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Quality Evaluation of Pasta Made From Some Durum Wheat Cultivars in Egypt

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ABSTRACT

During this study the effects of various durum wheat cultivars on the quality properties of pasta were evaluated. Chemical, physical, rheological, and sensory characteristics, as well as the cooking quality of pasta produced from wheat durum cultivars, were evaluated in a variation of seven durum wheat cultivars. Using a scanning electron microscope, it was determined that the optimal variety in terms of protein and starch cohesion is Beni Suef 5. Throughout sensory assessment, spaghetti prepared from Beni Suef 7 had superior characteristics, such as a smooth, translucent yellow color on the surface, as well as flavor and taste properties, when compared to other types. The chemical composition of durum wheat varied with cultivars; Sohag 5 had the highest zinc content (38.92±1.32) mg/kg, whereas Beni Suef 4 achieved the highest content of iron (51.34±2.49) mg/kg. In terms of cooking quality, pasta produced from Beni Suef 1 had the highest values when compared to other pasta varieties, including cooking loss (CL) (4.50±0.43) and water absorption (WA) (229.80±20.32).

KEYWORDS: Durum wheat, Pasta evaluation, Electron microscopy, Physicochemical

1. INTRODUCTION

Wheat is one of the prehistoric crops that meet the majority of the world's energy requirements. Wheat demand has recently increased due to the availability of a diverse variety of end products at cheaper prices than other cereal crops. According to FAO estimates, the world would require approximately 840 million tons of wheat by 2050, up from its present production level of 642 million tones. This demand excludes animal feed and the negative effects of climate change on wheat output. To achieve this need, developing nations should grow wheat production by 77%, with vertical expansion accounting for more than 80% of total demand (FAO, 2020). Wheat is an important component of the diet because of the wheat plant's agricultural adaptability, the simplicity with which the grain can be stored, and the ease with which the grain can be processed into flour to form edible, appealing, intriguing, and gratifying dishes. Wheat's economic significance stems mostly from the fact that it is one of the three major cereals, along with rice and maize, and is a staple diet around the world (Pingault et al., 2017).

Wheat is one of the most widely consumed food grains on the planet. It is used in the creation and production of a variety of foods, including bread, cake, pastries, and pasta. It is also a significant component of certain people's diet meals. Wheat has numerous health benefits, especially when consumed in whole grain form, because it provides key elements required for body growth. These grains are consumed whole or crushed into flour while keeping all of the seed's components (bran, germ, and endosperm). Whole grains include more fiber and other nutrients than other forms of grains, including vitamin B, iron, folic acid, selenium, potassium and magnesium. Consumption of whole wheat pasta may help to optimize the intake of bioactive substances, such as dietary fiber and antioxidants, which are known to lower the risk of numerous chronic diseases (Ciccoritti et al., 2017).

Egypt is the largest wheat importer in the world; however, it produces only half of the 20 million tons of wheat that it consumes annually. The population of Egypt is currently growing by 1.94% per year, and projections predict that the demand for wheat will be nearly doubled by 2050. Russia and Ukraine are major wheat exporters to Egypt and globally. Egypt's wheat production in 2023 was estimated to be around 8.7 million metric tons, a 6.8 percent decline from the previous year. Egypt's wheat production fluctuated between 7.2 and 9.3 million metric tons throughout the recent decade (Abdalla et al., 2022). Throughout the 13-year period, an overall upward trend can be seen, with a total gain of roughly 20.4 percent. Egypt is expected to import 10.5 million tons of wheat in 2022-23, the lowest amount in eight years, owing primarily to the economic consequences of the Ukraine conflict (Bertassello, 2023).

