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Research Article/Araştırma Makalesi

Influence of buckwheat flour on the quality characteristics of Fatayer (pastry with zahter mixture)

Karabuğday ununun Fatayer'in (zahter karışımlı börek) kalite özelliklerine etkisi

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ABSTRACT

In this study, the effect of the use of buckwheat flour on some quality characteristics of Fatayer which is a bakery product containing breakfast Zahter mixture as a top filling material and traditionally produced in Syria was investigated. The effect of buckwheat flour in different proportions on the physicochemical, textural, and sensory quality characteristics of Fatayer was investigated. In the study, 5 different types of Fatayers were produced with buckwheat flour ratios of 0, 30, 50, 70 and 100 % (g/g). The Fatayer produced with 100 % (g/g) wheat flour was used as a control. As the buckwheat content of Fatayers increased, the moisture content decreased from 26.61 to 14.92 % (w.b.), the fat content increased from 18.66 to 20.17 % (d.b.), and the weight loss decreased from 17.16 to 14.74 % (g/g) . The increase in the buckwheat flour ratio decreased the diameter (mm) and thickness (mm) of the Fatayers. It was observed that the increase in the buckwheat flour ratio causes an increase in hardness, flexibility, gumminess, chewiness and elasticity values, and a decrease in stickiness values. The sensory appearance, shape, color, hardness/softness, taste, smell, fragility, internal structure, chewiness and general acceptability scores of the pastries were detected in the ranges of 2.50-7.50, 2.30-7.70, 2.5-7.70, 2.30-8.40, 2.40-7.80, 4.30-7.30, 4.00-6.80, 3.40-7.60, 3.30-8.40 and 3.00-7.66, respectively. Considering the sensory properties of the samples, it was seen that the addition of 30% buckwheat flour was close to the control sample in terms of general acceptability. Considering the optimum chemical, physical, textural and sensory properties, it has been revealed that up to 50 % (g/g) Buckwheat flour can be used in the Fatayer formula.

Key Words: Buckwheat, Fatayer, Zahter pastry, quality

ÖZ

Bu çalışmada, Suriye'de geleneksel olarak üretilen ve üst dolgu malzemesi olarak kahvaltılık Zahter karışımını içeren bir fırın ürünü olan Fatayer'in karabuğday unu kullanımının bazı kalite özelliklerine etkisi araştırılmıştır. Fatayer fizikokimyasal, tekstürel ve duyusal kalite özellikleri üzerine farklı oranlarda karabuğday ununun etkisi incelenmiştir. Çalışmada karabuğday unu oranları % (g/g) 0, 30, 50, 70 ve 100 5 farklı Fatayer çeşidi üretilmiştir. Kontrol olarak % 100 (g/g) buğday unu ile üretilen Fatayer hamuru kullanılmıştır. Fatayerlerde karabuğday oranı arttıkça nem oranı ve ağırlık kaybı sırasıyla 17.16'dan % (k.m.) 14.74'e ve % (g/g) 26.61'den 14.92'ye düşerken, yağ oranı ise % (k.m.) 18.66'dan 20.17'ye artmıştır. Karabuğday unu oranının artması Fatayeryerlerde çap (mm) ve kalınlık (mm) değerlerini düşürmüştür. Karabuğday unu oranının artmasının sertlik, esneklik, sakızımsılık, çiğnenebilirlik ve elastikiyet gibi yapısal değerlerinde artışa, yapışkanlık değerlerinde ise azalmaya neden olduğu gözlemlenmiştir. Fatayerlerin görünüş, şekil, renk, sertlik/yumuşaklık, tat, koku, kırılganlık, iç yapı, çiğnenebilirlik ve genel kabul edilebilirlik gibi duyusal puanları sırasıyla 2.50-7.50, 2.30-7.70, 2.5-7.70, 2.30-8.40, 2.40-7.80, 4.30-7.30, 4.00-6.80, 40-7.60, 3.30-8.40 ve 3.00-7.66 aralıklarında tespit edilmiştir. Örneklerin

duyusal özellikleri incelendiğinde % (g/g) 30 karabuğday unu ilavesinin genel kabul edilebilirlik açısından kontrol örneğine yakın olduğu görülmüştür. Optimum kimyasal, fiziksel, dokusal ve duyusal özellikler dikkate alındığında Fatayer formülünde % 50 (g/g) oranına kadar Karabuğday unu kullanılabileceği ortaya çıkmıştır.

