Physicochemical characteristics and flourgraph properties of wheat varieties (Triticum aestivum L.) used in flat bread (Gaziantep pita)

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ABSTRACT

Physical, chemical and flourgraph properties of Sagittario, Zerun, Gerek 79, Bezostaja, Victoria, Ceyhan 99, Bezostaja (import) and Pioneer wheat varieties used in Gaziantep pita (flat type regional bread in Turkey) production were investigated. Results showed that the hectoliter weights of wheat samples were suitable except Ceyhan 99. The lowest sedimentation volume was for Gerek 79, while the highest value was for Ceyhan 99. Wet gluten amounts of wheat varieties were high above 27% except Zerun. The falling number values for the samples were higher than normal values excepting Bezostaja (import). The extensibility values were low for Zerun, Gerek 79 and Bezostaja, but high for Ceyhan 99, while the others were in normal values. Low resistance to extension values was determined except Sagittario. The energies for Sagittario, Victoria and Ceyhan 99 were in normal values, while the energy values for the others were low.

KEYWORDS

Flat bread; wheat varieties; physico-chemical; flourgraph

1. Introduction

The importance of bread in Turkish cuisine is great. It is considered not only as sacred, but also the symbol of labor and abundance. It is cheap, satisfying, a source of energy and meets the protein need. Many kinds of breads were made with grains especially with wheat grown in the Anatolian soil. In general, it has been observed that bread types in each region made with or without yeast were mostly baked in sheet, oven and tandır (Koca & Yazıcı, 2014). One of the most important local breads in the traditional Turkish cuisine is Gaziantep pita which is consumed in almost all urban and rural areas of Southeast Region of Turkey. It is made from white wheat flour and baked in Gaziantep bakeries. In 2017, the geographical sign registration certificate of the Gaziantep pita was awarded to Gaziantep which is among the UNESCO’s ‘Creative Cities Network’ in the gastronomy field by Gaziantep Commodity Exchange.

Gaziantep pita, which pertains to Gaziantep, is a well cooked bread, distinctive in appearance, smell and color. It is produced by kneading wheat flour, water, salt and yeast, fermenting of dough, then shaping appropriately and baking in stone or wood ovens. Production stages of Gaziantep pita are represented in Figure 1. Criteria for Gaziantep pita was determined exactly by Gaziantep Commodity Exchange. Gaziantep pita is a flat bread with a width of about 20 cm, a length of 39 cm and a thickness of about 1 cm (Figure 2). It has a 1.35 × 1.40 cm surface area with generally homogeneous nail spacing due to the application of a special dough shaping technique using fingertips. Chemical and physical properties of Gaziantep pita are given in Table 1. This table has been prepared by obtaining results from studies done on the pitas taken from three different local producers (Gaziantep Commodity Exchange, 2017).

Flour is the first basic component of bread. In Gaziantep pita making, generally bread wheat flour, containing 0.55% d.b. or 0.65% d.b. ash content, obtained from bread wheat (Triticum aestivum L.) is used. The flour used should not contain foreign taste and odor. The moisture content should be maximum 14.5% and the protein value of the dry substance should be minimum 10.5%. The acidity of the sulfuric acid type should not exceed 0.07% (d.b.). Flour used in Gaziantep pita should be
able to absorb a high amount of water and should thicken quickly and easily during kneading. In addition, the dough must be rolled without tearing and provide the desired base and swell (Gaziantep Commodity Exchange (GTB), 2017, Turkish food codex, 2013).

In Turkey, flour used in bread making is obtained by milling of many bread wheat varieties like Tosunbey, Seval, Eser, Kenanbey, Gün 91, İkizce 96, Bayraktar 2000, Demir 2000 and Zencirci 2002. The genotopic effect and the environmental conditions such as climate and soil and growing techniques have crucial effects on the physical, chemical and technological properties of wheat that make up quality (Barutcular et al., 2016; Otteson, Merqoum, & Ransom, 2008; Peterson, Graybosch, Baenziger, & Grombacher, 1992). There are numerous studies on bread wheat varieties and their properties (Aydoğan et al., 2013; Boros, Tarján, Mars, Borbély, & Győri, 2009; Çağlar, Karaölçü, Bulut, Kotancıl, & Öztürk, 2011; Çağlar, Öztürk, & Bulut, S., 2006; Channa, Ghangro, Sheikh, & Nizamani, 2015; Dizlek & Özer, 2016, 2017b; Ünal, Olçay, & Özer, 1996). As wheat varieties used in flat type of bread are different from bread wheat varieties generally used, there is a limited number of studies about wheat varieties used in flat type bread. In the present study, the purpose is to investigate the selected properties of some wheat varieties used in Gaziantep pita making.