Pasta is the Italian word for "dough" and refers to extruded meals like spaghetti and lasagna (Megyesi et al., 2022). Pasta is one of the foods that contain a lot of starch. Pasta-like doughs have been known in several Asian countries since ancient times, and they made their way to Italy in the thirteenth century. Italy is regarded as one of the most prominent European countries in the pasta business, particularly for its spaghetti manufactured from flour dough. And water, dried and molded into various forms and the main substance used in the production of pasta is semolina, which is produced from durum wheat and found in 100% pasta. Pasta produced from semolina is a good source of complex carbs. Pasta has a lot of resistant starch and is low in fat (Webb, 2019).

Pasta is mostly manufactured from durum wheat semolina (*Triticum turgidum ssp. durum*) due to its excellent cooking quality, distinct color, flavor and widespread consumer acceptability. When milling durum wheat into semolina, the bran and germ are removed. Bran and germ that remain in semolina are called pollutants. However, bran and germ are high in vitamins, minerals, natural antioxidants (Iqbal et al., 2022), and dietary fiber. Vitamins and minerals are essential nutritional components, while antioxidants and dietary fiber have been linked to a variety of health advantages (Loskutov and Khlestkina, 2021). Making pasta from ground whole wheat would thus boost the nutritional value of pasta as well as the health advantages for consumers.

The present investigation was carried out to evaluate the proximate chemical composition and physical properties of some wheat durum obtained from some Egyptian cultivars, i.e., Bani Suef 1, Bani Suef 4, Bani Suef 5, Bani Suef 6, Sohag 4, and Sohag 5, as well as the technological properties and sensory evaluation of pasta made using the last-mentioned cultivars.

2. MATERIALS AND METHODS

2.1. Materials

The wheat samples (*Triticum turgidum* L. ssp. durum) were grown in the same field trials in Beni-Suef governorate in 2020-2021. The Egyptian samples (Bani Suef 1, Bani Suef 4, Bani Suef 5, Bani Suef 6, Bani Suef 7, Sohag 4 and Sohag 5) were obtained from Agricultural Research Center Giza-Egypt.

2.2. Chemical analysis

Moisture, protein and ash content of the durum wheat cultivars were determined according to AACC (2000). Mineral, (K, Na, Mg, Fe, Ca, Cu, Mn and Zn) contents were estimated using Atomic Absorption (GBC 932/933-England) according to AACC (2000).

2.3. Scanning Electron Microscopy (SEM)

Scanning electron microscopy was used to examine the Pasta. By applying liquid nitrogen, pasta was dried, frozen, and a little portion was separated by a freeze-fracture.The tiny factions were adhered on aluminium stubs using double-sided carbon tape and subsequently coated with a 20 nm thick layer of carbon. The coated pasta was examined and photographed using a Zeiss Crossbeam 540 FE 6 (Carl Ziess Microscopy, 6mbH, Germany) 5.0 KV (Baah, *et al.,* 2022),

2.4.Farinograph tests

To investigate dough rheology, Farinograph Brabender uses the AACC 54-21.01 method. Farinographs are used to measure and record the resistance of flour/water dough to deformation caused by the mixing action of blades over time at a certain speed (rpm and temperature). Dough resistance is measured using dimensionless Farinograph or Brabender (FU or BU) units. The Farinograph quality number (FQN) is a classic index developed by the BrabenderTM firm. This rheological indicator, which combines all Farinogram indices, is used in wheat research (Arai et al., 2020).

2.5.Process of pasta

Pasta was made according to (Oyeyinka *et al.,* 2021). In summary, 50 g of flour, 22.5 g of water, and 1.0 g of salt were combined with each formulation in a bench top mixer until the dough reached a suitable consistency. The dough was split by hand and then extruded onto trays covered with aluminium foil using a metal clay extruder (YG-21, China) with a 1.3 mm diameter. The pasta was dried in a hot air oven (D-37520, Thermo Fischer Scientific, South Africa) for two hours at 80 ± 5 ◦ C. Before being used for further analysis, the dried pasta was kept at room temperature (25 ± 2 ◦ C) in Ziploc bags.