Anahtar Kelimeler: Karabuğday, Fatayer, Zahterli börek, kalite

Introduction

Powdered Zahter is a traditional spice mix consumed with olive oil for breakfast in North Africa, the Middle East and the Eastern Mediterranean regions (Syria, Türkiye). The use of Zahter, which consists of spice mixtures, as a breakfast dates to ancient times. Its composition is very rich and varies from country to country. It consists of many different raw materials, such as menengiç, sesame, chickpea powder, watermelon seeds, melon seeds, sumac, salt, cumin, red pepper, black cumin, lemon salt, coriander, fennel, thyme (zahter), and peanuts. Zahter-mixture is usually not eaten alone, it is consumed with olive oil by dipping with bread. Zahter mixture is also used as a medicinal ingredient in addition to its cholesterol-lowering effect (Hayoğlu et al., 2016; Dalkılıç et al., 2020). Fatayer is a traditional pastry filled with various flavors such as cheese, zahter, and spinach in Arab countries (Hassan et al, 1991). Fatayer is known as a bread with Zahter-mixture in the Hatay region of Türkiye (Iflazoglu and Sarper, 2021).

In recent years, there is an increasing interest in pseudocereals as substitutes for cereals or as a complete replacement. The use of pseudocereals with food products increased because they are rich in nutrients (vitamins, minerals, balanced amino acid and protein content, bioactive components such as lipids, dietary fibers and polyphenols) and because they do not contain the gluten protein that most cereals contain. Buckwheat belonging to the Polygonaceae family, which is in the pseudo-cereal group, is a product rich in antioxidants such as protein, dietary fiber, vitamins, mineral substances, basic polyunsaturated fatty acids, rutin, orientin, vitexin, quercetin, isovitexin, catechin (Dizlek et al. 2009; Sedej et al. 2011; Hayıt and Gül, 2017). Buckwheat is a gluten-free product with great potential in the functional and clinical food industry, is used to enrich gluten-free foods produced for celiac patients (Mariotti et al. 2013; Hayıt and Gül, 2015).

In the literature review, it was seen that scientific studies on Breakfast Zahter and Fatayer were not sufficient. In this study, the effect of using different ratios of buckwheat flour on the physicochemical, textural and sensory quality of Fatayer was investigated.

Material and Method

Materials

Wheat flour (WF) was supplied from Dayıoğlu flour factory (Gaziantep, Türkiye). Buckwheat flour (BWF) was purchased from Smart Kimya (İzmir, Türkiye). Zahter-mixture, yeast, salt, milk, sugar, sunflower oil and olive oil used for Zahter-pastry (Fatayer) were obtained from local markets in Şanlıurfa. Zahter mixture contains sesame, coriander, wheat, thyme, fennel, anise, citric acid, salt, pistachio, soy and mustard.

Methods

Fatayer production

The dough for Fatayer production contained 330 g flour, 15 g sugar, 10 g salt, 10 g dry yeast, 100 ml milk, 185 ml water and 27 ml sunflower oil. Fatayer contained 100 % (g/g) wheat flour (A) was chosen as the control Fatayer. The production of Fatayer was made with the modification of method of Hassan et al. (1991). In the study, “Kitchen Aid” brand, “Model 5KSM150 model Inc., St. Joseph, Michigan, USA” mixer with 2 kg of batter capacity and 10 different mixing speeds was used for batter preparation. Ten dough balls of approximately 50 g each were formed from the prepared dough. After the dough was shaped, 27 g Zahter-mix and 27 ml olive oil was used for top filling of each loaf of dough. The dough lined on baking paper then was baked at 180 ºC for 30 minutes. Baked samples were stored to room temperature for analysis. Wheat flour-buckwheat

flour mixture ratios determined by preliminary trials are given in Table 1. The production flowchart of Fatayer was shown in Figure 1.