2. Materials and method

2.1. Wheat samples

Eight different bread wheat (Triticum aestivum L.) varieties were used: Sagittario, Zerun, Gerek 79, Bezostaja, Victoria, Ceyhan 99, Bezostaja (import) and Pioneer. The wheat samples of Sagittario and Pioneer from Adana, Zerun, Gerek 79 and Bezostaja from Central Anatolia Region, Victoria and Ceyhan 99 from Southeastern Anatolia Region, Bezostaja (import) from Turkish food codex, 2013). In Turkey, flour used in bread making is obtained by milling of many bread wheat varieties like Tosunbey, Seval, Eser, Kenanbey, Gün 91, İkizce 96, Bayraktar 2000, Demir 2000 and Zencirci 2002. The genotopic effect and the environmental conditions such as climate and soil and growing techniques have crucial effects on the physical, chemical and technological properties of wheat that make up quality (Barutcular et al., 2016; Otteson, Merqoum, & Ransom, 2008; Peterson, Graybosch, Baenziger, & Grombacher, 1992). There are numerous studies on bread wheat varieties and their properties (Aydoğan et al., 2013; Boros, Tarján, Mars, Borbély, & Győri, 2009; Çağlar, Karaölçü, Bulut, Kotancıl, & Öztürk, 2011; Çağlar, Öztürk, & Bulut, S., 2006; Channa, Ghangro, Sheikh, & Nizamani, 2015; Dizlek & Özer, 2016, 2017b; Ünal, Olçay, & Özer, 1996). As wheat varieties used in flat type of bread are different from bread wheat varieties generally used, there is a limited number of studies about wheat varieties used in flat type bread. In the present study, the purpose is to investigate the selected properties of some wheat varieties used in Gaziantep pita making.
Russia were obtained from commercial miller in Gaziantep, Turkey. These varieties were selected as used in Gaziantep pita making. Wheat samples were milled in a Chopin CD1 Mill (Villeeneuve-la-Garenne Cedex, France) to white flour and measured using an analytical balance with an accuracy of ± 0.01g (Sartorius BL 510, Goettingen, Germany).

2.2. Physical and chemical analysis

The hectoliter weights of each wheat variety were determined as described by Elgün, Ertuğay, Certel, and Kotancılar (1999). Moisture contents were determined according to the American Association of Cereal Chemists-approved methods 44-15A (AACC, 2000). Wet gluten contents were determined according to the International Association for Cereal Science and Technology standard method 137–1 (ICC, 2012) using the Glutomatic 2200 system (Perten, Huddinge, Sweden). Falling number values and Zelenyi sedimentation volumes were determined according to AACC methods 56-81B and 56–60 (American Association of Cereal Chemists (AACC), 2000). All determinations were carried out in duplicate.

2.3. Rheological analysis

Extensibility in mm and maximum resistance to extension in HE (Haubelt Einheit) and energy in cm² of the dough were determined using a flourgraph (Haubelt Flourgraph E7, Duisburg, Germany) according to International Association for Cereal Science and Technology standard method 180 (International Associations for Cereal Science and Technology (ICC), 2012). Dough extension values were obtained and evaluated according to the curves after 45, 90 and 135 min of dough proofing. All determinations were carried out in duplicate.

2.4. Statistical analysis

The data were statistically analyzed by analysis of variance (ANOVA) using Statgraph software (Statgraph, 1991). The least significant differences (LSD) were calculated with the same software.

3. Results and discussion

3.1. Physical and chemical properties

The ANOVA results for some physical and chemical characteristics of wheat varieties used in Gaziantep pita are shown in Table 2.

