*	,23090	,000	7,6188	9,3412
	EH	6,16000*	,23090	,000	5,2988	7,0212
	E-HP-600	5,37000*	,23090	,000	4,5088	6,2312
	EH-HP-300	8,93000*	,23090	,000	8,0688	9,7912
	EH-HP-600	8,28000*	,23090	,000	7,4188	9,1412
	MW-HP-600	7,50000*	,23090	,000	6,6388	8,3612
	MW	5,50000*	,23090	,000	4,6388	6,3612
	E-HP-300	5,50000*	,23090	,000	4,6388	6,3612
	HP-300	5,50000*	,23090	,000	4,6388	6,3612
	TT	4,38000*	,23090	,000	3,5188	5,2412
	MW-E-HP-600	8,50000*	,23090	,000	7,6388	9,3612
	Control	1,50000*	,23090	,000	,6388	2,3612
	MW-E-HP-300	6,47000*	,23090	,000	5,6088	7,3312
	TT-HP-300	5,21000*	,23090	,000	4,3488	6,0712
	TT-HP-600	6,23000*	,23090	,000	5,3688	7,0912
MW-HP-300	MW-EH	-7,69000*	,23090	,000	-8,5512	-6,8288
	HP-600	-8,48000*	,23090	,000	-9,3412	-7,6188
	EH	-2,32000*	,23090	,000	-3,1812	-1,4588
	E-HP-600	-3,11000*	,23090	,000	-3,9712	-2,2488
	EH-HP-300	,45000	,23090	,855	-,4112	1,3112
	EH-HP-600	-,20000	,23090	1,000	-1,0612	,6612
	MW-HP-600	-,98000*	,23090	,014	-1,8412	-,1188
	MW	-2,98000*	,23090	,000	-3,8412	-2,1188
	E-HP-300	-2,98000*	,23090	,000	-3,8412	-2,1188
	HP-300	-2,98000*	,23090	,000	-3,8412	-2,1188
	TT	-4,10000*	,23090	,000	-4,9612	-3,2388
	MW-E-HP-600	,02000	,23090	1,000	-,8412	,8812
	Control	-6,98000*	,23090	,000	-7,8412	-6,1188
	MW-E-HP-300	-2,01000*	,23090	,000	-2,8712	-1,1488
	TT-HP-300	-3,27000*	,23090	,000	-4,1312	-2,4088
	TT-HP-600	-2,25000*	,23090	,000	-3,1112	-1,3888
EH	MW-EH	-5,37000*	,23090	,000	-6,2312	-4,5088
	HP-600	-6,16000*	,23090	,000	-7,0212	-5,2988
	MW-HP-300	2,32000*	,23090	,000	1,4588	3,1812
	E-HP-600	-,79000	,23090	,102	-1,6512	,0712
	EH-HP-300	2,77000*	,23090	,000	1,9088	3,6312
	EH-HP-600	2,12000*	,23090	,000	1,2588	2,9812

	MW-HP-600	1,34000*	,23090	,000	,4788	2,2012
	MW	-,66000	,23090	,306	-1,5212	,2012
	E-HP-300	-,66000	,23090	,306	-1,5212	,2012
	HP-300	-,66000	,23090	,306	-1,5212	,2012
	TT	-1,78000*	,23090	,000	-2,6412	-,9188
	MW-E-HP-600	2,34000*	,23090	,000	1,4788	3,2012
	Control	-4,66000*	,23090	,000	-5,5212	-3,7988
	MW-E-HP-300	,31000	,23090	,993	-,5512	1,1712
	TT-HP-300	-,95000*	,23090	,019	-1,8112	-,0888
	TT-HP-600	,07000	,23090	1,000	-,7912	,9312
E-HP-600	MW-EH	-4,58000*	,23090	,000	-5,4412	-3,7188
	HP-600	-5,37000*	,23090	,000	-6,2312	-4,5088
	MW-HP-300	3,11000*	,23090	,000	2,2488	3,9712
	EH	,79000	,23090	,102	-,0712	1,6512
	EH-HP-300	3,56000*	,23090	,000	2,6988	4,4212
	EH-HP-600	2,91000*	,23090	,000	2,0488	3,7712
	MW-HP-600	2,13000*	,23090	,000	1,2688	2,9912
	MW	,13000	,23090	1,000	-,7312	,9912
	E-HP-300	,13000	,23090	1,000	-,7312	,9912
	HP-300	,13000	,23090	1,000	-,7312	,9912
	TT	-,99000*	,23090	,012	-1,8512	-,1288
	MW-E-HP-600	3,13000*	,23090	,000	2,2688	3,9912
	Control	-3,87000*	,23090	,000	-4,7312	-3,0088
	MW-E-HP-300	1,10000*	,23090	,003	,2388	1,9612
	TT-HP-300	-,16000	,23090	1,000	-1,0212	,7012
	TT-HP-600	,86000	,23090	,051	-,0012	1,7212
EH-HP-300	MW-EH	-8,14000*	,23090	,000	-9,0012	-7,2788
	HP-600	-8,93000*	,23090	,000	-9,7912	-8,0688
	MW-HP-300	-,45000	,23090	,855	-1,3112	,4112
	EH	-2,77000*	,23090	,000	-3,6312	-1,9088
	E-HP-600	-3,56000*	,23090	,000	-4,4212	-2,6988
	EH-HP-600	-,65000	,23090	,329	-1,5112	,2112
	MW-HP-600	-1,43000*	,23090	,000	-2,2912	-,5688
	MW	-3,43000*	,23090	,000	-4,2912	-2,5688
	E-HP-300	-3,43000*	,23090	,000	-4,2912	-2,5688
	HP-300	-3,43000*	,23090	,000	-4,2912	-2,5688
	TT	-4,55000*	,23090	,000	-5,4112	-3,6888
	MW-E-HP-600	-,43000	,23090	,892	-1,2912	,4312
	Control	-7,43000*	,23090	,000	-8,2912	-6,5688
	MW-E-HP-300	-2,46000*	,23090	,000	-3,3212	-1,5988
	TT-HP-300	-3,72000*	,23090	,000	-4,5812	-2,8588
	TT-HP-600	-2,70000*	,23090	,000	-3,5612	-1,8388
EH-HP-600	MW-EH	-7,49000*	,23090	,000	-8,3512	-6,6288
	HP-600	-8,28000*	,23090	,000	-9,1412	-7,4188
	MW-HP-300	,20000	,23090	1,000	-,6612	1,0612
	EH	-2,12000*	,23090	,000	-2,9812	-1,2588
	E-HP-600	-2,91000*	,23090	,000	-3,7712	-2,0488
	EH-HP-300	,65000	,23090	,329	-,2112	1,5112
	MW-HP-600	-,78000	,23090	,112	-1,6412	,0812
	MW	-2,78000*	,23090	,000	-3,6412	-1,9188
	E-HP-300	-2,78000*	,23090	,000	-3,6412	-1,9188
	HP-300	-2,78000*	,23090	,000	-3,6412	-1,9188
	TT	-3,90000*	,23090	,000	-4,7612	-3,0388
	MW-E-HP-600	,22000	,23090	1,000	-,6412	1,0812
	Control	-6,78000*	,23090	,000	-7,6412	-5,9188
	MW-E-HP-300	-1,81000*	,23090	,000	-2,6712	-,9488
	TT-HP-300	-3,07000*	,23090	,000	-3,9312	-2,2088
	TT-HP-600	-2,05000*	,23090	,000	-2,9112	-1,1888
MW-HP-600	MW-EH	-6,71000*	,23090	,000	-7,5712	-5,8488
	HP-600	-7,50000*	,23090	,000	-8,3612	-6,6388
	MW-HP-300	,98000*	,23090	,014	,1188	1,8412

	EH	-1,34000*	,23090	,000	-2,2012	-,4788
	E-HP-600	-2,13000*	,23090	,000	-2,9912	-1,2688
	EH-HP-300	1,43000*	,23090	,000	,5688	2,2912
	EH-HP-600	,78000	,23090	,112	-,0812	1,6412
	MW	-2,00000*	,23090	,000	-2,8612	-1,1388
	E-HP-300	-2,00000*	,23090	,000	-2,8612	-1,1388
	HP-300	-2,00000*	,23090	,000	-2,8612	-1,1388
	TT	-3,12000*	,23090	,000	-3,9812	-2,2588
	MW-E-HP-600	1,00000*	,23090	,011	,1388	1,8612
	Control	-6,00000*	,23090	,000	-6,8612	-5,1388
	MW-E-HP-300	-1,03000*	,23090	,008	-1,8912	-,1688
	TT-HP-300	-2,29000*	,23090	,000	-3,1512	-1,4288
	TT-HP-600	-1,27000*	,23090	,000	-2,1312	-,4088
MW	MW-EH	-4,71000*	,23090	,000	-5,5712	-3,8488
	HP-600	-5,50000*	,23090	,000	-6,3612	-4,6388
	MW-HP-300	2,98000*	,23090	,000	2,1188	3,8412
	EH	,66000	,23090	,306	-,2012	1,5212
	E-HP-600	-,13000	,23090	1,000	-,9912	,7312
	EH-HP-300	3,43000*	,23090	,000	2,5688	4,2912
	EH-HP-600	2,78000*	,23090	,000	1,9188	3,6412
	MW-HP-600	2,00000*	,23090	,000	1,1388	2,8612
	E-HP-300	,00000	,23090	1,000	-,8612	,8612
	HP-300	,00000	,23090	1,000	-,8612	,8612
	TT	-1,12000*	,23090	,003	-1,9812	-,2588
	MW-E-HP-600	3,00000*	,23090	,000	2,1388	3,8612
	Control	-4,00000*	,23090	,000	-4,8612	-3,1388
	MW-E-HP-300	,97000*	,23090	,015	,1088	1,8312
	TT-HP-300	-,29000	,23090	,997	-1,1512	,5712
	TT-HP-600	,73000	,23090	,175	-,1312	1,5912
E-HP-300	MW-EH	-4,71000*	,23090	,000	-5,5712	-3,8488
	HP-600	-5,50000*	,23090	,000	-6,3612	-4,6388
	MW-HP-300	2,98000*	,23090	,000	2,1188	3,8412
	EH	,66000	,23090	,306	-,2012	1,5212
	E-HP-600	-,13000	,23090	1,000	-,9912	,7312
	EH-HP-300	3,43000*	,23090	,000	2,5688	4,2912
	EH-HP-600	2,78000*	,23090	,000	1,9188	3,6412
	MW-HP-600	2,00000*	,23090	,000	1,1388	2,8612
	MW	,00000	,23090	1,000	-,8612	,8612
	HP-300	,00000	,23090	1,000	-,8612	,8612
	TT	-1,12000*	,23090	,003	-1,9812	-,2588
	MW-E-HP-600	3,00000*	,23090	,000	2,1388	3,8612
	Control	-4,00000*	,23090	,000	-4,8612	-3,1388
	MW-E-HP-300	,97000*	,23090	,015	,1088	1,8312
	TT-HP-300	-,29000	,23090	,997	-1,1512	,5712
	TT-HP-600	,73000	,23090	,175	-,1312	1,5912
HP-300	MW-EH	-4,71000*	,23090	,000	-5,5712	-3,8488
	HP-600	-5,50000*	,23090	,000	-6,3612	-4,6388
	MW-HP-300	2,98000*	,23090	,000	2,1188	3,8412
	EH	,66000	,23090	,306	-,2012	1,5212
	E-HP-600	-,13000	,23090	1,000	-,9912	,7312
	EH-HP-300	3,43000*	,23090	,000	2,5688	4,2912
	EH-HP-600	2,78000*	,23090	,000	1,9188	3,6412
	MW-HP-600	2,00000*	,23090	,000	1,1388	2,8612
	MW	,00000	,23090	1,000	-,8612	,8612
	E-HP-300	,00000	,23090	1,000	-,8612	,8612
	TT	-1,12000*	,23090	,003	-1,9812	-,2588
	MW-E-HP-600	3,00000*	,23090	,000	2,1388	3,8612
	Control	-4,00000*	,23090	,000	-4,8612	-3,1388
	MW-E-HP-300	,97000*	,23090	,015	,1088	1,8312
	TT-HP-300	-,29000	,23090	,997	-1,1512	,5712
	TT-HP-600	,73000	,23090	,175	-,1312	1,5912

TT	MW-EH	-3,59000*	,23090	,000	-4,4512	-2,7288
	HP-600	-4,38000*	,23090	,000	-5,2412	-3,5188
	MW-HP-300	4,10000*	,23090	,000	3,2388	4,9612
	EH	1,78000*	,23090	,000	,9188	2,6412
	E-HP-600	,99000*	,23090	,012	,1288	1,8512
	EH-HP-300	4,55000*	,23090	,000	3,6888	5,4112
	EH-HP-600	3,90000*	,23090	,000	3,0388	4,7612
	MW-HP-600	3,12000*	,23090	,000	2,2588	3,9812
	MW	1,12000*	,23090	,003	,2588	1,9812
	E-HP-300	1,12000*	,23090	,003	,2588	1,9812
	HP-300	1,12000*	,23090	,003	,2588	1,9812
	MW-E-HP-600	4,12000*	,23090	,000	3,2588	4,9812
	Control	-2,88000*	,23090	,000	-3,7412	-2,0188
	MW-E-HP-300	2,09000*	,23090	,000	1,2288	2,9512
	TT-HP-300	,83000	,23090	,069	-,0312	1,6912
	TT-HP-600	1,85000*	,23090	,000	,9888	2,7112
MW-E-HP-600	MW-EH	-7,71000*	,23090	,000	-8,5712	-6,8488
	HP-600	-8,50000*	,23090	,000	-9,3612	-7,6388
	MW-HP-300	-,02000	,23090	1,000	-,8812	,8412
	EH	-2,34000*	,23090	,000	-3,2012	-1,4788
	E-HP-600	-3,13000*	,23090	,000	-3,9912	-2,2688
	EH-HP-300	,43000	,23090	,892	-,4312	1,2912
	EH-HP-600	-,22000	,23090	1,000	-1,0812	,6412
	MW-HP-600	-1,00000*	,23090	,011	-1,8612	-,1388
	MW	-3,00000*	,23090	,000	-3,8612	-2,1388
	E-HP-300	-3,00000*	,23090	,000	-3,8612	-2,1388
	HP-300	-3,00000*	,23090	,000	-3,8612	-2,1388
	TT	-4,12000*	,23090	,000	-4,9812	-3,2588
	Control	-7,00000*	,23090	,000	-7,8612	-6,1388
	MW-E-HP-300	-2,03000*	,23090	,000	-2,8912	-1,1688
	TT-HP-300	-3,29000*	,23090	,000	-4,1512	-2,4288
	TT-HP-600	-2,27000*	,23090	,000	-3,1312	-1,4088
Control	MW-EH	-,71000	,23090	,207	-1,5712	,1512
	HP-600	-1,50000*	,23090	,000	-2,3612	-,6388
	MW-HP-300	6,98000*	,23090	,000	6,1188	7,8412
	EH	4,66000*	,23090	,000	3,7988	5,5212
	E-HP-600	3,87000*	,23090	,000	3,0088	4,7312
	EH-HP-300	7,43000*	,23090	,000	6,5688	8,2912
	EH-HP-600	6,78000*	,23090	,000	5,9188	7,6412
	MW-HP-600	6,00000*	,23090	,000	5,1388	6,8612
	MW	4,00000*	,23090	,000	3,1388	4,8612
	E-HP-300	4,00000*	,23090	,000	3,1388	4,8612
	HP-300	4,00000*	,23090	,000	3,1388	4,8612
	TT	2,88000*	,23090	,000	2,0188	3,7412
	MW-E-HP-600	7,00000*	,23090	,000	6,1388	7,8612
	MW-E-HP-300	4,97000*	,23090	,000	4,1088	5,8312
	TT-HP-300	3,71000*	,23090	,000	2,8488	4,5712
	TT-HP-600	4,73000*	,23090	,000	3,8688	5,5912
MW-E-HP-300	MW-EH	-5,68000*	,23090	,000	-6,5412	-4,8188
	HP-600	-6,47000*	,23090	,000	-7,3312	-5,6088
	MW-HP-300	2,01000*	,23090	,000	1,1488	2,8712
	EH	-,31000	,23090	,993	-1,1712	,5512
	E-HP-600	-1,10000*	,23090	,003	-1,9612	-,2388
	EH-HP-300	2,46000*	,23090	,000	1,5988	3,3212
	EH-HP-600	1,81000*	,23090	,000	,9488	2,6712
	MW-HP-600	1,03000*	,23090	,008	,1688	1,8912
	MW	-,97000*	,23090	,015	-1,8312	-,1088
	E-HP-300	-,97000*	,23090	,015	-1,8312	-,1088
	HP-300	-,97000*	,23090	,015	-1,8312	-,1088
	TT	-2,09000*	,23090	,000	-2,9512	-1,2288
	MW-E-HP-600	2,03000*	,23090	,000	1,1688	2,8912

	Control	-4,97000*	,23090	,000	-5,8312	-4,1088
	TT-HP-300	-1,26000*	,23090	,000	-2,1212	-,3988
	TT-HP-600	-,24000	,23090	1,000	-1,1012	,6212
TT-HP-300	MW-EH	-4,42000*	,23090	,000	-5,2812	-3,5588
	HP-600	-5,21000*	,23090	,000	-6,0712	-4,3488
	MW-HP-300	3,27000*	,23090	,000	2,4088	4,1312
	EH	,95000*	,23090	,019	,0888	1,8112
	E-HP-600	,16000	,23090	1,000	-,7012	1,0212
	EH-HP-300	3,72000*	,23090	,000	2,8588	4,5812
	EH-HP-600	3,07000*	,23090	,000	2,2088	3,9312
	MW-HP-600	2,29000*	,23090	,000	1,4288	3,1512
	MW	,29000	,23090	,997	-,5712	1,1512
	E-HP-300	,29000	,23090	,997	-,5712	1,1512
	HP-300	,29000	,23090	,997	-,5712	1,1512
	TT	-,83000	,23090	,069	-1,6912	,0312
	MW-E-HP-600	3,29000*	,23090	,000	2,4288	4,1512
	Control	-3,71000*	,23090	,000	-4,5712	-2,8488
	MW-E-HP-300	1,26000*	,23090	,000	,3988	2,1212
	TT-HP-600	1,02000*	,23090	,009	,1588	1,8812
TT-HP-600	MW-EH	-5,44000*	,23090	,000	-6,3012	-4,5788
	HP-600	-6,23000*	,23090	,000	-7,0912	-5,3688
	MW-HP-300	2,25000*	,23090	,000	1,3888	3,1112
	EH	-,07000	,23090	1,000	-,9312	,7912
	E-HP-600	-,86000	,23090	,051	-1,7212	,0012
	EH-HP-300	2,70000*	,23090	,000	1,8388	3,5612
	EH-HP-600	2,05000*	,23090	,000	1,1888	2,9112
	MW-HP-600	1,27000*	,23090	,000	,4088	2,1312
	MW	-,73000	,23090	,175	-1,5912	,1312
	E-HP-300	-,73000	,23090	,175	-1,5912	,1312
	HP-300	-,73000	,23090	,175	-1,5912	,1312
	TT	-1,85000*	,23090	,000	-2,7112	-,9888
	MW-E-HP-600	2,27000*	,23090	,000	1,4088	3,1312
	Control	-4,73000*	,23090	,000	-5,5912	-3,8688
	MW-E-HP-300	,24000	,23090	1,000	-,6212	1,1012
	TT-HP-300	-1,02000*	,23090	,009	-1,8812	-,1588

*. The mean difference is significant at the 0.05 level.

SVF

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05							
		1	2	3	4	5	6	7	8
EH-HP-300	3	28,5700							
MW-E-HP-600	3	29,0000							
MW-HP-300	3	29,0200							
EH-HP-600	3	29,2200	29,2200						
MW-HP-600	3		30,0000						
MW-E-HP-300	3			31,0300					
TT-HP-600	3			31,2700	31,2700				
EH	3			31,3400	31,3400				
MW	3				32,0000	32,0000			
E-HP-300	3				32,0000	32,0000			
HP-300	3				32,0000	32,0000			
E-HP-600	3				32,1300	32,1300			
TT-HP-300	3					32,2900	32,2900		
TT	3						33,1200		
Control	3							36,0000	
MW-EH	3							36,7100	36,7100
HP-600	3								37,5000
Sig.		,329	,112	,993	,051	,997	,069	,207	,102

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

İ. Variance Analysis Outputs of OHC

Descriptives

OHC

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MW-EH	3	1,1600	,01000	,00577	1,1352	1,1848	1,15	1,17
HP-600	3	1,1900	,01732	,01000	1,1470	1,2330	1,18	1,21
MW-HP-300	3	1,1600	,04359	,02517	1,0517	1,2683	1,11	1,19
EH	3	1,1400	,02646	,01528	1,0743	1,2057	1,11	1,16
E-HP-600	3	1,0500	,02000	,01155	1,0003	1,0997	1,03	1,07
EH-HP-300	3	1,1400	,04000	,02309	1,0406	1,2394	1,10	1,18
EH-HP-600	3	1,1200	,03464	,02000	1,0339	1,2061	1,08	1,14
MW-HP-600	3	1,1500	,03464	,02000	1,0639	1,2361	1,13	1,19
MW	3	1,2500	,02646	,01528	1,1843	1,3157	1,22	1,27
E-HP-300	3	1,1500	,04359	,02517	1,0417	1,2583	1,10	1,18
HP-300	3	1,1600	,04583	,02646	1,0462	1,2738	1,12	1,21
TT	3	1,0900	,04000	,02309	,9906	1,1894	1,05	1,13
MW-E-HP-600	3	1,1500	,07000	,04041	,9761	1,3239	1,07	1,20
Control	3	2,2700	,04000	,02309	2,1706	2,3694	2,23	2,31
MW-E-HP-300	3	1,1600	,04359	,02517	1,0517	1,2683	1,11	1,19
TT-HP-300	3	1,0600	,07000	,04041	,8861	1,2339	1,01	1,14
TT-HP-600	3	1,1100	,05568	,03215	,9717	1,2483	1,05	1,16
Total	51	1,2065	,27459	,03845	1,1292	1,2837	1,01	2,31

ANOVA

OHC

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3,710	16	,232	130,951	,000
Within Groups	,060	34	,002		
Total	3,770	50			

Multiple Comparisons

Dependent Variable: OHC
Tukey HSD

(I) Sample	(J) Sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MW-EH	HP-600	-,03000	,03436	1,000	-,1581	,0981
	MW-HP-300	,00000	,03436	1,000	-,1281	,1281
	EH	,02000	,03436	1,000	-,1081	,1481
	E-HP-600	,11000	,03436	,161	-,0181	,2381
	EH-HP-300	,02000	,03436	1,000	-,1081	,1481
	EH-HP-600	,04000	,03436	,999	-,0881	,1681
	MW-HP-600	,01000	,03436	1,000	-,1181	,1381
	MW	-,09000	,03436	,443	-,2181	,0381
	E-HP-300	,01000	,03436	1,000	-,1181	,1381
	HP-300	,00000	,03436	1,000	-,1281	,1281
	TT	,07000	,03436	,811	-,0581	,1981
	MW-E-HP-600	,01000	,03436	1,000	-,1181	,1381
	Control	-1,11000*	,03436	,000	-1,2381	-,9819
	MW-E-HP-300	,00000	,03436	1,000	-,1281	,1281
	TT-HP-300	,10000	,03436	,280	-,0281	,2281
	TT-HP-600	,05000	,03436	,985	-,0781	,1781
HP-600	MW-EH	,03000	,03436	1,000	-,0981	,1581
	MW-HP-300	,03000	,03436	1,000	-,0981	,1581
	EH	,05000	,03436	,985	-,0781	,1781
	E-HP-600	,14000*	,03436	,021	,0119	,2681
	EH-HP-300	,05000	,03436	,985	-,0781	,1781
	EH-HP-600	,07000	,03436	,811	-,0581	,1981
	MW-HP-600	,04000	,03436	,999	-,0881	,1681
	MW	-,06000	,03436	,931	-,1881	,0681
	E-HP-300	,04000	,03436	,999	-,0881	,1681
	HP-300	,03000	,03436	1,000	-,0981	,1581
	TT	,10000	,03436	,280	-,0281	,2281
	MW-E-HP-600	,04000	,03436	,999	-,0881	,1681
	Control	-1,08000*	,03436	,000	-1,2081	-,9519
	MW-E-HP-300	,03000	,03436	1,000	-,0981	,1581
	TT-HP-300	,13000*	,03436	,044	,0019	,2581
	TT-HP-600	,08000	,03436	,634	-,0481	,2081
MW-HP-300	MW-EH	,00000	,03436	1,000	-,1281	,1281
	HP-600	-,03000	,03436	1,000	-,1581	,0981
	EH	,02000	,03436	1,000	-,1081	,1481
	E-HP-600	,11000	,03436	,161	-,0181	,2381
	EH-HP-300	,02000	,03436	1,000	-,1081	,1481
	EH-HP-600	,04000	,03436	,999	-,0881	,1681
	MW-HP-600	,01000	,03436	1,000	-,1181	,1381
	MW	-,09000	,03436	,443	-,2181	,0381
	E-HP-300	,01000	,03436	1,000	-,1181	,1381
	HP-300	,00000	,03436	1,000	-,1281	,1281
	TT	,07000	,03436	,811	-,0581	,1981
	MW-E-HP-600	,01000	,03436	1,000	-,1181	,1381
	Control	-1,11000*	,03436	,000	-1,2381	-,9819
	MW-E-HP-300	,00000	,03436	1,000	-,1281	,1281
	TT-HP-300	,10000	,03436	,280	-,0281	,2281
	TT-HP-600	,05000	,03436	,985	-,0781	,1781
EH	MW-EH	-,02000	,03436	1,000	-,1481	,1081
	HP-600	-,05000	,03436	,985	-,1781	,0781
	MW-HP-300	-,02000	,03436	1,000	-,1481	,1081
	E-HP-600	,09000	,03436	,443	-,0381	,2181
	EH-HP-300	,00000	,03436	1,000	-,1281	,1281
	EH-HP-600	,02000	,03436	1,000	-,1081	,1481
	MW-HP-600	-,01000	,03436	1,000	-,1381	,1181

	MW	-,11000	,03436	,161	-,2381	,0181
	E-HP-300	-,01000	,03436	1,000	-,1381	,1181
	HP-300	-,02000	,03436	1,000	-,1481	,1081
	TT	,05000	,03436	,985	-,0781	,1781
	MW-E-HP-600	-,01000	,03436	1,000	-,1381	,1181
	Control	-1,13000*	,03436	,000	-1,2581	-1,0019
	MW-E-HP-300	-,02000	,03436	1,000	-,1481	,1081
	TT-HP-300	,08000	,03436	,634	-,0481	,2081
	TT-HP-600	,03000	,03436	1,000	-,0981	,1581
E-HP-600	MW-EH	-,11000	,03436	,161	-,2381	,0181
	HP-600	-,14000*	,03436	,021	-,2681	-,0119
	MW-HP-300	-,11000	,03436	,161	-,2381	,0181
	EH	-,09000	,03436	,443	-,2181	,0381
	EH-HP-300	-,09000	,03436	,443	-,2181	,0381
	EH-HP-600	-,07000	,03436	,811	-,1981	,0581
	MW-HP-600	-,10000	,03436	,280	-,2281	,0281
	MW	-,20000*	,03436	,000	-,3281	-,0719
	E-HP-300	-,10000	,03436	,280	-,2281	,0281
	HP-300	-,11000	,03436	,161	-,2381	,0181
	TT	-,04000	,03436	,999	-,1681	,0881
	MW-E-HP-600	-,10000	,03436	,280	-,2281	,0281
	Control	-1,22000*	,03436	,000	-1,3481	-1,0919
	MW-E-HP-300	-,11000	,03436	,161	-,2381	,0181
	TT-HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT-HP-600	-,06000	,03436	,931	-,1881	,0681
EH-HP-300	MW-EH	-,02000	,03436	1,000	-,1481	,1081
	HP-600	-,05000	,03436	,985	-,1781	,0781
	MW-HP-300	-,02000	,03436	1,000	-,1481	,1081
	EH	,00000	,03436	1,000	-,1281	,1281
	E-HP-600	,09000	,03436	,443	-,0381	,2181
	EH-HP-600	,02000	,03436	1,000	-,1081	,1481
	MW-HP-600	-,01000	,03436	1,000	-,1381	,1181
	MW	-,11000	,03436	,161	-,2381	,0181
	E-HP-300	-,01000	,03436	1,000	-,1381	,1181
	HP-300	-,02000	,03436	1,000	-,1481	,1081
	TT	,05000	,03436	,985	-,0781	,1781
	MW-E-HP-600	-,01000	,03436	1,000	-,1381	,1181
	Control	-1,13000*	,03436	,000	-1,2581	-1,0019
	MW-E-HP-300	-,02000	,03436	1,000	-,1481	,1081
	TT-HP-300	,08000	,03436	,634	-,0481	,2081
	TT-HP-600	,03000	,03436	1,000	-,0981	,1581
EH-HP-600	MW-EH	-,04000	,03436	,999	-,1681	,0881
	HP-600	-,07000	,03436	,811	-,1981	,0581
	MW-HP-300	-,04000	,03436	,999	-,1681	,0881
	EH	-,02000	,03436	1,000	-,1481	,1081
	E-HP-600	,07000	,03436	,811	-,0581	,1981
	EH-HP-300	-,02000	,03436	1,000	-,1481	,1081
	MW-HP-600	-,03000	,03436	1,000	-,1581	,0981
	MW	-,13000*	,03436	,044	-,2581	-,0019
	E-HP-300	-,03000	,03436	1,000	-,1581	,0981
	HP-300	-,04000	,03436	,999	-,1681	,0881
	TT	,03000	,03436	1,000	-,0981	,1581
	MW-E-HP-600	-,03000	,03436	1,000	-,1581	,0981
	Control	-1,15000*	,03436	,000	-1,2781	-1,0219
	MW-E-HP-300	-,04000	,03436	,999	-,1681	,0881
	TT-HP-300	,06000	,03436	,931	-,0681	,1881
	TT-HP-600	,01000	,03436	1,000	-,1181	,1381
MW-HP-600	MW-EH	-,01000	,03436	1,000	-,1381	,1181
	HP-600	-,04000	,03436	,999	-,1681	,0881
	MW-HP-300	-,01000	,03436	1,000	-,1381	,1181