Table 1. Percentages of wheat and buckwheat flours for Fatayer samples

Sample	Wheat Flour (%, g/g)	Buckwheat Flour (%, g/g)
A	100	-
B	70	30
C	50	50
D	30	70
E	-	100

Chemical and energy analysis of samples

Standard methods of analysis (AACC, 2000) were used to determine moisture (AACC 44-16.01), ash (AACC 08-01), crude protein (AACC 46-10) and crude fat (AACC 30-10.01) contents. The nitrogen-to-protein conversion factor of 5.80 and 6.25 were used for wheat and buckwheat flours, respectively. The total carbohydrate was calculated using the standard equation: 100% - (%protein + %fat +%ash + %moisture) (FAO, 2003). The energy calculation was done by multiplying the protein, fat and carbohydrate by the factors 4, 9 and 4, respectively (FAO, 2003).

Measurement of color

The color (L*, a* and b*) of raw materials and Fatayer samples were measured using a Hunter's Lab color analyzer (Hunter lab scan XE, Reston VA, USA)

Dimension analysis

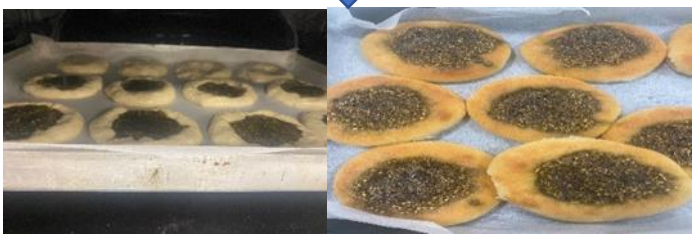
The diameter (D, mm) and thickness (T, mm) of 10 Fatayer samples were measured with a digital caliper with an accuracy of 0.02 mm (Model: 505–633, Mitutoyo, Tokyo, Japan), respectively, and the average of 10 measurements was obtained.

flour, water, oil, milk, yeast, salt, sugar

Mixing and dough kneading (10 min)

Resting of dough (2 hour, 25 ºC)

Forming



Baking (30 min, 180 ºC)

Cooling of Fatayers at room temperature

Figure 1. Production flow chart of Fatayer

Weight loss

In order to calculate the weight loss, the average of 10 dough of the samples was weighed before and after the baking process and the weight loss was calculated by using Eq. (1) (Turabi et al., 2010).

$$Weight\ los(\%) = [\frac{W_i - W_f}{W_i}) * 100] \qquad (1)$$

Where, Wi and Wf are the weight of the sample before and after baking (g), respectively.

Texture profile analysis (TPA)

Texture profile analysis (TPA) tests of Fatayer samples were performed using a Texture Analyzer (TA-XT Plus Stable Micro Systems, UK) with a 36 mm diameter cylindrical probe (P/36) to determine the textural properties of the pastries. Hardness, springiness, cohesiveness, gumminess, chewiness, and elasticity values were calculated from the TPA

curve (Karaoğlu et al., 2008).

Sensory evaluation

Sensory evaluation of Fatayer samples in different formulations were carried out by 10 semi-trained panelists at Harran University, Faculty of Engineering, Department of Food Engineering. The panelists were asked to evaluate each sample attribute applying a Hedonic scale of 9-points (1 - dislike extremely, 9- like extremely). Test was applied to the panelists in terms of appearance, shape, color, hardness/softness, taste, smell, fracturability, internal structure, chewiness and general acceptability of the pastry samples (Volpini-Rapina et al., 2012; Emmanuel and Sackle, 2013).

Statistical analysis

For the statistical analysis of data, the SPSS version 26.0 (IBM, Statistical Package software for Windows, SPSS Inc., USA) was used. Mean and standard deviation were computed for all the attributes. Significant differences were determined by Duncan Multiple Range Test. Differences were considered significant at $P \leq 0.05$ to know the accuracy. All analyses were performed in triplicate.

Results and Discussion

Chemical, energy and color values of raw materials used in Fatayer samples

Chemical and color properties of composite flours and Zahter mixture were given in Table 2. Moisture, ash, fat, protein, total carbohydrate, energy, L*, a* and b* values of Zahter mixture were found as 2.19%, 7.36%, 6.73%, 17.96%, 67.95%, 404.21 Kcal/g, 48.58, 3.34 and 16.80, respectively. The chemical composition of breakfast zahter is varied from the origin of ingredients used in production. Its composition varies according to different cultures and countries. Similar results were reported by Hayoğlu et al. (2016), Uçan et al. (2014) and Köten and Satouf (2019).