It can be shown from Table 2, where hectoliter weight is presented, the values were between 70.1 and 81.1 kg. Bezostaja, Victoria, Pioneer had the highest hectoliter weight, while Ceyhan 99 had the lowest value. The hectoliter weights of Sagittario, Zerun and Bezostaja (import) were not significantly from each other (P > 0.05). One of the quality criteria is the weight of the hectoliter, which is a sign of flour production. The hectoliter weight considered as a sign of wheat yield and a quality element in wheat standards has a commercial prerequisite and it is required to be high in bread wheat varieties (Dizlek and Özer, 2016). Significant differences between bread wheat varieties due to hectoliter weight were also determined by other researchers (Çağlar et al., 2006, Soylu, Topal, Sade, & Akgün, 1999). The weight of the hectoliter changes depending on the change in the grain size. Depending on the increase in the plant spacing, the hectoliter weight increases while the grain size decreases, but decreases in the opposite case. Nutritional differences also affect grain size and indirectly hectoliter weight. In addition, in the presence of weeds, lower hectoliter weights are obtained as a result of weeds competing for wheat with respect to moisture and nutrients, and flour yield is reduced. In the product years in which the hot and dry climatic conditions in the grain filling period are dominant, weak and small grains are formed due to the shortening of ripening period, which leads to obtaining lower flour yield values at significant levels (Dizlek, Özer, Gül, Dizlek, & Özkan, 2013b). As the proportion of small grains increases in wheat, the yield of flour decreases and the amount of ash increases (Dizlek, 2017). On the other hand, as the flour yield increases, the value of sedimentation and gluten decrease is reported (Bulut, 2012). The weight of hectoliter in Turkish wheat is between 72 and 83 kg, with an average of 78 kg (MEB, 2013). In the present study, the hectoliter weights of all wheat samples were determined as suitable for use in Gaziantep pita except Ceyhan 99. However, wheat having low hectoliter weight could be improved by blending with the wheat varieties having higher hectoliter weight.

The results in Table 2 represent all varieties containing moisture between 11.5% and 14.9%. Ceyhan 99 had the highest moisture content, while the Bezostaja had the lowest value. The moisture contents of Sagittario, Zerun, Gerek-79 and Pioneer were not significantly different from each other (P > 0.05). However, Ceyhan 99 and Bezostaja (import) had a significantly higher moisture content of the others (P ≤ 0.05). On the other hand, Bezostaja and Victoria had a significantly lower moisture content compared to all of them (P ≤ 0.05). Moisture content has a crucial effect on the grinding time of wheat. The moisture content of wheat is also important for storage besides the milling process. As

### Table 2. Results of physical and chemical analyses on wheat varieties. Results are average of duplicate measurements ± SD.

| Analyses               | Sagittario | Zerun  | Gerek 79 | Bezostaja | Victoria | Ceyhan 99 | Bezostaja (import) | Pioneer |
|-----------------------|------------|--------|----------|-----------|----------|-----------|-------------------|---------|
| Hectoliter weight (kg) | 79.0 ± 2.5α| 77.9 ± 2.3α| 76.1 ± 2.0α| 80.4 ± 3.4α| 81.1 ± 4.1d| 70.1 ± 1.9d| 79.2 ± 2.6a        | 80.3 ± 3.6a|
| Moisture content (%)   | 13.3 ± 0.6α| 13.4 ± 0.66| 13.1 ± 0.4α| 11.5 ± 0.3α| 12.4 ± 0.5d| 14.9 ± 0.8d| 14.8 ± 0.7d        | 13.5 ± 0.5a|
| Sedimentation volume (mL)| 34.5 ± 0.9α| 25.2 ± 0.4b| 18.1 ± 0.4α| 33.8 ± 0.6α| 29.5 ± 0.5d| 44.7 ± 1.1b| 29.2 ± 0.4d        | 30.2 ± 0.5d|
| Wet gluten (%)         | 30.3 ± 0.6α| 26.2 ± 0.5a| 30.1 ± 0.5a| 34.2 ± 0.8a| 40.1 ± 0.9b| 29.5 ± 0.6a| 38.9 ± 0.9d        | 40.3 ± 0.9d|
| Falling number (s)     | 349 ± 7a   | 351 ± 8a | 285 ± 5a  | 425 ± 8a  | 650 ± 9a  | 800 ± 9a  | 250 ± 5d          | 310 ± 5g |

Means with the same letter within a row are not significantly different (P = 0.05) by LSD. S.D.: desviación estándar.
the high moisture content of wheat reduces in dry matter, it also causes a decrease in commercial value. Besides this, germination of bacterial and fungal activities is promoted by high moisture content which makes the storage of wheat difficult (Elgün et al., 1999). High moisture content enhances proteolytic and lipolytic activities leading to loss of nutrients (Channa et al., 2015). Anjum, Ahmad, Rehman, Butt, and Bajwa (2003) showed that storage time and yield of flour decreases due to increased amount of moisture content in wheat grains. There are many factors affecting the moisture content of wheat such as growing and storing conditions and harvesting time (Elgin et al., 1999). Moisture content in wheat grain in Turkey is between 8% and 14%, with an average of 9–11%. The upper limit for moisture content in wheat is 14.6% (Ünal, 2002). In the present study, moisture contents of wheat varieties were between normal limits except Ceyhan 99 and Bezostaja (import). However, the moisture contents of Ceyhan 99 and Bezostaja (import) are not significantly different from the upper limit of wheat, 14.6%, described by Ünal. These values are in conformity with the results of other studies (Ekinci & Ünal, 2002; Tayyar, 2005). In the present study, the moisture content of all wheat varieties and in particular to Bezostaja were determined as suitable for flour used in Gaziantep pita making.