2.6.Measurements of pasta

Cooking loss (CL) and water absorption (WA) were evaluated according to the AACC-approved method 66-50.01 (AACC, 2010). The optimum cooking time (OCT) for pasta samples squashed between two glass plates was determined by observing the disappearance of the white centre core (Zarzycki et al., 2020). To put it briefly, 1000 mL of boiling distilled water was added to 100 g of pasta. To calculate the OCT, samples were obtained every 15 seconds until the white core was completely obscured. The cooking time was utilized to get samples ready for sensory analysis and was done in triplicate.

2.7.Sensory evaluation

The pasta samples were organoleptically evaluated for their external and internal properties by 29 stuff members, according to (Oyeyinka *et al.,* 2021).

2.8.Statistical analysis

The obtained data were exposed to analysis of variance. Duncan's multiple range tests at ($P \leq 0.05$) level was used to compare between means. The analysis was carried out using the PRO ANOVA procedure of Statistical Analysis System **(SAS, 1996).**

3. RESULTS AND DISCUSSION

The major chemical constituents of tested whole wheat flour samples are given in Table (1). Moisture content is considered one of the most important considerations in judging the quality of wheat because it is fundamental to the keeping and milling quality of the grain (Awulachew, 2020). Beni Suef 5 was the highest content (14.60 %) but, Beni Suef 4 was being the less result (12.30 %) while Beni Suef 6 recorded (18.50 %) as the maximum content of protein.

Although, Beni Suef 1 and Beni Suef 4 the less (14.20 - 14.60 %) respectively. Whereas Beni Suef 6 represents the highest amount of ash (2.09) despite, Sohag 4 and Sohag 5 were the minimum and identical amount of ash (0.41), these observations in the same line with Collazo-Bigliardi *et al*., (2019) and Combrzy *et al*., (2021).

Table 1. Chemical composition (g/100g dry mater) of durum wheat cultivars

Sample	Protein	Moisture	Ash
Beni Suef 1	14.20±0.02^{d}	13.40±0.22^{b}	0.62±0.01^{d}
Beni Suef 4	14.60±0.1^{d}	12.30±0.02^{d}	0.96±0.02^{c}
Beni Suef 5	15.30±0.21^{c}	14.60±0.01^{a}	1.06±0.01^{b}
Beni Suef 6	18.50±0.31^{a}	13.00±0.02^{c}	2.09±0.01^{a}
Beni Suef7	15.40±0.1^{c}	13.60±0.12^{b}	0.50±0.02^{e}
Sohag 4	16.20±0.2^{b}	12.80±0.08^{c}	0.41±0.02^{f}
Sohag 5	15.83±01.2^{b}	13.00±0.11^{c}	0.41±0.01^{f}

*Average and standard Deviation of three replications
*Means within a column with different letters are significantly different at P≤ 0.05.

Mineral elements are widely used in nutrition, which refers to inorganic nutrients. Similar to vitamins and amino acids, minerals are essential for maintaining the balance and growth of the body's trillions of living cells (Ciudad-Mulero et al., 2021). Table 2 displays some of the variations found in the mineral content comparison of the durum wheat test samples. Sohag 4 had the lowest concentration of iron (42.42 mg/kg), whereas Beni Suef 4 had the greatest concentration of iron (51.34 mg/kg). Cultivars differences in zinc, calcium, and manganese contents were not statistically significant. Beni Suef 1 and Sohag 4 obtained the highest amounts of copper per kg (33.24 - 34.32 mg/kg), respectively. For potassium content, Beni Suef 4 had the lowest amount (3484.63 mg/kg), and Sohag 5 had the greatest amount (4526.27 mg/kg). While evaluating the mineral salts in durum wheat grains, other studies have validated results that are equivalent to our results (El-Naggar et al., 2018; Kljak et al., 2020; EL Sabagh et al., 2021).