	EH	,01000	,03436	1,000	-,1181	,1381
	E-HP-600	,10000	,03436	,280	-,0281	,2281
	EH-HP-300	,01000	,03436	1,000	-,1181	,1381
	EH-HP-600	,03000	,03436	1,000	-,0981	,1581
	MW	-,10000	,03436	,280	-,2281	,0281
	E-HP-300	,00000	,03436	1,000	-,1281	,1281
	HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT	,06000	,03436	,931	-,0681	,1881
	MW-E-HP-600	,00000	,03436	1,000	-,1281	,1281
	Control	-1,12000*	,03436	,000	-1,2481	-,9919
	MW-E-HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT-HP-300	,09000	,03436	,443	-,0381	,2181
	TT-HP-600	,04000	,03436	,999	-,0881	,1681
MW	MW-EH	,09000	,03436	,443	-,0381	,2181
	HP-600	,06000	,03436	,931	-,0681	,1881
	MW-HP-300	,09000	,03436	,443	-,0381	,2181
	EH	,11000	,03436	,161	-,0181	,2381
	E-HP-600	,20000*	,03436	,000	,0719	,3281
	EH-HP-300	,11000	,03436	,161	-,0181	,2381
	EH-HP-600	,13000*	,03436	,044	,0019	,2581
	MW-HP-600	,10000	,03436	,280	-,0281	,2281
	E-HP-300	,10000	,03436	,280	-,0281	,2281
	HP-300	,09000	,03436	,443	-,0381	,2181
	TT	,16000*	,03436	,004	,0319	,2881
	MW-E-HP-600	,10000	,03436	,280	-,0281	,2281
	Control	-1,02000*	,03436	,000	-1,1481	-,8919
	MW-E-HP-300	,09000	,03436	,443	-,0381	,2181
	TT-HP-300	,19000*	,03436	,000	,0619	,3181
	TT-HP-600	,14000*	,03436	,021	,0119	,2681
E-HP-300	MW-EH	-,01000	,03436	1,000	-,1381	,1181
	HP-600	-,04000	,03436	,999	-,1681	,0881
	MW-HP-300	-,01000	,03436	1,000	-,1381	,1181
	EH	,01000	,03436	1,000	-,1181	,1381
	E-HP-600	,10000	,03436	,280	-,0281	,2281
	EH-HP-300	,01000	,03436	1,000	-,1181	,1381
	EH-HP-600	,03000	,03436	1,000	-,0981	,1581
	MW-HP-600	,00000	,03436	1,000	-,1281	,1281
	MW	-,10000	,03436	,280	-,2281	,0281
	HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT	,06000	,03436	,931	-,0681	,1881
	MW-E-HP-600	,00000	,03436	1,000	-,1281	,1281
	Control	-1,12000*	,03436	,000	-1,2481	-,9919
	MW-E-HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT-HP-300	,09000	,03436	,443	-,0381	,2181
	TT-HP-600	,04000	,03436	,999	-,0881	,1681
HP-300	MW-EH	,00000	,03436	1,000	-,1281	,1281
	HP-600	-,03000	,03436	1,000	-,1581	,0981
	MW-HP-300	,00000	,03436	1,000	-,1281	,1281
	EH	,02000	,03436	1,000	-,1081	,1481
	E-HP-600	,11000	,03436	,161	-,0181	,2381
	EH-HP-300	,02000	,03436	1,000	-,1081	,1481
	EH-HP-600	,04000	,03436	,999	-,0881	,1681
	MW-HP-600	,01000	,03436	1,000	-,1181	,1381
	MW	-,09000	,03436	,443	-,2181	,0381
	E-HP-300	,01000	,03436	1,000	-,1181	,1381
	TT	,07000	,03436	,811	-,0581	,1981
	MW-E-HP-600	,01000	,03436	1,000	-,1181	,1381
	Control	-1,11000*	,03436	,000	-1,2381	-,9819
	MW-E-HP-300	,00000	,03436	1,000	-,1281	,1281
	TT-HP-300	,10000	,03436	,280	-,0281	,2281
	TT-HP-600	,05000	,03436	,985	-,0781	,1781

TT	MW-EH	-,07000	,03436	,811	-,1981	,0581
	HP-600	-,10000	,03436	,280	-,2281	,0281
	MW-HP-300	-,07000	,03436	,811	-,1981	,0581
	EH	-,05000	,03436	,985	-,1781	,0781
	E-HP-600	,04000	,03436	,999	-,0881	,1681
	EH-HP-300	-,05000	,03436	,985	-,1781	,0781
	EH-HP-600	-,03000	,03436	1,000	-,1581	,0981
	MW-HP-600	-,06000	,03436	,931	-,1881	,0681
	MW	-,16000*	,03436	,004	-,2881	-,0319
	E-HP-300	-,06000	,03436	,931	-,1881	,0681
	HP-300	-,07000	,03436	,811	-,1981	,0581
	MW-E-HP-600	-,06000	,03436	,931	-,1881	,0681
	Control	-1,18000*	,03436	,000	-1,3081	-1,0519
	MW-E-HP-300	-,07000	,03436	,811	-,1981	,0581
	TT-HP-300	,03000	,03436	1,000	-,0981	,1581
	TT-HP-600	-,02000	,03436	1,000	-,1481	,1081
MW-E-HP-600	MW-EH	-,01000	,03436	1,000	-,1381	,1181
	HP-600	-,04000	,03436	,999	-,1681	,0881
	MW-HP-300	-,01000	,03436	1,000	-,1381	,1181
	EH	,01000	,03436	1,000	-,1181	,1381
	E-HP-600	,10000	,03436	,280	-,0281	,2281
	EH-HP-300	,01000	,03436	1,000	-,1181	,1381
	EH-HP-600	,03000	,03436	1,000	-,0981	,1581
	MW-HP-600	,00000	,03436	1,000	-,1281	,1281
	MW	-,10000	,03436	,280	-,2281	,0281
	E-HP-300	,00000	,03436	1,000	-,1281	,1281
	HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT	,06000	,03436	,931	-,0681	,1881
	Control	-1,12000*	,03436	,000	-1,2481	-,9919
	MW-E-HP-300	-,01000	,03436	1,000	-,1381	,1181
	TT-HP-300	,09000	,03436	,443	-,0381	,2181
	TT-HP-600	,04000	,03436	,999	-,0881	,1681
Control	MW-EH	1,11000*	,03436	,000	,9819	1,2381
	HP-600	1,08000*	,03436	,000	,9519	1,2081
	MW-HP-300	1,11000*	,03436	,000	,9819	1,2381
	EH	1,13000*	,03436	,000	1,0019	1,2581
	E-HP-600	1,22000*	,03436	,000	1,0919	1,3481
	EH-HP-300	1,13000*	,03436	,000	1,0019	1,2581
	EH-HP-600	1,15000*	,03436	,000	1,0219	1,2781
	MW-HP-600	1,12000*	,03436	,000	,9919	1,2481
	MW	1,02000*	,03436	,000	,8919	1,1481
	E-HP-300	1,12000*	,03436	,000	,9919	1,2481
	HP-300	1,11000*	,03436	,000	,9819	1,2381
	TT	1,18000*	,03436	,000	1,0519	1,3081
	MW-E-HP-600	1,12000*	,03436	,000	,9919	1,2481
	MW-E-HP-300	1,11000*	,03436	,000	,9819	1,2381
	TT-HP-300	1,21000*	,03436	,000	1,0819	1,3381
	TT-HP-600	1,16000*	,03436	,000	1,0319	1,2881
MW-E-HP-300	MW-EH	,00000	,03436	1,000	-,1281	,1281
	HP-600	-,03000	,03436	1,000	-,1581	,0981
	MW-HP-300	,00000	,03436	1,000	-,1281	,1281
	EH	,02000	,03436	1,000	-,1081	,1481
	E-HP-600	,11000	,03436	,161	-,0181	,2381
	EH-HP-300	,02000	,03436	1,000	-,1081	,1481
	EH-HP-600	,04000	,03436	,999	-,0881	,1681
	MW-HP-600	,01000	,03436	1,000	-,1181	,1381
	MW	-,09000	,03436	,443	-,2181	,0381
	E-HP-300	,01000	,03436	1,000	-,1181	,1381
	HP-300	,00000	,03436	1,000	-,1281	,1281

	TT	,07000	,03436	,811	-,0581	,1981
	MW-E-HP-600	,01000	,03436	1,000	-,1181	,1381
	Control	-1,11000*	,03436	,000	-1,2381	-,9819
	TT-HP-300	,10000	,03436	,280	-,0281	,2281
	TT-HP-600	,05000	,03436	,985	-,0781	,1781
TT-HP-300	MW-EH	-,10000	,03436	,280	-,2281	,0281
	HP-600	-,13000*	,03436	,044	-,2581	-,0019
	MW-HP-300	-,10000	,03436	,280	-,2281	,0281
	EH	-,08000	,03436	,634	-,2081	,0481
	E-HP-600	,01000	,03436	1,000	-,1181	,1381
	EH-HP-300	-,08000	,03436	,634	-,2081	,0481
	EH-HP-600	-,06000	,03436	,931	-,1881	,0681
	MW-HP-600	-,09000	,03436	,443	-,2181	,0381
	MW	-,19000*	,03436	,000	-,3181	-,0619
	E-HP-300	-,09000	,03436	,443	-,2181	,0381
	HP-300	-,10000	,03436	,280	-,2281	,0281
	TT	-,03000	,03436	1,000	-,1581	,0981
	MW-E-HP-600	-,09000	,03436	,443	-,2181	,0381
	Control	-1,21000*	,03436	,000	-1,3381	-1,0819
	MW-E-HP-300	-,10000	,03436	,280	-,2281	,0281
	TT-HP-600	-,05000	,03436	,985	-,1781	,0781
TT-HP-600	MW-EH	-,05000	,03436	,985	-,1781	,0781
	HP-600	-,08000	,03436	,634	-,2081	,0481
	MW-HP-300	-,05000	,03436	,985	-,1781	,0781
	EH	-,03000	,03436	1,000	-,1581	,0981
	E-HP-600	,06000	,03436	,931	-,0681	,1881
	EH-HP-300	-,03000	,03436	1,000	-,1581	,0981
	EH-HP-600	-,01000	,03436	1,000	-,1381	,1181
	MW-HP-600	-,04000	,03436	,999	-,1681	,0881
	MW	-,14000*	,03436	,021	-,2681	-,0119
	E-HP-300	-,04000	,03436	,999	-,1681	,0881
	HP-300	-,05000	,03436	,985	-,1781	,0781
	TT	,02000	,03436	1,000	-,1081	,1481
	MW-E-HP-600	-,04000	,03436	,999	-,1681	,0881
	Control	-1,16000*	,03436	,000	-1,2881	-1,0319
	MW-E-HP-300	-,05000	,03436	,985	-,1781	,0781
	TT-HP-300	,05000	,03436	,985	-,0781	,1781

*. The mean difference is significant at the 0.05 level.

OHC

Tukey HSD[a]

Sample	N	Subset for alpha = 0.05			
		1	2	3	4
E-HP-600	3	1,0500			
TT-HP-300	3	1,0600			
TT	3	1,0900	1,0900		
TT-HP-600	3	1,1100	1,1100		
EH-HP-600	3	1,1200	1,1200		
EH	3	1,1400	1,1400	1,1400	
EH-HP-300	3	1,1400	1,1400	1,1400	
MW-HP-600	3	1,1500	1,1500	1,1500	
E-HP-300	3	1,1500	1,1500	1,1500	
MW-E-HP-600	3	1,1500	1,1500	1,1500	
MW-EH	3	1,1600	1,1600	1,1600	
MW-HP-300	3	1,1600	1,1600	1,1600	
HP-300	3	1,1600	1,1600	1,1600	
MW-E-HP-300	3	1,1600	1,1600	1,1600	
HP-600	3		1,1900	1,1900	
MW	3			1,2500	
Control	3				2,2700
Sig.		,161	,280	,161	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

I. Variance Analysis Outputs of Dough Hardness

Descriptives

hardness_N

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
Control30%		3	1,3933	,01528	,00882	1,3554	1,4313	1,38	1,41	
Control20%		3	2,1333	,07506	,04333	1,9469	2,3198	2,06	2,21	
Control10%		3	4,7200	,11136	,06429	4,4434	4,9966	4,62	4,84	
HSDF		3	3,6867	,24786	,14310	3,0710	4,3024	3,42	3,91	
HMSDF		3	3,0167	,07234	,04177	2,8370	3,1964	2,97	3,10	
HM600SDF		3	1,0667	,08327	,04807	,8598	1,2735	1,00	1,16	
HMEI600SDF		3	2,0167	,07234	,04177	1,8370	2,1964	1,97	2,10	
HIDF		3	4,3933	,13614	,07860	4,0551	4,7315	4,24	4,50	
HMIDF		3	3,7367	,56854	,32824	2,3243	5,1490	3,12	4,24	
HM600IDF		3	2,6867	,24786	,14310	2,0710	3,3024	2,42	2,91	
HMEI600IDF		3	3,0000	,11533	,06658	2,7135	3,2865	2,91	3,13	
HPWD		3	14,3633	,44736	,25828	13,2520	15,4746	13,85	14,67	
HMPWD		3	6,4267	,18037	,10414	5,9786	6,8747	6,24	6,60	
HM600PWD		3	4,1233	,01528	,00882	4,0854	4,1613	4,11	4,14	
HMEI600PWD		3	1,5600	,06557	,03786	1,3971	1,7229	1,50	1,63	
Total		45	3,8882	3,16500	,47181	2,9374	4,8391	1,00	14,67	
Model	Fixed Effects			,22373	,03335	3,8201	3,9563			
	Random Effects				,83500	2,0973	5,6791			10,44177

ANOVA

hardness_N

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	439,255	14	31,375	626,839	,000
Within Groups	1,502	30	,050		
Total	440,757	44			

Multiple Comparisons

Dependent Variable: hardness_N
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	-,74000*	,18267	,021	-1,4131	-,0669
	Control10%	-3,32667*	,18267	,000	-3,9998	-2,6535
	HSDF	-2,29333*	,18267	,000	-2,9665	-1,6202
	HMSDF	-1,62333*	,18267	,000	-2,2965	-,9502
	HM600SDF	,32667	,18267	,885	-,3465	,9998
	HMEI600SDF	-,62333	,18267	,092	-1,2965	,0498
	HIDF	-3,00000*	,18267	,000	-3,6731	-2,3269
	HMIDF	-2,34333*	,18267	,000	-3,0165	-1,6702
	HM600IDF	-1,29333*	,18267	,000	-1,9665	-,6202
	HMEI600IDF	-1,60667*	,18267	,000	-2,2798	-,9335
	HPWD	-12,97000*	,18267	,000	-13,6431	-12,2969
	HMPWD	-5,03333*	,18267	,000	-5,7065	-4,3602
	HM600PWD	-2,73000*	,18267	,000	-3,4031	-2,0569
	HMEI600PWD	-,16667	,18267	1,000	-,8398	,5065
Control20%	Control30%	,74000*	,18267	,021	,0669	1,4131
	Control10%	-2,58667*	,18267	,000	-3,2598	-1,9135
	HSDF	-1,55333*	,18267	,000	-2,2265	-,8802
	HMSDF	-,88333*	,18267	,003	-1,5565	-,2102
	HM600SDF	1,06667*	,18267	,000	,3935	1,7398
	HMEI600SDF	,11667	,18267	1,000	-,5565	,7898
	HIDF	-2,26000*	,18267	,000	-2,9331	-1,5869
	HMIDF	-1,60333*	,18267	,000	-2,2765	-,9302
	HM600IDF	-,55333	,18267	,199	-1,2265	,1198
	HMEI600IDF	-,86667*	,18267	,004	-1,5398	-,1935
	HPWD	-12,23000*	,18267	,000	-12,9031	-11,5569
	HMPWD	-4,29333*	,18267	,000	-4,9665	-3,6202
	HM600PWD	-1,99000*	,18267	,000	-2,6631	-1,3169
	HMEI600PWD	,57333	,18267	,162	-,0998	1,2465
Control10%	Control30%	3,32667*	,18267	,000	2,6535	3,9998
	Control20%	2,58667*	,18267	,000	1,9135	3,2598
	HSDF	1,03333*	,18267	,000	,3602	1,7065
	HMSDF	1,70333*	,18267	,000	1,0302	2,3765
	HM600SDF	3,65333*	,18267	,000	2,9802	4,3265
	HMEI600SDF	2,70333*	,18267	,000	2,0302	3,3765
	HIDF	,32667	,18267	,885	-,3465	,9998
	HMIDF	,98333*	,18267	,001	,3102	1,6565
	HM600IDF	2,03333*	,18267	,000	1,3602	2,7065
	HMEI600IDF	1,72000*	,18267	,000	1,0469	2,3931
	HPWD	-9,64333*	,18267	,000	-10,3165	-8,9702
	HMPWD	-1,70667*	,18267	,000	-2,3798	-1,0335
	HM600PWD	,59667	,18267	,125	-,0765	1,2698
	HMEI600PWD	3,16000*	,18267	,000	2,4869	3,8331
HSDF	Control30%	2,29333*	,18267	,000	1,6202	2,9665
	Control20%	1,55333*	,18267	,000	,8802	2,2265
	Control10%	-1,03333*	,18267	,000	-1,7065	-,3602
	HMSDF	,67000	,18267	,052	-,0031	1,3431
	HM600SDF	2,62000*	,18267	,000	1,9469	3,2931
	HMEI600SDF	1,67000*	,18267	,000	,9969	2,3431
	HIDF	-,70667*	,18267	,032	-1,3798	-,0335
	HMIDF	-,05000	,18267	1,000	-,7231	,6231
	HM600IDF	1,00000*	,18267	,000	,3269	1,6731
	HMEI600IDF	,68667*	,18267	,042	,0135	1,3598
	HPWD	-10,67667*	,18267	,000	-11,3498	-10,0035
	HMPWD	-2,74000*	,18267	,000	-3,4131	-2,0669

	HM600PWD	-,43667	,18267	,539	-1,1098	,2365
	HMEI600PWD	2,12667*	,18267	,000	1,4535	2,7998
HMSDF	Control30%	1,62333*	,18267	,000	,9502	2,2965
	Control20%	,88333*	,18267	,003	,2102	1,5565
	Control10%	-1,70333*	,18267	,000	-2,3765	-1,0302
	HSDF	-,67000	,18267	,052	-1,3431	,0031
	HM600SDF	1,95000*	,18267	,000	1,2769	2,6231
	HMEI600SDF	1,00000*	,18267	,000	,3269	1,6731
	HIDF	-1,37667*	,18267	,000	-2,0498	-,7035
	HMIDF	-,72000*	,18267	,027	-1,3931	-,0469
	HM600IDF	,33000	,18267	,878	-,3431	1,0031
	HMEI600IDF	,01667	,18267	1,000	-,6565	,6898
	HPWD	-11,34667*	,18267	,000	-12,0198	-10,6735
	HMPWD	-3,41000*	,18267	,000	-4,0831	-2,7369
	HM600PWD	-1,10667*	,18267	,000	-1,7798	-,4335
	HMEI600PWD	1,45667*	,18267	,000	,7835	2,1298
HM600SDF	Control30%	-,32667	,18267	,885	-,9998	,3465
	Control20%	-1,06667*	,18267	,000	-1,7398	-,3935
	Control10%	-3,65333*	,18267	,000	-4,3265	-2,9802
	HSDF	-2,62000*	,18267	,000	-3,2931	-1,9469
	HMSDF	-1,95000*	,18267	,000	-2,6231	-1,2769
	HMEI600SDF	-,95000*	,18267	,001	-1,6231	-,2769
	HIDF	-3,32667*	,18267	,000	-3,9998	-2,6535
	HMIDF	-2,67000*	,18267	,000	-3,3431	-1,9969
	HM600IDF	-1,62000*	,18267	,000	-2,2931	-,9469
	HMEI600IDF	-1,93333*	,18267	,000	-2,6065	-1,2602
	HPWD	-13,29667*	,18267	,000	-13,9698	-12,6235
	HMPWD	-5,36000*	,18267	,000	-6,0331	-4,6869
	HM600PWD	-3,05667*	,18267	,000	-3,7298	-2,3835
	HMEI600PWD	-,49333	,18267	,351	-1,1665	,1798
HMEI600SDF	Control30%	,62333	,18267	,092	-,0498	1,2965
	Control20%	-,11667	,18267	1,000	-,7898	,5565
	Control10%	-2,70333*	,18267	,000	-3,3765	-2,0302
	HSDF	-1,67000*	,18267	,000	-2,3431	-,9969
	HMSDF	-1,00000*	,18267	,000	-1,6731	-,3269
	HM600SDF	,95000*	,18267	,001	,2769	1,6231
	HIDF	-2,37667*	,18267	,000	-3,0498	-1,7035
	HMIDF	-1,72000*	,18267	,000	-2,3931	-1,0469
	HM600IDF	-,67000	,18267	,052	-1,3431	,0031
	HMEI600IDF	-,98333*	,18267	,001	-1,6565	-,3102
	HPWD	-12,34667*	,18267	,000	-13,0198	-11,6735
	HMPWD	-4,41000*	,18267	,000	-5,0831	-3,7369
	HM600PWD	-2,10667*	,18267	,000	-2,7798	-1,4335
	HMEI600PWD	,45667	,18267	,469	-,2165	1,1298
HIDF	Control30%	3,00000*	,18267	,000	2,3269	3,6731
	Control20%	2,26000*	,18267	,000	1,5869	2,9331
	Control10%	-,32667	,18267	,885	-,9998	,3465
	HSDF	,70667*	,18267	,032	,0335	1,3798
	HMSDF	1,37667*	,18267	,000	,7035	2,0498
	HM600SDF	3,32667*	,18267	,000	2,6535	3,9998
	HMEI600SDF	2,37667*	,18267	,000	1,7035	3,0498
	HMIDF	,65667	,18267	,061	-,0165	1,3298
	HM600IDF	1,70667*	,18267	,000	1,0335	2,3798
	HMEI600IDF	1,39333*	,18267	,000	,7202	2,0665
	HPWD	-9,97000*	,18267	,000	-10,6431	-9,2969
	HMPWD	-2,03333*	,18267	,000	-2,7065	-1,3602
	HM600PWD	,27000	,18267	,970	-,4031	,9431
	HMEI600PWD	2,83333*	,18267	,000	2,1602	3,5065

HMIDF	Control30%	2,34333*	,18267	,000	1,6702	3,0165
	Control20%	1,60333*	,18267	,000	,9302	2,2765
	Control10%	-,98333*	,18267	,001	-1,6565	-,3102
	HSDF	,05000	,18267	1,000	-,6231	,7231
	HMSDF	,72000*	,18267	,027	,0469	1,3931
	HM600SDF	2,67000*	,18267	,000	1,9969	3,3431
	HMEI600SDF	1,72000*	,18267	,000	1,0469	2,3931
	HIDF	-,65667	,18267	,061	-1,3298	,0165
	HM600IDF	1,05000*	,18267	,000	,3769	1,7231
	HMEI600IDF	,73667*	,18267	,022	,0635	1,4098
	HPWD	-10,62667*	,18267	,000	-11,2998	-9,9535
	HMPWD	-2,69000*	,18267	,000	-3,3631	-2,0169
	HM600PWD	-,38667	,18267	,715	-1,0598	,2865
	HMEI600PWD	2,17667*	,18267	,000	1,5035	2,8498
HM600IDF	Control30%	1,29333*	,18267	,000	,6202	1,9665
	Control20%	,55333	,18267	,199	-,1198	1,2265
	Control10%	-2,03333*	,18267	,000	-2,7065	-1,3602
	HSDF	-1,00000*	,18267	,000	-1,6731	-,3269
	HMSDF	-,33000	,18267	,878	-1,0031	,3431
	HM600SDF	1,62000*	,18267	,000	,9469	2,2931
	HMEI600SDF	,67000	,18267	,052	-,0031	1,3431
	HIDF	-1,70667*	,18267	,000	-2,3798	-1,0335
	HMIDF	-1,05000*	,18267	,000	-1,7231	-,3769
	HMEI600IDF	-,31333	,18267	,912	-,9865	,3598
	HPWD	-11,67667*	,18267	,000	-12,3498	-11,0035
	HMPWD	-3,74000*	,18267	,000	-4,4131	-3,0669
	HM600PWD	-1,43667*	,18267	,000	-2,1098	-,7635
	HMEI600PWD	1,12667*	,18267	,000	,4535	1,7998
HMEI600IDF	Control30%	1,60667*	,18267	,000	,9335	2,2798
	Control20%	,86667*	,18267	,004	,1935	1,5398
	Control10%	-1,72000*	,18267	,000	-2,3931	-1,0469
	HSDF	-,68667*	,18267	,042	-1,3598	-,0135
	HMSDF	-,01667	,18267	1,000	-,6898	,6565
	HM600SDF	1,93333*	,18267	,000	1,2602	2,6065
	HMEI600SDF	,98333*	,18267	,001	,3102	1,6565
	HIDF	-1,39333*	,18267	,000	-2,0665	-,7202
	HMIDF	-,73667*	,18267	,022	-1,4098	-,0635
	HM600IDF	,31333	,18267	,912	-,3598	,9865
	HPWD	-11,36333*	,18267	,000	-12,0365	-10,6902
	HMPWD	-3,42667*	,18267	,000	-4,0998	-2,7535
	HM600PWD	-1,12333*	,18267	,000	-1,7965	-,4502
	HMEI600PWD	1,44000*	,18267	,000	,7669	2,1131
HPWD	Control30%	12,97000*	,18267	,000	12,2969	13,6431
	Control20%	12,23000*	,18267	,000	11,5569	12,9031
	Control10%	9,64333*	,18267	,000	8,9702	10,3165
	HSDF	10,67667*	,18267	,000	10,0035	11,3498
	HMSDF	11,34667*	,18267	,000	10,6735	12,0198
	HM600SDF	13,29667*	,18267	,000	12,6235	13,9698
	HMEI600SDF	12,34667*	,18267	,000	11,6735	13,0198
	HIDF	9,97000*	,18267	,000	9,2969	10,6431
	HMIDF	10,62667*	,18267	,000	9,9535	11,2998
	HM600IDF	11,67667*	,18267	,000	11,0035	12,3498
	HMEI600IDF	11,36333*	,18267	,000	10,6902	12,0365
	HMPWD	7,93667*	,18267	,000	7,2635	8,6098
	HM600PWD	10,24000*	,18267	,000	9,5669	10,9131
	HMEI600PWD	12,80333*	,18267	,000	12,1302	13,4765
HMPWD	Control30%	5,03333*	,18267	,000	4,3602	5,7065
	Control20%	4,29333*	,18267	,000	3,6202	4,9665
	Control10%	1,70667*	,18267	,000	1,0335	2,3798
	HSDF	2,74000*	,18267	,000	2,0669	3,4131

	HMSDF	3,41000*	,18267	,000	2,7369	4,0831
	HM600SDF	5,36000*	,18267	,000	4,6869	6,0331
	HMEI600SDF	4,41000*	,18267	,000	3,7369	5,0831
	HIDF	2,03333*	,18267	,000	1,3602	2,7065
	HMIDF	2,69000*	,18267	,000	2,0169	3,3631
	HM600IDF	3,74000*	,18267	,000	3,0669	4,4131
	HMEI600IDF	3,42667*	,18267	,000	2,7535	4,0998
	HPWD	-7,93667*	,18267	,000	-8,6098	-7,2635
	HM600PWD	2,30333*	,18267	,000	1,6302	2,9765
	HMEI600PWD	4,86667*	,18267	,000	4,1935	5,5398
HM600PWD	Control30%	2,73000*	,18267	,000	2,0569	3,4031
	Control20%	1,99000*	,18267	,000	1,3169	2,6631
	Control10%	-,59667	,18267	,125	-1,2698	,0765
	HSDF	,43667	,18267	,539	-,2365	1,1098
	HMSDF	1,10667*	,18267	,000	,4335	1,7798
	HM600SDF	3,05667*	,18267	,000	2,3835	3,7298
	HMEI600SDF	2,10667*	,18267	,000	1,4335	2,7798
	HIDF	-,27000	,18267	,970	-,9431	,4031
	HMIDF	,38667	,18267	,715	-,2865	1,0598
	HM600IDF	1,43667*	,18267	,000	,7635	2,1098
	HMEI600IDF	1,12333*	,18267	,000	,4502	1,7965
	HPWD	-10,24000*	,18267	,000	-10,9131	-9,5669
	HMPWD	-2,30333*	,18267	,000	-2,9765	-1,6302
	HMEI600PWD	2,56333*	,18267	,000	1,8902	3,2365
HMEI600PWD	Control30%	,16667	,18267	1,000	-,5065	,8398
	Control20%	-,57333	,18267	,162	-1,2465	,0998
	Control10%	-3,16000*	,18267	,000	-3,8331	-2,4869
	HSDF	-2,12667*	,18267	,000	-2,7998	-1,4535
	HMSDF	-1,45667*	,18267	,000	-2,1298	-,7835
	HM600SDF	,49333	,18267	,351	-,1798	1,1665
	HMEI600SDF	-,45667	,18267	,469	-1,1298	,2165
	HIDF	-2,83333*	,18267	,000	-3,5065	-2,1602
	HMIDF	-2,17667*	,18267	,000	-2,8498	-1,5035
	HM600IDF	-1,12667*	,18267	,000	-1,7998	-,4535
	HMEI600IDF	-1,44000*	,18267	,000	-2,1131	-,7669
	HPWD	-12,80333*	,18267	,000	-13,4765	-12,1302
	HMPWD	-4,86667*	,18267	,000	-5,5398	-4,1935
	HM600PWD	-2,56333*	,18267	,000	-3,2365	-1,8902

