



Research Article

**THE PRODUCTION OF BREAD TYPES PECULIAR TO TURKISH AND WORLD CUISINE
WITH LOCAL IZA WHEAT (*Triticum monococcum* ssp. *Monococcum*) AND CONSUMER
OPINIONS ON THE QUALITY OF BREAD**

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Abstract

The most important grain type in terms of food history is wheat, and the oldest and the most basic and important food element known to mankind is bread. Wild wheat collected by Paleolithic people and einkorn wheat and IZA wheat (*Triticum monococcum* ssp. *monococcum*) developed by Neolithic people who were engaged in farming for the first time did not contain much gluten, so they were used to make unleavened bread after boiling or grounding as grains. In time, farmers have developed higher gluten wheat varieties, and thanks to the gluten it contains, it has been possible to make both well-rising yeast bread and thinly rolled dough products such as phyllo, meat pasty (ravioli) and pasta. However, the nutritional value of wild wheat is higher than domestic wheat. Today, while there is 14.5% protein in the best breed domestic wheat, this rate is 22.83% in wild wheat. In addition, wild wheat species have a higher flavor because of their high protein and mineral content. Though the lack of gluten makes it hard to process wild wheat flours, shape the products properly and bake them in accordance with the general taste and especially to make it rise and provide crust formation in the making of bread, it is considered important to develop recipes suitable for consumption and general taste, and to increase the awareness and consumption of wild wheat varieties, which are the wheat heritage of Anatolia. In recent years, the number of scientific studies on the importance of IZA wheat (*Triticum monococcum* ssp. *monococcum*), which attracts attention with its low gluten content and nutritious properties, has increased and it began to take more place in consumption with popular culture. However, the information in the literature on the processing of flour obtained from IZA wheat and the production of bread suitable for general taste is quite limited. This study aims to produce bread varieties that are peculiar to Turkish and world cuisines, using local IZA flour specific to Bolu, develop and disseminate standard recipes suitable for qualified production, and evaluate the general appreciation rate with the sensory analysis, although it contains low gluten. For this purpose, standard recipes of 8 bread types, including (1) Whole Grain IZA, (2) Three Grain IZA, (3) Carrot Purple IZA, (4) Village Bread, (5) German Bread, (6) Walnut Bread, (7) Yellow Gelin and (8) Focaccia with Olives were developed and produced in a professional kitchen environment by sticking to their original recipes and presented to the individuals who participated in the IZA Workshop organized in cooperation with Bolu Municipality. Breads were evaluated by consumers under the name of external color, internal color, scent, pore structure, texture, chewiness, flavor and general evaluation. The opinions of 20 participants, including man and woman who have different education levels from primary education to doctor's degree were taken by questionnaire technique. A scale ranging from extremely poor (1) to excellent (7) was implemented in the study. The survey results were evaluated according to the Analysis of Variance (ANOVA), and it was concluded that the difference between the characteristics considered in terms of sensory analysis was not statistically significant. Average values showed that all bread types scored higher than 6. In terms of sensory analysis, it was concluded that all types of bread were liked by the participants.

Anahtar Kelimeler: IZA, *Triticum monococcum* ssp. *monococcum*, Bread types, Sensory analysis

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DOI: 10.33083/joghat.2022.230

Introduction

Wheat, which has been a staple food around the world since 9,000 and 3,500 BC, provides 90% of our daily calories nowadays (Harari, 2015). Archaeo-botanical research has revealed that the first agricultural activities started in Fertile Crescent which includes Turkey's southeast region. Einkorn wheat, emmer wheat, legumes, barley, lentils and peas are known as the oldest agricultural products. DNA fingerprint studies revealed that einkorn wheat (*Triticum boeoticum*) was cultured near Karacadağ for the first time in Diyarbakır, approximately 10,000 years ago (Özberk, 2016). As a result of natural evolution, man-made selection or natural breeding, first cultivated hulled wheats and then naked modern varieties were developed in Turkey. Previously, wild einkorn (*Triticum boeoticum*) and wild emmer (*T. dicoccoides*) were collected from nature. Then, these two wild species evolved into the primitive forms of einkorn (*T. monococcum*) and emmer (*T. dicoccon*) which have been cultivated by humans (Özberk, 2016). Before today's modern bread wheat varieties have become widespread in Anatolia, primitive wheat culture forms such as einkorn (*T. monococcum*) and emmer (*T. dicoccon*) had been cultivated. Studies examining the relationship between human and wheat shows that modern life causes the loss of some local botanical cultures and natural richness. Today, it is of importance to regain the primitive forms of wheat species chosen by humans thousands of years ago (Özberk, 2016).