Table 2. Chemical composition and color (L*, a* and b*) of raw materials

Propery	A	B	C	D	E	Zahter
Moisture content (%, w.b.)	10.97^{c}±0.03	11.30^{b}±0.01	11.65^{a}±0.02	11.63^{a}±0.01	11.76^{a}±0.04	2.19±0.02
Ash content (%, d.b)	0.71^{d}±0.03	1.21^{c}±0.02	1.30^{c}±0.03	1.65^{b}±0.01	1.93^{a}±0.02	7.36±0.03
Fat content (%, d.b)	1.40^{d}±0.02	1.71^{cd}±0.03	1.92^{bc}±0.01	2.12^{ab}±0.04	2.43^{a}±0.02	6.73±0.04
Protein content (%, d.b)	11.94^{e}±0.01	12.26^{d}±0.02	12.47^{c}±0.02	12.69^{b}±0.03	13.01^{a}±0.02	17.96±0.03
Carbohydrate content (%, d.b)	85.95^{e} ±0.02	84.82^{d} ±0.03	84.31^{c}±0.02	83.54^{b}±0.04	82.63^{a}±0.01	67.95±0.01
Energy (Kcal/100 g)	404.16^{c}±0.03	403.71^{e}±0.01	404.31^{b}±0.02	404.00^{d}±0.03	404.43^{a}±0.01	404.21±0.02
L*	92.76^{a}±0.02	90.87^{b}±0.04	89.00^{c}±0.03	88.61^{c}±0.06	92.76^{d}±0.02	48.58±0.03
a*	0.53^{d}±0.01	0.81^{c}±0.02	0.89^{c}±0.02	1.23^{b}±0.03	1.57^{a}±0.02	3.34±0.04
b*	8.95^{a}±0.05	8.22^{a}±0.02	8.17^{a}±0.03	8.06^{a}±0.06	8.05^{a}±0.04	16.80±0.02

A:100%(g/g) Wheat flour, B: 70%(g/g) wheat flour+30%(g/g) Buckwheat flour, C: 50%(g/g) wheat flour +50%(g/g) Buckwheat flour , D: 30%(g/g) wheat flour + 70%(g/g) Buckwheat flour and E: 100%(g/g) Buckwheat flour. Results are Mean ± SD; Means having the same superscript do not differ significantly at P≤0.05.

The chemical composition of composite flours was shown in Table 2. As the buckwheat flour addition increased, the moisture, ash, fat, protein contents of flour samples increased from 10.97 to 11.76%(w.b.), 71 to 1.93%(d.b.), 1.40 to 2.43%(d.b.), 11.94 to

13.01%(d.b.), while the carbohydrate content decreased from 85.95 to 82.63%(d.b.), respectively. Energy value also increased with buckwheat flour addition. In a study, it was reported that ash (0.49-2.4%), fat (1.03-2.05%) and protein content (11.69-12.04%) increased in a mixture of wheat flour and buckwheat flour as the buckwheat flour ratio increased (Selimovic et al., 2014). Yıldız and Bilgiçli (2012) reported that moisture, ash and protein contents of wheat flour were found to be 0.70%, 0.47% and 11.60%, and those of buckwheat flour 11.10%, 1.73% and 12.10%, respectively. The study is compatible with the literature studies.

Color changes of composite flours were given Table 2. As the buckwheat flour addition increased, L* (92.76-92.76.0) and b* (8.95-8.05) values decreased, while a* (0.53-1.57) values increased. While the decrease in L* value and the increase in a* value were significant (P≤0.05), the decrease in b* value was not significant (P>0.05). Similar results were reported in the study of Bilgiçli and İbanoğlu (2015).

Chemical and physical properties of Fatayer samples

This work deals with the use of buckwheat and wheat flour to produce gluten-free pastry with zahter mixtures. A gluten-free cereal can be widely used for producing gluten free products (Wronkowska et al., 2010; Sedej et al., 2011).