*. The mean difference is significant at the 0.05 level.

hardness_N

Tukey HSD[a]

		Subset for alpha = 0.05										
sample	N	1	2	3	4	5	6	7	8	9	10	11
HM600SDF	3	1,0667										
Control30%	3	1,3933	1,3933									
HMEI600PWD	3	1,5600	1,5600	1,5600								
HMEI600SDF	3		2,0167	2,0167	2,0167							
Control20%	3			2,1333	2,1333							
HM600IDF	3				2,6867	2,6867						
HMEI600IDF	3					3,0000						
HMSDF	3					3,0167	3,0167					
HSDF	3						3,6867	3,6867				
HMIDF	3							3,7367	3,7367			
HM600PWD	3							4,1233	4,1233	4,1233		
HIDF	3								4,3933	4,3933		
Control10%	3									4,7200		
HMPWD	3										6,4267	
HPWD	3											14,3633
Sig.		,351	,092	,162	,052	,878	,052	,539	,061	,125	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

J. Variance Analysis Outputs of Adhesiveness

Descriptives

adhesiveness_Nmm

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	5,1133	,71808	,41458	3,3295	6,8971	4,29	5,61
Control20%	3	3,2667	,39273	,22674	2,2911	4,2423	2,85	3,63
Control10%	3	4,0600	,46776	,27006	2,8980	5,2220	3,78	4,60
HSDF	3	4,5000	,29052	,16773	3,7783	5,2217	4,20	4,78
HMSDF	3	13,1900	,03606	,02082	13,1004	13,2796	13,15	13,22
HM600SDF	3	4,3667	,37541	,21674	3,4341	5,2992	3,96	4,70
HMEI600SDF	3	12,8567	,56977	,32895	11,4413	14,2720	12,20	13,22
HIDF	3	4,9000	,66701	,38510	3,2431	6,5569	4,50	5,67
HMIDF	3	4,8400	,37363	,21572	3,9118	5,7682	4,50	5,24
HM600IDF	3	4,6333	,04163	,02404	4,5299	4,7368	4,60	4,68
HMEI600IDF	3	4,6000	,26627	,15373	3,9385	5,2615	4,32	4,85
HPWD	3	6,4567	1,45840	,84201	2,8338	10,0795	5,15	8,03
HMPWD	3	4,5667	,09074	,05239	4,3413	4,7921	4,50	4,67
HM600PWD	3	3,4933	,44061	,25438	2,3988	4,5879	3,20	4,00
HMEI600PWD	3	4,0400	,15000	,08660	3,6674	4,4126	3,89	4,19
Total	45	5,6589	3,04109	,45334	4,7452	6,5725	2,85	13,22

ANOVA

adhesiveness_Nmm

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	398,024	14	28,430	95,857	,000
Within Groups	8,898	30	,297		
Total	406,922	44			

Multiple Comparisons

Dependent Variable: adhesiveness_Nmm
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	1,84667*	,44467	,016	,2081	3,4853
	Control10%	1,05333	,44467	,553	-,5853	2,6919
	HSDF	,61333	,44467	,983	-1,0253	2,2519
	HMSDF	-8,07667*	,44467	,000	-9,7153	-6,4381
	HM600SDF	,74667	,44467	,924	-,8919	2,3853
	HMEI600SDF	-7,74333*	,44467	,000	-9,3819	-6,1047
	HIDF	,21333	,44467	1,000	-1,4253	1,8519
	HMIDF	,27333	,44467	1,000	-1,3653	1,9119
	HM600IDF	,48000	,44467	,998	-1,1586	2,1186
	HMEI600IDF	,51333	,44467	,997	-1,1253	2,1519
	HPWD	-1,34333	,44467	,202	-2,9819	,2953
	HMPWD	,54667	,44467	,994	-1,0919	2,1853
	HM600PWD	1,62000	,44467	,055	-,0186	3,2586
	HMEI600PWD	1,07333	,44467	,524	-,5653	2,7119
Control20%	Control30%	-1,84667*	,44467	,016	-3,4853	-,2081
	Control10%	-,79333	,44467	,887	-2,4319	,8453
	HSDF	-1,23333	,44467	,312	-2,8719	,4053
	HMSDF	-9,92333*	,44467	,000	-11,5619	-8,2847
	HM600SDF	-1,10000	,44467	,485	-2,7386	,5386
	HMEI600SDF	-9,59000*	,44467	,000	-11,2286	-7,9514
	HIDF	-1,63333	,44467	,051	-3,2719	,0053
	HMIDF	-1,57333	,44467	,070	-3,2119	,0653
	HM600IDF	-1,36667	,44467	,183	-3,0053	,2719
	HMEI600IDF	-1,33333	,44467	,211	-2,9719	,3053
	HPWD	-3,19000*	,44467	,000	-4,8286	-1,5514
	HMPWD	-1,30000	,44467	,242	-2,9386	,3386
	HM600PWD	-,22667	,44467	1,000	-1,8653	1,4119
	HMEI600PWD	-,77333	,44467	,904	-2,4119	,8653
Control10%	Control30%	-1,05333	,44467	,553	-2,6919	,5853
	Control20%	,79333	,44467	,887	-,8453	2,4319
	HSDF	-,44000	,44467	,999	-2,0786	1,1986
	HMSDF	-9,13000*	,44467	,000	-10,7686	-7,4914
	HM600SDF	-,30667	,44467	1,000	-1,9453	1,3319
	HMEI600SDF	-8,79667*	,44467	,000	-10,4353	-7,1581
	HIDF	-,84000	,44467	,841	-2,4786	,7986
	HMIDF	-,78000	,44467	,898	-2,4186	,8586
	HM600IDF	-,57333	,44467	,991	-2,2119	1,0653
	HMEI600IDF	-,54000	,44467	,995	-2,1786	1,0986
	HPWD	-2,39667*	,44467	,001	-4,0353	-,7581
	HMPWD	-,50667	,44467	,997	-2,1453	1,1319
	HM600PWD	,56667	,44467	,992	-1,0719	2,2053
	HMEI600PWD	,02000	,44467	1,000	-1,6186	1,6586
HSDF	Control30%	-,61333	,44467	,983	-2,2519	1,0253
	Control20%	1,23333	,44467	,312	-,4053	2,8719
	Control10%	,44000	,44467	,999	-1,1986	2,0786
	HMSDF	-8,69000*	,44467	,000	-10,3286	-7,0514
	HM600SDF	,13333	,44467	1,000	-1,5053	1,7719
	HMEI600SDF	-8,35667*	,44467	,000	-9,9953	-6,7181
	HIDF	-,40000	,44467	1,000	-2,0386	1,2386
	HMIDF	-,34000	,44467	1,000	-1,9786	1,2986
	HM600IDF	-,13333	,44467	1,000	-1,7719	1,5053
	HMEI600IDF	-,10000	,44467	1,000	-1,7386	1,5386
	HPWD	-1,95667*	,44467	,009	-3,5953	-,3181
	HMPWD	-,06667	,44467	1,000	-1,7053	1,5719

	HM600PWD	1,00667	,44467	,621	-,6319	2,6453
	HMEI600PWD	,46000	,44467	,999	-1,1786	2,0986
HMSDF	Control30%	8,07667*	,44467	,000	6,4381	9,7153
	Control20%	9,92333*	,44467	,000	8,2847	11,5619
	Control10%	9,13000*	,44467	,000	7,4914	10,7686
	HSDF	8,69000*	,44467	,000	7,0514	10,3286
	HM600SDF	8,82333*	,44467	,000	7,1847	10,4619
	HMEI600SDF	,33333	,44467	1,000	-1,3053	1,9719
	HIDF	8,29000*	,44467	,000	6,6514	9,9286
	HMIDF	8,35000*	,44467	,000	6,7114	9,9886
	HM600IDF	8,55667*	,44467	,000	6,9181	10,1953
	HMEI600IDF	8,59000*	,44467	,000	6,9514	10,2286
	HPWD	6,73333*	,44467	,000	5,0947	8,3719
	HMPWD	8,62333*	,44467	,000	6,9847	10,2619
	HM600PWD	9,69667*	,44467	,000	8,0581	11,3353
	HMEI600PWD	9,15000*	,44467	,000	7,5114	10,7886
HM600SDF	Control30%	-,74667	,44467	,924	-2,3853	,8919
	Control20%	1,10000	,44467	,485	-,5386	2,7386
	Control10%	,30667	,44467	1,000	-1,3319	1,9453
	HSDF	-,13333	,44467	1,000	-1,7719	1,5053
	HMSDF	-8,82333*	,44467	,000	-10,4619	-7,1847
	HMEI600SDF	-8,49000*	,44467	,000	-10,1286	-6,8514
	HIDF	-,53333	,44467	,995	-2,1719	1,1053
	HMIDF	-,47333	,44467	,999	-2,1119	1,1653
	HM600IDF	-,26667	,44467	1,000	-1,9053	1,3719
	HMEI600IDF	-,23333	,44467	1,000	-1,8719	1,4053
	HPWD	-2,09000*	,44467	,004	-3,7286	-,4514
	HMPWD	-,20000	,44467	1,000	-1,8386	1,4386
	HM600PWD	,87333	,44467	,803	-,7653	2,5119
	HMEI600PWD	,32667	,44467	1,000	-1,3119	1,9653
HMEI600SDF	Control30%	7,74333*	,44467	,000	6,1047	9,3819
	Control20%	9,59000*	,44467	,000	7,9514	11,2286
	Control10%	8,79667*	,44467	,000	7,1581	10,4353
	HSDF	8,35667*	,44467	,000	6,7181	9,9953
	HMSDF	-,33333	,44467	1,000	-1,9719	1,3053
	HM600SDF	8,49000*	,44467	,000	6,8514	10,1286
	HIDF	7,95667*	,44467	,000	6,3181	9,5953
	HMIDF	8,01667*	,44467	,000	6,3781	9,6553
	HM600IDF	8,22333*	,44467	,000	6,5847	9,8619
	HMEI600IDF	8,25667*	,44467	,000	6,6181	9,8953
	HPWD	6,40000*	,44467	,000	4,7614	8,0386
	HMPWD	8,29000*	,44467	,000	6,6514	9,9286
	HM600PWD	9,36333*	,44467	,000	7,7247	11,0019
	HMEI600PWD	8,81667*	,44467	,000	7,1781	10,4553
HIDF	Control30%	-,21333	,44467	1,000	-1,8519	1,4253
	Control20%	1,63333	,44467	,051	-,0053	3,2719
	Control10%	,84000	,44467	,841	-,7986	2,4786
	HSDF	,40000	,44467	1,000	-1,2386	2,0386
	HMSDF	-8,29000*	,44467	,000	-9,9286	-6,6514
	HM600SDF	,53333	,44467	,995	-1,1053	2,1719
	HMEI600SDF	-7,95667*	,44467	,000	-9,5953	-6,3181
	HMIDF	,06000	,44467	1,000	-1,5786	1,6986
	HM600IDF	,26667	,44467	1,000	-1,3719	1,9053
	HMEI600IDF	,30000	,44467	1,000	-1,3386	1,9386
	HPWD	-1,55667	,44467	,076	-3,1953	,0819
	HMPWD	,33333	,44467	1,000	-1,3053	1,9719
	HM600PWD	1,40667	,44467	,154	-,2319	3,0453
	HMEI600PWD	,86000	,44467	,818	-,7786	2,4986
HMIDF	Control30%	-,27333	,44467	1,000	-1,9119	1,3653
	Control20%	1,57333	,44467	,070	-,0653	3,2119
	Control10%	,78000	,44467	,898	-,8586	2,4186

	HSDF	,34000	,44467	1,000	-1,2986	1,9786
	HMSDF	-8,35000*	,44467	,000	-9,9886	-6,7114
	HM600SDF	,47333	,44467	,999	-1,1653	2,1119
	HMEI600SDF	-8,01667*	,44467	,000	-9,6553	-6,3781
	HIDF	-,06000	,44467	1,000	-1,6986	1,5786
	HM600IDF	,20667	,44467	1,000	-1,4319	1,8453
	HMEI600IDF	,24000	,44467	1,000	-1,3986	1,8786
	HPWD	-1,61667	,44467	,056	-3,2553	,0219
	HMPWD	,27333	,44467	1,000	-1,3653	1,9119
	HM600PWD	1,34667	,44467	,200	-,2919	2,9853
	HMEI600PWD	,80000	,44467	,881	-,8386	2,4386
HM600IDF	Control30%	-,48000	,44467	,998	-2,1186	1,1586
	Control20%	1,36667	,44467	,183	-,2719	3,0053
	Control10%	,57333	,44467	,991	-1,0653	2,2119
	HSDF	,13333	,44467	1,000	-1,5053	1,7719
	HMSDF	-8,55667*	,44467	,000	-10,1953	-6,9181
	HM600SDF	,26667	,44467	1,000	-1,3719	1,9053
	HMEI600SDF	-8,22333*	,44467	,000	-9,8619	-6,5847
	HIDF	-,26667	,44467	1,000	-1,9053	1,3719
	HMIDF	-,20667	,44467	1,000	-1,8453	1,4319
	HMEI600IDF	,03333	,44467	1,000	-1,6053	1,6719
	HPWD	-1,82333*	,44467	,018	-3,4619	-,1847
	HMPWD	,06667	,44467	1,000	-1,5719	1,7053
	HM600PWD	1,14000	,44467	,430	-,4986	2,7786
	HMEI600PWD	,59333	,44467	,987	-1,0453	2,2319
HMEI600IDF	Control30%	-,51333	,44467	,997	-2,1519	1,1253
	Control20%	1,33333	,44467	,211	-,3053	2,9719
	Control10%	,54000	,44467	,995	-1,0986	2,1786
	HSDF	,10000	,44467	1,000	-1,5386	1,7386
	HMSDF	-8,59000*	,44467	,000	-10,2286	-6,9514
	HM600SDF	,23333	,44467	1,000	-1,4053	1,8719
	HMEI600SDF	-8,25667*	,44467	,000	-9,8953	-6,6181
	HIDF	-,30000	,44467	1,000	-1,9386	1,3386
	HMIDF	-,24000	,44467	1,000	-1,8786	1,3986
	HM600IDF	-,03333	,44467	1,000	-1,6719	1,6053
	HPWD	-1,85667*	,44467	,015	-3,4953	-,2181
	HMPWD	,03333	,44467	1,000	-1,6053	1,6719
	HM600PWD	1,10667	,44467	,476	-,5319	2,7453
	HMEI600PWD	,56000	,44467	,993	-1,0786	2,1986
HPWD	Control30%	1,34333	,44467	,202	-,2953	2,9819
	Control20%	3,19000*	,44467	,000	1,5514	4,8286
	Control10%	2,39667*	,44467	,001	,7581	4,0353
	HSDF	1,95667*	,44467	,009	,3181	3,5953
	HMSDF	-6,73333*	,44467	,000	-8,3719	-5,0947
	HM600SDF	2,09000*	,44467	,004	,4514	3,7286
	HMEI600SDF	-6,40000*	,44467	,000	-8,0386	-4,7614
	HIDF	1,55667	,44467	,076	-,0819	3,1953
	HMIDF	1,61667	,44467	,056	-,0219	3,2553
	HM600IDF	1,82333*	,44467	,018	,1847	3,4619
	HMEI600IDF	1,85667*	,44467	,015	,2181	3,4953
	HMPWD	1,89000*	,44467	,013	,2514	3,5286
	HM600PWD	2,96333*	,44467	,000	1,3247	4,6019
	HMEI600PWD	2,41667*	,44467	,001	,7781	4,0553
HMPWD	Control30%	-,54667	,44467	,994	-2,1853	1,0919
	Control20%	1,30000	,44467	,242	-,3386	2,9386
	Control10%	,50667	,44467	,997	-1,1319	2,1453
	HSDF	,06667	,44467	1,000	-1,5719	1,7053
	HMSDF	-8,62333*	,44467	,000	-10,2619	-6,9847
	HM600SDF	,20000	,44467	1,000	-1,4386	1,8386
	HMEI600SDF	-8,29000*	,44467	,000	-9,9286	-6,6514
	HIDF	-,33333	,44467	1,000	-1,9719	1,3053

	HMIDF	-,27333	,44467	1,000	-1,9119	1,3653
	HM600IDF	-,06667	,44467	1,000	-1,7053	1,5719
	HMEI600IDF	-,03333	,44467	1,000	-1,6719	1,6053
	HPWD	-1,89000*	,44467	,013	-3,5286	-,2514
	HM600PWD	1,07333	,44467	,524	-,5653	2,7119
	HMEI600PWD	,52667	,44467	,996	-1,1119	2,1653
HM600PWD	Control30%	-1,62000	,44467	,055	-3,2586	,0186
	Control20%	,22667	,44467	1,000	-1,4119	1,8653
	Control10%	-,56667	,44467	,992	-2,2053	1,0719
	HSDF	-1,00667	,44467	,621	-2,6453	,6319
	HMSDF	-9,69667*	,44467	,000	-11,3353	-8,0581
	HM600SDF	-,87333	,44467	,803	-2,5119	,7653
	HMEI600SDF	-9,36333*	,44467	,000	-11,0019	-7,7247
	HIDF	-1,40667	,44467	,154	-3,0453	,2319
	HMIDF	-1,34667	,44467	,200	-2,9853	,2919
	HM600IDF	-1,14000	,44467	,430	-2,7786	,4986
	HMEI600IDF	-1,10667	,44467	,476	-2,7453	,5319
	HPWD	-2,96333*	,44467	,000	-4,6019	-1,3247
	HMPWD	-1,07333	,44467	,524	-2,7119	,5653
	HMEI600PWD	-,54667	,44467	,994	-2,1853	1,0919
HMEI600PWD	Control30%	-1,07333	,44467	,524	-2,7119	,5653
	Control20%	,77333	,44467	,904	-,8653	2,4119
	Control10%	-,02000	,44467	1,000	-1,6586	1,6186
	HSDF	-,46000	,44467	,999	-2,0986	1,1786
	HMSDF	-9,15000*	,44467	,000	-10,7886	-7,5114
	HM600SDF	-,32667	,44467	1,000	-1,9653	1,3119
	HMEI600SDF	-8,81667*	,44467	,000	-10,4553	-7,1781
	HIDF	-,86000	,44467	,818	-2,4986	,7786
	HMIDF	-,80000	,44467	,881	-2,4386	,8386
	HM600IDF	-,59333	,44467	,987	-2,2319	1,0453
	HMEI600IDF	-,56000	,44467	,993	-2,1986	1,0786
	HPWD	-2,41667*	,44467	,001	-4,0553	-,7781
	HMPWD	-,52667	,44467	,996	-2,1653	1,1119
	HM600PWD	,54667	,44467	,994	-1,0919	2,1853

*. The mean difference is significant at the 0.05 level.

adhesiveness_Nmm

Tukey HSD[a]

sample	N	Subset for alpha = 0.05			
		1	2	3	4
Control20%	3	3,2667			
HM600PWD	3	3,4933	3,4933		
HMEI600PWD	3	4,0400	4,0400		
Control10%	3	4,0600	4,0600		
HM600SDF	3	4,3667	4,3667		
HSDF	3	4,5000	4,5000		
HMPWD	3	4,5667	4,5667		
HMEI600IDF	3	4,6000	4,6000		
HM600IDF	3	4,6333	4,6333		
HMIDF	3	4,8400	4,8400	4,8400	
HIDF	3	4,9000	4,9000	4,9000	
Control30%	3		5,1133	5,1133	
HPWD	3			6,4567	
HMEI600SDF	3				12,8567
HMSDF	3				13,1900
Sig.		,051	,055	,056	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

K. Variance Analysis Outputs of Cohesiveness

Descriptives

cohesiveness

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	3,6667	,47511	,27431	2,4864	4,8469	3,12	3,98
Control20%	3	1,5300	,13748	,07937	1,1885	1,8715	1,38	1,65
Control10%	3	,6700	,07937	,04583	,4728	,8672	,61	,76
HSDF	3	1,6800	,05292	,03055	1,5486	1,8114	1,64	1,74
HMSDF	3	4,3767	,11015	,06360	4,1030	4,6503	4,25	4,45
HM600SDF	3	4,0967	,15535	,08969	3,7108	4,4826	3,97	4,27
HMEI600SDF	3	4,5100	,29462	,17010	3,7781	5,2419	4,25	4,83
HIDF	3	,7600	,08718	,05033	,5434	,9766	,70	,86
HMIDF	3	1,0233	,05508	,03180	,8865	1,1601	,97	1,08
HM600IDF	3	1,6700	,10149	,05859	1,4179	1,9221	1,56	1,76
HMEI600IDF	3	1,7000	,05292	,03055	1,5686	1,8314	1,66	1,76
HPWD	3	,4500	,10000	,05774	,2016	,6984	,35	,55
HMPWD	3	,9267	,23007	,13283	,3551	1,4982	,70	1,16
HM600PWD	3	8,3400	,19157	,11060	7,8641	8,8159	8,21	8,56
HMEI600PWD	3	2,9800	,06000	,03464	2,8310	3,1290	2,92	3,04
Total	45	2,5587	2,09333	,31206	1,9298	3,1876	,35	8,56

ANOVA

cohesiveness

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	191,802	14	13,700	407,931	,000
Within Groups	1,008	30	,034		
Total	192,809	44			

Multiple Comparisons

Dependent Variable: cohesiveness
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	2,13667*	,14963	,000	1,5853	2,6881
	Control10%	2,99667*	,14963	,000	2,4453	3,5481
	HSDF	1,98667*	,14963	,000	1,4353	2,5381
	HMSDF	-,71000*	,14963	,004	-1,2614	-,1586
	HM600SDF	-,43000	,14963	,264	-,9814	,1214
	HMEI600SDF	-,84333*	,14963	,000	-1,3947	-,2919
	HIDF	2,90667*	,14963	,000	2,3553	3,4581
	HMIDF	2,64333*	,14963	,000	2,0919	3,1947
	HM600IDF	1,99667*	,14963	,000	1,4453	2,5481
	HMEI600IDF	1,96667*	,14963	,000	1,4153	2,5181
	HPWD	3,21667*	,14963	,000	2,6653	3,7681
	HMPWD	2,74000*	,14963	,000	2,1886	3,2914
	HM600PWD	-4,67333*	,14963	,000	-5,2247	-4,1219
	HMEI600PWD	,68667*	,14963	,005	,1353	1,2381
Control20%	Control30%	-2,13667*	,14963	,000	-2,6881	-1,5853
	Control10%	,86000*	,14963	,000	,3086	1,4114
	HSDF	-,15000	,14963	,999	-,7014	,4014
	HMSDF	-2,84667*	,14963	,000	-3,3981	-2,2953
	HM600SDF	-2,56667*	,14963	,000	-3,1181	-2,0153
	HMEI600SDF	-2,98000*	,14963	,000	-3,5314	-2,4286
	HIDF	,77000*	,14963	,001	,2186	1,3214
	HMIDF	,50667	,14963	,097	-,0447	1,0581
	HM600IDF	-,14000	,14963	1,000	-,6914	,4114
	HMEI600IDF	-,17000	,14963	,997	-,7214	,3814
	HPWD	1,08000*	,14963	,000	,5286	1,6314
	HMPWD	,60333*	,14963	,022	,0519	1,1547
	HM600PWD	-6,81000*	,14963	,000	-7,3614	-6,2586
	HMEI600PWD	-1,45000*	,14963	,000	-2,0014	-,8986
Control10%	Control30%	-2,99667*	,14963	,000	-3,5481	-2,4453
	Control20%	-,86000*	,14963	,000	-1,4114	-,3086
	HSDF	-1,01000*	,14963	,000	-1,5614	-,4586
	HMSDF	-3,70667*	,14963	,000	-4,2581	-3,1553
	HM600SDF	-3,42667*	,14963	,000	-3,9781	-2,8753
	HMEI600SDF	-3,84000*	,14963	,000	-4,3914	-3,2886
	HIDF	-,09000	,14963	1,000	-,6414	,4614
	HMIDF	-,35333	,14963	,558	-,9047	,1981
	HM600IDF	-1,00000*	,14963	,000	-1,5514	-,4486
	HMEI600IDF	-1,03000*	,14963	,000	-1,5814	-,4786
	HPWD	,22000	,14963	,972	-,3314	,7714
	HMPWD	-,25667	,14963	,912	-,8081	,2947
	HM600PWD	-7,67000*	,14963	,000	-8,2214	-7,1186
	HMEI600PWD	-2,31000*	,14963	,000	-2,8614	-1,7586
HSDF	Control30%	-1,98667*	,14963	,000	-2,5381	-1,4353
	Control20%	,15000	,14963	,999	-,4014	,7014
	Control10%	1,01000*	,14963	,000	,4586	1,5614
	HMSDF	-2,69667*	,14963	,000	-3,2481	-2,1453
	HM600SDF	-2,41667*	,14963	,000	-2,9681	-1,8653
	HMEI600SDF	-2,83000*	,14963	,000	-3,3814	-2,2786
	HIDF	,92000*	,14963	,000	,3686	1,4714
	HMIDF	,65667*	,14963	,009	,1053	1,2081
	HM600IDF	,01000	,14963	1,000	-,5414	,5614
	HMEI600IDF	-,02000	,14963	1,000	-,5714	,5314
	HPWD	1,23000*	,14963	,000	,6786	1,7814

	HMPWD	,75333*	,14963	,002	,2019	1,3047
	HM600PWD	-6,66000*	,14963	,000	-7,2114	-6,1086
	HMEI600PWD	-1,30000*	,14963	,000	-1,8514	-,7486
HMSDF	Control30%	,71000*	,14963	,004	,1586	1,2614
	Control20%	2,84667*	,14963	,000	2,2953	3,3981
	Control10%	3,70667*	,14963	,000	3,1553	4,2581
	HSDF	2,69667*	,14963	,000	2,1453	3,2481
	HM600SDF	,28000	,14963	,849	-,2714	,8314
	HMEI600SDF	-,13333	,14963	1,000	-,6847	,4181
	HIDF	3,61667*	,14963	,000	3,0653	4,1681
	HMIDF	3,35333*	,14963	,000	2,8019	3,9047
	HM600IDF	2,70667*	,14963	,000	2,1553	3,2581
	HMEI600IDF	2,67667*	,14963	,000	2,1253	3,2281
	HPWD	3,92667*	,14963	,000	3,3753	4,4781
	HMPWD	3,45000*	,14963	,000	2,8986	4,0014
	HM600PWD	-3,96333*	,14963	,000	-4,5147	-3,4119
	HMEI600PWD	1,39667*	,14963	,000	,8453	1,9481
HM600SDF	Control30%	,43000	,14963	,264	-,1214	,9814
	Control20%	2,56667*	,14963	,000	2,0153	3,1181
	Control10%	3,42667*	,14963	,000	2,8753	3,9781
	HSDF	2,41667*	,14963	,000	1,8653	2,9681
	HMSDF	-,28000	,14963	,849	-,8314	,2714
	HMEI600SDF	-,41333	,14963	,318	-,9647	,1381
	HIDF	3,33667*	,14963	,000	2,7853	3,8881
	HMIDF	3,07333*	,14963	,000	2,5219	3,6247
	HM600IDF	2,42667*	,14963	,000	1,8753	2,9781
	HMEI600IDF	2,39667*	,14963	,000	1,8453	2,9481
	HPWD	3,64667*	,14963	,000	3,0953	4,1981
	HMPWD	3,17000*	,14963	,000	2,6186	3,7214
	HM600PWD	-4,24333*	,14963	,000	-4,7947	-3,6919
	HMEI600PWD	1,11667*	,14963	,000	,5653	1,6681
HMEI600SDF	Control30%	,84333*	,14963	,000	,2919	1,3947
	Control20%	2,98000*	,14963	,000	2,4286	3,5314
	Control10%	3,84000*	,14963	,000	3,2886	4,3914
	HSDF	2,83000*	,14963	,000	2,2786	3,3814
	HMSDF	,13333	,14963	1,000	-,4181	,6847
	HM600SDF	,41333	,14963	,318	-,1381	,9647
	HIDF	3,75000*	,14963	,000	3,1986	4,3014
	HMIDF	3,48667*	,14963	,000	2,9353	4,0381
	HM600IDF	2,84000*	,14963	,000	2,2886	3,3914
	HMEI600IDF	2,81000*	,14963	,000	2,2586	3,3614
	HPWD	4,06000*	,14963	,000	3,5086	4,6114
	HMPWD	3,58333*	,14963	,000	3,0319	4,1347
	HM600PWD	-3,83000*	,14963	,000	-4,3814	-3,2786
	HMEI600PWD	1,53000*	,14963	,000	,9786	2,0814
HIDF	Control30%	-2,90667*	,14963	,000	-3,4581	-2,3553
	Control20%	-,77000*	,14963	,001	-1,3214	-,2186
	Control10%	,09000	,14963	1,000	-,4614	,6414
	HSDF	-,92000*	,14963	,000	-1,4714	-,3686
	HMSDF	-3,61667*	,14963	,000	-4,1681	-3,0653
	HM600SDF	-3,33667*	,14963	,000	-3,8881	-2,7853
	HMEI600SDF	-3,75000*	,14963	,000	-4,3014	-3,1986
	HMIDF	-,26333	,14963	,896	-,8147	,2881
	HM600IDF	-,91000*	,14963	,000	-1,4614	-,3586
	HMEI600IDF	-,94000*	,14963	,000	-1,4914	-,3886
	HPWD	,31000	,14963	,742	-,2414	,8614
	HMPWD	-,16667	,14963	,998	-,7181	,3847
	HM600PWD	-7,58000*	,14963	,000	-8,1314	-7,0286
	HMEI600PWD	-2,22000*	,14963	,000	-2,7714	-1,6686
HMIDF	Control30%	-2,64333*	,14963	,000	-3,1947	-2,0919
	Control20%	-,50667	,14963	,097	-1,0581	,0447