Sedimentation volumes of flour obtained from wheat varieties for Gaziantep pita making are shown in Table 2. The values for sedimentation were between 18.1 and 44.7 mL. The lowest sedimentation volume was found as 18.1 mL for Gerek 79, while the highest sedimentation value was found to be 44.7 mL for Ceyhan 99. The sedimentation values of Victoria, Bezostaja (import) and Pioneer were not significantly different from each other (P > 0.05). Sagittario, Bezostaja and Ceyhan 99 had significantly higher sedimentation values than they had (P ≤ 0.05). Zeleny sedimentation test was used to measure the total amount of gluten in wheat flour; hence, its quality for bread making can be revealed (Zeleny, 1947), as the protein showed positive correlations with dry gluten and in tune with Zeleny values (Noorka et al., 2009). Sedimentation value is used to predict the quantity and quality of gluten, as well as to estimate the protein content of wheat with the same gluten quality (Dizlek and İsmailoğlu, 2015). The high value of this value indicates that the gluten has good water-holding capacity and the volume of the bread made from these is high (Elgün, Türkü, & Bilgiçli, 2001). With high levels of gluten-containing flours, the sedimentation rate is high when the gluten quality is high (Elgün et al., 1999). Zeleny sedimentation value for bread wheat is very good above 36 mL, good between 25-36 mL poor between 16-24 mL and very poor below 15 mL (Ministry of Education (MEB), 2013). The sedimentation volume of different wheat varieties in our country varies between 26.0 and 56.0 mL (Öztürk and Gökkuş, 2008). In the present study, the sedimentation value for Ceyhan 99 was found to be very good above, while the sedimentation values for other wheat varieties were found to be good according to values of MEB (2013) except Gerek 79. The sedimentation values for all wheat varieties studied in this research were suitable to use as flour in Gaziantep pita. Besides this, Bulut (2012) notes that sedimentation value is influenced by climatic factors, while Zeleny is under the influence of sedimentation value inheritance, and the differences are more related to genotypes.

Wet gluten contents of wheat varieties used as the materials of the present study are represented in Table 2. The values were found between 26.2% and 40.3%. The highest value of gluten content was obtained from Pioneer, while the lowest value of gluten content was obtained from Zerun. Wet gluten contents of Victoria and Bezostaja (import) were not significantly different from Pioneer gluten amount (P > 0.05). Sagittario, Gerek 79 and Ceyhan 99 had approximate wet gluten contents. Gluten, an important indicator of the bread quality of wheat, is elastic protein showing the suitability of flour for bread making. During the dough kneading, it forms a net-like structure, allowing the CO₂ produced by the yeast to be retained during fermentation and to form large volume breads. The high level of wet gluten is an indication that the bread quality is good. Wet gluten content refers to the amount and properties of gluten found in the protein content. This amount decreases during the wet product years in grain filling period, while it increases during the dry product years like protein ratio (Ö, Karaoğlu, Bulut, Kotancilar, & Öztürk, 2011). Uluöz (1965) defined the gluten content as high, if it is above 27%, as medium if it is between 20% and 27% and as low if it is below 20%. In the present study, wet gluten contents of all wheat varieties were found as high, because they were above 27% except Zerun. It had a medium level of wet gluten. Wet gluten contents of wheat varieties used in this study were found acceptable for Gaziantep pita making. Elgün et al. (1999) reported that, although the amount of wet gluten is generally positively related to the amount of nitrogen in the grain, it gives an idea of protein quantity rather than protein quality.