Visual appearance of Fatayer samples produced from wheat and buckwheat flours were shown in Figure 2. Table 3 shows chemical, energy and physical characteristics of Fatayer samples. As the buckwheat addition increased in formulation of Fatayer samples, the moisture, carbohydrate contents and weight loss decreased, while the ash, fat and protein contents increased (Table 3). The decrease in moisture, carbohydrate contents and weight loss and the increase in fat, ash and protein contents were found to be significant (P≤0.05). This is in consistent with the levels of these components observed in the raw materials (zahter mixture and buckwheat flour). Mohajan et al. (2019) reported in a study that as the buckwheat flour rate increased, the moisture content of the bread decreased (29.91-25.41%), while the fat content increased (4.88-5.85%). In another study, related bread production (Selimovic et al. (2014), it was reported that the weight loss decreased as the buckwheat ratio increased. The results of previous studies were found to be compatible with this study. The decrease in the moisture content and weight loss samples is a result of the decrease in the water absorption capacity of the dough due to the addition of buckwheat flour. The lower water absorption capacity of buckwheat flour could be attributed to the presence of lower amount of hydrophilic constituents in buckwheat flour (Akubor and Badifu, 2001). Also, oil in the zahter mixture would be the reason of decrease of hydrophilic propery. Isolated buckwheat starch was reported to have higher water-binding capacity than wheat and corn starch (Wijngaard & Arendt, 2006).

A **B** **C** **D** **E**

Figure 2. Pictures of different Fatayer (A:100%(g/g) Wheat flour, B: 70%(g/g) wheat flour+30%(g/g) Buckwheat flour, C: 50%(g/g) wheat flour +50%(g/g) Buckwheat flour, D: 30%(g/g) wheat flour + 70%(g/g) Buckwheat flour and E: 100%(g/g) Buckwheat flour)

Table 3. Chemical, energy, and physical characteristics of Fatayer samples.

Property	A	B	C	D	E
Moisture content (%, w.b.)	26.61^{a}±0.20	21.46^{b}±2.1	21.04^{bc}±0.06	18.35^{c}±0.22	14.92^{d}±1.31
Ash content (%. d.b)	8.07^{d}±0.00	8.57^{c}±0.10	8.66^{c}±0.06	9.01^{b}±0.01	9.29^{a}±0.07
Fat content (%. d.b)	8.13^{d}±0.12	8.44^{cd}±0.06	8.65^{bc}±0.08	8.85^{ab}±0.14	9.16^{a}±0.23
Protein content (%. d.b)	29.90^{e}±0.04	30.22^{d}±0.02	30.43^{c}±0.02	30.65^{b}±0.03	30.97^{a}±0.05
Carbohydrate content (%. d.b)	53.90^{e}±0.16	52.77^{d}±0.09	52.26^{c}±0.05	51.49^{b}±0.14	50.58^{a}±0.31
Energy (Kcal/100 g)	408.37^{b}±0.02	407.92^{a}±0.03	408.61^{cd}±0.04	408.21^{c}±0.04	408.64^{cd}±0.06
Weight loss (%, g/g)	17.16^{a}±0.33	16.58^{a}±0.46	16.26^{ab}±0.57	15.06^{bc}±0.91	14.74^{c}±0.11
Diameter(mm)	82.01^{c}±2.80	70.76^{b}±8.22	79.43^{a}±2.04	64.74^{c}±4.97	68.12^{bc}±2.79
Thickness (mm)	18.74^{a}±1.42	19.36^{a}±2.16	13.70^{b}±1.04	14.56^{b}±1.46	15.25^{b}±0.65
L*	26.16^{e}±0.05	27.80^{d}±0.04	29.89^{c}±0.02	34.39^{a}±0.06	32.38^{b}±0.03
a*	5.80^{c}±0.04	5.66^{d}±0.02	6.50^{a}±0.03^{a}	5.89^{b}±0.02	5.83^{bc}±0.02
b*	11.03^{e}±0.02	12.62^{d}±0.07	14.66^{b}±0.19	15.85^{a}±0.03	13.73^{c}±0.01

A:100%(g/g) Wheat flour, B: 70%(g/g) wheat flour+30%(g/g) Buckwheat flour, C: 50%(g/g) wheat flour +50%(g/g) Buckwheat flour , D: 30%(g/g) wheat flour + 70%(g/g) Buckwheat flour and E: 100%(g/g) Buckwheat flour. Results are Mean ± SD; Means having the same superscript do not differ significantly at P≤0.05.