	Control10%	,35333	,14963	,558	-,1981	,9047
	HSDF	-,65667*	,14963	,009	-1,2081	-,1053
	HMSDF	-3,35333*	,14963	,000	-3,9047	-2,8019
	HM600SDF	-3,07333*	,14963	,000	-3,6247	-2,5219
	HMEI600SDF	-3,48667*	,14963	,000	-4,0381	-2,9353
	HIDF	,26333	,14963	,896	-,2881	,8147
	HM600IDF	-,64667*	,14963	,011	-1,1981	-,0953
	HMEI600IDF	-,67667*	,14963	,006	-1,2281	-,1253
	HPWD	,57333*	,14963	,035	,0219	1,1247
	HMPWD	,09667	,14963	1,000	-,4547	,6481
	HM600PWD	-7,31667*	,14963	,000	-7,8681	-6,7653
	HMEI600PWD	-1,95667*	,14963	,000	-2,5081	-1,4053
HM600IDF	Control30%	-1,99667*	,14963	,000	-2,5481	-1,4453
	Control20%	,14000	,14963	1,000	-,4114	,6914
	Control10%	1,00000*	,14963	,000	,4486	1,5514
	HSDF	-,01000	,14963	1,000	-,5614	,5414
	HMSDF	-2,70667*	,14963	,000	-3,2581	-2,1553
	HM600SDF	-2,42667*	,14963	,000	-2,9781	-1,8753
	HMEI600SDF	-2,84000*	,14963	,000	-3,3914	-2,2886
	HIDF	,91000*	,14963	,000	,3586	1,4614
	HMIDF	,64667*	,14963	,011	,0953	1,1981
	HMEI600IDF	-,03000	,14963	1,000	-,5814	,5214
	HPWD	1,22000*	,14963	,000	,6686	1,7714
	HMPWD	,74333*	,14963	,002	,1919	1,2947
	HM600PWD	-6,67000*	,14963	,000	-7,2214	-6,1186
	HMEI600PWD	-1,31000*	,14963	,000	-1,8614	-,7586
HMEI600IDF	Control30%	-1,96667*	,14963	,000	-2,5181	-1,4153
	Control20%	,17000	,14963	,997	-,3814	,7214
	Control10%	1,03000*	,14963	,000	,4786	1,5814
	HSDF	,02000	,14963	1,000	-,5314	,5714
	HMSDF	-2,67667*	,14963	,000	-3,2281	-2,1253
	HM600SDF	-2,39667*	,14963	,000	-2,9481	-1,8453
	HMEI600SDF	-2,81000*	,14963	,000	-3,3614	-2,2586
	HIDF	,94000*	,14963	,000	,3886	1,4914
	HMIDF	,67667*	,14963	,006	,1253	1,2281
	HM600IDF	,03000	,14963	1,000	-,5214	,5814
	HPWD	1,25000*	,14963	,000	,6986	1,8014
	HMPWD	,77333*	,14963	,001	,2219	1,3247
	HM600PWD	-6,64000*	,14963	,000	-7,1914	-6,0886
	HMEI600PWD	-1,28000*	,14963	,000	-1,8314	-,7286
HPWD	Control30%	-3,21667*	,14963	,000	-3,7681	-2,6653
	Control20%	-1,08000*	,14963	,000	-1,6314	-,5286
	Control10%	-,22000	,14963	,972	-,7714	,3314
	HSDF	-1,23000*	,14963	,000	-1,7814	-,6786
	HMSDF	-3,92667*	,14963	,000	-4,4781	-3,3753
	HM600SDF	-3,64667*	,14963	,000	-4,1981	-3,0953
	HMEI600SDF	-4,06000*	,14963	,000	-4,6114	-3,5086
	HIDF	-,31000	,14963	,742	-,8614	,2414
	HMIDF	-,57333*	,14963	,035	-1,1247	-,0219
	HM600IDF	-1,22000*	,14963	,000	-1,7714	-,6686
	HMEI600IDF	-1,25000*	,14963	,000	-1,8014	-,6986
	HMPWD	-,47667	,14963	,147	-1,0281	,0747
	HM600PWD	-7,89000*	,14963	,000	-8,4414	-7,3386
	HMEI600PWD	-2,53000*	,14963	,000	-3,0814	-1,9786
HMPWD	Control30%	-2,74000*	,14963	,000	-3,2914	-2,1886
	Control20%	-,60333*	,14963	,022	-1,1547	-,0519
	Control10%	,25667	,14963	,912	-,2947	,8081
	HSDF	-,75333*	,14963	,002	-1,3047	-,2019
	HMSDF	-3,45000*	,14963	,000	-4,0014	-2,8986
	HM600SDF	-3,17000*	,14963	,000	-3,7214	-2,6186
	HMEI600SDF	-3,58333*	,14963	,000	-4,1347	-3,0319

	HIDF	,16667	,14963	,998	-,3847	,7181
	HMIDF	-,09667	,14963	1,000	-,6481	,4547
	HM600IDF	-,74333*	,14963	,002	-1,2947	-,1919
	HMEI600IDF	-,77333*	,14963	,001	-1,3247	-,2219
	HPWD	,47667	,14963	,147	-,0747	1,0281
	HM600PWD	-7,41333*	,14963	,000	-7,9647	-6,8619
	HMEI600PWD	-2,05333*	,14963	,000	-2,6047	-1,5019
HM600PWD	Control30%	4,67333*	,14963	,000	4,1219	5,2247
	Control20%	6,81000*	,14963	,000	6,2586	7,3614
	Control10%	7,67000*	,14963	,000	7,1186	8,2214
	HSDF	6,66000*	,14963	,000	6,1086	7,2114
	HMSDF	3,96333*	,14963	,000	3,4119	4,5147
	HM600SDF	4,24333*	,14963	,000	3,6919	4,7947
	HMEI600SDF	3,83000*	,14963	,000	3,2786	4,3814
	HIDF	7,58000*	,14963	,000	7,0286	8,1314
	HMIDF	7,31667*	,14963	,000	6,7653	7,8681
	HM600IDF	6,67000*	,14963	,000	6,1186	7,2214
	HMEI600IDF	6,64000*	,14963	,000	6,0886	7,1914
	HPWD	7,89000*	,14963	,000	7,3386	8,4414
	HMPWD	7,41333*	,14963	,000	6,8619	7,9647
	HMEI600PWD	5,36000*	,14963	,000	4,8086	5,9114
HMEI600PWD	Control30%	-,68667*	,14963	,005	-1,2381	-,1353
	Control20%	1,45000*	,14963	,000	,8986	2,0014
	Control10%	2,31000*	,14963	,000	1,7586	2,8614
	HSDF	1,30000*	,14963	,000	,7486	1,8514
	HMSDF	-1,39667*	,14963	,000	-1,9481	-,8453
	HM600SDF	-1,11667*	,14963	,000	-1,6681	-,5653
	HMEI600SDF	-1,53000*	,14963	,000	-2,0814	-,9786
	HIDF	2,22000*	,14963	,000	1,6686	2,7714
	HMIDF	1,95667*	,14963	,000	1,4053	2,5081
	HM600IDF	1,31000*	,14963	,000	,7586	1,8614
	HMEI600IDF	1,28000*	,14963	,000	,7286	1,8314
	HPWD	2,53000*	,14963	,000	1,9786	3,0814
	HMPWD	2,05333*	,14963	,000	1,5019	2,6047
	HM600PWD	-5,36000*	,14963	,000	-5,9114	-4,8086

*. The mean difference is significant at the 0.05 level.

cohesiveness

Tukey HSD[a]

sample	N	Subset for alpha = 0.05							
		1	2	3	4	5	6	7	8
HPWD	3	,4500							
Control10%	3	,6700	,6700						
HIDF	3	,7600	,7600						
HMPWD	3	,9267	,9267						
HMIDF	3		1,0233	1,0233					
Control20%	3			1,5300	1,5300				
HM600IDF	3				1,6700				
HSDF	3				1,6800				
HMEI600IDF	3				1,7000				
HMEI600PWD	3					2,9800			
Control30%	3						3,6667		
HM600SDF	3						4,0967	4,0967	
HMSDF	3							4,3767	
HMEI600SDF	3							4,5100	
HM600PWD	3								8,3400
Sig.		,147	,558	,097	,997	1,000	,264	,318	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

L. Variance Analysis Outputs of Biscuit Hardness

Descriptives

hardness_biscuit_g_

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	2771,7933	48,71269	28,12428	2650,7843	2892,8024	2739,19	2827,79
Control20%	3	3354,6700	167,54586	96,73265	2938,4630	3770,8770	3196,70	3530,38
Control10%	3	3834,1633	127,73604	73,74844	3516,8494	4151,4772	3733,80	3977,95
HSDF	3	3611,8033	450,16046	259,90026	2493,5428	4730,0639	3092,55	3892,08
HMSDF	3	2266,6933	67,82731	39,16012	2098,2009	2435,1857	2203,07	2338,06
HM600SDF	3	2058,2133	115,75294	66,82999	1770,6671	2345,7596	1978,68	2191,01
HMEI600SDF	3	3866,6933	67,82731	39,16012	3698,2009	4035,1857	3803,07	3938,06
HIDF	3	6312,2533	6,01500	3,47276	6297,3112	6327,1954	6306,24	6318,27
HMIDF	3	5315,5867	11,38772	6,57470	5287,2980	5343,8753	5306,24	5328,27
HM600IDF	3	3211,8000	80,66623	46,57267	3011,4140	3412,1860	3126,60	3287,00
HMEI600IDF	3	3251,3367	75,06564	43,33916	3064,8633	3437,8100	3196,70	3336,93
HPWD	3	6594,2533	65,65305	37,90480	6431,1621	6757,3445	6535,03	6664,85
HMPWD	3	5318,9200	8,33948	4,81480	5298,2036	5339,6364	5312,25	5328,27
HM600PWD	3	3700,8300	144,79351	83,59657	3341,1430	4060,5170	3533,80	3790,74
HMEI600PWD	3	3443,5500	15,81987	9,13361	3404,2513	3482,8487	3431,37	3461,43
Total	45	3927,5040	1335,31020	199,05629	3526,3324	4328,6756	1978,68	6664,85

ANOVA

hardness_biscuit_g_

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	77834530,052	14	5559609,289	269,093	,000
Within Groups	619816,722	30	20660,557		
Total	78454346,774	44			

Multiple Comparisons

Dependent Variable: hardness_biscuit_g
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	-582,87667*	117,36143	,002	-1015,3546	-150,3987
	Control10%	-1062,37000*	117,36143	,000	-1494,8479	-629,8921
	HSDF	-840,01000*	117,36143	,000	-1272,4879	-407,5321
	HMSDF	505,10000*	117,36143	,011	72,6221	937,5779
	HM600SDF	713,58000*	117,36143	,000	281,1021	1146,0579
	HMEI600SDF	-1094,90000*	117,36143	,000	-1527,3779	-662,4221
	HIDF	-3540,46000*	117,36143	,000	-3972,9379	-3107,9821
	HMIDF	-2543,79333*	117,36143	,000	-2976,2713	-2111,3154
	HM600IDF	-440,00667*	117,36143	,043	-872,4846	-7,5287
	HMEI600IDF	-479,54333*	117,36143	,019	-912,0213	-47,0654
	HPWD	-3822,46000*	117,36143	,000	-4254,9379	-3389,9821
	HMPWD	-2547,12667*	117,36143	,000	-2979,6046	-2114,6487
	HM600PWD	-929,03667*	117,36143	,000	-1361,5146	-496,5587
	HMEI600PWD	-671,75667*	117,36143	,000	-1104,2346	-239,2787
Control20%	Control30%	582,87667*	117,36143	,002	150,3987	1015,3546
	Control10%	-479,49333*	117,36143	,019	-911,9713	-47,0154
	HSDF	-257,13333	117,36143	,668	-689,6113	175,3446
	HMSDF	1087,97667*	117,36143	,000	655,4987	1520,4546
	HM600SDF	1296,45667*	117,36143	,000	863,9787	1728,9346
	HMEI600SDF	-512,02333*	117,36143	,010	-944,5013	-79,5454
	HIDF	-2957,58333*	117,36143	,000	-3390,0613	-2525,1054
	HMIDF	-1960,91667*	117,36143	,000	-2393,3946	-1528,4387
	HM600IDF	142,87000	117,36143	,995	-289,6079	575,3479
	HMEI600IDF	103,33333	117,36143	1,000	-329,1446	535,8113
	HPWD	-3239,58333*	117,36143	,000	-3672,0613	-2807,1054
	HMPWD	-1964,25000*	117,36143	,000	-2396,7279	-1531,7721
	HM600PWD	-346,16000	117,36143	,231	-778,6379	86,3179
	HMEI600PWD	-88,88000	117,36143	1,000	-521,3579	343,5979
Control10%	Control30%	1062,37000*	117,36143	,000	629,8921	1494,8479
	Control20%	479,49333*	117,36143	,019	47,0154	911,9713
	HSDF	222,36000	117,36143	,838	-210,1179	654,8379
	HMSDF	1567,47000*	117,36143	,000	1134,9921	1999,9479
	HM600SDF	1775,95000*	117,36143	,000	1343,4721	2208,4279
	HMEI600SDF	-32,53000	117,36143	1,000	-465,0079	399,9479
	HIDF	-2478,09000*	117,36143	,000	-2910,5679	-2045,6121
	HMIDF	-1481,42333*	117,36143	,000	-1913,9013	-1048,9454
	HM600IDF	622,36333*	117,36143	,001	189,8854	1054,8413
	HMEI600IDF	582,82667*	117,36143	,002	150,3487	1015,3046
	HPWD	-2760,09000*	117,36143	,000	-3192,5679	-2327,6121
	HMPWD	-1484,75667*	117,36143	,000	-1917,2346	-1052,2787
	HM600PWD	133,33333	117,36143	,997	-299,1446	565,8113
	HMEI600PWD	390,61333	117,36143	,110	-41,8646	823,0913
HSDF	Control30%	840,01000*	117,36143	,000	407,5321	1272,4879
	Control20%	257,13333	117,36143	,668	-175,3446	689,6113
	Control10%	-222,36000	117,36143	,838	-654,8379	210,1179
	HMSDF	1345,11000*	117,36143	,000	912,6321	1777,5879
	HM600SDF	1553,59000*	117,36143	,000	1121,1121	1986,0679
	HMEI600SDF	-254,89000	117,36143	,681	-687,3679	177,5879
	HIDF	-2700,45000*	117,36143	,000	-3132,9279	-2267,9721
	HMIDF	-1703,78333*	117,36143	,000	-2136,2613	-1271,3054
	HM600IDF	400,00333	117,36143	,093	-32,4746	832,4813
	HMEI600IDF	360,46667	117,36143	,184	-72,0113	792,9446
	HPWD	-2982,45000*	117,36143	,000	-3414,9279	-2549,9721
	HMPWD	-1707,11667*	117,36143	,000	-2139,5946	-1274,6387

	HM600PWD	-89,02667	117,36143	1,000	-521,5046	343,4513
	HMEI600PWD	168,25333	117,36143	,977	-264,2246	600,7313
HMSDF	Control30%	-505,10000*	117,36143	,011	-937,5779	-72,6221
	Control20%	-1087,97667*	117,36143	,000	-1520,4546	-655,4987
	Control10%	-1567,47000*	117,36143	,000	-1999,9479	-1134,9921
	HSDF	-1345,11000*	117,36143	,000	-1777,5879	-912,6321
	HM600SDF	208,48000	117,36143	,890	-223,9979	640,9579
	HMEI600SDF	-1600,00000*	117,36143	,000	-2032,4779	-1167,5221
	HIDF	-4045,56000*	117,36143	,000	-4478,0379	-3613,0821
	HMIDF	-3048,89333*	117,36143	,000	-3481,3713	-2616,4154
	HM600IDF	-945,10667*	117,36143	,000	-1377,5846	-512,6287
	HMEI600IDF	-984,64333*	117,36143	,000	-1417,1213	-552,1654
	HPWD	-4327,56000*	117,36143	,000	-4760,0379	-3895,0821
	HMPWD	-3052,22667*	117,36143	,000	-3484,7046	-2619,7487
	HM600PWD	-1434,13667*	117,36143	,000	-1866,6146	-1001,6587
	HMEI600PWD	-1176,85667*	117,36143	,000	-1609,3346	-744,3787
HM600SDF	Control30%	-713,58000*	117,36143	,000	-1146,0579	-281,1021
	Control20%	-1296,45667*	117,36143	,000	-1728,9346	-863,9787
	Control10%	-1775,95000*	117,36143	,000	-2208,4279	-1343,4721
	HSDF	-1553,59000*	117,36143	,000	-1986,0679	-1121,1121
	HMSDF	-208,48000	117,36143	,890	-640,9579	223,9979
	HMEI600SDF	-1808,48000*	117,36143	,000	-2240,9579	-1376,0021
	HIDF	-4254,04000*	117,36143	,000	-4686,5179	-3821,5621
	HMIDF	-3257,37333*	117,36143	,000	-3689,8513	-2824,8954
	HM600IDF	-1153,58667*	117,36143	,000	-1586,0646	-721,1087
	HMEI600IDF	-1193,12333*	117,36143	,000	-1625,6013	-760,6454
	HPWD	-4536,04000*	117,36143	,000	-4968,5179	-4103,5621
	HMPWD	-3260,70667*	117,36143	,000	-3693,1846	-2828,2287
	HM600PWD	-1642,61667*	117,36143	,000	-2075,0946	-1210,1387
	HMEI600PWD	-1385,33667*	117,36143	,000	-1817,8146	-952,8587
HMEI600SDF	Control30%	1094,90000*	117,36143	,000	662,4221	1527,3779
	Control20%	512,02333*	117,36143	,010	79,5454	944,5013
	Control10%	32,53000	117,36143	1,000	-399,9479	465,0079
	HSDF	254,89000	117,36143	,681	-177,5879	687,3679
	HMSDF	1600,00000*	117,36143	,000	1167,5221	2032,4779
	HM600SDF	1808,48000*	117,36143	,000	1376,0021	2240,9579
	HIDF	-2445,56000*	117,36143	,000	-2878,0379	-2013,0821
	HMIDF	-1448,89333*	117,36143	,000	-1881,3713	-1016,4154
	HM600IDF	654,89333*	117,36143	,000	222,4154	1087,3713
	HMEI600IDF	615,35667*	117,36143	,001	182,8787	1047,8346
	HPWD	-2727,56000*	117,36143	,000	-3160,0379	-2295,0821
	HMPWD	-1452,22667*	117,36143	,000	-1884,7046	-1019,7487
	HM600PWD	165,86333	117,36143	,979	-266,6146	598,3413
	HMEI600PWD	423,14333	117,36143	,060	-9,3346	855,6213
HIDF	Control30%	3540,46000*	117,36143	,000	3107,9821	3972,9379
	Control20%	2957,58333*	117,36143	,000	2525,1054	3390,0613
	Control10%	2478,09000*	117,36143	,000	2045,6121	2910,5679
	HSDF	2700,45000*	117,36143	,000	2267,9721	3132,9279
	HMSDF	4045,56000*	117,36143	,000	3613,0821	4478,0379
	HM600SDF	4254,04000*	117,36143	,000	3821,5621	4686,5179
	HMEI600SDF	2445,56000*	117,36143	,000	2013,0821	2878,0379
	HMIDF	996,66667*	117,36143	,000	564,1887	1429,1446
	HM600IDF	3100,45333*	117,36143	,000	2667,9754	3532,9313
	HMEI600IDF	3060,91667*	117,36143	,000	2628,4387	3493,3946
	HPWD	-282,00000	117,36143	,531	-714,4779	150,4779
	HMPWD	993,33333*	117,36143	,000	560,8554	1425,8113
	HM600PWD	2611,42333*	117,36143	,000	2178,9454	3043,9013
	HMEI600PWD	2868,70333*	117,36143	,000	2436,2254	3301,1813
HMIDF	Control30%	2543,79333*	117,36143	,000	2111,3154	2976,2713
	Control20%	1960,91667*	117,36143	,000	1528,4387	2393,3946
	Control10%	1481,42333*	117,36143	,000	1048,9454	1913,9013

	HSDF	1703,78333*	117,36143	,000	1271,3054	2136,2613
	HMSDF	3048,89333*	117,36143	,000	2616,4154	3481,3713
	HM600SDF	3257,37333*	117,36143	,000	2824,8954	3689,8513
	HMEI600SDF	1448,89333*	117,36143	,000	1016,4154	1881,3713
	HIDF	-996,66667*	117,36143	,000	-1429,1446	-564,1887
	HM600IDF	2103,78667*	117,36143	,000	1671,3087	2536,2646
	HMEI600IDF	2064,25000*	117,36143	,000	1631,7721	2496,7279
	HPWD	-1278,66667*	117,36143	,000	-1711,1446	-846,1887
	HMPWD	-3,33333	117,36143	1,000	-435,8113	429,1446
	HM600PWD	1614,75667*	117,36143	,000	1182,2787	2047,2346
	HMEI600PWD	1872,03667*	117,36143	,000	1439,5587	2304,5146
HM600IDF	Control30%	440,00667*	117,36143	,043	7,5287	872,4846
	Control20%	-142,87000	117,36143	,995	-575,3479	289,6079
	Control10%	-622,36333*	117,36143	,001	-1054,8413	-189,8854
	HSDF	-400,00333	117,36143	,093	-832,4813	32,4746
	HMSDF	945,10667*	117,36143	,000	512,6287	1377,5846
	HM600SDF	1153,58667*	117,36143	,000	721,1087	1586,0646
	HMEI600SDF	-654,89333*	117,36143	,000	-1087,3713	-222,4154
	HIDF	-3100,45333*	117,36143	,000	-3532,9313	-2667,9754
	HMIDF	-2103,78667*	117,36143	,000	-2536,2646	-1671,3087
	HMEI600IDF	-39,53667	117,36143	1,000	-472,0146	392,9413
	HPWD	-3382,45333*	117,36143	,000	-3814,9313	-2949,9754
	HMPWD	-2107,12000*	117,36143	,000	-2539,5979	-1674,6421
	HM600PWD	-489,03000*	117,36143	,016	-921,5079	-56,5521
	HMEI600PWD	-231,75000	117,36143	,797	-664,2279	200,7279
HMEI600IDF	Control30%	479,54333*	117,36143	,019	47,0654	912,0213
	Control20%	-103,33333	117,36143	1,000	-535,8113	329,1446
	Control10%	-582,82667*	117,36143	,002	-1015,3046	-150,3487
	HSDF	-360,46667	117,36143	,184	-792,9446	72,0113
	HMSDF	984,64333*	117,36143	,000	552,1654	1417,1213
	HM600SDF	1193,12333*	117,36143	,000	760,6454	1625,6013
	HMEI600SDF	-615,35667*	117,36143	,001	-1047,8346	-182,8787
	HIDF	-3060,91667*	117,36143	,000	-3493,3946	-2628,4387
	HMIDF	-2064,25000*	117,36143	,000	-2496,7279	-1631,7721
	HM600IDF	39,53667	117,36143	1,000	-392,9413	472,0146
	HPWD	-3342,91667*	117,36143	,000	-3775,3946	-2910,4387
	HMPWD	-2067,58333*	117,36143	,000	-2500,0613	-1635,1054
	HM600PWD	-449,49333*	117,36143	,036	-881,9713	-17,0154
	HMEI600PWD	-192,21333	117,36143	,936	-624,6913	240,2646
HPWD	Control30%	3822,46000*	117,36143	,000	3389,9821	4254,9379
	Control20%	3239,58333*	117,36143	,000	2807,1054	3672,0613
	Control10%	2760,09000*	117,36143	,000	2327,6121	3192,5679
	HSDF	2982,45000*	117,36143	,000	2549,9721	3414,9279
	HMSDF	4327,56000*	117,36143	,000	3895,0821	4760,0379
	HM600SDF	4536,04000*	117,36143	,000	4103,5621	4968,5179
	HMEI600SDF	2727,56000*	117,36143	,000	2295,0821	3160,0379
	HIDF	282,00000	117,36143	,531	-150,4779	714,4779
	HMIDF	1278,66667*	117,36143	,000	846,1887	1711,1446
	HM600IDF	3382,45333*	117,36143	,000	2949,9754	3814,9313
	HMEI600IDF	3342,91667*	117,36143	,000	2910,4387	3775,3946
	HMPWD	1275,33333*	117,36143	,000	842,8554	1707,8113
	HM600PWD	2893,42333*	117,36143	,000	2460,9454	3325,9013
	HMEI600PWD	3150,70333*	117,36143	,000	2718,2254	3583,1813
HMPWD	Control30%	2547,12667*	117,36143	,000	2114,6487	2979,6046
	Control20%	1964,25000*	117,36143	,000	1531,7721	2396,7279
	Control10%	1484,75667*	117,36143	,000	1052,2787	1917,2346
	HSDF	1707,11667*	117,36143	,000	1274,6387	2139,5946
	HMSDF	3052,22667*	117,36143	,000	2619,7487	3484,7046
	HM600SDF	3260,70667*	117,36143	,000	2828,2287	3693,1846
	HMEI600SDF	1452,22667*	117,36143	,000	1019,7487	1884,7046
	HIDF	-993,33333*	117,36143	,000	-1425,8113	-560,8554

	HMIDF	3,33333	117,36143	1,000	-429,1446	435,8113
	HM600IDF	2107,12000*	117,36143	,000	1674,6421	2539,5979
	HMEI600IDF	2067,58333*	117,36143	,000	1635,1054	2500,0613
	HPWD	-1275,33333*	117,36143	,000	-1707,8113	-842,8554
	HM600PWD	1618,09000*	117,36143	,000	1185,6121	2050,5679
	HMEI600PWD	1875,37000*	117,36143	,000	1442,8921	2307,8479
HM600PWD	Control30%	929,03667*	117,36143	,000	496,5587	1361,5146
	Control20%	346,16000	117,36143	,231	-86,3179	778,6379
	Control10%	-133,33333	117,36143	,997	-565,8113	299,1446
	HSDF	89,02667	117,36143	1,000	-343,4513	521,5046
	HMSDF	1434,13667*	117,36143	,000	1001,6587	1866,6146
	HM600SDF	1642,61667*	117,36143	,000	1210,1387	2075,0946
	HMEI600SDF	-165,86333	117,36143	,979	-598,3413	266,6146
	HIDF	-2611,42333*	117,36143	,000	-3043,9013	-2178,9454
	HMIDF	-1614,75667*	117,36143	,000	-2047,2346	-1182,2787
	HM600IDF	489,03000*	117,36143	,016	56,5521	921,5079
	HMEI600IDF	449,49333*	117,36143	,036	17,0154	881,9713
	HPWD	-2893,42333*	117,36143	,000	-3325,9013	-2460,9454
	HMPWD	-1618,09000*	117,36143	,000	-2050,5679	-1185,6121
	HMEI600PWD	257,28000	117,36143	,668	-175,1979	689,7579
HMEI600PWD	Control30%	671,75667*	117,36143	,000	239,2787	1104,2346
	Control20%	88,88000	117,36143	1,000	-343,5979	521,3579
	Control10%	-390,61333	117,36143	,110	-823,0913	41,8646
	HSDF	-168,25333	117,36143	,977	-600,7313	264,2246
	HMSDF	1176,85667*	117,36143	,000	744,3787	1609,3346
	HM600SDF	1385,33667*	117,36143	,000	952,8587	1817,8146
	HMEI600SDF	-423,14333	117,36143	,060	-855,6213	9,3346
	HIDF	-2868,70333*	117,36143	,000	-3301,1813	-2436,2254
	HMIDF	-1872,03667*	117,36143	,000	-2304,5146	-1439,5587
	HM600IDF	231,75000	117,36143	,797	-200,7279	664,2279
	HMEI600IDF	192,21333	117,36143	,936	-240,2646	624,6913
	HPWD	-3150,70333*	117,36143	,000	-3583,1813	-2718,2254
	HMPWD	-1875,37000*	117,36143	,000	-2307,8479	-1442,8921
	HM600PWD	-257,28000	117,36143	,668	-689,7579	175,1979

*. The mean difference is significant at the 0.05 level.

hardness_biscuit_g

Tukey HSD[a]

sample	N	Subset for alpha = 0.05						
		1	2	3	4	5	6	7
HM600SDF	3	2058,2133						
HMSDF	3	2266,6933						
Control30%	3		2771,7933					
HM600IDF	3			3211,8000				
HMEI600IDF	3			3251,3367				
Control20%	3			3354,6700	3354,6700			
HMEI600PWD	3			3443,5500	3443,5500	3443,5500		
HSDF	3			3611,8033	3611,8033	3611,8033		
HM600PWD	3				3700,8300	3700,8300		
Control10%	3					3834,1633		
HMEI600SDF	3					3866,6933		
HMIDF	3						5315,5867	
HMPWD	3						5318,9200	
HIDF	3							6312,2533
HPWD	3							6594,2533
Sig.		,890	1,000	,093	,231	,060	1,000	,531