Einkorn is a part of Turkey's cultural heritage that is one of the local wheat varieties among its genetic resources. With its tight glume structure, it is resistant to diseases and pests, and it can grow in arid or poor nutritional areas (Arzani, 2017; D. Aslan, Aktaş, H., Ordu, B., Zencirci, N., 2017; D. Aslan, Ordu B., Zencirci, N., 2016; Karagöz, 2005; Özberk, 2016; Zencirci, 2005). Kastamonu, Bolu and Bilecik provinces are certain regions where einkorn is grown in Turkey (D. Aslan, Aktaş, H., Ordu, B., Zencirci, N., 2017). People who live in those provinces gave local names to einkorn such as Siyez, Küçük Buğday, Kavılca, Kaplıca and Gabulca (Zaharieva, 2014). In Bolu, einkorn was called "IZA."

With the increase of the human population, the possibility of healthy and adequate nutrition has decreased (Kumar, 2016; Miller, 2013). One of the partial reasons for this decrease of this healthy nutrition opportunity was the decrease in the cultivation of ancient products. It has been supported by studies that modern and ancient wheat differ in terms of micronutrient content concentration (Table 1) (Fan, 2008).

There are many reasons why IZA has higher nutrient content than modern wheat. One of the reasons may be modern wheat's exposure to the intensive cultivation program, and the other reason is that modern wheat may not be able to absorb enough nutrients from the soil due to the short roots (Arzani, 2017; Fan, 2008; Garvin, 2006; P. R. Shewry, Pellny, T.K., Lovegrove, A., 2016). Moreover, modern wheat with high starch content may cause other nutrients to be reduced (Table 1, Table 2) (Arzani, 2017).

Due to the einkorn content, it is difficult to get the consistency of bread dough. The aim of the study is to apply new recipes in bread making of einkorn and to present these breads to taste.

Conceptual framework

Wheat grain mostly contains the types of vitamin B, tocopherols, carotenes, protein, carbohydrates, lipids and minerals especially iron and zinc which are of highly importance for humans' health (Table 1, Table 2). Tocopherols and carotenes are antioxidant contents that reduce the risk of cardiovascular disease and types of cancers (Comitato, 2009; Czerwinski, 2004; Luk, 2011; Namitha, 2010; Yang, 2010). Tocopherols have the same features with vitamin E such as reducing the level of LDL in blood. (Czerwinski, 2004). It also prevents retinopathy, impaired immune response, anemia, and neurological problems (Shahidi, 2016). Carotenes, on the other hand, have the feature of vitamin A and reduce the risk of eye related diseases (Namitha, 2010). Many studies focused on wheat's content of vitamin B, which plays an important role in health as well. While thiamine (B₁) has a role in carbohydrate metabolism, riboflavin (B₂) and niacin (B₃) take place in energy metabolism ((*Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline, National Academies Press (US)*), Institute of Medicine (US) Standing Committee on the Scientific Evaluation of Dietary Reference Intakes 1998; McCormick, 2012). Foliates (B₉) have a function in DNA replication and are important for decreasing the risk of vascular disease, cancer and neural tube defect (Bailey, 2012). Moreover, pyridoxine (B₆) is involved in neurotransmitter and amino acid metabolism. B₆ deficiency causes decrease in heme synthesis, which is why red blood cells are formed in smaller sizes than usual, leading to microcytic anemia (Da Silva, 2012). While beriberi disease and depression can be seen in thiamine deficiency, pellagra disease and memory loss can be seen in niacin deficiency or skin diseases or hair loss are seen after B₂ deficiency, as well (*Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline, National Academies Press (US)*), Institute of

Medicine (US) Standing Committee on the Scientific Evaluation of Dietary Reference Intakes 1998). Wheat highly contains iron (Fe) and zinc (Zn) among other minerals. While iron deficiency causes anemia, zinc deficiency may affect the possibility of fertility, reproduction and growth (Berg, 2002; Gibson, 2006). In most of these contents, einkorn has shown superiority although it lost advantage in terms of fiber content when compared to modern wheat (Table 2). It would be more appropriate to mix it with other grains to balance these values.