The size (diameter and thickness) variation of Fatayer samples was presented in Table 3. Addition of buckwheat flour decreased the diameter and thickness values of Fatayer samples. These decrease values were found to be significant (P≤0.05). The results indicated that an increase in the proportion of buckwheat flour resulted in a decrease in the size of the samples due to the lower water absorption capacity of buckwheat flour and buckwheat flour does not contain gluten. Buckwheat-supplemented samples exhibited a decreased spread (Figure 2). Similar results were found in the studies of Baljeet et al. (2010), Mahmood et al. (2019) and Makpoul et al. (2015) for biscuits.

Color is an important quality characteristic that can animate individual's appetence. It is a considerable factor used for process control during baking and roasting because of brown pigments appearing due to browning and caramelization reactions (Pereira et al., 2013). The surface color changes of Fatayer were shown in Table 3. The surface L*, and a* color values increased but b* values of Fatayer samples decreased with buckwheat flour addition and the colors changed to dark brown from creamy yellow (Figure 2 and Table 3). The positive values of a* and b* values represented the superiority of redness and yellowness of Fatayer samples. The change of color of fatayer samples from yellow to dark brown may be due to the ingredient composition such as buckwheat flour, zahter mixture, and red pigment formation

resulting from the Maillard reaction or nonenzymatic browning which depends on the amount of reducing sugars and amino acids on the surface, baking temperature and time. The results of color values of the present study were found compatible with the findings of other previous researchers (Pereira et al., 2013).

Texture profile analysis (TPA) of Fatayer samples

The hardness is the main determinant of the quality of the bread and similar bakery products and is closely related to the perception of fresh bread by consumers. The textural properties of Fatayer samples were given in Table 4. As the buckwheat flour content of samples increased, it was seen that cohesiveness decreased while hardness, springiness, chewiness, gumminess, and elasticity increased. The hardness value of bread increased as the ratio of pseudocereals addition increased breads (Yeşil and Levent, 2022) Similar results were reported by Sanz-Penella et al. (2013), Bilgiçli & İbanoglu (2015) and Azizi et al. (2020). Lower hardness reached the control sample without buckwheat (1506.30 g) in comparison with sample 100% buckwheat (3487.47 g), but the increasing trend of hardness was observed with higher portion of buckwheat flour in the mixture. Similar results were observed in the study of Dvorakova et al. (2013).

Table 4. Textural properties of Fatayer samples

Property	A	B	C	D	E
Hardness	1506.30^{c}±139.95	2149.29^{bc}±447.13	2871.61^{ab}±504.13	3459.57^{a}±584.04	3487.47^{a}±354.55
Springiness	0.95^{c}±0.08	1.08^{b}±0.02	1.15^{ab}±0.01	1.18^{ab}±0.03	1.21^{b}±0.03
Cohesiveness	0.52^{a}±0.01	0.51^{ab}±0.01	0.51^{ab}±0.02	0.49^{ab}±0.01	0.46^{b}±0.04
Chewiness	785.74^{c}±85.22	1087.03^{bc}±241.18	1514.43^{ab}±257.26	1703.00^{a}±313.59	1845.62^{a}±87.81
Gumminess	783.30^{c}±84.47	1118.99^{bc}±219.02	1541.58^{ab}±293.97	1691.47^{a}±352.24	1704.05^{a}±90.31
Elasticity	0.44^{c}±0.02	0.45^{c}±0.02	0.48^{bc}±0.01	0.51^{ab}±0.02	0.56^{a}±0.04

A:100%(g/g) Wheat flour, B: 70%(g/g) wheat flour+30%(g/g) Buckwheat flour, C: 50%(g/g) wheat flour +50%(g/g) Buckwheat flour , D: 30%(g/g) wheat flour + 70%(g/g) Buckwheat flour and E: 100%(g/g) Buckwheat flour. Results are Mean ± SD; Means having the same superscript do not differ significantly at P≤0.05.