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

M. Variance Analysis Outputs of Biscuit Moisture

Descriptives

moisture

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	7,3733	,18877	,10899	6,9044	7,8423	7,21	7,58
Control20%	3	7,2700	,06000	,03464	7,1210	7,4190	7,21	7,33
Control10%	3	7,2633	,05033	,02906	7,1383	7,3884	7,21	7,31
HSDF	3	7,2767	,03055	,01764	7,2008	7,3526	7,25	7,31
HMSDF	3	7,4067	,22143	,12785	6,8566	7,9567	7,25	7,66
HM600SDF	3	7,4700	,20664	,11930	6,9567	7,9833	7,25	7,66
HMEI600SDF	3	7,6100	,09539	,05508	7,3730	7,8470	7,50	7,67
HIDF	3	9,8067	,80376	,46405	7,8100	11,8033	9,08	10,67
HMIDF	3	8,8667	,07024	,04055	8,6922	9,0411	8,80	8,94
HM600IDF	3	8,9400	,14000	,08083	8,5922	9,2878	8,80	9,08
HMEI600IDF	3	8,7933	,15011	,08667	8,4204	9,1662	8,64	8,94
HPWD	3	7,1800	,21656	,12503	6,6420	7,7180	7,05	7,43
HMPWD	3	7,6067	,14640	,08452	7,2430	7,9703	7,45	7,74
HM600PWD	3	9,0967	,40079	,23140	8,1010	10,0923	8,76	9,54
HMEI600PWD	3	8,8100	,21000	,12124	8,2883	9,3317	8,66	9,05
Total	45	8,0513	,89281	,13309	7,7831	8,3196	7,05	10,67

ANOVA

moisture

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	32,853	14	2,347	31,720	,000
Within Groups	2,219	30	,074		
Total	35,073	44			

Multiple Comparisons

Dependent Variable: moisture
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	,10333	,22208	1,000	-,7150	,9217
	Control10%	,11000	,22208	1,000	-,7084	,9284
	HSDF	,09667	,22208	1,000	-,7217	,9150
	HMSDF	-,03333	,22208	1,000	-,8517	,7850
	HM600SDF	-,09667	,22208	1,000	-,9150	,7217
	HMEI600SDF	-,23667	,22208	,999	-1,0550	,5817
	HIDF	-2,43333*	,22208	,000	-3,2517	-1,6150
	HMIDF	-1,49333*	,22208	,000	-2,3117	-,6750
	HM600IDF	-1,56667*	,22208	,000	-2,3850	-,7483
	HMEI600IDF	-1,42000*	,22208	,000	-2,2384	-,6016
	HPWD	,19333	,22208	1,000	-,6250	1,0117
	HMPWD	-,23333	,22208	,999	-1,0517	,5850
	HM600PWD	-1,72333*	,22208	,000	-2,5417	-,9050
	HMEI600PWD	-1,43667*	,22208	,000	-2,2550	-,6183
Control20%	Control30%	-,10333	,22208	1,000	-,9217	,7150
	Control10%	,00667	,22208	1,000	-,8117	,8250
	HSDF	-,00667	,22208	1,000	-,8250	,8117
	HMSDF	-,13667	,22208	1,000	-,9550	,6817
	HM600SDF	-,20000	,22208	1,000	-1,0184	,6184
	HMEI600SDF	-,34000	,22208	,961	-1,1584	,4784
	HIDF	-2,53667*	,22208	,000	-3,3550	-1,7183
	HMIDF	-1,59667*	,22208	,000	-2,4150	-,7783
	HM600IDF	-1,67000*	,22208	,000	-2,4884	-,8516
	HMEI600IDF	-1,52333*	,22208	,000	-2,3417	-,7050
	HPWD	,09000	,22208	1,000	-,7284	,9084
	HMPWD	-,33667	,22208	,964	-1,1550	,4817
	HM600PWD	-1,82667*	,22208	,000	-2,6450	-1,0083
	HMEI600PWD	-1,54000*	,22208	,000	-2,3584	-,7216
Control10%	Control30%	-,11000	,22208	1,000	-,9284	,7084
	Control20%	-,00667	,22208	1,000	-,8250	,8117
	HSDF	-,01333	,22208	1,000	-,8317	,8050
	HMSDF	-,14333	,22208	1,000	-,9617	,6750
	HM600SDF	-,20667	,22208	1,000	-1,0250	,6117
	HMEI600SDF	-,34667	,22208	,955	-1,1650	,4717
	HIDF	-2,54333*	,22208	,000	-3,3617	-1,7250
	HMIDF	-1,60333*	,22208	,000	-2,4217	-,7850
	HM600IDF	-1,67667*	,22208	,000	-2,4950	-,8583
	HMEI600IDF	-1,53000*	,22208	,000	-2,3484	-,7116
	HPWD	,08333	,22208	1,000	-,7350	,9017
	HMPWD	-,34333	,22208	,958	-1,1617	,4750
	HM600PWD	-1,83333*	,22208	,000	-2,6517	-1,0150
	HMEI600PWD	-1,54667*	,22208	,000	-2,3650	-,7283
HSDF	Control30%	-,09667	,22208	1,000	-,9150	,7217
	Control20%	,00667	,22208	1,000	-,8117	,8250
	Control10%	,01333	,22208	1,000	-,8050	,8317
	HMSDF	-,13000	,22208	1,000	-,9484	,6884
	HM600SDF	-,19333	,22208	1,000	-1,0117	,6250
	HMEI600SDF	-,33333	,22208	,966	-1,1517	,4850
	HIDF	-2,53000*	,22208	,000	-3,3484	-1,7116
	HMIDF	-1,59000*	,22208	,000	-2,4084	-,7716
	HM600IDF	-1,66333*	,22208	,000	-2,4817	-,8450
	HMEI600IDF	-1,51667*	,22208	,000	-2,3350	-,6983
	HPWD	,09667	,22208	1,000	-,7217	,9150
	HMPWD	-,33000	,22208	,969	-1,1484	,4884

	HM600PWD	-1,82000*	,22208	,000	-2,6384	-1,0016
	HMEI600PWD	-1,53333*	,22208	,000	-2,3517	-,7150
HMSDF	Control30%	,03333	,22208	1,000	-,7850	,8517
	Control20%	,13667	,22208	1,000	-,6817	,9550
	Control10%	,14333	,22208	1,000	-,6750	,9617
	HSDF	,13000	,22208	1,000	-,6884	,9484
	HM600SDF	-,06333	,22208	1,000	-,8817	,7550
	HMEI600SDF	-,20333	,22208	1,000	-1,0217	,6150
	HIDF	-2,40000*	,22208	,000	-3,2184	-1,5816
	HMIDF	-1,46000*	,22208	,000	-2,2784	-,6416
	HM600IDF	-1,53333*	,22208	,000	-2,3517	-,7150
	HMEI600IDF	-1,38667*	,22208	,000	-2,2050	-,5683
	HPWD	,22667	,22208	,999	-,5917	1,0450
	HMPWD	-,20000	,22208	1,000	-1,0184	,6184
	HM600PWD	-1,69000*	,22208	,000	-2,5084	-,8716
	HMEI600PWD	-1,40333*	,22208	,000	-2,2217	-,5850
HM600SDF	Control30%	,09667	,22208	1,000	-,7217	,9150
	Control20%	,20000	,22208	1,000	-,6184	1,0184
	Control10%	,20667	,22208	1,000	-,6117	1,0250
	HSDF	,19333	,22208	1,000	-,6250	1,0117
	HMSDF	,06333	,22208	1,000	-,7550	,8817
	HMEI600SDF	-,14000	,22208	1,000	-,9584	,6784
	HIDF	-2,33667*	,22208	,000	-3,1550	-1,5183
	HMIDF	-1,39667*	,22208	,000	-2,2150	-,5783
	HM600IDF	-1,47000*	,22208	,000	-2,2884	-,6516
	HMEI600IDF	-1,32333*	,22208	,000	-2,1417	-,5050
	HPWD	,29000	,22208	,990	-,5284	1,1084
	HMPWD	-,13667	,22208	1,000	-,9550	,6817
	HM600PWD	-1,62667*	,22208	,000	-2,4450	-,8083
	HMEI600PWD	-1,34000*	,22208	,000	-2,1584	-,5216
HMEI600SDF	Control30%	,23667	,22208	,999	-,5817	1,0550
	Control20%	,34000	,22208	,961	-,4784	1,1584
	Control10%	,34667	,22208	,955	-,4717	1,1650
	HSDF	,33333	,22208	,966	-,4850	1,1517
	HMSDF	,20333	,22208	1,000	-,6150	1,0217
	HM600SDF	,14000	,22208	1,000	-,6784	,9584
	HIDF	-2,19667*	,22208	,000	-3,0150	-1,3783
	HMIDF	-1,25667*	,22208	,000	-2,0750	-,4383
	HM600IDF	-1,33000*	,22208	,000	-2,1484	-,5116
	HMEI600IDF	-1,18333*	,22208	,001	-2,0017	-,3650
	HPWD	,43000	,22208	,817	-,3884	1,2484
	HMPWD	,00333	,22208	1,000	-,8150	,8217
	HM600PWD	-1,48667*	,22208	,000	-2,3050	-,6683
	HMEI600PWD	-1,20000*	,22208	,001	-2,0184	-,3816
HIDF	Control30%	2,43333*	,22208	,000	1,6150	3,2517
	Control20%	2,53667*	,22208	,000	1,7183	3,3550
	Control10%	2,54333*	,22208	,000	1,7250	3,3617
	HSDF	2,53000*	,22208	,000	1,7116	3,3484
	HMSDF	2,40000*	,22208	,000	1,5816	3,2184
	HM600SDF	2,33667*	,22208	,000	1,5183	3,1550
	HMEI600SDF	2,19667*	,22208	,000	1,3783	3,0150
	HMIDF	,94000*	,22208	,013	,1216	1,7584
	HM600IDF	,86667*	,22208	,030	,0483	1,6850
	HMEI600IDF	1,01333*	,22208	,006	,1950	1,8317
	HPWD	2,62667*	,22208	,000	1,8083	3,4450
	HMPWD	2,20000*	,22208	,000	1,3816	3,0184
	HM600PWD	,71000	,22208	,144	-,1084	1,5284
	HMEI600PWD	,99667*	,22208	,007	,1783	1,8150
HMIDF	Control30%	1,49333*	,22208	,000	,6750	2,3117
	Control20%	1,59667*	,22208	,000	,7783	2,4150
	Control10%	1,60333*	,22208	,000	,7850	2,4217

	HSDF	1,59000*	,22208	,000	,7716	2,4084
	HMSDF	1,46000*	,22208	,000	,6416	2,2784
	HM600SDF	1,39667*	,22208	,000	,5783	2,2150
	HMEI600SDF	1,25667*	,22208	,000	,4383	2,0750
	HIDF	-,94000*	,22208	,013	-1,7584	-,1216
	HM600IDF	-,07333	,22208	1,000	-,8917	,7450
	HMEI600IDF	,07333	,22208	1,000	-,7450	,8917
	HPWD	1,68667*	,22208	,000	,8683	2,5050
	HMPWD	1,26000*	,22208	,000	,4416	2,0784
	HM600PWD	-,23000	,22208	,999	-1,0484	,5884
	HMEI600PWD	,05667	,22208	1,000	-,7617	,8750
HM600IDF	Control30%	1,56667*	,22208	,000	,7483	2,3850
	Control20%	1,67000*	,22208	,000	,8516	2,4884
	Control10%	1,67667*	,22208	,000	,8583	2,4950
	HSDF	1,66333*	,22208	,000	,8450	2,4817
	HMSDF	1,53333*	,22208	,000	,7150	2,3517
	HM600SDF	1,47000*	,22208	,000	,6516	2,2884
	HMEI600SDF	1,33000*	,22208	,000	,5116	2,1484
	HIDF	-,86667*	,22208	,030	-1,6850	-,0483
	HMIDF	,07333	,22208	1,000	-,7450	,8917
	HMEI600IDF	,14667	,22208	1,000	-,6717	,9650
	HPWD	1,76000*	,22208	,000	,9416	2,5784
	HMPWD	1,33333*	,22208	,000	,5150	2,1517
	HM600PWD	-,15667	,22208	1,000	-,9750	,6617
	HMEI600PWD	,13000	,22208	1,000	-,6884	,9484
HMEI600IDF	Control30%	1,42000*	,22208	,000	,6016	2,2384
	Control20%	1,52333*	,22208	,000	,7050	2,3417
	Control10%	1,53000*	,22208	,000	,7116	2,3484
	HSDF	1,51667*	,22208	,000	,6983	2,3350
	HMSDF	1,38667*	,22208	,000	,5683	2,2050
	HM600SDF	1,32333*	,22208	,000	,5050	2,1417
	HMEI600SDF	1,18333*	,22208	,001	,3650	2,0017
	HIDF	-1,01333*	,22208	,006	-1,8317	-,1950
	HMIDF	-,07333	,22208	1,000	-,8917	,7450
	HM600IDF	-,14667	,22208	1,000	-,9650	,6717
	HPWD	1,61333*	,22208	,000	,7950	2,4317
	HMPWD	1,18667*	,22208	,001	,3683	2,0050
	HM600PWD	-,30333	,22208	,985	-1,1217	,5150
	HMEI600PWD	-,01667	,22208	1,000	-,8350	,8017
HPWD	Control30%	-,19333	,22208	1,000	-1,0117	,6250
	Control20%	-,09000	,22208	1,000	-,9084	,7284
	Control10%	-,08333	,22208	1,000	-,9017	,7350
	HSDF	-,09667	,22208	1,000	-,9150	,7217
	HMSDF	-,22667	,22208	,999	-1,0450	,5917
	HM600SDF	-,29000	,22208	,990	-1,1084	,5284
	HMEI600SDF	-,43000	,22208	,817	-1,2484	,3884
	HIDF	-2,62667*	,22208	,000	-3,4450	-1,8083
	HMIDF	-1,68667*	,22208	,000	-2,5050	-,8683
	HM600IDF	-1,76000*	,22208	,000	-2,5784	-,9416
	HMEI600IDF	-1,61333*	,22208	,000	-2,4317	-,7950
	HMPWD	-,42667	,22208	,825	-1,2450	,3917
	HM600PWD	-1,91667*	,22208	,000	-2,7350	-1,0983
	HMEI600PWD	-1,63000*	,22208	,000	-2,4484	-,8116
HMPWD	Control30%	,23333	,22208	,999	-,5850	1,0517
	Control20%	,33667	,22208	,964	-,4817	1,1550
	Control10%	,34333	,22208	,958	-,4750	1,1617
	HSDF	,33000	,22208	,969	-,4884	1,1484
	HMSDF	,20000	,22208	1,000	-,6184	1,0184
	HM600SDF	,13667	,22208	1,000	-,6817	,9550
	HMEI600SDF	-,00333	,22208	1,000	-,8217	,8150
	HIDF	-2,20000*	,22208	,000	-3,0184	-1,3816

	HMIDF	-1,26000*	,22208	,000	-2,0784	-,4416
	HM600IDF	-1,33333*	,22208	,000	-2,1517	-,5150
	HMEI600IDF	-1,18667*	,22208	,001	-2,0050	-,3683
	HPWD	,42667	,22208	,825	-,3917	1,2450
	HM600PWD	-1,49000*	,22208	,000	-2,3084	-,6716
	HMEI600PWD	-1,20333*	,22208	,001	-2,0217	-,3850
HM600PWD	Control30%	1,72333*	,22208	,000	,9050	2,5417
	Control20%	1,82667*	,22208	,000	1,0083	2,6450
	Control10%	1,83333*	,22208	,000	1,0150	2,6517
	HSDF	1,82000*	,22208	,000	1,0016	2,6384
	HMSDF	1,69000*	,22208	,000	,8716	2,5084
	HM600SDF	1,62667*	,22208	,000	,8083	2,4450
	HMEI600SDF	1,48667*	,22208	,000	,6683	2,3050
	HIDF	-,71000	,22208	,144	-1,5284	,1084
	HMIDF	,23000	,22208	,999	-,5884	1,0484
	HM600IDF	,15667	,22208	1,000	-,6617	,9750
	HMEI600IDF	,30333	,22208	,985	-,5150	1,1217
	HPWD	1,91667*	,22208	,000	1,0983	2,7350
	HMPWD	1,49000*	,22208	,000	,6716	2,3084
	HMEI600PWD	,28667	,22208	,991	-,5317	1,1050
HMEI600PWD	Control30%	1,43667*	,22208	,000	,6183	2,2550
	Control20%	1,54000*	,22208	,000	,7216	2,3584
	Control10%	1,54667*	,22208	,000	,7283	2,3650
	HSDF	1,53333*	,22208	,000	,7150	2,3517
	HMSDF	1,40333*	,22208	,000	,5850	2,2217
	HM600SDF	1,34000*	,22208	,000	,5216	2,1584
	HMEI600SDF	1,20000*	,22208	,001	,3816	2,0184
	HIDF	-,99667*	,22208	,007	-1,8150	-,1783
	HMIDF	-,05667	,22208	1,000	-,8750	,7617
	HM600IDF	-,13000	,22208	1,000	-,9484	,6884
	HMEI600IDF	,01667	,22208	1,000	-,8017	,8350
	HPWD	1,63000*	,22208	,000	,8116	2,4484
	HMPWD	1,20333*	,22208	,001	,3850	2,0217
	HM600PWD	-,28667	,22208	,991	-1,1050	,5317

*. The mean difference is significant at the 0.05 level.

moisture

Tukey HSD[a]

sample	N	Subset for alpha = 0.05		
		1	2	3
HPWD	3	7,1800		
Control10%	3	7,2633		
Control20%	3	7,2700		
HSDF	3	7,2767		
Control30%	3	7,3733		
HMSDF	3	7,4067		
HM600SDF	3	7,4700		
HMPWD	3	7,6067		
HMEI600SDF	3	7,6100		
HMEI600IDF	3		8,7933	
HMEI600PWD	3		8,8100	
HMIDF	3		8,8667	
HM600IDF	3		8,9400	
HM600PWD	3		9,0967	9,0967
HIDF	3			9,8067
Sig.		,817	,985	,144

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

N. Variance Analysis Outputs of Color (L*)

Descriptives

L

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	63,2167	,90357	,52167	60,9721	65,4613	62,69	64,26
Control20%	3	64,1533	,46479	,26835	62,9987	65,3079	63,88	64,69
Control10%	3	64,5800	,77942	,45000	62,6438	66,5162	64,13	65,48
HSDF	3	63,1167	2,01649	1,16422	58,1074	68,1259	61,20	65,22
HMSDF	3	58,8767	,70685	,40810	57,1208	60,6326	58,35	59,68
HM600SDF	3	59,9933	,68705	,39667	58,2866	61,7001	59,20	60,39
HMEI600SDF	3	62,0933	,48789	,28168	60,8814	63,3053	61,53	62,38
HIDF	3	63,5000	1,04790	,60501	60,8969	66,1031	62,29	64,11
HMIDF	3	60,2967	1,06810	,61667	57,6434	62,9500	59,68	61,53
HM600IDF	3	59,2367	,76788	,44333	57,3292	61,1442	58,35	59,68
HMEI600IDF	3	58,5167	,13577	,07839	58,1794	58,8539	58,36	58,60
HPWD	3	46,6667	,60863	,35139	45,1547	48,1786	46,10	47,31
HMPWD	3	60,4133	,55627	,32116	59,0315	61,7952	59,88	60,99
HM600PWD	3	59,5533	,90666	,52346	57,3011	61,8056	58,59	60,39
HMEI600PWD	3	59,7067	,60053	,34671	58,2149	61,1985	59,35	60,40
Total	45	60,2613	4,24274	,63247	58,9867	61,5360	46,10	65,48

ANOVA

L

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	768,785	14	54,913	70,853	,000
Within Groups	23,251	30	,775		
Total	792,036	44			

Multiple Comparisons

Dependent Variable: L
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	-,93667	,71881	,990	-3,5855	1,7121
	Control10%	-1,36333	,71881	,837	-4,0121	1,2855
	HSDF	,10000	,71881	1,000	-2,5488	2,7488
	HMSDF	4,34000*	,71881	,000	1,6912	6,9888
	HM600SDF	3,22333*	,71881	,007	,5745	5,8721
	HMEI600SDF	1,12333	,71881	,954	-1,5255	3,7721
	HIDF	-,28333	,71881	1,000	-2,9321	2,3655
	HMIDF	2,92000*	,71881	,020	,2712	5,5688
	HM600IDF	3,98000*	,71881	,000	1,3312	6,6288
	HMEI600IDF	4,70000*	,71881	,000	2,0512	7,3488
	HPWD	16,55000*	,71881	,000	13,9012	19,1988
	HMPWD	2,80333*	,71881	,030	,1545	5,4521
	HM600PWD	3,66333*	,71881	,001	1,0145	6,3121
	HMEI600PWD	3,51000*	,71881	,002	,8612	6,1588
Control20%	Control30%	,93667	,71881	,990	-1,7121	3,5855
	Control10%	-,42667	,71881	1,000	-3,0755	2,2221
	HSDF	1,03667	,71881	,976	-1,6121	3,6855
	HMSDF	5,27667*	,71881	,000	2,6279	7,9255
	HM600SDF	4,16000*	,71881	,000	1,5112	6,8088
	HMEI600SDF	2,06000	,71881	,267	-,5888	4,7088
	HIDF	,65333	,71881	1,000	-1,9955	3,3021
	HMIDF	3,85667*	,71881	,001	1,2079	6,5055
	HM600IDF	4,91667*	,71881	,000	2,2679	7,5655
	HMEI600IDF	5,63667*	,71881	,000	2,9879	8,2855
	HPWD	17,48667*	,71881	,000	14,8379	20,1355
	HMPWD	3,74000*	,71881	,001	1,0912	6,3888
	HM600PWD	4,60000*	,71881	,000	1,9512	7,2488
	HMEI600PWD	4,44667*	,71881	,000	1,7979	7,0955
Control10%	Control30%	1,36333	,71881	,837	-1,2855	4,0121
	Control20%	,42667	,71881	1,000	-2,2221	3,0755
	HSDF	1,46333	,71881	,763	-1,1855	4,1121
	HMSDF	5,70333*	,71881	,000	3,0545	8,3521
	HM600SDF	4,58667*	,71881	,000	1,9379	7,2355
	HMEI600SDF	2,48667	,71881	,083	-,1621	5,1355
	HIDF	1,08000	,71881	,966	-1,5688	3,7288
	HMIDF	4,28333*	,71881	,000	1,6345	6,9321
	HM600IDF	5,34333*	,71881	,000	2,6945	7,9921
	HMEI600IDF	6,06333*	,71881	,000	3,4145	8,7121
	HPWD	17,91333*	,71881	,000	15,2645	20,5621
	HMPWD	4,16667*	,71881	,000	1,5179	6,8155
	HM600PWD	5,02667*	,71881	,000	2,3779	7,6755
	HMEI600PWD	4,87333*	,71881	,000	2,2245	7,5221
HSDF	Control30%	-,10000	,71881	1,000	-2,7488	2,5488
	Control20%	-1,03667	,71881	,976	-3,6855	1,6121
	Control10%	-1,46333	,71881	,763	-4,1121	1,1855
	HMSDF	4,24000*	,71881	,000	1,5912	6,8888
	HM600SDF	3,12333*	,71881	,010	,4745	5,7721
	HMEI600SDF	1,02333	,71881	,978	-1,6255	3,6721
	HIDF	-,38333	,71881	1,000	-3,0321	2,2655
	HMIDF	2,82000*	,71881	,028	,1712	5,4688
	HM600IDF	3,88000*	,71881	,001	1,2312	6,5288
	HMEI600IDF	4,60000*	,71881	,000	1,9512	7,2488
	HPWD	16,45000*	,71881	,000	13,8012	19,0988
	HMPWD	2,70333*	,71881	,042	,0545	5,3521

	HM600PWD	3,56333*	,71881	,002	,9145	6,2121
	HMEI600PWD	3,41000*	,71881	,004	,7612	6,0588
HMSDF	Control30%	-4,34000*	,71881	,000	-6,9888	-1,6912
	Control20%	-5,27667*	,71881	,000	-7,9255	-2,6279
	Control10%	-5,70333*	,71881	,000	-8,3521	-3,0545
	HSDF	-4,24000*	,71881	,000	-6,8888	-1,5912
	HM600SDF	-1,11667	,71881	,956	-3,7655	1,5321
	HMEI600SDF	-3,21667*	,71881	,007	-5,8655	-,5679
	HIDF	-4,62333*	,71881	,000	-7,2721	-1,9745
	HMIDF	-1,42000	,71881	,797	-4,0688	1,2288
	HM600IDF	-,36000	,71881	1,000	-3,0088	2,2888
	HMEI600IDF	,36000	,71881	1,000	-2,2888	3,0088
	HPWD	12,21000*	,71881	,000	9,5612	14,8588
	HMPWD	-1,53667	,71881	,702	-4,1855	1,1121
	HM600PWD	-,67667	,71881	1,000	-3,3255	1,9721
	HMEI600PWD	-,83000	,71881	,997	-3,4788	1,8188
HM600SDF	Control30%	-3,22333*	,71881	,007	-5,8721	-,5745
	Control20%	-4,16000*	,71881	,000	-6,8088	-1,5112
	Control10%	-4,58667*	,71881	,000	-7,2355	-1,9379
	HSDF	-3,12333*	,71881	,010	-5,7721	-,4745
	HMSDF	1,11667	,71881	,956	-1,5321	3,7655
	HMEI600SDF	-2,10000	,71881	,243	-4,7488	,5488
	HIDF	-3,50667*	,71881	,002	-6,1555	-,8579
	HMIDF	-,30333	,71881	1,000	-2,9521	2,3455
	HM600IDF	,75667	,71881	,999	-1,8921	3,4055
	HMEI600IDF	1,47667	,71881	,752	-1,1721	4,1255
	HPWD	13,32667*	,71881	,000	10,6779	15,9755
	HMPWD	-,42000	,71881	1,000	-3,0688	2,2288
	HM600PWD	,44000	,71881	1,000	-2,2088	3,0888
	HMEI600PWD	,28667	,71881	1,000	-2,3621	2,9355
HMEI600SDF	Control30%	-1,12333	,71881	,954	-3,7721	1,5255
	Control20%	-2,06000	,71881	,267	-4,7088	,5888
	Control10%	-2,48667	,71881	,083	-5,1355	,1621
	HSDF	-1,02333	,71881	,978	-3,6721	1,6255
	HMSDF	3,21667*	,71881	,007	,5679	5,8655
	HM600SDF	2,10000	,71881	,243	-,5488	4,7488
	HIDF	-1,40667	,71881	,806	-4,0555	1,2421
	HMIDF	1,79667	,71881	,469	-,8521	4,4455
	HM600IDF	2,85667*	,71881	,025	,2079	5,5055
	HMEI600IDF	3,57667*	,71881	,002	,9279	6,2255
	HPWD	15,42667*	,71881	,000	12,7779	18,0755
	HMPWD	1,68000	,71881	,574	-,9688	4,3288
	HM600PWD	2,54000	,71881	,070	-,1088	5,1888
	HMEI600PWD	2,38667	,71881	,112	-,2621	5,0355
HIDF	Control30%	,28333	,71881	1,000	-2,3655	2,9321
	Control20%	-,65333	,71881	1,000	-3,3021	1,9955
	Control10%	-1,08000	,71881	,966	-3,7288	1,5688
	HSDF	,38333	,71881	1,000	-2,2655	3,0321
	HMSDF	4,62333*	,71881	,000	1,9745	7,2721
	HM600SDF	3,50667*	,71881	,002	,8579	6,1555
	HMEI600SDF	1,40667	,71881	,806	-1,2421	4,0555
	HMIDF	3,20333*	,71881	,007	,5545	5,8521
	HM600IDF	4,26333*	,71881	,000	1,6145	6,9121
	HMEI600IDF	4,98333*	,71881	,000	2,3345	7,6321
	HPWD	16,83333*	,71881	,000	14,1845	19,4821
	HMPWD	3,08667*	,71881	,011	,4379	5,7355
	HM600PWD	3,94667*	,71881	,000	1,2979	6,5955
	HMEI600PWD	3,79333*	,71881	,001	1,1445	6,4421
HMIDF	Control30%	-2,92000*	,71881	,020	-5,5688	-,2712
	Control20%	-3,85667*	,71881	,001	-6,5055	-1,2079
	Control10%	-4,28333*	,71881	,000	-6,9321	-1,6345