IZA, like the other wheat varieties known all over the world, has similar properties in terms of taste and appearance, but it is rich by means of protein and lipid compared to spelt and bread wheat (Table 2). It is known that the glycemic index associated with consumed carbohydrates poses a risk for most age-related diseases such as diabetes, cardiovascular diseases and cancer (Jenkins, 2002). Due to its low digestible carbohydrate and starch content, the glycemic activity of IZA can decrease. Therefore it creates positive effects on blood sugar and intestinal activities (Jenkins, 2002).

Foods that are both important for health and rich in nutritional ingredients are called *functional foods*. Consumers currently have goals such as having quality life, to delay aging, alleviating health problems or reducing their risk, providing endurance, strengthening the immune system, and avoiding high medical treatment costs. This shows that there is a link between health and food according to the consumers' perceptions. These reasons enabled the consumer to discover the functional product. Because of these healthy properties of IZA, the products obtained with organic production have been attracting the attention of most people today (Ares, 2009; Childs, 1997; Di Pasquale, 2011; Gray, 2003; Krystallis, 2008; Siro, 2008). Due to its content and antioxidant structure, IZA can be included in functional foods. One of the most important reasons for organic and functional food products to be preferred by consumers is to adapt easily to the daily nutrition routine and to create healthier products without changing their eating habits (Larsen, 2003). Moreover, consumers' perceptions of functional products can be shaped around traditional nutrition cultures and flavors which they are accustomed to (Gray, 2003; Krystallis, 2008; Menrad, 2003; Verbeke, 2006; W., 2005). IZA wheat is advantageous in this aspect.

Table 1. Tocol, carotene, vitamin B types and some mineral contents in bread wheat, spelt and einkorn
 $\mu\text{g g}^{-1}$ Dry Matter

Contents	Einkorn	Bread wheat	Spelt	Contents	Einkorn	Bread wheat	Spelt
Lutein	7.69	1.79	2.58	B vitamins			
α -carotene	0.53	0.06	0.31	Tiamin (B1)	5.00	4.60	5.20
β -carotene	0.19	0.10	0.09	Riboflavin (B2)	4.50	1.30	1.40
Total caroten	8.41	1.95	2.98	Niacin (B3)	31.00	55.00	20.00
α -tocopherol	12.18	14.10	15.20	Pyrodoxine (B6)	4.90	55.00	3.50
β -tocopherol	4.79	7.92	10.11	Folate (B9)	0.58	0.56	0.58
α -tocotrienol	12.77	5.36	5.83	Minerals			
β -tocotrienol	48.22	34.09	37.21	Iron (Fe)	76.30	37.50	50.00
Total Tocol	77.96	61.47	68.35	Zinc (Zn)	53.75	35.00	47.00

Abdel-Aal, 1995; A. Hidalgo, Brandolini, A., Pompei, C., Piscozzi, R., 2006; P. R. Shewry, Hey, S., 2015; E. Suchowilska, Wiwart, M., Kandler, W., Krska, R., 2012

Table 2. Percentage of some components in einkorn, bread wheat and spelt

Component	% of dry matter		
	Einkorn	Bread wheat	Spelt
Starch	62.30	68.50	63.84
Protein	18.20	14.82	17.90
Lipid	3.50	2.80	2.39
Ash	2.30	1.90	2.10
Dietary Fiber	9.80	13.40	12.00
Digestible carbohydrate	64.5	73.00	65.90