Table 2. Minerals composition (mg/kg dry mater) of durum wheat cultivar

Sample	Iron	zinc	calcium	copper
Beni Suef 1	49.95±0.57^{ab}	32.53±8.06^{a}	503.21±3.85^{a}	33.24±0.98^{a}
Beni Suef 4	51.34±2.49^{a}	33.51±5.32^{a}	492.79±10.20^{a}	30.05±0.27^{bc}
Beni Suef 5	45.64±0.16^{ab}	34.16±0.90^{a}	472.80±6.15^{a}	29.54±1.19^{bc}
Beni Suef 6	49.91±5.77^{ab}	33.87±4.67^{a}	482.45±24.34^{a}	28.87±0.44^{c}
Beni Suef7	47.74±8.19^{ab}	33.22±4.65^{a}	496.23±1.58^{a}	32.07±0.61^{ab}
Sohag 4	42.42±1.05^{b}	31.39±6.71^{a}	500.24±15.58^{a}	34.32±3.61^{a}
Sohag 5	43.67±1.95^{ab}	38.92±1.32^{a}	484.67±24.87^{a}	29.36±0.10^{bc}
Sample	**magnesium**	**manganese**	**potassium**	
Beni Suef 1	273.39±3.48^{a}	39.94±1.19^{a}	3955.37±426.18^{b}	
Beni Suef 4	217.86±11.89^{b}	35.52±6.28^{a}	3484.63±5.65^{c}	
Beni Suef 5	237.89±16.69^{ab}	38.25±1.25^{a}	3990.53±15.28^{b}	
Beni Suef 6	273.66±38.23^{a}	37.57±4.12^{a}	4147.10±30.15^{ab}	
Beni Suef7	238.62±19.04^{ab}	34.97±1.06^{a}	3899.04±195.50^{b}	
Sohag 4	254.65±35.93^{ab}	36.60±3.89^{a}	4190.53±350.93^{ab}	
Sohag 5	239.46±11.26^{ab}	34.49±0.56^{a}	4526.27±9.55^{a}	

*Average and standard Deviation of three replications
*Means within a column with different letters are significantly different at P≤ 0.05.

Scanning electron microscopy analysis (SEM)

SEM used to analyze the morphological characteristics (i.e., size and form) of the particles of starch that make up all sorts of pasta cross-sections of dry pasta made from the durum wheat varieties. The examinations were conducted at 8 degrees of magnification with an electron microscope, which are: 1, 2, 5, 10, 20, 50 and 100 μm for dry pasta samples from durum wheat for each of the seven varieties, as shown by the following:

Figure 1 (A : G) showed the visible oval-shaped starch granules, ranging from 2 to 30 lm, which swell in heated water above 70 °C (Manno et al., 2009). Also, the cross-sections of