	HSDF	-2,82000*	,71881	,028	-5,4688	-,1712
	HMSDF	1,42000	,71881	,797	-1,2288	4,0688
	HM600SDF	,30333	,71881	1,000	-2,3455	2,9521
	HMEI600SDF	-1,79667	,71881	,469	-4,4455	,8521
	HIDF	-3,20333*	,71881	,007	-5,8521	-,5545
	HM600IDF	1,06000	,71881	,971	-1,5888	3,7088
	HMEI600IDF	1,78000	,71881	,484	-,8688	4,4288
	HPWD	13,63000*	,71881	,000	10,9812	16,2788
	HMPWD	-,11667	,71881	1,000	-2,7655	2,5321
	HM600PWD	,74333	,71881	,999	-1,9055	3,3921
	HMEI600PWD	,59000	,71881	1,000	-2,0588	3,2388
HM600IDF	Control30%	-3,98000*	,71881	,000	-6,6288	-1,3312
	Control20%	-4,91667*	,71881	,000	-7,5655	-2,2679
	Control10%	-5,34333*	,71881	,000	-7,9921	-2,6945
	HSDF	-3,88000*	,71881	,001	-6,5288	-1,2312
	HMSDF	,36000	,71881	1,000	-2,2888	3,0088
	HM600SDF	-,75667	,71881	,999	-3,4055	1,8921
	HMEI600SDF	-2,85667*	,71881	,025	-5,5055	-,2079
	HIDF	-4,26333*	,71881	,000	-6,9121	-1,6145
	HMIDF	-1,06000	,71881	,971	-3,7088	1,5888
	HMEI600IDF	,72000	,71881	,999	-1,9288	3,3688
	HPWD	12,57000*	,71881	,000	9,9212	15,2188
	HMPWD	-1,17667	,71881	,936	-3,8255	1,4721
	HM600PWD	-,31667	,71881	1,000	-2,9655	2,3321
	HMEI600PWD	-,47000	,71881	1,000	-3,1188	2,1788
HMEI600IDF	Control30%	-4,70000*	,71881	,000	-7,3488	-2,0512
	Control20%	-5,63667*	,71881	,000	-8,2855	-2,9879
	Control10%	-6,06333*	,71881	,000	-8,7121	-3,4145
	HSDF	-4,60000*	,71881	,000	-7,2488	-1,9512
	HMSDF	-,36000	,71881	1,000	-3,0088	2,2888
	HM600SDF	-1,47667	,71881	,752	-4,1255	1,1721
	HMEI600SDF	-3,57667*	,71881	,002	-6,2255	-,9279
	HIDF	-4,98333*	,71881	,000	-7,6321	-2,3345
	HMIDF	-1,78000	,71881	,484	-4,4288	,8688
	HM600IDF	-,72000	,71881	,999	-3,3688	1,9288
	HPWD	11,85000*	,71881	,000	9,2012	14,4988
	HMPWD	-1,89667	,71881	,385	-4,5455	,7521
	HM600PWD	-1,03667	,71881	,976	-3,6855	1,6121
	HMEI600PWD	-1,19000	,71881	,931	-3,8388	1,4588
HPWD	Control30%	-16,55000*	,71881	,000	-19,1988	-13,9012
	Control20%	-17,48667*	,71881	,000	-20,1355	-14,8379
	Control10%	-17,91333*	,71881	,000	-20,5621	-15,2645
	HSDF	-16,45000*	,71881	,000	-19,0988	-13,8012
	HMSDF	-12,21000*	,71881	,000	-14,8588	-9,5612
	HM600SDF	-13,32667*	,71881	,000	-15,9755	-10,6779
	HMEI600SDF	-15,42667*	,71881	,000	-18,0755	-12,7779
	HIDF	-16,83333*	,71881	,000	-19,4821	-14,1845
	HMIDF	-13,63000*	,71881	,000	-16,2788	-10,9812
	HM600IDF	-12,57000*	,71881	,000	-15,2188	-9,9212
	HMEI600IDF	-11,85000*	,71881	,000	-14,4988	-9,2012
	HMPWD	-13,74667*	,71881	,000	-16,3955	-11,0979
	HM600PWD	-12,88667*	,71881	,000	-15,5355	-10,2379
	HMEI600PWD	-13,04000*	,71881	,000	-15,6888	-10,3912
HMPWD	Control30%	-2,80333*	,71881	,030	-5,4521	-,1545
	Control20%	-3,74000*	,71881	,001	-6,3888	-1,0912
	Control10%	-4,16667*	,71881	,000	-6,8155	-1,5179
	HSDF	-2,70333*	,71881	,042	-5,3521	-,0545
	HMSDF	1,53667	,71881	,702	-1,1121	4,1855
	HM600SDF	,42000	,71881	1,000	-2,2288	3,0688
	HMEI600SDF	-1,68000	,71881	,574	-4,3288	,9688
	HIDF	-3,08667*	,71881	,011	-5,7355	-,4379

	HMIDF	,11667	,71881	1,000	-2,5321	2,7655
	HM600IDF	1,17667	,71881	,936	-1,4721	3,8255
	HMEI600IDF	1,89667	,71881	,385	-,7521	4,5455
	HPWD	13,74667*	,71881	,000	11,0979	16,3955
	HM600PWD	,86000	,71881	,995	-1,7888	3,5088
	HMEI600PWD	,70667	,71881	,999	-1,9421	3,3555
HM600PWD	Control30%	-3,66333*	,71881	,001	-6,3121	-1,0145
	Control20%	-4,60000*	,71881	,000	-7,2488	-1,9512
	Control10%	-5,02667*	,71881	,000	-7,6755	-2,3779
	HSDF	-3,56333*	,71881	,002	-6,2121	-,9145
	HMSDF	,67667	,71881	1,000	-1,9721	3,3255
	HM600SDF	-,44000	,71881	1,000	-3,0888	2,2088
	HMEI600SDF	-2,54000	,71881	,070	-5,1888	,1088
	HIDF	-3,94667*	,71881	,000	-6,5955	-1,2979
	HMIDF	-,74333	,71881	,999	-3,3921	1,9055
	HM600IDF	,31667	,71881	1,000	-2,3321	2,9655
	HMEI600IDF	1,03667	,71881	,976	-1,6121	3,6855
	HPWD	12,88667*	,71881	,000	10,2379	15,5355
	HMPWD	-,86000	,71881	,995	-3,5088	1,7888
	HMEI600PWD	-,15333	,71881	1,000	-2,8021	2,4955
HMEI600PWD	Control30%	-3,51000*	,71881	,002	-6,1588	-,8612
	Control20%	-4,44667*	,71881	,000	-7,0955	-1,7979
	Control10%	-4,87333*	,71881	,000	-7,5221	-2,2245
	HSDF	-3,41000*	,71881	,004	-6,0588	-,7612
	HMSDF	,83000	,71881	,997	-1,8188	3,4788
	HM600SDF	-,28667	,71881	1,000	-2,9355	2,3621
	HMEI600SDF	-2,38667	,71881	,112	-5,0355	,2621
	HIDF	-3,79333*	,71881	,001	-6,4421	-1,1445
	HMIDF	-,59000	,71881	1,000	-3,2388	2,0588
	HM600IDF	,47000	,71881	1,000	-2,1788	3,1188
	HMEI600IDF	1,19000	,71881	,931	-1,4588	3,8388
	HPWD	13,04000*	,71881	,000	10,3912	15,6888
	HMPWD	-,70667	,71881	,999	-3,3555	1,9421
	HM600PWD	,15333	,71881	1,000	-2,4955	2,8021

*. The mean difference is significant at the 0.05 level.

L

Tukey HSD[a]

sample	N	Subset for alpha = 0.05			
		1	2	3	4
HPWD	3	46,6667			
HMEI600IDF	3		58,5167		
HMSDF	3		58,8767		
HM600IDF	3		59,2367		
HM600PWD	3		59,5533	59,5533	
HMEI600PWD	3		59,7067	59,7067	
HM600SDF	3		59,9933	59,9933	
HMIDF	3		60,2967	60,2967	
HMPWD	3		60,4133	60,4133	
HMEI600SDF	3			62,0933	62,0933
HSDF	3				63,1167
Control30%	3				63,2167
HIDF	3				63,5000
Control20%	3				64,1533
Control10%	3				64,5800
Sig.		1,000	,385	,070	,083

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

P. Variance Analysis Outputs of Color (a*)

Descriptives

a

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	12,1000	,57158	,33000	10,6801	13,5199	11,44	12,43
Control20%	3	11,3233	,08386	,04842	11,1150	11,5317	11,27	11,42
Control10%	3	10,6600	,13856	,08000	10,3158	11,0042	10,50	10,74
HSDF	3	9,3367	,88030	,50824	7,1499	11,5235	8,47	10,23
HMSDF	3	9,7833	,56871	,32835	8,3706	11,1961	9,45	10,44
HM600SDF	3	11,3633	,15308	,08838	10,9831	11,7436	11,27	11,54
HMEI600SDF	3	10,6100	,14731	,08505	10,2441	10,9759	10,44	10,70
HIDF	3	7,3267	,47899	,27655	6,1368	8,5165	6,91	7,85
HMIDF	3	10,8900	,33779	,19502	10,0509	11,7291	10,69	11,28
HM600IDF	3	9,6633	,36088	,20835	8,7669	10,5598	9,45	10,08
HMEI600IDF	3	9,3033	,07572	,04372	9,1152	9,4914	9,25	9,39
HPWD	3	4,8400	,79618	,45967	2,8622	6,8178	4,07	5,66
HMPWD	3	10,3267	,09815	,05667	10,0828	10,5705	10,27	10,44
HM600PWD	3	10,4667	,21127	,12197	9,9419	10,9915	10,27	10,69
HMEI600PWD	3	10,1467	,21362	,12333	9,6160	10,6773	9,90	10,27
Total	45	9,8760	1,77865	,26515	9,3416	10,4104	4,07	12,43

ANOVA

a

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	133,779	14	9,556	52,896	,000
Within Groups	5,419	30	,181		
Total	139,198	44			

Multiple Comparisons

Dependent Variable: a
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Control30%	Control20%	,77667	,34703	,638	-,5022	2,0555
	Control10%	1,44000*	,34703	,016	,1612	2,7188
	HSDF	2,76333*	,34703	,000	1,4845	4,0422
	HMSDF	2,31667*	,34703	,000	1,0378	3,5955
	HM600SDF	,73667	,34703	,711	-,5422	2,0155
	HMEI600SDF	1,49000*	,34703	,011	,2112	2,7688
	HIDF	4,77333*	,34703	,000	3,4945	6,0522
	HMIDF	1,21000	,34703	,078	-,0688	2,4888
	HM600IDF	2,43667*	,34703	,000	1,1578	3,7155
	HMEI600IDF	2,79667*	,34703	,000	1,5178	4,0755
	HPWD	7,26000*	,34703	,000	5,9812	8,5388
	HMPWD	1,77333*	,34703	,001	,4945	3,0522
	HM600PWD	1,63333*	,34703	,004	,3545	2,9122
	HMEI600PWD	1,95333*	,34703	,000	,6745	3,2322
Control20%	Control30%	-,77667	,34703	,638	-2,0555	,5022
	Control10%	,66333	,34703	,830	-,6155	1,9422
	HSDF	1,98667*	,34703	,000	,7078	3,2655
	HMSDF	1,54000*	,34703	,008	,2612	2,8188
	HM600SDF	-,04000	,34703	1,000	-1,3188	1,2388
	HMEI600SDF	,71333	,34703	,752	-,5655	1,9922
	HIDF	3,99667*	,34703	,000	2,7178	5,2755
	HMIDF	,43333	,34703	,993	-,8455	1,7122
	HM600IDF	1,66000*	,34703	,003	,3812	2,9388
	HMEI600IDF	2,02000*	,34703	,000	,7412	3,2988
	HPWD	6,48333*	,34703	,000	5,2045	7,7622
	HMPWD	,99667	,34703	,265	-,2822	2,2755
	HM600PWD	,85667	,34703	,489	-,4222	2,1355
	HMEI600PWD	1,17667	,34703	,096	-,1022	2,4555
Control10%	Control30%	-1,44000*	,34703	,016	-2,7188	-,1612
	Control20%	-,66333	,34703	,830	-1,9422	,6155
	HSDF	1,32333*	,34703	,037	,0445	2,6022
	HMSDF	,87667	,34703	,453	-,4022	2,1555
	HM600SDF	-,70333	,34703	,768	-1,9822	,5755
	HMEI600SDF	,05000	,34703	1,000	-1,2288	1,3288
	HIDF	3,33333*	,34703	,000	2,0545	4,6122
	HMIDF	-,23000	,34703	1,000	-1,5088	1,0488
	HM600IDF	,99667	,34703	,265	-,2822	2,2755
	HMEI600IDF	1,35667*	,34703	,029	,0778	2,6355
	HPWD	5,82000*	,34703	,000	4,5412	7,0988
	HMPWD	,33333	,34703	1,000	-,9455	1,6122
	HM600PWD	,19333	,34703	1,000	-1,0855	1,4722
	HMEI600PWD	,51333	,34703	,970	-,7655	1,7922
HSDF	Control30%	-2,76333*	,34703	,000	-4,0422	-1,4845
	Control20%	-1,98667*	,34703	,000	-3,2655	-,7078
	Control10%	-1,32333*	,34703	,037	-2,6022	-,0445
	HMSDF	-,44667	,34703	,991	-1,7255	,8322
	HM600SDF	-2,02667*	,34703	,000	-3,3055	-,7478
	HMEI600SDF	-1,27333	,34703	,052	-2,5522	,0055
	HIDF	2,01000*	,34703	,000	,7312	3,2888
	HMIDF	-1,55333*	,34703	,007	-2,8322	-,2745
	HM600IDF	-,32667	,34703	1,000	-1,6055	,9522
	HMEI600IDF	,03333	,34703	1,000	-1,2455	1,3122
	HPWD	4,49667*	,34703	,000	3,2178	5,7755
	HMPWD	-,99000	,34703	,273	-2,2688	,2888

	HM600PWD	-1,13000	,34703	,128	-2,4088	,1488
	HMEI600PWD	-,81000	,34703	,576	-2,0888	,4688
HMSDF	Control30%	-2,31667*	,34703	,000	-3,5955	-1,0378
	Control20%	-1,54000*	,34703	,008	-2,8188	-,2612
	Control10%	-,87667	,34703	,453	-2,1555	,4022
	HSDF	,44667	,34703	,991	-,8322	1,7255
	HM600SDF	-1,58000*	,34703	,006	-2,8588	-,3012
	HMEI600SDF	-,82667	,34703	,544	-2,1055	,4522
	HIDF	2,45667*	,34703	,000	1,1778	3,7355
	HMIDF	-1,10667	,34703	,146	-2,3855	,1722
	HM600IDF	,12000	,34703	1,000	-1,1588	1,3988
	HMEI600IDF	,48000	,34703	,983	-,7988	1,7588
	HPWD	4,94333*	,34703	,000	3,6645	6,2222
	HMPWD	-,54333	,34703	,954	-1,8222	,7355
	HM600PWD	-,68333	,34703	,800	-1,9622	,5955
	HMEI600PWD	-,36333	,34703	,999	-1,6422	,9155
HM600SDF	Control30%	-,73667	,34703	,711	-2,0155	,5422
	Control20%	,04000	,34703	1,000	-1,2388	1,3188
	Control10%	,70333	,34703	,768	-,5755	1,9822
	HSDF	2,02667*	,34703	,000	,7478	3,3055
	HMSDF	1,58000*	,34703	,006	,3012	2,8588
	HMEI600SDF	,75333	,34703	,681	-,5255	2,0322
	HIDF	4,03667*	,34703	,000	2,7578	5,3155
	HMIDF	,47333	,34703	,985	-,8055	1,7522
	HM600IDF	1,70000*	,34703	,002	,4212	2,9788
	HMEI600IDF	2,06000*	,34703	,000	,7812	3,3388
	HPWD	6,52333*	,34703	,000	5,2445	7,8022
	HMPWD	1,03667	,34703	,215	-,2422	2,3155
	HM600PWD	,89667	,34703	,418	-,3822	2,1755
	HMEI600PWD	1,21667	,34703	,075	-,0622	2,4955
HMEI600SDF	Control30%	-1,49000*	,34703	,011	-2,7688	-,2112
	Control20%	-,71333	,34703	,752	-1,9922	,5655
	Control10%	-,05000	,34703	1,000	-1,3288	1,2288
	HSDF	1,27333	,34703	,052	-,0055	2,5522
	HMSDF	,82667	,34703	,544	-,4522	2,1055
	HM600SDF	-,75333	,34703	,681	-2,0322	,5255
	HIDF	3,28333*	,34703	,000	2,0045	4,5622
	HMIDF	-,28000	,34703	1,000	-1,5588	,9988
	HM600IDF	,94667	,34703	,336	-,3322	2,2255
	HMEI600IDF	1,30667*	,34703	,041	,0278	2,5855
	HPWD	5,77000*	,34703	,000	4,4912	7,0488
	HMPWD	,28333	,34703	1,000	-,9955	1,5622
	HM600PWD	,14333	,34703	1,000	-1,1355	1,4222
	HMEI600PWD	,46333	,34703	,987	-,8155	1,7422
HIDF	Control30%	-4,77333*	,34703	,000	-6,0522	-3,4945
	Control20%	-3,99667*	,34703	,000	-5,2755	-2,7178
	Control10%	-3,33333*	,34703	,000	-4,6122	-2,0545
	HSDF	-2,01000*	,34703	,000	-3,2888	-,7312
	HMSDF	-2,45667*	,34703	,000	-3,7355	-1,1778
	HM600SDF	-4,03667*	,34703	,000	-5,3155	-2,7578
	HMEI600SDF	-3,28333*	,34703	,000	-4,5622	-2,0045
	HMIDF	-3,56333*	,34703	,000	-4,8422	-2,2845
	HM600IDF	-2,33667*	,34703	,000	-3,6155	-1,0578
	HMEI600IDF	-1,97667*	,34703	,000	-3,2555	-,6978
	HPWD	2,48667*	,34703	,000	1,2078	3,7655
	HMPWD	-3,00000*	,34703	,000	-4,2788	-1,7212
	HM600PWD	-3,14000*	,34703	,000	-4,4188	-1,8612
	HMEI600PWD	-2,82000*	,34703	,000	-4,0988	-1,5412
HMIDF	Control30%	-1,21000	,34703	,078	-2,4888	,0688
	Control20%	-,43333	,34703	,993	-1,7122	,8455
	Control10%	,23000	,34703	1,000	-1,0488	1,5088

	HSDF	1,55333*	,34703	,007	,2745	2,8322
	HMSDF	1,10667	,34703	,146	-,1722	2,3855
	HM600SDF	-,47333	,34703	,985	-1,7522	,8055
	HMEI600SDF	,28000	,34703	1,000	-,9988	1,5588
	HIDF	3,56333*	,34703	,000	2,2845	4,8422
	HM600IDF	1,22667	,34703	,070	-,0522	2,5055
	HMEI600IDF	1,58667*	,34703	,006	,3078	2,8655
	HPWD	6,05000*	,34703	,000	4,7712	7,3288
	HMPWD	,56333	,34703	,940	-,7155	1,8422
	HM600PWD	,42333	,34703	,994	-,8555	1,7022
	HMEI600PWD	,74333	,34703	,699	-,5355	2,0222
HM600IDF	Control30%	-2,43667*	,34703	,000	-3,7155	-1,1578
	Control20%	-1,66000*	,34703	,003	-2,9388	-,3812
	Control10%	-,99667	,34703	,265	-2,2755	,2822
	HSDF	,32667	,34703	1,000	-,9522	1,6055
	HMSDF	-,12000	,34703	1,000	-1,3988	1,1588
	HM600SDF	-1,70000*	,34703	,002	-2,9788	-,4212
	HMEI600SDF	-,94667	,34703	,336	-2,2255	,3322
	HIDF	2,33667*	,34703	,000	1,0578	3,6155
	HMIDF	-1,22667	,34703	,070	-2,5055	,0522
	HMEI600IDF	,36000	,34703	,999	-,9188	1,6388
	HPWD	4,82333*	,34703	,000	3,5445	6,1022
	HMPWD	-,66333	,34703	,830	-1,9422	,6155
	HM600PWD	-,80333	,34703	,588	-2,0822	,4755
	HMEI600PWD	-,48333	,34703	,982	-1,7622	,7955
HMEI600IDF	Control30%	-2,79667*	,34703	,000	-4,0755	-1,5178
	Control20%	-2,02000*	,34703	,000	-3,2988	-,7412
	Control10%	-1,35667*	,34703	,029	-2,6355	-,0778
	HSDF	-,03333	,34703	1,000	-1,3122	1,2455
	HMSDF	-,48000	,34703	,983	-1,7588	,7988
	HM600SDF	-2,06000*	,34703	,000	-3,3388	-,7812
	HMEI600SDF	-1,30667*	,34703	,041	-2,5855	-,0278
	HIDF	1,97667*	,34703	,000	,6978	3,2555
	HMIDF	-1,58667*	,34703	,006	-2,8655	-,3078
	HM600IDF	-,36000	,34703	,999	-1,6388	,9188
	HPWD	4,46333*	,34703	,000	3,1845	5,7422
	HMPWD	-1,02333	,34703	,231	-2,3022	,2555
	HM600PWD	-1,16333	,34703	,105	-2,4422	,1155
	HMEI600PWD	-,84333	,34703	,513	-2,1222	,4355
HPWD	Control30%	-7,26000*	,34703	,000	-8,5388	-5,9812
	Control20%	-6,48333*	,34703	,000	-7,7622	-5,2045
	Control10%	-5,82000*	,34703	,000	-7,0988	-4,5412
	HSDF	-4,49667*	,34703	,000	-5,7755	-3,2178
	HMSDF	-4,94333*	,34703	,000	-6,2222	-3,6645
	HM600SDF	-6,52333*	,34703	,000	-7,8022	-5,2445
	HMEI600SDF	-5,77000*	,34703	,000	-7,0488	-4,4912
	HIDF	-2,48667*	,34703	,000	-3,7655	-1,2078
	HMIDF	-6,05000*	,34703	,000	-7,3288	-4,7712
	HM600IDF	-4,82333*	,34703	,000	-6,1022	-3,5445
	HMEI600IDF	-4,46333*	,34703	,000	-5,7422	-3,1845
	HMPWD	-5,48667*	,34703	,000	-6,7655	-4,2078
	HM600PWD	-5,62667*	,34703	,000	-6,9055	-4,3478
	HMEI600PWD	-5,30667*	,34703	,000	-6,5855	-4,0278
HMPWD	Control30%	-1,77333*	,34703	,001	-3,0522	-,4945
	Control20%	-,99667	,34703	,265	-2,2755	,2822
	Control10%	-,33333	,34703	1,000	-1,6122	,9455
	HSDF	,99000	,34703	,273	-,2888	2,2688
	HMSDF	,54333	,34703	,954	-,7355	1,8222
	HM600SDF	-1,03667	,34703	,215	-2,3155	,2422
	HMEI600SDF	-,28333	,34703	1,000	-1,5622	,9955
	HIDF	3,00000*	,34703	,000	1,7212	4,2788

	HMIDF	-,56333	,34703	,940	-1,8422	,7155
	HM600IDF	,66333	,34703	,830	-,6155	1,9422
	HMEI600IDF	1,02333	,34703	,231	-,2555	2,3022
	HPWD	5,48667*	,34703	,000	4,2078	6,7655
	HM600PWD	-,14000	,34703	1,000	-1,4188	1,1388
	HMEI600PWD	,18000	,34703	1,000	-1,0988	1,4588
HM600PWD	Control30%	-1,63333*	,34703	,004	-2,9122	-,3545
	Control20%	-,85667	,34703	,489	-2,1355	,4222
	Control10%	-,19333	,34703	1,000	-1,4722	1,0855
	HSDF	1,13000	,34703	,128	-,1488	2,4088
	HMSDF	,68333	,34703	,800	-,5955	1,9622
	HM600SDF	-,89667	,34703	,418	-2,1755	,3822
	HMEI600SDF	-,14333	,34703	1,000	-1,4222	1,1355
	HIDF	3,14000*	,34703	,000	1,8612	4,4188
	HMIDF	-,42333	,34703	,994	-1,7022	,8555
	HM600IDF	,80333	,34703	,588	-,4755	2,0822
	HMEI600IDF	1,16333	,34703	,105	-,1155	2,4422
	HPWD	5,62667*	,34703	,000	4,3478	6,9055
	HMPWD	,14000	,34703	1,000	-1,1388	1,4188
	HMEI600PWD	,32000	,34703	1,000	-,9588	1,5988
HMEI600PWD	Control30%	-1,95333*	,34703	,000	-3,2322	-,6745
	Control20%	-1,17667	,34703	,096	-2,4555	,1022
	Control10%	-,51333	,34703	,970	-1,7922	,7655
	HSDF	,81000	,34703	,576	-,4688	2,0888
	HMSDF	,36333	,34703	,999	-,9155	1,6422
	HM600SDF	-1,21667	,34703	,075	-2,4955	,0622
	HMEI600SDF	-,46333	,34703	,987	-1,7422	,8155
	HIDF	2,82000*	,34703	,000	1,5412	4,0988
	HMIDF	-,74333	,34703	,699	-2,0222	,5355
	HM600IDF	,48333	,34703	,982	-,7955	1,7622
	HMEI600IDF	,84333	,34703	,513	-,4355	2,1222
	HPWD	5,30667*	,34703	,000	4,0278	6,5855
	HMPWD	-,18000	,34703	1,000	-1,4588	1,0988
	HM600PWD	-,32000	,34703	1,000	-1,5988	,9588

*. The mean difference is significant at the 0.05 level.

a

Tukey HSD[a]

sample	N	Subset for alpha = 0.05						
		1	2	3	4	5	6	7
HPWD	3	4,8400						
HIDF	3		7,3267					
HMEI600IDF	3			9,3033				
HSDF	3			9,3367	9,3367			
HM600IDF	3			9,6633	9,6633	9,6633		
HMSDF	3			9,7833	9,7833	9,7833		
HMEI600PWD	3			10,1467	10,1467	10,1467	10,1467	
HMPWD	3			10,3267	10,3267	10,3267	10,3267	
HM600PWD	3			10,4667	10,4667	10,4667	10,4667	
HMEI600SDF	3				10,6100	10,6100	10,6100	
Control10%	3					10,6600	10,6600	
HMIDF	3					10,8900	10,8900	10,8900
Control20%	3						11,3233	11,3233
HM600SDF	3						11,3633	11,3633
Control30%	3							12,1000
Sig.		1,000	1,000	,105	,052	,070	,075	,078

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

R. Variance Analysis Outputs of Color (b*)

Descriptives

b

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	34,4133	,82561	,47667	32,3624	36,4643	33,46	34,89
Control20%	3	32,6300	,50229	,29000	31,3822	33,8778	32,34	33,21
Control10%	3	32,2500	,06928	,04000	32,0779	32,4221	32,21	32,33
HSDF	3	29,1067	,81119	,46834	27,0916	31,1218	28,47	30,02
HMSDF	3	29,6033	,88455	,51070	27,4060	31,8007	29,01	30,62
HM600SDF	3	32,3700	,06083	,03512	32,2189	32,5211	32,30	32,41
HMEI600SDF	3	32,0300	1,00459	,58000	29,5345	34,5255	30,87	32,61
HIDF	3	30,5900	,78734	,45457	28,6341	32,5459	29,84	31,41
HMIDF	3	30,6100	,10149	,05859	30,3579	30,8621	30,52	30,72
HM600IDF	3	30,6367	,10116	,05840	30,3854	30,8880	30,52	30,70
HMEI600IDF	3	29,0667	,09815	,05667	28,8228	29,3105	29,01	29,18
HPWD	3	26,8267	1,03467	,59736	24,2564	29,3969	25,74	27,80
HMPWD	3	30,5767	,05132	,02963	30,4492	30,7041	30,52	30,62
HM600PWD	3	30,6100	,08544	,04933	30,3978	30,8222	30,52	30,69
HMEI600PWD	3	30,4933	,19399	,11200	30,0114	30,9752	30,27	30,62
Total	45	30,7876	1,83343	,27331	30,2367	31,3384	25,74	34,89

ANOVA

b

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	137,583	14	9,827	28,567	,000
Within Groups	10,321	30	,344		
Total	147,904	44			

Multiple Comparisons

Dependent Variable: b
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Control30%	Control20%	1,78333*	,47890	,046	,0186	3,5481
	Control10%	2,16333*	,47890	,006	,3986	3,9281
	HSDF	5,30667*	,47890	,000	3,5419	7,0714
	HMSDF	4,81000*	,47890	,000	3,0452	6,5748
	HM600SDF	2,04333*	,47890	,012	,2786	3,8081
	HMEI600SDF	2,38333*	,47890	,002	,6186	4,1481
	HIDF	3,82333*	,47890	,000	2,0586	5,5881
	HMIDF	3,80333*	,47890	,000	2,0386	5,5681
	HM600IDF	3,77667*	,47890	,000	2,0119	5,5414
	HMEI600IDF	5,34667*	,47890	,000	3,5819	7,1114
	HPWD	7,58667*	,47890	,000	5,8219	9,3514
	HMPWD	3,83667*	,47890	,000	2,0719	5,6014
	HM600PWD	3,80333*	,47890	,000	2,0386	5,5681
	HMEI600PWD	3,92000*	,47890	,000	2,1552	5,6848
Control20%	Control30%	-1,78333*	,47890	,046	-3,5481	-,0186
	Control10%	,38000	,47890	1,000	-1,3848	2,1448
	HSDF	3,52333*	,47890	,000	1,7586	5,2881
	HMSDF	3,02667*	,47890	,000	1,2619	4,7914
	HM600SDF	,26000	,47890	1,000	-1,5048	2,0248
	HMEI600SDF	,60000	,47890	,993	-1,1648	2,3648
	HIDF	2,04000*	,47890	,012	,2752	3,8048
	HMIDF	2,02000*	,47890	,014	,2552	3,7848
	HM600IDF	1,99333*	,47890	,016	,2286	3,7581
	HMEI600IDF	3,56333*	,47890	,000	1,7986	5,3281
	HPWD	5,80333*	,47890	,000	4,0386	7,5681
	HMPWD	2,05333*	,47890	,012	,2886	3,8181
	HM600PWD	2,02000*	,47890	,014	,2552	3,7848
	HMEI600PWD	2,13667*	,47890	,007	,3719	3,9014
Control10%	Control30%	-2,16333*	,47890	,006	-3,9281	-,3986
	Control20%	-,38000	,47890	1,000	-2,1448	1,3848
	HSDF	3,14333*	,47890	,000	1,3786	4,9081
	HMSDF	2,64667*	,47890	,000	,8819	4,4114
	HM600SDF	-,12000	,47890	1,000	-1,8848	1,6448
	HMEI600SDF	,22000	,47890	1,000	-1,5448	1,9848
	HIDF	1,66000	,47890	,082	-,1048	3,4248
	HMIDF	1,64000	,47890	,090	-,1248	3,4048
	HM600IDF	1,61333	,47890	,101	-,1514	3,3781
	HMEI600IDF	3,18333*	,47890	,000	1,4186	4,9481
	HPWD	5,42333*	,47890	,000	3,6586	7,1881
	HMPWD	1,67333	,47890	,077	-,0914	3,4381
	HM600PWD	1,64000	,47890	,090	-,1248	3,4048
	HMEI600PWD	1,75667	,47890	,052	-,0081	3,5214
HSDF	Control30%	-5,30667*	,47890	,000	-7,0714	-3,5419
	Control20%	-3,52333*	,47890	,000	-5,2881	-1,7586
	Control10%	-3,14333*	,47890	,000	-4,9081	-1,3786
	HMSDF	-,49667	,47890	,999	-2,2614	1,2681
	HM600SDF	-3,26333*	,47890	,000	-5,0281	-1,4986
	HMEI600SDF	-2,92333*	,47890	,000	-4,6881	-1,1586
	HIDF	-1,48333	,47890	,175	-3,2481	,2814
	HMIDF	-1,50333	,47890	,161	-3,2681	,2614
	HM600IDF	-1,53000	,47890	,145	-3,2948	,2348
	HMEI600IDF	,04000	,47890	1,000	-1,7248	1,8048
	HPWD	2,28000*	,47890	,003	,5152	4,0448
	HMPWD	-1,47000	,47890	,185	-3,2348	,2948