Abdel-Aal, 1995; Andersson, 2013; Brandolini, 2008; Davis, 1981; Gebruers, 2008; Grausgruber, 2004; A. Hidalgo, Brandolini, A., Ratti, S., 2009; P. R. Shewry, Hawkesford, M.J., Pironen, V., Lampi, A.M., Gebruers, K., Boros, D., Andersson, A.A.M., Aman, P., Rakszegi, M., Bedo, Z., Ward, J.L., 2013; E. Suchowilska, Wiwart, M., Borejszo, Z., Packa, D., Kandler, W., Krska, R., 2009

Nowadays, with the popularity of functional foods and with the help of Bolu Municipality, the production of IZA has increased. Although IZA acreage expanded, IZA's place on the table was mostly limited with bulgur. Recently, innovations in bread production have presented new opportunities to make breads by using IZA flour. In this study, these opportunities were evaluated, and eight bread types were produced. Produced bread types were dished up to participants in a survey and evaluated according to a sensory analysis.

Materials and Methods

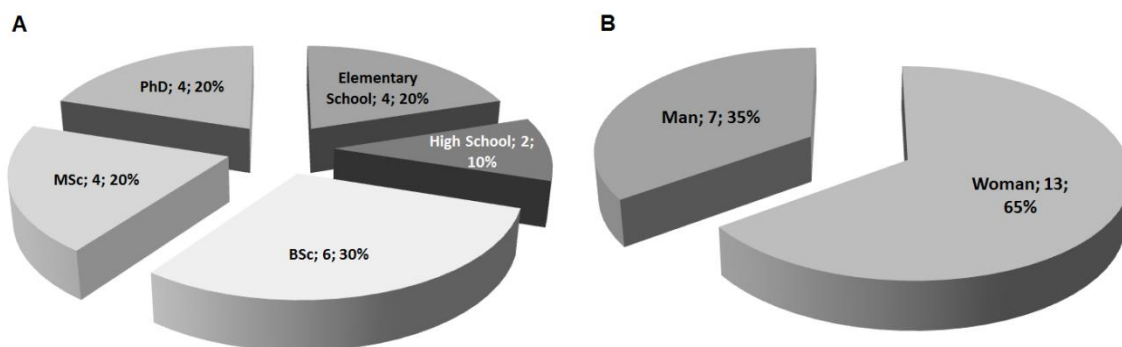
In this study, IZA (einkorn) grown in rural areas of Bolu is supplied as the flour material by Bolu municipality. Grains obtained from the samples of IZA harvested in 2019 were milled in Bolu Park and Gardens Directorate. Utilizing this material, eight bread types were produced. Since the amount of gluten is low in einkorn, it was difficult to form a bread dough consistency. However, by trying different methods, the most suitable bread dough was obtained. The breads were generally made by sourdough. These bread types can be summarized as (1) Whole Grain IZA, (2) Three Grain IZA, (3) Purple IZA with Carrots, (4) Village Bread, (5) German bread, (6) Walnut Bread, (7) Blonde Bride and (8) Focaccia with Olives (Figure 1).

Figure 1. A) Whole Grain IZA, B) Three Grain IZA, C) Purple IZA with Carrots, D) Village Bread, E) German bread, F) Walnut Bread, G) Blonde Bride, H) Focaccia with Olives.



Sensory analyses were conducted for 8 bread types according to their (1) external color, (2) internal color, (3) scent, (4) pore structure, (5) texture, (6) chewiness, (7) flavor and (8) general evaluation. An assessment scale ranging from extremely bad (1) to excellent (7) were applied in the survey. A survey was applied to 20 participants including men and women who have different education levels from primary education to doctorate level. Average age of the participants was determined as 47.6. Characteristics of participants were summarized in Figure 2. Ethics committee report was not needed for this study.

Figure 2. (A) Education levels and (B) genders of the participants.



Materials for Bread Making

Ingredients of Whole Grain IZA: Wheat sourdough (Pre-Ferment) contains 50 g of wheat sourdough starter, 200 g of all-purpose flour, 150 mL of water. For bread dough the ingredients were 1 kg of IZA flour, 25 g of rock salt, 400 mL of water, 400 g of mixed grain (100 g of IZA flour, 50 g of porridge, 50 g of sesame, 50 g of sunflower seeds and 150 mL of water).