Falling numbers of wheat varieties, between 250 and 800 s, are shown in Table 2. Falling numbers for Sagittario and Zerun were not significantly different (P > 0.05). However, falling numbers for all wheat varieties were significantly different from each other except Sagittario and Zerun values. The highest falling number value was found 800 s for Ceyhan 99, while the lowest falling number value was found 250 s for Bezostaja (import). Falling number is an indication of α-amylase activity in flour (Kökşel, Sivri, Ö, Basman, & Karacan, 2000). The deficiency of α-amylase in flour can result in problems in the breads produced (Hoseney, 1994). Falling number is a parameter used in the determination of diastatic activity in wheat flour and it is important for the amount of gas to be produced in bread making, bread volume, bread texture and bread color. It is desirable that the number of drops is not high as an indication of normal enzyme activity in wheat cultivars. The duration of wheat starch under saturation and loss of viscosity by the activity of amylase enzymes gives the number of drops in seconds (Ünal, 2002). It is desirable that falling number in wheat be between 220 and 250 s (Bulut, 2012). In the present study, the results showed that the falling number of Bezostaja (import) variety was in normal values. However, the falling number values for all wheat varieties were higher than normal values. This means that diastatic activity in wheat flour samples was not enough to make bread except Bezostaja (import). In wheat, the amount of precipitation during the period of starch formation is high, resulting in a decrease in falling number (Errekul, Kautz, Eilmer, & Turgut, 2009). Ünal (2002) states that if the falling number is higher than the acceptable limits, the flour is not able to form enough gas and the bread is tight, as the enzyme content is not added to the flour. For this reason, flour, which is not suitable for falling number, needs to be improved by...
blending. Erekle et al. (2009) report that falling number may vary according to varieties as well as climatic conditions. Flour used in Gaziantep pita, which is a flat type of bread, has lower α-amylase activity than the flour for loaf of bread types has. So they could be improved by adding α-amylase and/or blending with the wheat flours having higher α-amylase activity as the fermentation period is shorter in Gaziantep pita making (Dizlek, Gül, Ozer, Aksoy, & Ozkan, 2013a).

3.2. Rheological properties by flourgraph

Flourgraph results of flours milled from wheat varieties are shown in Table 3. Flourgraph extensibility values of wheat varieties were between 138 and 175 mm at 45 min, 123–168 mm at 90 min and 120–162 mm at 135 min. Ceyhan 99 showed the highest extensibility at 45 min, 90 min, 135 min, while Gerek 79 showed the lowest extensibility at 45 min and 90 min. Zerun had the lowest extensibility at 135 min. The resistances of the varieties were between 159 and 344 HE at 45 min, between 222 and 395 HE at 90 min and between 234 and 418 HE at 135 min. The highest resistance to extension was obtained from Sagittario and the lowest value was obtained from Zerun. Energy value ranges of wheat flour samples varied from 53 to 120 cm² at 45 min, from 61 to 129 cm² at 90 min and 59 to 109 cm² at 135 min. The highest values for energy at 45 min, 90 min and 135 min were obtained from Sagittario and the lowest values were obtained from Zerun variety. Extensibility values, resistance to extension values and energy values for almost all wheat samples were significantly different from each other (P ≤ 0.05).

The extensograph has proved useful in the classification and assessment of flours on the basis of physical dough properties (in particular, flour strength) for both quality control and applied and basic research application (Boros et al., 2009; Dizlek & Ozer, 2017a). In the study of lancu, Ognereanu, Haubelt, and Jäcanu (2010), the Brabender extensograph and Haubelt Flourgraph E7 were compared and they demonstrated that the equipment used can give values that similarly characterize the behavior of dough, if the same method of determination is used. Dough extensibility and resistance to extension are widely used in determining the differences between the qualities of bread flour and in selecting suitable raw materials. Extensibility and dough strength (resistance) from rheological properties are used to determine the ability of wheat to be processed into different crops. Extensibility is one of the keys to grain chemistry as it provides important information about cooking performance and final product quality (Anderssen, Bekes, Gras, Nikolov, & Wood, 2004). In addition, it is stated that during fermentation by extensibility test, changes in the dough during fermentation can be determined and very important information about the process can be obtained (Dogan, Ponte, & Walker, 1996). The maximum resistance value affecting the final product quality is significantly affected by the protein content of the flour. As in the case for extensibility, the increase in protein content of the flour also increases this value (Aydogdan et al., 2013).