	HM600PWD	-1,50333	,47890	,161	-3,2681	,2614
	HMEI600PWD	-1,38667	,47890	,254	-3,1514	,3781
HMSDF	Control30%	-4,81000*	,47890	,000	-6,5748	-3,0452
	Control20%	-3,02667*	,47890	,000	-4,7914	-1,2619
	Control10%	-2,64667*	,47890	,000	-4,4114	-,8819
	HSDF	,49667	,47890	,999	-1,2681	2,2614
	HM600SDF	-2,76667*	,47890	,000	-4,5314	-1,0019
	HMEI600SDF	-2,42667*	,47890	,001	-4,1914	-,6619
	HIDF	-,98667	,47890	,749	-2,7514	,7781
	HMIDF	-1,00667	,47890	,724	-2,7714	,7581
	HM600IDF	-1,03333	,47890	,689	-2,7981	,7314
	HMEI600IDF	,53667	,47890	,998	-1,2281	2,3014
	HPWD	2,77667*	,47890	,000	1,0119	4,5414
	HMPWD	-,97333	,47890	,765	-2,7381	,7914
	HM600PWD	-1,00667	,47890	,724	-2,7714	,7581
	HMEI600PWD	-,89000	,47890	,855	-2,6548	,8748
HM600SDF	Control30%	-2,04333*	,47890	,012	-3,8081	-,2786
	Control20%	-,26000	,47890	1,000	-2,0248	1,5048
	Control10%	,12000	,47890	1,000	-1,6448	1,8848
	HSDF	3,26333*	,47890	,000	1,4986	5,0281
	HMSDF	2,76667*	,47890	,000	1,0019	4,5314
	HMEI600SDF	,34000	,47890	1,000	-1,4248	2,1048
	HIDF	1,78000*	,47890	,046	,0152	3,5448
	HMIDF	1,76000	,47890	,051	-,0048	3,5248
	HM600IDF	1,73333	,47890	,058	-,0314	3,4981
	HMEI600IDF	3,30333*	,47890	,000	1,5386	5,0681
	HPWD	5,54333*	,47890	,000	3,7786	7,3081
	HMPWD	1,79333*	,47890	,044	,0286	3,5581
	HM600PWD	1,76000	,47890	,051	-,0048	3,5248
	HMEI600PWD	1,87667*	,47890	,029	,1119	3,6414
HMEI600SDF	Control30%	-2,38333*	,47890	,002	-4,1481	-,6186
	Control20%	-,60000	,47890	,993	-2,3648	1,1648
	Control10%	-,22000	,47890	1,000	-1,9848	1,5448
	HSDF	2,92333*	,47890	,000	1,1586	4,6881
	HMSDF	2,42667*	,47890	,001	,6619	4,1914
	HM600SDF	-,34000	,47890	1,000	-2,1048	1,4248
	HIDF	1,44000	,47890	,208	-,3248	3,2048
	HMIDF	1,42000	,47890	,224	-,3448	3,1848
	HM600IDF	1,39333	,47890	,248	-,3714	3,1581
	HMEI600IDF	2,96333*	,47890	,000	1,1986	4,7281
	HPWD	5,20333*	,47890	,000	3,4386	6,9681
	HMPWD	1,45333	,47890	,197	-,3114	3,2181
	HM600PWD	1,42000	,47890	,224	-,3448	3,1848
	HMEI600PWD	1,53667	,47890	,141	-,2281	3,3014
HIDF	Control30%	-3,82333*	,47890	,000	-5,5881	-2,0586
	Control20%	-2,04000*	,47890	,012	-3,8048	-,2752
	Control10%	-1,66000	,47890	,082	-3,4248	,1048
	HSDF	1,48333	,47890	,175	-,2814	3,2481
	HMSDF	,98667	,47890	,749	-,7781	2,7514
	HM600SDF	-1,78000*	,47890	,046	-3,5448	-,0152
	HMEI600SDF	-1,44000	,47890	,208	-3,2048	,3248
	HMIDF	-,02000	,47890	1,000	-1,7848	1,7448
	HM600IDF	-,04667	,47890	1,000	-1,8114	1,7181
	HMEI600IDF	1,52333	,47890	,149	-,2414	3,2881
	HPWD	3,76333*	,47890	,000	1,9986	5,5281
	HMPWD	,01333	,47890	1,000	-1,7514	1,7781
	HM600PWD	-,02000	,47890	1,000	-1,7848	1,7448
	HMEI600PWD	,09667	,47890	1,000	-1,6681	1,8614
HMIDF	Control30%	-3,80333*	,47890	,000	-5,5681	-2,0386
	Control20%	-2,02000*	,47890	,014	-3,7848	-,2552
	Control10%	-1,64000	,47890	,090	-3,4048	,1248

	HSDF	1,50333	,47890	,161	-,2614	3,2681
	HMSDF	1,00667	,47890	,724	-,7581	2,7714
	HM600SDF	-1,76000	,47890	,051	-3,5248	,0048
	HMEI600SDF	-1,42000	,47890	,224	-3,1848	,3448
	HIDF	,02000	,47890	1,000	-1,7448	1,7848
	HM600IDF	-,02667	,47890	1,000	-1,7914	1,7381
	HMEI600IDF	1,54333	,47890	,137	-,2214	3,3081
	HPWD	3,78333*	,47890	,000	2,0186	5,5481
	HMPWD	,03333	,47890	1,000	-1,7314	1,7981
	HM600PWD	,00000	,47890	1,000	-1,7648	1,7648
	HMEI600PWD	,11667	,47890	1,000	-1,6481	1,8814
HM600IDF	Control30%	-3,77667*	,47890	,000	-5,5414	-2,0119
	Control20%	-1,99333*	,47890	,016	-3,7581	-,2286
	Control10%	-1,61333	,47890	,101	-3,3781	,1514
	HSDF	1,53000	,47890	,145	-,2348	3,2948
	HMSDF	1,03333	,47890	,689	-,7314	2,7981
	HM600SDF	-1,73333	,47890	,058	-3,4981	,0314
	HMEI600SDF	-1,39333	,47890	,248	-3,1581	,3714
	HIDF	,04667	,47890	1,000	-1,7181	1,8114
	HMIDF	,02667	,47890	1,000	-1,7381	1,7914
	HMEI600IDF	1,57000	,47890	,122	-,1948	3,3348
	HPWD	3,81000*	,47890	,000	2,0452	5,5748
	HMPWD	,06000	,47890	1,000	-1,7048	1,8248
	HM600PWD	,02667	,47890	1,000	-1,7381	1,7914
	HMEI600PWD	,14333	,47890	1,000	-1,6214	1,9081
HMEI600IDF	Control30%	-5,34667*	,47890	,000	-7,1114	-3,5819
	Control20%	-3,56333*	,47890	,000	-5,3281	-1,7986
	Control10%	-3,18333*	,47890	,000	-4,9481	-1,4186
	HSDF	-,04000	,47890	1,000	-1,8048	1,7248
	HMSDF	-,53667	,47890	,998	-2,3014	1,2281
	HM600SDF	-3,30333*	,47890	,000	-5,0681	-1,5386
	HMEI600SDF	-2,96333*	,47890	,000	-4,7281	-1,1986
	HIDF	-1,52333	,47890	,149	-3,2881	,2414
	HMIDF	-1,54333	,47890	,137	-3,3081	,2214
	HM600IDF	-1,57000	,47890	,122	-3,3348	,1948
	HPWD	2,24000*	,47890	,004	,4752	4,0048
	HMPWD	-1,51000	,47890	,157	-3,2748	,2548
	HM600PWD	-1,54333	,47890	,137	-3,3081	,2214
	HMEI600PWD	-1,42667	,47890	,219	-3,1914	,3381
HPWD	Control30%	-7,58667*	,47890	,000	-9,3514	-5,8219
	Control20%	-5,80333*	,47890	,000	-7,5681	-4,0386
	Control10%	-5,42333*	,47890	,000	-7,1881	-3,6586
	HSDF	-2,28000*	,47890	,003	-4,0448	-,5152
	HMSDF	-2,77667*	,47890	,000	-4,5414	-1,0119
	HM600SDF	-5,54333*	,47890	,000	-7,3081	-3,7786
	HMEI600SDF	-5,20333*	,47890	,000	-6,9681	-3,4386
	HIDF	-3,76333*	,47890	,000	-5,5281	-1,9986
	HMIDF	-3,78333*	,47890	,000	-5,5481	-2,0186
	HM600IDF	-3,81000*	,47890	,000	-5,5748	-2,0452
	HMEI600IDF	-2,24000*	,47890	,004	-4,0048	-,4752
	HMPWD	-3,75000*	,47890	,000	-5,5148	-1,9852
	HM600PWD	-3,78333*	,47890	,000	-5,5481	-2,0186
	HMEI600PWD	-3,66667*	,47890	,000	-5,4314	-1,9019
HMPWD	Control30%	-3,83667*	,47890	,000	-5,6014	-2,0719
	Control20%	-2,05333*	,47890	,012	-3,8181	-,2886
	Control10%	-1,67333	,47890	,077	-3,4381	,0914
	HSDF	1,47000	,47890	,185	-,2948	3,2348
	HMSDF	,97333	,47890	,765	-,7914	2,7381
	HM600SDF	-1,79333*	,47890	,044	-3,5581	-,0286
	HMEI600SDF	-1,45333	,47890	,197	-3,2181	,3114
	HIDF	-,01333	,47890	1,000	-1,7781	1,7514

	HMIDF	-,03333	,47890	1,000	-1,7981	1,7314
	HM600IDF	-,06000	,47890	1,000	-1,8248	1,7048
	HMEI600IDF	1,51000	,47890	,157	-,2548	3,2748
	HPWD	3,75000*	,47890	,000	1,9852	5,5148
	HM600PWD	-,03333	,47890	1,000	-1,7981	1,7314
	HMEI600PWD	,08333	,47890	1,000	-1,6814	1,8481
HM600PWD	Control30%	-3,80333*	,47890	,000	-5,5681	-2,0386
	Control20%	-2,02000*	,47890	,014	-3,7848	-,2552
	Control10%	-1,64000	,47890	,090	-3,4048	,1248
	HSDF	1,50333	,47890	,161	-,2614	3,2681
	HMSDF	1,00667	,47890	,724	-,7581	2,7714
	HM600SDF	-1,76000	,47890	,051	-3,5248	,0048
	HMEI600SDF	-1,42000	,47890	,224	-3,1848	,3448
	HIDF	,02000	,47890	1,000	-1,7448	1,7848
	HMIDF	,00000	,47890	1,000	-1,7648	1,7648
	HM600IDF	-,02667	,47890	1,000	-1,7914	1,7381
	HMEI600IDF	1,54333	,47890	,137	-,2214	3,3081
	HPWD	3,78333*	,47890	,000	2,0186	5,5481
	HMPWD	,03333	,47890	1,000	-1,7314	1,7981
	HMEI600PWD	,11667	,47890	1,000	-1,6481	1,8814
HMEI600PWD	Control30%	-3,92000*	,47890	,000	-5,6848	-2,1552
	Control20%	-2,13667*	,47890	,007	-3,9014	-,3719
	Control10%	-1,75667	,47890	,052	-3,5214	,0081
	HSDF	1,38667	,47890	,254	-,3781	3,1514
	HMSDF	,89000	,47890	,855	-,8748	2,6548
	HM600SDF	-1,87667*	,47890	,029	-3,6414	-,1119
	HMEI600SDF	-1,53667	,47890	,141	-3,3014	,2281
	HIDF	-,09667	,47890	1,000	-1,8614	1,6681
	HMIDF	-,11667	,47890	1,000	-1,8814	1,6481
	HM600IDF	-,14333	,47890	1,000	-1,9081	1,6214
	HMEI600IDF	1,42667	,47890	,219	-,3381	3,1914
	HPWD	3,66667*	,47890	,000	1,9019	5,4314
	HMPWD	-,08333	,47890	1,000	-1,8481	1,6814
	HM600PWD	-,11667	,47890	1,000	-1,8814	1,6481

*. The mean difference is significant at the 0.05 level.

b

Tukey HSD[a]

		Subset for alpha = 0.05					
sample	N	1	2	3	4	5	6
HPWD	3	26,8267					
HMEI600IDF	3		29,0667				
HSDF	3		29,1067				
HMSDF	3		29,6033				
HMEI600PWD	3		30,4933	30,4933			
HMPWD	3		30,5767	30,5767			
HIDF	3		30,5900	30,5900			
HMIDF	3		30,6100	30,6100	30,6100		
HM600PWD	3		30,6100	30,6100	30,6100		
HM600IDF	3		30,6367	30,6367	30,6367		
HMEI600SDF	3			32,0300	32,0300	32,0300	
Control10%	3			32,2500	32,2500	32,2500	
HM600SDF	3				32,3700	32,3700	
Control20%	3					32,6300	
Control30%	3						34,4133
Sig.		1,000	,122	,052	,051	,993	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

S. Variance Analysis Outputs of Color (ΔE*)

Descriptives

DE

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	48,2000	1,32503	,76501	44,9084	51,4916	46,67	48,97
Control20%	3	46,1100	,08660	,05000	45,8949	46,3251	46,06	46,21
Control10%	3	45,3900	,48497	,28000	44,1853	46,5947	44,83	45,67
HSDF	3	43,8000	2,13586	1,23314	38,4942	49,1058	41,70	45,97
HMSDF	3	47,4400	,76210	,44000	45,5468	49,3332	47,00	48,32
HM600SDF	3	48,6800	,46765	,27000	47,5183	49,8417	48,41	49,22
HMEI600SDF	3	46,8233	,39260	,22667	45,8481	47,7986	46,37	47,05
HIDF	3	40,3733	1,54108	,88974	36,5451	44,2016	39,00	42,04
HMIDF	3	47,2533	,84335	,48691	45,1583	49,3483	46,37	48,05
HM600IDF	3	47,6633	,56871	,32835	46,2506	49,0761	47,33	48,32
HMEI600IDF	3	47,1067	,18475	,10667	46,6477	47,5656	47,00	47,32
HPWD	3	33,6133	1,82717	1,05491	29,0744	38,1523	32,30	35,70
HMPWD	3	46,5800	,40780	,23544	45,5670	47,5930	46,32	47,05
HM600PWD	3	46,9200	,49790	,28746	45,6832	48,1568	46,37	47,34
HMEI600PWD	3	47,3400	,60622	,35000	45,8341	48,8459	46,64	47,69
Total	45	45,5529	3,87897	,57824	44,3875	46,7183	32,30	49,22

ANOVA

DE

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	631,887	14	45,135	44,902	,000
Within Groups	30,156	30	1,005		
Total	662,043	44			

Multiple Comparisons

Dependent Variable: DE
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	2,09000	,81861	,436	-,9266	5,1066
	Control10%	2,81000	,81861	,088	-,2066	5,8266
	HSDF	4,40000*	,81861	,001	1,3834	7,4166
	HMSDF	,76000	,81861	1,000	-2,2566	3,7766
	HM600SDF	-,48000	,81861	1,000	-3,4966	2,5366
	HMEI600SDF	1,37667	,81861	,923	-1,6399	4,3933
	HIDF	7,82667*	,81861	,000	4,8101	10,8433
	HMIDF	,94667	,81861	,997	-2,0699	3,9633
	HM600IDF	,53667	,81861	1,000	-2,4799	3,5533
	HMEI600IDF	1,09333	,81861	,987	-1,9233	4,1099
	HPWD	14,58667*	,81861	,000	11,5701	17,6033
	HMPWD	1,62000	,81861	,795	-1,3966	4,6366
	HM600PWD	1,28000	,81861	,954	-1,7366	4,2966
	HMEI600PWD	,86000	,81861	,999	-2,1566	3,8766
Control20%	Control30%	-2,09000	,81861	,436	-5,1066	,9266
	Control10%	,72000	,81861	1,000	-2,2966	3,7366
	HSDF	2,31000	,81861	,288	-,7066	5,3266
	HMSDF	-1,33000	,81861	,939	-4,3466	1,6866
	HM600SDF	-2,57000	,81861	,161	-5,5866	,4466
	HMEI600SDF	-,71333	,81861	1,000	-3,7299	2,3033
	HIDF	5,73667*	,81861	,000	2,7201	8,7533
	HMIDF	-1,14333	,81861	,981	-4,1599	1,8733
	HM600IDF	-1,55333	,81861	,837	-4,5699	1,4633
	HMEI600IDF	-,99667	,81861	,995	-4,0133	2,0199
	HPWD	12,49667*	,81861	,000	9,4801	15,5133
	HMPWD	-,47000	,81861	1,000	-3,4866	2,5466
	HM600PWD	-,81000	,81861	,999	-3,8266	2,2066
	HMEI600PWD	-1,23000	,81861	,966	-4,2466	1,7866
Control10%	Control30%	-2,81000	,81861	,088	-5,8266	,2066
	Control20%	-,72000	,81861	1,000	-3,7366	2,2966
	HSDF	1,59000	,81861	,814	-1,4266	4,6066
	HMSDF	-2,05000	,81861	,466	-5,0666	,9666
	HM600SDF	-3,29000*	,81861	,023	-6,3066	-,2734
	HMEI600SDF	-1,43333	,81861	,899	-4,4499	1,5833
	HIDF	5,01667*	,81861	,000	2,0001	8,0333
	HMIDF	-1,86333	,81861	,613	-4,8799	1,1533
	HM600IDF	-2,27333	,81861	,310	-5,2899	,7433
	HMEI600IDF	-1,71667	,81861	,727	-4,7333	1,2999
	HPWD	11,77667*	,81861	,000	8,7601	14,7933
	HMPWD	-1,19000	,81861	,974	-4,2066	1,8266
	HM600PWD	-1,53000	,81861	,850	-4,5466	1,4866
	HMEI600PWD	-1,95000	,81861	,544	-4,9666	1,0666
HSDF	Control30%	-4,40000*	,81861	,001	-7,4166	-1,3834
	Control20%	-2,31000	,81861	,288	-5,3266	,7066
	Control10%	-1,59000	,81861	,814	-4,6066	1,4266
	HMSDF	-3,64000*	,81861	,008	-6,6566	-,6234
	HM600SDF	-4,88000*	,81861	,000	-7,8966	-1,8634
	HMEI600SDF	-3,02333*	,81861	,049	-6,0399	-,0067
	HIDF	3,42667*	,81861	,015	,4101	6,4433
	HMIDF	-3,45333*	,81861	,014	-6,4699	-,4367
	HM600IDF	-3,86333*	,81861	,004	-6,8799	-,8467
	HMEI600IDF	-3,30667*	,81861	,021	-6,3233	-,2901
	HPWD	10,18667*	,81861	,000	7,1701	13,2033
	HMPWD	-2,78000	,81861	,095	-5,7966	,2366

	HM600PWD	-3,12000*	,81861	,037	-6,1366	-,1034
	HMEI600PWD	-3,54000*	,81861	,010	-6,5566	-,5234
HMSDF	Control30%	-,76000	,81861	1,000	-3,7766	2,2566
	Control20%	1,33000	,81861	,939	-1,6866	4,3466
	Control10%	2,05000	,81861	,466	-,9666	5,0666
	HSDF	3,64000*	,81861	,008	,6234	6,6566
	HM600SDF	-1,24000	,81861	,964	-4,2566	1,7766
	HMEI600SDF	,61667	,81861	1,000	-2,3999	3,6333
	HIDF	7,06667*	,81861	,000	4,0501	10,0833
	HMIDF	,18667	,81861	1,000	-2,8299	3,2033
	HM600IDF	-,22333	,81861	1,000	-3,2399	2,7933
	HMEI600IDF	,33333	,81861	1,000	-2,6833	3,3499
	HPWD	13,82667*	,81861	,000	10,8101	16,8433
	HMPWD	,86000	,81861	,999	-2,1566	3,8766
	HM600PWD	,52000	,81861	1,000	-2,4966	3,5366
	HMEI600PWD	,10000	,81861	1,000	-2,9166	3,1166
HM600SDF	Control30%	,48000	,81861	1,000	-2,5366	3,4966
	Control20%	2,57000	,81861	,161	-,4466	5,5866
	Control10%	3,29000*	,81861	,023	,2734	6,3066
	HSDF	4,88000*	,81861	,000	1,8634	7,8966
	HMSDF	1,24000	,81861	,964	-1,7766	4,2566
	HMEI600SDF	1,85667	,81861	,619	-1,1599	4,8733
	HIDF	8,30667*	,81861	,000	5,2901	11,3233
	HMIDF	1,42667	,81861	,902	-1,5899	4,4433
	HM600IDF	1,01667	,81861	,993	-1,9999	4,0333
	HMEI600IDF	1,57333	,81861	,824	-1,4433	4,5899
	HPWD	15,06667*	,81861	,000	12,0501	18,0833
	HMPWD	2,10000	,81861	,429	-,9166	5,1166
	HM600PWD	1,76000	,81861	,694	-1,2566	4,7766
	HMEI600PWD	1,34000	,81861	,936	-1,6766	4,3566
HMEI600SDF	Control30%	-1,37667	,81861	,923	-4,3933	1,6399
	Control20%	,71333	,81861	1,000	-2,3033	3,7299
	Control10%	1,43333	,81861	,899	-1,5833	4,4499
	HSDF	3,02333*	,81861	,049	,0067	6,0399
	HMSDF	-,61667	,81861	1,000	-3,6333	2,3999
	HM600SDF	-1,85667	,81861	,619	-4,8733	1,1599
	HIDF	6,45000*	,81861	,000	3,4334	9,4666
	HMIDF	-,43000	,81861	1,000	-3,4466	2,5866
	HM600IDF	-,84000	,81861	,999	-3,8566	2,1766
	HMEI600IDF	-,28333	,81861	1,000	-3,2999	2,7333
	HPWD	13,21000*	,81861	,000	10,1934	16,2266
	HMPWD	,24333	,81861	1,000	-2,7733	3,2599
	HM600PWD	-,09667	,81861	1,000	-3,1133	2,9199
	HMEI600PWD	-,51667	,81861	1,000	-3,5333	2,4999
HIDF	Control30%	-7,82667*	,81861	,000	-10,8433	-4,8101
	Control20%	-5,73667*	,81861	,000	-8,7533	-2,7201
	Control10%	-5,01667*	,81861	,000	-8,0333	-2,0001
	HSDF	-3,42667*	,81861	,015	-6,4433	-,4101
	HMSDF	-7,06667*	,81861	,000	-10,0833	-4,0501
	HM600SDF	-8,30667*	,81861	,000	-11,3233	-5,2901
	HMEI600SDF	-6,45000*	,81861	,000	-9,4666	-3,4334
	HMIDF	-6,88000*	,81861	,000	-9,8966	-3,8634
	HM600IDF	-7,29000*	,81861	,000	-10,3066	-4,2734
	HMEI600IDF	-6,73333*	,81861	,000	-9,7499	-3,7167
	HPWD	6,76000*	,81861	,000	3,7434	9,7766
	HMPWD	-6,20667*	,81861	,000	-9,2233	-3,1901
	HM600PWD	-6,54667*	,81861	,000	-9,5633	-3,5301
	HMEI600PWD	-6,96667*	,81861	,000	-9,9833	-3,9501
HMIDF	Control30%	-,94667	,81861	,997	-3,9633	2,0699
	Control20%	1,14333	,81861	,981	-1,8733	4,1599
	Control10%	1,86333	,81861	,613	-1,1533	4,8799

	HSDF	3,45333*	,81861	,014	,4367	6,4699
	HMSDF	-,18667	,81861	1,000	-3,2033	2,8299
	HM600SDF	-1,42667	,81861	,902	-4,4433	1,5899
	HMEI600SDF	,43000	,81861	1,000	-2,5866	3,4466
	HIDF	6,88000*	,81861	,000	3,8634	9,8966
	HM600IDF	-,41000	,81861	1,000	-3,4266	2,6066
	HMEI600IDF	,14667	,81861	1,000	-2,8699	3,1633
	HPWD	13,64000*	,81861	,000	10,6234	16,6566
	HMPWD	,67333	,81861	1,000	-2,3433	3,6899
	HM600PWD	,33333	,81861	1,000	-2,6833	3,3499
	HMEI600PWD	-,08667	,81861	1,000	-3,1033	2,9299
HM600IDF	Control30%	-,53667	,81861	1,000	-3,5533	2,4799
	Control20%	1,55333	,81861	,837	-1,4633	4,5699
	Control10%	2,27333	,81861	,310	-,7433	5,2899
	HSDF	3,86333*	,81861	,004	,8467	6,8799
	HMSDF	,22333	,81861	1,000	-2,7933	3,2399
	HM600SDF	-1,01667	,81861	,993	-4,0333	1,9999
	HMEI600SDF	,84000	,81861	,999	-2,1766	3,8566
	HIDF	7,29000*	,81861	,000	4,2734	10,3066
	HMIDF	,41000	,81861	1,000	-2,6066	3,4266
	HMEI600IDF	,55667	,81861	1,000	-2,4599	3,5733
	HPWD	14,05000*	,81861	,000	11,0334	17,0666
	HMPWD	1,08333	,81861	,988	-1,9333	4,0999
	HM600PWD	,74333	,81861	1,000	-2,2733	3,7599
	HMEI600PWD	,32333	,81861	1,000	-2,6933	3,3399
HMEI600IDF	Control30%	-1,09333	,81861	,987	-4,1099	1,9233
	Control20%	,99667	,81861	,995	-2,0199	4,0133
	Control10%	1,71667	,81861	,727	-1,2999	4,7333
	HSDF	3,30667*	,81861	,021	,2901	6,3233
	HMSDF	-,33333	,81861	1,000	-3,3499	2,6833
	HM600SDF	-1,57333	,81861	,824	-4,5899	1,4433
	HMEI600SDF	,28333	,81861	1,000	-2,7333	3,2999
	HIDF	6,73333*	,81861	,000	3,7167	9,7499
	HMIDF	-,14667	,81861	1,000	-3,1633	2,8699
	HM600IDF	-,55667	,81861	1,000	-3,5733	2,4599
	HPWD	13,49333*	,81861	,000	10,4767	16,5099
	HMPWD	,52667	,81861	1,000	-2,4899	3,5433
	HM600PWD	,18667	,81861	1,000	-2,8299	3,2033
	HMEI600PWD	-,23333	,81861	1,000	-3,2499	2,7833
HPWD	Control30%	-14,58667*	,81861	,000	-17,6033	-11,5701
	Control20%	-12,49667*	,81861	,000	-15,5133	-9,4801
	Control10%	-11,77667*	,81861	,000	-14,7933	-8,7601
	HSDF	-10,18667*	,81861	,000	-13,2033	-7,1701
	HMSDF	-13,82667*	,81861	,000	-16,8433	-10,8101
	HM600SDF	-15,06667*	,81861	,000	-18,0833	-12,0501
	HMEI600SDF	-13,21000*	,81861	,000	-16,2266	-10,1934
	HIDF	-6,76000*	,81861	,000	-9,7766	-3,7434
	HMIDF	-13,64000*	,81861	,000	-16,6566	-10,6234
	HM600IDF	-14,05000*	,81861	,000	-17,0666	-11,0334
	HMEI600IDF	-13,49333*	,81861	,000	-16,5099	-10,4767
	HMPWD	-12,96667*	,81861	,000	-15,9833	-9,9501
	HM600PWD	-13,30667*	,81861	,000	-16,3233	-10,2901
	HMEI600PWD	-13,72667*	,81861	,000	-16,7433	-10,7101
HMPWD	Control30%	-1,62000	,81861	,795	-4,6366	1,3966
	Control20%	,47000	,81861	1,000	-2,5466	3,4866
	Control10%	1,19000	,81861	,974	-1,8266	4,2066
	HSDF	2,78000	,81861	,095	-,2366	5,7966
	HMSDF	-,86000	,81861	,999	-3,8766	2,1566
	HM600SDF	-2,10000	,81861	,429	-5,1166	,9166
	HMEI600SDF	-,24333	,81861	1,000	-3,2599	2,7733
	HIDF	6,20667*	,81861	,000	3,1901	9,2233

	HMIDF	-,67333	,81861	1,000	-3,6899	2,3433
	HM600IDF	-1,08333	,81861	,988	-4,0999	1,9333
	HMEI600IDF	-,52667	,81861	1,000	-3,5433	2,4899
	HPWD	12,96667*	,81861	,000	9,9501	15,9833
	HM600PWD	-,34000	,81861	1,000	-3,3566	2,6766
	HMEI600PWD	-,76000	,81861	1,000	-3,7766	2,2566
HM600PWD	Control30%	-1,28000	,81861	,954	-4,2966	1,7366
	Control20%	,81000	,81861	,999	-2,2066	3,8266
	Control10%	1,53000	,81861	,850	-1,4866	4,5466
	HSDF	3,12000*	,81861	,037	,1034	6,1366
	HMSDF	-,52000	,81861	1,000	-3,5366	2,4966
	HM600SDF	-1,76000	,81861	,694	-4,7766	1,2566
	HMEI600SDF	,09667	,81861	1,000	-2,9199	3,1133
	HIDF	6,54667*	,81861	,000	3,5301	9,5633
	HMIDF	-,33333	,81861	1,000	-3,3499	2,6833
	HM600IDF	-,74333	,81861	1,000	-3,7599	2,2733
	HMEI600IDF	-,18667	,81861	1,000	-3,2033	2,8299
	HPWD	13,30667*	,81861	,000	10,2901	16,3233
	HMPWD	,34000	,81861	1,000	-2,6766	3,3566
	HMEI600PWD	-,42000	,81861	1,000	-3,4366	2,5966
HMEI600PWD	Control30%	-,86000	,81861	,999	-3,8766	2,1566
	Control20%	1,23000	,81861	,966	-1,7866	4,2466
	Control10%	1,95000	,81861	,544	-1,0666	4,9666
	HSDF	3,54000*	,81861	,010	,5234	6,5566
	HMSDF	-,10000	,81861	1,000	-3,1166	2,9166
	HM600SDF	-1,34000	,81861	,936	-4,3566	1,6766
	HMEI600SDF	,51667	,81861	1,000	-2,4999	3,5333
	HIDF	6,96667*	,81861	,000	3,9501	9,9833
	HMIDF	,08667	,81861	1,000	-2,9299	3,1033
	HM600IDF	-,32333	,81861	1,000	-3,3399	2,6933
	HMEI600IDF	,23333	,81861	1,000	-2,7833	3,2499
	HPWD	13,72667*	,81861	,000	10,7101	16,7433
	HMPWD	,76000	,81861	1,000	-2,2566	3,7766
	HM600PWD	,42000	,81861	1,000	-2,5966	3,4366

*. The mean difference is significant at the 0.05 level.