Ingredients of Three Grain IZA Bread: For Wheat sourdough (Pre-Ferment) ingredients, there were 25 g of wheat sourdough starter 10% and 250 g all-purpose flour and 200 mL of water used. 100 g of oat, 100 g of flax seeds and 300 mL of water were used for filling ingredients. For bread dough ingredients, 300 g of bread wheat flour, 300 g of IZA flour, 50 g of rye flour, 20 g of yeast, 23 g of salt and 360 mL of water were used.

Ingredients of Purple IZA with Carrots: For Wheat sourdough (Pre-Ferment) ingredients, 25 g of wheat sourdough starter 10%, 250 g of all-purpose flour and 200 mL of water were used, and for bread dough, 500 g of boiled purple carrot water, 800 g of IZA flour, 20 g yeast and 23 g of salt were used.

Ingredients of Village Bread: For Wheat sourdough (Pre-Ferment) ingredients, there were 25 g of wheat sourdough starter 10%, 250 g of all-purpose flour and 200 mL of water used. 500 g of carrot water, 1 kg of IZA flour, 300 g of mashed potatoes, 20 g of yeast and 23 g of salt were used for bread dough, as well.

Ingredients of German bread: For bread dough, 1 kg of IZA flour, 500 g of bread wheat flour, 600 g of wheat sourdough, 30 g of salt, 1 L of water, 20 g malt and 10 g of yeast were used. 50 grams of sunflower seeds, pumpkin seeds, oat, sesame seeds and poppy were used for topping the breads.

Ingredients of Walnut Bread: 1 kg of IZA flour, 20 g of salt, 650 mL of water, 400 g of wheat sourdough and 100 g of walnut were used for walnut bread.

Ingredients of Blonde Bride: 1 kg of IZA flour, 20 g of turmeric powder, 500 mL of water, 30 g of yeast, 15 g of salt and 20 g of virgin olive oil were used for the blonde bride.

Focaccia with Olives: 5 kg of IZA flour, 50 g of salt, 3.2 L of water, 200 g of yeast, 200 g of green olive, 320 g of tomato, 50 g of dried thyme and 900 g of black olive were used for focaccia.

Method of Breads

Whole Grain IZA: For pre-ferment; 50 g wheat sourdough starter, 200 g of all-purpose flour and 150 g of water were mixed and left for 12-16 hours. For bread dough; except salt and mixed grain (100 g IZA, 50 g porridge, 50 g sesame, 50 g sunflower seeds, 450 g of wheat sourdough), all ingredients were mixed well with a spiral mixer slowly in 3 minutes. Then, 25 g of rock salt was added and mixed, as well. 400 g of mixed grain was added later. Dough temperature was kept at 22-24°C. All dough left for 1 hour for fermentation. Then, the dough was divided into 900g pieces, and the dough was covered and fermented for 40 minutes. After this fermentation, part of dough were given a round form with the folding technique. They were dipped in mixed grain and put in round bamboo molds. The dough was covered with stretch film and re-fermented for 14 hours in the refrigerator at 4°C. After waiting for an hour at room temperature, they were baked at 240°C for 50 minutes.

Three Grain IZA: All filling ingredients (100 g of oat, 100 g of flax seed, 0.3 L water) were mixed and left for 3 hours. For pre-ferment; 250 g of all-purpose flour, 0.2 L of water and 25 g of wheat sourdough starter were

mixed well with a spiral mixer slowly in 3 minutes. The dough was kept between 23 -28°C. This wheat sourdough was left for 16-24 hours. For bread dough; 450 g of wheat sourdough , 500 g of filling gradients, 300 g wheat flour, 300 g of IZA flour, 50 g of rye flour, 20 g of yeast, 0.36 L of water and 23 g of salt were all mixed together with spiral mixer for 3 minutes in first motion and for 5 minutes in second motion. The dough rested for 15 minutes for first fermentation. Then, it was divided into three pieces, and these pieces were given a round shape as well as sesame seeds added on top. Then, the dough was fermented for 45 minutes again. After fermentation, they cooked at 240-200°C in 45-50 minutes.