Extensibility value for bread wheat flour is evaluated as high if it is 151 mm and higher, normal if it is between 130 and 150 mm and low if it is 129 mm and lower. Resistance to extension of dough is high if it is 601 BU (Brabender unit) or HE (Haubelt Einheit) and higher, normal if it is between 400 and 600 BU and low if it is 399 BU and lower. The energy value for dough is accepted as high if it is 121 cm² and higher, normal if it is between 80 and 120 cm² and low if it is 79 cm² and lower value (Ministry of Education (MEB), 2013). According to this evaluation, the extensibility values were low for Zerun, Gerek 79 and Bezostaja and high for Ceyhan 99, while the others were in normal values. The resistance to extension values for all wheat samples was low except Sagittario. The energy values for Sagittario, Victoria and Ceyhan 99 were within normal values, while the energy values for the others were determined as low. In practice, high extensibility, low resistance to extension and low energy are desired by Gaziantep bakers for easy dough processing and special shaping due to shorter fermentation time.

### 4. Conclusions

In the present study, the results showed that the hectoliter weights and the moisture contents of wheat samples were convenient excepting Ceyhan 99. The lowest sedimentation volume was for Gerek 79, while the highest value was for Ceyhan 99. Wet gluten amounts of wheat varieties were high

### Table 3. Flourgraph results of flours milled from wheat varieties. Results are average of duplicate measurements ± SD.

| Samples | Sagittario | Zerun | Gerek 79 | Bezostaja | Victoria | Ceyhan 99 | Bezostaja (import) | Pioneer |
|---------|------------|-------|----------|-----------|----------|-----------|-------------------|---------|
| Extensibility (mm) | | | | | | | | |
| 45 min | 163 ± 8a | 157 ± 6b | 138 ± 5c | 150 ± 5d | 172 ± 9e | 175 ± 10f | 166 ± 8g | 147 ± 5h |
| 90 min | 155 ± 7a | 124 ± 5b | 123 ± 4c | 138 ± 5d | 135 ± 5e | 168 ± 9f | 145 ± 7g | 135 ± 5h |
| 135 min | 134 ± 6a | 120 ± 5b | 125 ± 5c | 120 ± 5d | 141 ± 7e | 162 ± 8f | 143 ± 7g | 129 ± 5h |
| Resistance to extension (HE) | | | | | | | | |
| 45 min | 344 ± 10a | 159 ± 5b | 224 ± 7c | 273 ± 8d | 232 ± 7e | 246 ± 8f | 263 ± 8g | 194 ± 4h |
| 90 min | 395 ± 9a | 222 ± 5b | 308 ± 6c | 380 ± 8d | 331 ± 7e | 333 ± 7f | 286 ± 6g | 260 ± 5h |
| 135 min | 418 ± 10a | 234 ± 5b | 268 ± 6c | 361 ± 9d | 332 ± 8e | 332 ± 8f | 308 ± 7g | 267 ± 6h |
| Energy (cm²) | | | | | | | | |
| 45 min | 120 ± 6a | 42 ± 1b | 55 ± 2c | 81 ± 4d | 81 ± 4e | 96 ± 5f | 85 ± 4g | 53 ± 2h |
| 90 min | 129 ± 7a | 45 ± 3b | 61 ± 3c | 93 ± 5d | 79 ± 4e | 115 ± 6f | 75 ± 4g | 61 ± 3h |
| 135 min | 109 ± 6a | 44 ± 3b | 54 ± 4c | 73 ± 5d | 84 ± 5e | 114 ± 7f | 77 ± 5g | 59 ± 4h |

Means with the same letter within a row are not significantly different (P = 0.05) by LSD.
SD: standard deviation.
Las medias con la misma letra en una fila no son significativamente diferentes (P = 0.05) por LSD.
S.D.: desviación estándar.
above 27% except Zerun. The falling number values for the samples were higher than normal values excepting Bezostaja (import). The extensibility values were low for Zerun, Gerek 79, Bezostaja, but high for Ceyhan 99, while the others were in normal values. Low resistance to extension values was determined except Sagittario. The energies for Sagittario, Victoria and Ceyhan 99 were within normal values, while the energy values for the others were low. It was concluded that physical, chemical and extensibility properties of bread wheat (Triticum aestivum L.) varieties such as Sagittario, Zerun, Gerek 79, Ceyhan 99, Bezostaja, Victoria, Ceyhan 99, Bezostaja (import) and Pioneer investigated in this research were generally convenient and acceptable to use in flat bread (Gaziantep pita) making. However, they could be improved by blending and adding α-amylase to make the flour stronger and hence Gaziantep pita more attractive as a final product. Further analyses are required to understand the flat bread characteristics by using these and other wheat varieties.

Disclosure statement
No potential conflict of interest was reported by the author.

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