ΔE

Tukey HSD[a]

sample	N	Subset for alpha = 0.05				
		1	2	3	4	5
HPWD	3	33,6133				
HIDF	3		40,3733			
HSDF	3			43,8000		
Control10%	3			45,3900	45,3900	
Control20%	3			46,1100	46,1100	46,1100
HMPWD	3			46,5800	46,5800	46,5800
HMEI600SDF	3				46,8233	46,8233
HM600PWD	3				46,9200	46,9200
HMEI600IDF	3				47,1067	47,1067
HMIDF	3				47,2533	47,2533
HMEI600PWD	3				47,3400	47,3400
HMSDF	3				47,4400	47,4400
HM600IDF	3				47,6633	47,6633
Control30%	3				48,2000	48,2000
HM600SDF	3					48,6800
Sig.		1,000	1,000	,095	,088	,161

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

T. Variance Analysis Outputs of Spread Ratio

Descriptives

Spread_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control30%	3	7,8133	,05033	,02906	7,6883	7,9384	7,76	7,86
Control20%	3	7,2800	,07000	,04041	7,1061	7,4539	7,21	7,35
Control10%	3	6,3533	,34078	,19675	5,5068	7,1999	5,96	6,56
HSDF	3	5,1560	,03030	,01749	5,0807	5,2313	5,12	5,18
HMSDF	3	6,2406	,10342	,05971	5,9837	6,4975	6,16	6,36
HM600SDF	3	8,0113	,33126	,19125	7,1884	8,8342	7,63	8,24
HMEI600SDF	3	8,4903	,29679	,17135	7,7531	9,2276	8,19	8,79
HIDF	3	5,2833	,08083	,04667	5,0825	5,4841	5,21	5,37
HMIDF	3	5,0667	,15044	,08686	4,6929	5,4404	4,91	5,21
HM600IDF	3	4,8533	,16921	,09770	4,4330	5,2737	4,71	5,04
HMEI600IDF	3	5,4067	,14844	,08570	5,0379	5,7754	5,28	5,57
HPWD	3	4,7067	,02082	,01202	4,6550	4,7584	4,69	4,73
HMPWD	3	5,1733	,11015	,06360	4,8997	5,4470	5,06	5,28
HM600PWD	3	5,7733	,19502	,11260	5,2889	6,2578	5,58	5,97
HMEI600PWD	3	4,9633	,10408	,06009	4,7048	5,2219	4,88	5,08
Total	45	6,0381	1,24946	,18626	5,6627	6,4135	4,69	8,79

ANOVA

Spread_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	67,742	14	4,839	153,039	,000
Within Groups	,949	30	,032		
Total	68,691	44			

Multiple Comparisons

Dependent Variable: Spread_ratio
Tukey HSD

(I) sample	(J) sample	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control30%	Control20%	,53333	,14518	,051	-,0017	1,0683
	Control10%	1,46000*	,14518	,000	,9250	1,9950
	HSDF	2,65732*	,14518	,000	2,1223	3,1923
	HMSDF	1,57276*	,14518	,000	1,0378	2,1078
	HM600SDF	-,19798	,14518	,985	-,7330	,3370
	HMEI600SDF	-,67701*	,14518	,004	-1,2120	-,1420
	HIDF	2,53000*	,14518	,000	1,9950	3,0650
	HMIDF	2,74667*	,14518	,000	2,2117	3,2817
	HM600IDF	2,96000*	,14518	,000	2,4250	3,4950
	HMEI600IDF	2,40667*	,14518	,000	1,8717	2,9417
	HPWD	3,10667*	,14518	,000	2,5717	3,6417
	HMPWD	2,64000*	,14518	,000	2,1050	3,1750
	HM600PWD	2,04000*	,14518	,000	1,5050	2,5750
	HMEI600PWD	2,85000*	,14518	,000	2,3150	3,3850
Control20%	Control30%	-,53333	,14518	,051	-1,0683	,0017
	Control10%	,92667*	,14518	,000	,3917	1,4617
	HSDF	2,12398*	,14518	,000	1,5890	2,6590
	HMSDF	1,03943*	,14518	,000	,5044	1,5744
	HM600SDF	-,73132*	,14518	,002	-1,2663	-,1963
	HMEI600SDF	-1,21034*	,14518	,000	-1,7453	-,6753
	HIDF	1,99667*	,14518	,000	1,4617	2,5317
	HMIDF	2,21333*	,14518	,000	1,6783	2,7483
	HM600IDF	2,42667*	,14518	,000	1,8917	2,9617
	HMEI600IDF	1,87333*	,14518	,000	1,3383	2,4083
	HPWD	2,57333*	,14518	,000	2,0383	3,1083
	HMPWD	2,10667*	,14518	,000	1,5717	2,6417
	HM600PWD	1,50667*	,14518	,000	,9717	2,0417
	HMEI600PWD	2,31667*	,14518	,000	1,7817	2,8517
Control10%	Control30%	-1,46000*	,14518	,000	-1,9950	-,9250
	Control20%	-,92667*	,14518	,000	-1,4617	-,3917
	HSDF	1,19732*	,14518	,000	,6623	1,7323
	HMSDF	,11276	,14518	1,000	-,4222	,6478
	HM600SDF	-1,65798*	,14518	,000	-2,1930	-1,1230
	HMEI600SDF	-2,13701*	,14518	,000	-2,6720	-1,6020
	HIDF	1,07000*	,14518	,000	,5350	1,6050
	HMIDF	1,28667*	,14518	,000	,7517	1,8217
	HM600IDF	1,50000*	,14518	,000	,9650	2,0350
	HMEI600IDF	,94667*	,14518	,000	,4117	1,4817
	HPWD	1,64667*	,14518	,000	1,1117	2,1817
	HMPWD	1,18000*	,14518	,000	,6450	1,7150
	HM600PWD	,58000*	,14518	,024	,0450	1,1150
	HMEI600PWD	1,39000*	,14518	,000	,8550	1,9250
HSDF	Control30%	-2,65732*	,14518	,000	-3,1923	-2,1223
	Control20%	-2,12398*	,14518	,000	-2,6590	-1,5890
	Control10%	-1,19732*	,14518	,000	-1,7323	-,6623
	HMSDF	-1,08456*	,14518	,000	-1,6196	-,5496
	HM600SDF	-2,85530*	,14518	,000	-3,3903	-2,3203
	HMEI600SDF	-3,33432*	,14518	,000	-3,8693	-2,7993
	HIDF	-,12732	,14518	1,000	-,6623	,4077
	HMIDF	,08935	,14518	1,000	-,4457	,6244
	HM600IDF	,30268	,14518	,734	-,2323	,8377
	HMEI600IDF	-,25065	,14518	,908	-,7857	,2844
	HPWD	,44935	,14518	,176	-,0857	,9844
	HMPWD	-,01732	,14518	1,000	-,5523	,5177

	HM600PWD	-,61732*	,14518	,013	-1,1523	-,0823
	HMEI600PWD	,19268	,14518	,988	-,3423	,7277
HMSDF	Control30%	-1,57276*	,14518	,000	-2,1078	-1,0378
	Control20%	-1,03943*	,14518	,000	-1,5744	-,5044
	Control10%	-,11276	,14518	1,000	-,6478	,4222
	HSDF	1,08456*	,14518	,000	,5496	1,6196
	HM600SDF	-1,77074*	,14518	,000	-2,3057	-1,2357
	HMEI600SDF	-2,24977*	,14518	,000	-2,7848	-1,7148
	HIDF	,95724*	,14518	,000	,4222	1,4922
	HMIDF	1,17391*	,14518	,000	,6389	1,7089
	HM600IDF	1,38724*	,14518	,000	,8522	1,9222
	HMEI600IDF	,83391*	,14518	,000	,2989	1,3689
	HPWD	1,53391*	,14518	,000	,9989	2,0689
	HMPWD	1,06724*	,14518	,000	,5322	1,6022
	HM600PWD	,46724	,14518	,138	-,0678	1,0022
	HMEI600PWD	1,27724*	,14518	,000	,7422	1,8122
HM600SDF	Control30%	,19798	,14518	,985	-,3370	,7330
	Control20%	,73132*	,14518	,002	,1963	1,2663
	Control10%	1,65798*	,14518	,000	1,1230	2,1930
	HSDF	2,85530*	,14518	,000	2,3203	3,3903
	HMSDF	1,77074*	,14518	,000	1,2357	2,3057
	HMEI600SDF	-,47902	,14518	,117	-1,0140	,0560
	HIDF	2,72798*	,14518	,000	2,1930	3,2630
	HMIDF	2,94465*	,14518	,000	2,4096	3,4797
	HM600IDF	3,15798*	,14518	,000	2,6230	3,6930
	HMEI600IDF	2,60465*	,14518	,000	2,0696	3,1397
	HPWD	3,30465*	,14518	,000	2,7696	3,8397
	HMPWD	2,83798*	,14518	,000	2,3030	3,3730
	HM600PWD	2,23798*	,14518	,000	1,7030	2,7730
	HMEI600PWD	3,04798*	,14518	,000	2,5130	3,5830
HMEI600SDF	Control30%	,67701*	,14518	,004	,1420	1,2120
	Control20%	1,21034*	,14518	,000	,6753	1,7453
	Control10%	2,13701*	,14518	,000	1,6020	2,6720
	HSDF	3,33432*	,14518	,000	2,7993	3,8693
	HMSDF	2,24977*	,14518	,000	1,7148	2,7848
	HM600SDF	,47902	,14518	,117	-,0560	1,0140
	HIDF	3,20701*	,14518	,000	2,6720	3,7420
	HMIDF	3,42367*	,14518	,000	2,8887	3,9587
	HM600IDF	3,63701*	,14518	,000	3,1020	4,1720
	HMEI600IDF	3,08367*	,14518	,000	2,5487	3,6187
	HPWD	3,78367*	,14518	,000	3,2487	4,3187
	HMPWD	3,31701*	,14518	,000	2,7820	3,8520
	HM600PWD	2,71701*	,14518	,000	2,1820	3,2520
	HMEI600PWD	3,52701*	,14518	,000	2,9920	4,0620
HIDF	Control30%	-2,53000*	,14518	,000	-3,0650	-1,9950
	Control20%	-1,99667*	,14518	,000	-2,5317	-1,4617
	Control10%	-1,07000*	,14518	,000	-1,6050	-,5350
	HSDF	,12732	,14518	1,000	-,4077	,6623
	HMSDF	-,95724*	,14518	,000	-1,4922	-,4222
	HM600SDF	-2,72798*	,14518	,000	-3,2630	-2,1930
	HMEI600SDF	-3,20701*	,14518	,000	-3,7420	-2,6720
	HMIDF	,21667	,14518	,968	-,3183	,7517
	HM600IDF	,43000	,14518	,226	-,1050	,9650
	HMEI600IDF	-,12333	,14518	1,000	-,6583	,4117
	HPWD	,57667*	,14518	,025	,0417	1,1117
	HMPWD	,11000	,14518	1,000	-,4250	,6450
	HM600PWD	-,49000	,14518	,100	-1,0250	,0450
	HMEI600PWD	,32000	,14518	,660	-,2150	,8550
HMIDF	Control30%	-2,74667*	,14518	,000	-3,2817	-2,2117
	Control20%	-2,21333*	,14518	,000	-2,7483	-1,6783
	Control10%	-1,28667*	,14518	,000	-1,8217	-,7517

	HSDF	-,08935	,14518	1,000	-,6244	,4457
	HMSDF	-1,17391*	,14518	,000	-1,7089	-,6389
	HM600SDF	-2,94465*	,14518	,000	-3,4797	-2,4096
	HMEI600SDF	-3,42367*	,14518	,000	-3,9587	-2,8887
	HIDF	-,21667	,14518	,968	-,7517	,3183
	HM600IDF	,21333	,14518	,972	-,3217	,7483
	HMEI600IDF	-,34000	,14518	,571	-,8750	,1950
	HPWD	,36000	,14518	,482	-,1750	,8950
	HMPWD	-,10667	,14518	1,000	-,6417	,4283
	HM600PWD	-,70667*	,14518	,003	-1,2417	-,1717
	HMEI600PWD	,10333	,14518	1,000	-,4317	,6383
HM600IDF	Control30%	-2,96000*	,14518	,000	-3,4950	-2,4250
	Control20%	-2,42667*	,14518	,000	-2,9617	-1,8917
	Control10%	-1,50000*	,14518	,000	-2,0350	-,9650
	HSDF	-,30268	,14518	,734	-,8377	,2323
	HMSDF	-1,38724*	,14518	,000	-1,9222	-,8522
	HM600SDF	-3,15798*	,14518	,000	-3,6930	-2,6230
	HMEI600SDF	-3,63701*	,14518	,000	-4,1720	-3,1020
	HIDF	-,43000	,14518	,226	-,9650	,1050
	HMIDF	-,21333	,14518	,972	-,7483	,3217
	HMEI600IDF	-,55333*	,14518	,037	-1,0883	-,0183
	HPWD	,14667	,14518	,999	-,3883	,6817
	HMPWD	-,32000	,14518	,660	-,8550	,2150
	HM600PWD	-,92000*	,14518	,000	-1,4550	-,3850
	HMEI600PWD	-,11000	,14518	1,000	-,6450	,4250
HMEI600IDF	Control30%	-2,40667*	,14518	,000	-2,9417	-1,8717
	Control20%	-1,87333*	,14518	,000	-2,4083	-1,3383
	Control10%	-,94667*	,14518	,000	-1,4817	-,4117
	HSDF	,25065	,14518	,908	-,2844	,7857
	HMSDF	-,83391*	,14518	,000	-1,3689	-,2989
	HM600SDF	-2,60465*	,14518	,000	-3,1397	-2,0696
	HMEI600SDF	-3,08367*	,14518	,000	-3,6187	-2,5487
	HIDF	,12333	,14518	1,000	-,4117	,6583
	HMIDF	,34000	,14518	,571	-,1950	,8750
	HM600IDF	,55333*	,14518	,037	,0183	1,0883
	HPWD	,70000*	,14518	,003	,1650	1,2350
	HMPWD	,23333	,14518	,944	-,3017	,7683
	HM600PWD	-,36667	,14518	,453	-,9017	,1683
	HMEI600PWD	,44333	,14518	,190	-,0917	,9783
HPWD	Control30%	-3,10667*	,14518	,000	-3,6417	-2,5717
	Control20%	-2,57333*	,14518	,000	-3,1083	-2,0383
	Control10%	-1,64667*	,14518	,000	-2,1817	-1,1117
	HSDF	-,44935	,14518	,176	-,9844	,0857
	HMSDF	-1,53391*	,14518	,000	-2,0689	-,9989
	HM600SDF	-3,30465*	,14518	,000	-3,8397	-2,7696
	HMEI600SDF	-3,78367*	,14518	,000	-4,3187	-3,2487
	HIDF	-,57667*	,14518	,025	-1,1117	-,0417
	HMIDF	-,36000	,14518	,482	-,8950	,1750
	HM600IDF	-,14667	,14518	,999	-,6817	,3883
	HMEI600IDF	-,70000*	,14518	,003	-1,2350	-,1650
	HMPWD	-,46667	,14518	,139	-1,0017	,0683
	HM600PWD	-1,06667*	,14518	,000	-1,6017	-,5317
	HMEI600PWD	-,25667	,14518	,893	-,7917	,2783
HMPWD	Control30%	-2,64000*	,14518	,000	-3,1750	-2,1050
	Control20%	-2,10667*	,14518	,000	-2,6417	-1,5717
	Control10%	-1,18000*	,14518	,000	-1,7150	-,6450
	HSDF	,01732	,14518	1,000	-,5177	,5523
	HMSDF	-1,06724*	,14518	,000	-1,6022	-,5322
	HM600SDF	-2,83798*	,14518	,000	-3,3730	-2,3030
	HMEI600SDF	-3,31701*	,14518	,000	-3,8520	-2,7820
	HIDF	-,11000	,14518	1,000	-,6450	,4250

	HMIDF	,10667	,14518	1,000	-,4283	,6417
	HM600IDF	,32000	,14518	,660	-,2150	,8550
	HMEI600IDF	-,23333	,14518	,944	-,7683	,3017
	HPWD	,46667	,14518	,139	-,0683	1,0017
	HM600PWD	-,60000*	,14518	,017	-1,1350	-,0650
	HMEI600PWD	,21000	,14518	,975	-,3250	,7450
HM600PWD	Control30%	-2,04000*	,14518	,000	-2,5750	-1,5050
	Control20%	-1,50667*	,14518	,000	-2,0417	-,9717
	Control10%	-,58000*	,14518	,024	-1,1150	-,0450
	HSDF	,61732*	,14518	,013	,0823	1,1523
	HMSDF	-,46724	,14518	,138	-1,0022	,0678
	HM600SDF	-2,23798*	,14518	,000	-2,7730	-1,7030
	HMEI600SDF	-2,71701*	,14518	,000	-3,2520	-2,1820
	HIDF	,49000	,14518	,100	-,0450	1,0250
	HMIDF	,70667*	,14518	,003	,1717	1,2417
	HM600IDF	,92000*	,14518	,000	,3850	1,4550
	HMEI600IDF	,36667	,14518	,453	-,1683	,9017
	HPWD	1,06667*	,14518	,000	,5317	1,6017
	HMPWD	,60000*	,14518	,017	,0650	1,1350
	HMEI600PWD	,81000*	,14518	,000	,2750	1,3450
HMEI600PWD	Control30%	-2,85000*	,14518	,000	-3,3850	-2,3150
	Control20%	-2,31667*	,14518	,000	-2,8517	-1,7817
	Control10%	-1,39000*	,14518	,000	-1,9250	-,8550
	HSDF	-,19268	,14518	,988	-,7277	,3423
	HMSDF	-1,27724*	,14518	,000	-1,8122	-,7422
	HM600SDF	-3,04798*	,14518	,000	-3,5830	-2,5130
	HMEI600SDF	-3,52701*	,14518	,000	-4,0620	-2,9920
	HIDF	-,32000	,14518	,660	-,8550	,2150
	HMIDF	-,10333	,14518	1,000	-,6383	,4317
	HM600IDF	,11000	,14518	1,000	-,4250	,6450
	HMEI600IDF	-,44333	,14518	,190	-,9783	,0917
	HPWD	,25667	,14518	,893	-,2783	,7917
	HMPWD	-,21000	,14518	,975	-,7450	,3250
	HM600PWD	-,81000*	,14518	,000	-1,3450	-,2750

*. The mean difference is significant at the 0.05 level.

Spread_ratio

Tukey HSD[a]

sample	N	Subset for alpha = 0.05								
		1	2	3	4	5	6	7	8	9
HPWD	3	4,7067								
HM600IDF	3	4,8533	4,8533							
HMEI600PWD	3	4,9633	4,9633	4,9633						
HMIDF	3	5,0667	5,0667	5,0667						
HSDF	3	5,1560	5,1560	5,1560						
HMPWD	3	5,1733	5,1733	5,1733						
HIDF	3		5,2833	5,2833	5,2833					
HMEI600IDF	3			5,4067	5,4067					
HM600PWD	3				5,7733	5,7733				
HMSDF	3					6,2406	6,2406			
Control10%	3						6,3533			
Control20%	3							7,2800		
Control30%	3							7,8133	7,8133	
HM600SDF	3								8,0113	8,0113
HMEI600SDF	3									8,4903
Sig.		,139	,226	,190	,100	,138	1,000	,051	,985	,117

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

U. The Enriched Biscuits

Figure A. The enriched biscuits a. C30, b. C20, c. C10,d. U-SDF, e. U-IDF, f. U-PSCP, g. MW-SDF, h. MW-IDF, i. MW- PSCP, j. MW-HP600-SDF, k. MW-HP600-IDF, l. MW-HP600- PSCP, m. MW-EH-HP600-SDF, n. MW-EH-HP600-IDF, p. MW-EH-HP600- PSCP.

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Başkaya Sezer, Duygu
Nationality: The Republic of Turkey
Contact: duygu.baskaya@amasya.edu.tr

RESEARCH INTERESTS

Hybrid processes in food engineering
Modification in dietary fiber
Enrichment of cereal-based products

ACADEMIC BACKGROUND

Visiting Researcher — 2019-2020
Environmental and Life Science Department
Food and Nutrition Programme
Kuwait Institute for Scientific Research Safat-Kuwait

Doctor of Philosophy — 2014−
Department of Food Engineering
Middle East Technical University Ankara-Turkey

Master of Science — 2011−2014
Department of Food Engineering
Gaziosmanpasa University Tokat-Turkey

Bachelor of Business — 2003−2007
Department of Business
Anadolu University,Eskişehir, Turkey

Bachelor of Science — 2001−2006
Department of Food Engineering
Ege University, İzmir, Turkey

PROFESSIONAL EXPERIENCE

Instructor — 2011−Present
Culinary Programme
Amasya Vocational School, Amasya, Turkey
Amasya University
Food Engineer — 2008 - 2010
Sheraton Cesme Hotel, Resort & SPA , İzmir, Turkey

Food Engineer 2007 (7 months)
Tesco Kipa Retailing

INTERNATIONAL PUBLICATIONS

1. Mulla, M. Z., Ahmed, J., Baskaya- Sezer, D., & Al- Ruwaih, N., 2021. Effect of high- pressure treatment and cellulase- mediate hydrolysis on functional, rheological and microstructural properties of garden cress seed residual fibre. International Journal of Food Science & Technology. https://doi.org/10.1111/ijfs.15464

2. Baskaya Sezer, D., Ahmed, J., Sumnu, G., & Sahin, S., 2021. Green processing of sour cherry (*Prunus cerasus* L.) pomace: Process optimization for the modification of dietary fibers and property measurements. Journal of Food Measurement and Characterization. 15 (4): 3015-3025, ISSN 2193-4134. https://doi.org/10.1007/s11694-021-00883-0

3. Başkaya Sezer, D. & Demirdöven, A., 2015. The effects of microwave blanching conditions on carrot slices: optimization and comparison. Journal of Food Processing and Preservation. 39 (6), 2188–2196, ISSN 1745-4549. https://doi.org/10.1111/jfpp.12463

NATIONAL PUBLICATIONS

1. Başkaya-Sezer, D., Erdoğan-Tokatlı, K., & Demirdöven, A. 2016. Bullace ve Yonuz Plum Marmelades (in Turkish). Journal of Agricultural Faculty of Gaziosmanpasa University (JAFAG). ISSN 1300-2910 (e-ISSN: 2147-8848), 33 (1) 125-131. https://doi.org/10.13002/jafag899

2. Başkaya Sezer, D.& Demirdöven, A., 2015. Microwave blanching applications in fruit and vegetable processing (in Turkish), The Journal of Food, ISSN: 1309-6273, 40 (3), 171-177. https://doi.org/10.15237/gida.GD14048

PRESENTATIONS IN INTERNATIONAL CONFERENCES

1. Baskaya Sezer, D., Ahmed, J., Sumnu, G., & Sahin, S., 2020. Effects of microwave, high-pressure, and enzymatic treatment on the structure, type, functionalities of sour cherry (*Prunus cerasus* L.) pomace dietary fiber, IFT20, July 12-15, 2020, Chicago, IL. (E-poster presentation)

2. Baskaya Sezer, D., Ahmed, J., Sumnu, G., &Sahin, S., 2020. Characterization of the reduced-fat biscuit fortified with microwave, and enzymatic treated sour cherry (*Prunus cerasus* L.) pomace, IFT20, July 12-15, 2020, Chicago, IL. (E-poster presentation)

3. Baskaya Sezer, D., Ahmed, J., Sumnu, G., &Sahin, S., 2019. Dielectric properties of sour cherry (*Prunus cerasus* L.) pomace: Influence of frequency, concentration, pH, temperature and particle size, 1st International/11th National Food Engineering Congress, November 7-9, 2019, 232, Antalya. (Oral presentation)

4. Başkaya-Sezer, D. &Demirdöven, A., 2014. Microwave blanching applications for pectin methylesterase inactivation in carrot slices and comparison with conventional blanching, International Food Congress Novel Approaches to Food Industry (NAFI2014), May 26-29, 2014, 71, Kuşadası, Aydın. (Oral presentation)

5. Başkaya, D.& Demirdöven, A., 2013. Wheat Sprout, The 2nd International Symposium on "Traditional Foods from Adriatic to Caucasus" October 24-26, 2013, 382, Struga-Ohrid, Macedonia. (Poster presentation)

6. Anıl, M.& Başkaya, D., 2011. Usage psyllium (*Plantago ovata*) in food industry and soluble fiber effects on health, TUBITAK MAM 4th International Food and Nutrition Congress, October 12-14, 2011, İstanbul. (Poster presentation)

7. Anıl, M.&Başkaya, D., 2011. Lignan varieties and the effects on health, TUBITAK MAM 4th International Food and Nutrition Congress, October 12-14, 2011, İstanbul. (Poster presentation)

PRESENTATIONS IN NATIONAL CONFERENCES

1. Baskaya-Sezer, D., Şumnu, G., Şahin, S.,& Şakıyan-Demirkol, Ö. 2016. Determination and comparison of the dielectric properties of cake formulations by using sour cherry (*Prunus cerasus* L.) pomace and extract 12th Food Congress, October 5-7, 2016, 217, Edirne. (Poster presentation)

2. Başkaya, D.& Demirdöven, A., 2013. Microwave blanching in fruit and vegetable processing, 8th Food Engineering Congress, November 7-9, 2013, 68, Ankara. (Poster presentation)

3. Aydın, G., Kılıç, O.,& Başkaya, D., 2012. A Research on the relationship between income and expenditure in families: The case of Samsun Province (in Turkish), 10th National Agricultural Economy Congress, September 7-9, 2012, 895-899, Konya.

4. Anıl, M., Başkaya, D., 2011. The effects of Silybum marianum on health (in Turkish), 7th Food Engineering Congress, November 24-26, 2011, 136, Ankara. (Poster presentation)

5. Anıl, M., Kılıç, O., Başkaya, D., Dinçer, M., Aydın, G., 2011. Cereal products in fast-food type feeding behaviour (in Turkish), 7th Food Engineering Congress, November 24-26, 2011, 156, Ankara. (Poster presentation)

6. Anıl, M., Başkaya, D., 2011. Nutrition alternatives in celiac disease (in Turkish), 7th Food Engineering Congress, November 24-26, 2011, 159, Ankara. (Poster presentation)

SCIENTIFIC REFEREEING

Food Chemistry (Reviewer)
Journal of the Science of Food (Reviewer)
Agriculture, and Food and Bioprocess Technology (Reviewer)
Food and Bioprocess Technology (Reviewer)
Journal of Tourism and Management Research (Reviewer)

RESEARCH PROJECTS

1. Dietary fiber extraction from sour cherry (*Prunus cerasus L.*) pomace and utilization in low fat biscuit production, Middle East Technical University Research Fund Project (BAP-07-02-2014-007-634), Researcher, 2016.

2. Optimization of microwave blanching conditions in carrot slices (in Turkish), Gaziosmanpasa University Research Fund Project (BAP-2013/135), Researcher, 2014.

FELLOWSHIPS

1. TUBITAK 2214-A/2018-1 (App. number: 1059B141800169) International Research Fellowship Programme for PhD Students, (2019-12 months), Kuwait Institute for Scientific Research (KISR), Kuwait. The Scientific and Technological Research Council of Turkey.