Purple IZA with Carrots: 3 purple carrots were boiled in 1 L water, and smashed in rondo. Then, it was left at 10°C in the refrigerator. For pre-ferment; 250 g of all-purpose flour, 0.2 L of water and 25 g of wheat sourdough starter were mixed well with a spiral mixer slowly in 3 minutes. The wheat sourdough was kept between 23 -28°C. This wheat sourdough was left for 16-24 hours. 450 g of wheat sourdough, 0.5 L of purple carrot water, 800 g of IZA flour, 20 g of yeast and 23 g of salt were all mixed together with spiral mixer for 3 minutes in first motion, and the dough was kept in 25°C. It was rest for 25 minutes for first fermentation. The dough was divided into two pieces, and they were given a round shape and also rest for 45 minutes for last fermentation. After fermentation, they cooked at 200-220°C in 45-50 minutes.

Village Bread: 3 medium potatoes are boiled and mashed at first. For pre-ferment 250 g of all-purpose flour, 0.2 L of water and 25 g of wheat sourdough starter are kneaded in a spiral mixer slowly in 3 minutes. The wheat sourdough was covered up and kept for 16-24 hours for fermentation at room temperature. For dough making; 450 g of wheat sourdough, 0.5 L of carrot water, 1 kg of IZA flour, 300 g mashed potatoes, 20 g of yeast and 23 g of salt were mixed with a spiral mixer for 3 minutes at first degree speed. The dough was covered and left at room temperature for 30 minutes. 764 g of this dough was divided into 3 equal parts and all of them were given a round shape. Par of dough were covered and fermented for 45 minutes. Then, the dough was cooked at 210 – 190°C for 70 minutes in the oven.

German Bread: All ingredients (1 kg of IZA flour, 500 g of bread wheat flour, 1 L of water, 600 g of wheat sour and 20 g of malt) except salt and yeast were mixed together with spiral mixer for 3 minutes in first motion and for 5 minutes in speedy motion. Then, 10 g of yeast and 30 g of salt were added and mixed, as well. The dough rested for 30 minutes for fermentation, then it was thinned with a roller. Water was applied with a brush. Sunflower seeds, pumpkin seeds, oats and sesame seeds were added at the top of the dough. The dough was divided into 50 g pieces and rested for 45 minutes again. Then, it cooked at 230°C in 15 minutes.

Walnut Bread: 1 kg of IZA flour, 400 g of wheat sourdough, 0.65 L of water and 20 g of salt were mixed together with a spiral mixer for 3 minutes in first motion and for 6 minutes in speedy motion. After the dough was created, walnuts were added and kneaded. The dough rested for 25 minutes for fermentation, then it was given a round shape. After fermentation, it cooked at 230°C in the first 6 minutes and 210°C in the last 15 minutes.

Blonde Bride: All ingredients (1 kg of IZA flour, 20 g of turmeric powder, 0.6 L of water, 20 g of virgin olive oil) except salt and yeast were mixed together with a spiral mixer for 3 minutes in first motion and for 5 minutes in speedy motion. Then, 30 g of yeast and 15 g of salt were added and mixed, as well. The dough left for an hour. The dough was stretched 3 times within 30 minutes. It was divided into 2 pieces and left for an hour. After fermentation, they cooked at 220°C in 45 minutes

Focaccia with Olives; 5 kg of IZA flour, 200 g of yeast, 3.2 L of water and 50 g of salt were mixed together with a spiral mixer for 3 minutes in first motion and for 6 minutes in speedy motion. Then, olive oil, 50 g of dried thyme and 320 g dried tomato were added to the dough and were mixed together. At the end 900 g of black olives were added to the mixture. Dough rested for 1 hour in a container lubricated with olive oil. The dough was shaped on the tray and rested for 20 minutes for fermentation. After fermentation, it is cooked at 250°C in the first 6 minutes and 230°C in the last 15 minutes.

Statistical Analysis

Analysis of variance (ANOVA) was considered appropriate since there are more than three dependent variables (in this case: 8 dependent variables as sensory analysis criteria). Before conducting ANOVA, Shapiro Wilk Normality Test was applied in order to check if the conditions of ANOVA were met. Then, ANOVA was applied to collected data. The validity of the ANOVA was confirmed by the test of homogeneity.