Sensory properties of Fatayer samples

Table 5 shows the sensory properties of Fatayer samples were evaluated between 1-9 points. Accordingly, appearance, shape, color, hardness/softness, taste, smell, fragility, internal structure, chewiness and general acceptability scores are found as in the range of 7.50-2.50, 7.70-2.30, 7.70-2.50, 8.40-2.30, 7.80-2.40, 7.30-4.30, 6.80-4.00, 7.60 -3.40, 8.40-3.30 and 7.66-3.00, respectively. Considering the sensory properties of the samples, it was observed that 30% buckwheat flour addition was close to the control sample in terms of general acceptability. Sensory evaluation indicated that successful Fatayer could be manufactured with the addition of buckwheat flour up to 50%. In particular, similar sensory scores were found with the control Fatayer samples, and 30% buckwheat added samples Similar results have also been reported by Lorenz and Coulter (1991), Bojnanska et al. 2009) and Bilgiçli & İbanoğlu (2015).

Table 5. Sensory score of Fatayer samples

Property	A	B	C	D	E
Appearance	7.50^{a}±1.65	7.40^{a}±1.65	6.30^{ab}±2.00	4.80^{b}±1.69	2.50^{c}±1.08
Shape	7.70^{a}±1.25	7.60^{a}±1.51	6.90^{ab}±1.79	5.20^{b}±1.75	2.30^{c}±2.06
Color	7.70^{a}±1.49	7.50^{a}±1.72	6.70^{ab}±2.36	5.00^{b}±2.11	2.50^{c}±1.58
Hardness	8.40^{a}±0.70	7.80^{ab}±0.79	6.40^{b}±1.27	4.20^{c}±1.62	2.30^{d}±0.95
Taste	7.80^{a}±1.40	7.50^{a}±1.43	6.40^{ab}±1.65	5.10^{b}±1.10	2.40^{c}±1.35
Smell	7.30^{a}±1.77	7.10^{a}±1.52	5.90^{ab}±2.13	5.20^{ab}±1.93	4.30^{b}±2.45
Fracturability	6.80^{a}±2.57	6.60^{a}±2.32	6.00^{a}±1.33	5.10^{a}±1.52	4.00^{a}±2.91
Internal structure	7.60^{a}±1.90	7.70^{a}±1.06	7.20^{ab}±1.32	5.50^{b}±1.08	3.40^{c}±1.51
Chewiness	8.40^{a}±0.84	7.90^{a}±0.88	7.00^{a}±1.16	5.20^{b}±1.87	3.30^{c}±1.34
General acceptability	7.66^{a}±1.02	7.46^{a}±0.96	6.53^{a}±1.33	5.03^{b}±1.13	3.00^{c}±1.16

A:100%(g/g) Wheat flour, B: 70%(g/g) wheat flour+30%(g/g) Buckwheat flour, C: 50%(g/g) wheat flour +50%(g/g) Buckwheat flour , D: 30%(g/g) wheat flour + 70%(g/g) Buckwheat flour and E: 100%(g/g) Buckwheat flour. Results are Mean ± SD; Means having the same superscript do not differ significantly at P≤0.05.

Conclusion

This research shows that Fatayer produced by substituting Buckwheat flour at a 50% (g/g) level with wheat flour can successfully be produced. At 70 and 100 % (g/g) levels of buckwheat flour however, has been less acceptable in their sensory characteristics and physical properties. The nutritional content of the Fatayer pastries were improved with buckwheat flour. Since buckwheat contain higher levels of nutrients than many cereals, Fatayer pastries improve the diets of consumers. Buckwheat provided the Fatayers darker crust as a result of natural pigmentation. Considering the optimum chemical, physical, textural and sensory properties, it has been revealed that up to 50 % (g/g) Buckwheat flour can be used in the Fatayer formula.

Conflict of Interest: The authors declare no conflict of interest.

Authors' Contribution: A.YILDIRIM, Z.KARABOĞA and Firuze AMASYALI were responsible for selection of the research topic, conducting experiments, data collection and analysis, writing and submitting the manuscript.

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