Results and Discussion

The sensory characteristics of the foods are important for the target customer whether they like or dislike the product. On the other hand, the most important indicator that reveals the quality of food is sensory analysis tests. It has an important role in increasing the consumption and appreciation of these products. (Olgun et al., 2017).

Significance values of dependent variables higher than 0.05 in the test of homogeneity (Table 3) showed that conducted ANOVA results were valid. ANOVA results showed that there were no significant differences among the bread types and sensory properties ($p > 0.05$) (Table 4). Although there were no statistically significant differences among the bread types according to the sensory analysis, high average scores in all quality parameters indicated that participants were pleased with all bread types in every aspect (Table 5). In est., all bread types were appreciated in terms of external color, interior color, scent, pore structure, texture, chewiness, flavor and general evaluation.

However, some participants' recommendations are still noteworthy. One of them proposed that rather than using 100% IZA flour, blending with other modern flours to make bread may be more appropriate, and added that it might be perfect for productions like cookies and cakes. Another participant stated that IZA is flour which needs to be kneaded well. Also, one of them stated that IZA is similar to corn flour. These opinions and recommendations are due to the fact that the participants are aware of the low gluten content in IZA breads.

Olgun et al. (2017) carried out a sensory analysis study on some bread types. 100 students tasted whole wheat, normal, Trabzon, potato, corn, rye, sesame, oat, toast and lavash breads. The students were evaluated in terms of taste, smell and color. On average, sesame was liked the most in terms of color, smell and taste, while lavash bread was liked the least. The students stated that because sesame bread smelled pleasant, it enhanced the taste of the bread. Perhaps different ingredients added to breads such as sesame seeds increased the appreciation. For this reason, bread products are more appreciated with the addition of different additives such as olives, thyme and tomatoes into focaccia; carrot in purple IZA. Another study of sensory analyses was made by Dirim et al. (2014). The conductors of the study made bread with chickpea, soybean, kidney bean, lentil, carob and pea flour. These products were tasted by ten people and made a sensory analysis test. As a result, kidney bean, soy and pea breads were liked the most. According to these results, bread with 5%, 10%, 15%, 20% and 25% kidney beans was made and tasted by ten people. Breads with kidney bean flour containing 5% and 10% were preferred more by panelists. As it is understood in this study, breads that contain different food products are more liked than normal breads. Another different work was done by Dursun et al. (2010). They used fish mince in the dough to increase the protein value of the bread. Sensory analysis test was applied by adding 5%, 10%, 15% and 20% fish mince to the breads. Breads were evaluated in terms of shape symmetry, crust color, inner color, pore structure, texture, smell, chewiness, taste and aroma. As a result of the panel test, breads containing 5% and 10% fish mince were more acceptable. These results seem to be compatible with the results of the study of Dirim et al. (2014) on kidney beans breads. Breads with 15% and 20% of additional products were less appreciated by consumers. As a result, it shows that adding excessive flavoring to breads is not preferred by consumers. According to the previous studies, it can be seen that the breads made for this study do not contain excessive aroma, as it was liked by the panelists.

Table 3. Test of homogeneity of variance.

	Levene Statistic	f1	df2	Sig.
External Color	0.558	7	152	0.789
Internal Color	1.602	7	152	0.139
Scent	0.327	7	152	0.941
Pore structure	1.467	7	152	0.183
Texture	1.358	7	152	0.227
Chewiness	0.221	7	152	0.980
Flavour	1.356	7	152	0.228
General Evaluation	0.824	7	152	0.569

Table 4. ANOVA analysis results of sensory scores of IZA wheat breads.

		Sum of Squares	df	Mean Square	F	Sig.
External Color	Between Groups	3.675	7	0.525	0.643	0.720
	Within Groups	124.100	152	0.816		
	Total	127.775	159			
Internal Color	Between Groups	1.875	7	0.268	0.413	0.893
	Within Groups	98.500	152	0.648		
	Total	100.375	159			
Scent	Between Groups	5.600	7	0.800	1.147	0.337
	Within Groups	106.000	152	0.697		
	Total	111.600	159			
Pore Structure	Between Groups	9.100	7	1.300	1.423	0.200
	Within Groups	138.900	152	0.914		
	Total	148.000	159			
Texture	Between Groups	6.094	7	0.871	1.123	0.352
	Within Groups	117.850	152	0.775		
	Total	123.944	159			
Chewiness	Between Groups	4.875	7	0.696	0.874	0.528
	Within Groups	121.100	152	0.797		
	Total	125.975	159			
Flavour	Between Groups	2.775	7	0.396	0.617	0.741
	Within Groups	97.600	152	0.642		
	Total	100.375	159			
General Evaluation	Between Groups	2.800	7	0.400	0.987	0.443
	Within Groups	61.600	152	0.405		
	Total	64.400	159			

Table 5. Mean sensory scores of bread varieties with IZA flour

Samples	External Color	Internal Color	Scent	Pore Structure	Texture	Chewiness	Flavor	General Evaluation
Whole Gained IZA	6.35±0.75	6.30±0.57	6.25±0.79	5.65±1.18	5.65±1.04	5.95±1.15	6.30±0.66	6.35±0.59
Three Grain IZA	6.05±1.28	6.15±1.09	6.15±0.99	5.80±0.95	5.80±0.89	6.10±0.97	6.40±0.88	6.40±0.60
Purple IZA with Carrots	6.2±0.89	6.20±0.89	5.95±0.89	5.85±1.14	5.65±0.99	5.90±0.97	6.05±0.94	6.05±0.89
Village Bread	6.45±0.89	6.30±0.66	6.5±0.69	6.10±0.91	6.00±0.79	6.20±0.83	6.40±0.60	6.40±0.50
German Bread	6.35±0.99	6.40±0.75	6.4±0.99	6.00±0.92	5.90±0.97	5.90±0.91	6.45±0.60	6.40±0.50
Walnut Bread	6.35±0.81	6.25±0.85	6.4±0.82	5.90±1.02	6.00±0.92	6.30±0.80	6.25±0.91	6.30±0.66
Blonde Bread	6.6±0.68	6.50±0.76	6.2±0.77	6.40±0.75	6.15±0.59	6.15±0.75	6.20±0.95	6.35±0.67
Focaccia with Olives	6.35±0.81	6.40±0.75	6.55±0.69	6.30±0.66	6.20±0.77	6.40±0.68	6.45±0.76	6.55±0.60

Conclusion

The paucity of studies carried out on whole grain einkorn bread and pastry products drove this research to improve making of variety about pastry and bread. Bread and bakery products, which the recipes were developed with sourdough, were presented to the tastes of those who participated in the survey. Since einkorn

has a low gluten value, it is not generally preferred in bread making. However, this study provides recipe about how to make bread with einkorn to the chefs and consumers. Whole grain IZA, three grain IZA, carrot purple IZA, village bread, german bread, walnut bread, yellow gelin and focaccia with olives recipes were described and submitted to the survey. In general, it was observed that all bread types were regarded as good because they scored above 6 points. However, there is prejudice by the public that IZA wheat is not suitable for bread making because of its low gluten content. These prejudices were overcome by this experiment which is proved by the great acclaim received by the participants. As the study showed, although the gluten rate is low, IZA wheat is suitable for bread making. For this reason, low gluten content can provide more advantages rather than disadvantages. Recently, bread made of IZA wheat is thought to be a healthy choice especially for athletes, dieters and those who want to be healthy. This situation is promising in terms of different tastes and human health.

There were very few studies on einkorn products done before. Cakes, bakery products and unleavened bread were studied (Corbellini et al., 1999). Pasta was also made and submitted for sensory analysis. As a result, it was evaluated as a good quality product, but received low values in terms of hardness and stickiness (Gazza et al. 2022). There are studies that break the prejudice that there will be no dough consistency due to its low gluten value. In a study, bread was produced from twenty-five types of einkorn wheat flours and the ideal gluten value was determined in one third of them (Borghini et al., 1996; Brandolini and Hidalgo, 2011).

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