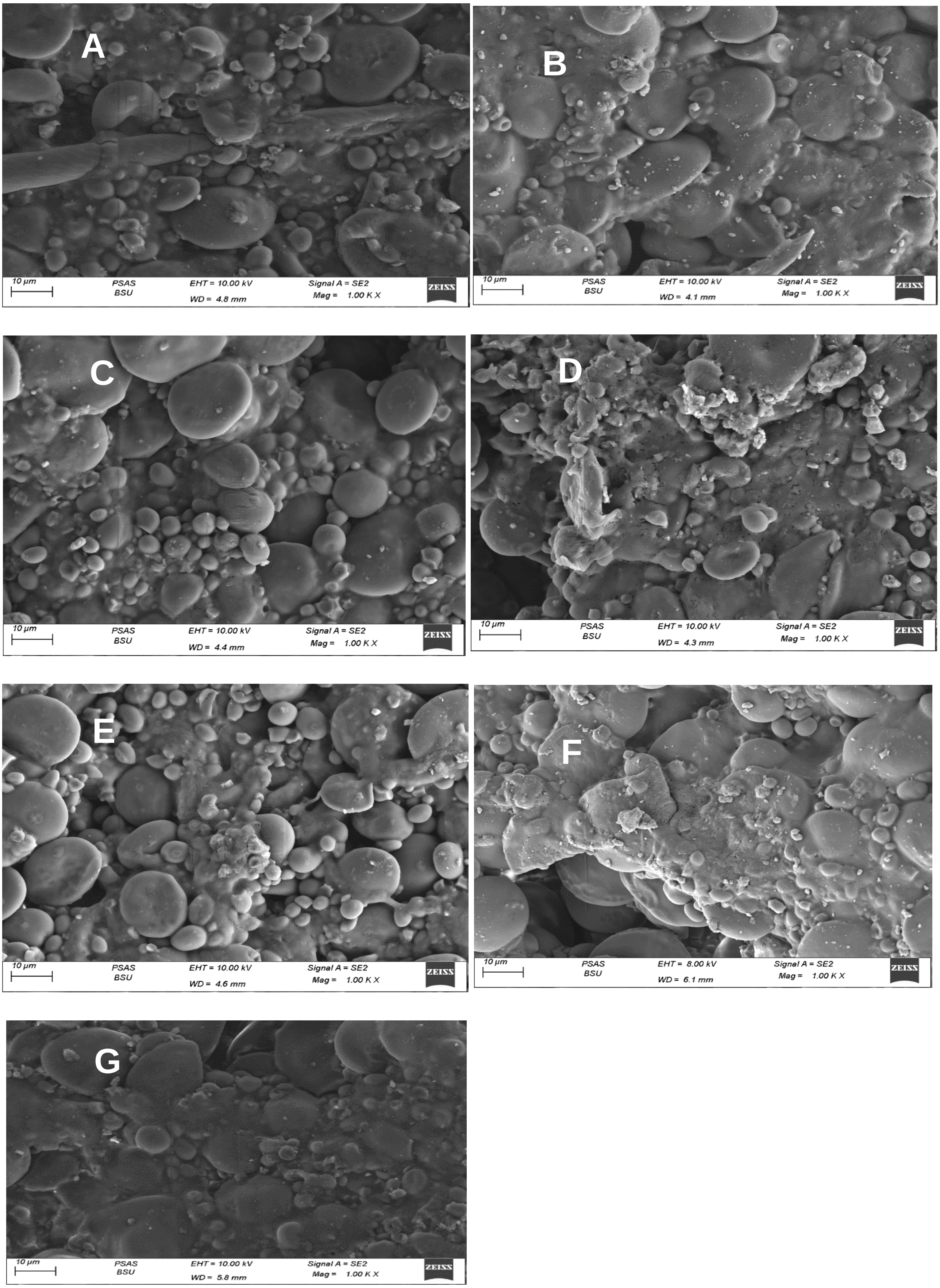

Figure 1. Scanning electron micrographs (1-7;10 µm) of durum wheat cultivars. Fig of wheat pasta (Beni Suef 1; A) - (Beni Suef 4; B) - (Beni Suef 5; C) - (Beni Suef 6; D) - (Beni Suef 7; E) - (Sohag 4; F) (Sohag 5; G).

durum wheat pasta made from all cultivars at 10 µm indicate that there are barely any differences in the degree of cohesiveness between protein and starch in pasta such as Beni Suef 4 and Beni Suef 5 (Gull et al., 2018). In terms of the cohesiveness gap between protein and starch in pasta, however, this can be caused by the gluten protein network in wheat semolina. In Beni Suef 6 and Sohag 4, there are a few starch shadows that are visible on the cross section following a razor blade break.

As shown in Table 3, Sohag 4 had the lowest SDS value (4.50 ml) and Sohag 5 had the highest (6.50 ml). Beni Suef 4 and 5 had the lowest values (1.34 -1.10 mm.ss), though Beni Suef 7 had the highest "DT" development time (3.18 mm.ss). Beni Suef 4 and 5 had the lowest consistency values (495.00 and 496.50 FU), although Beni Suef 6 had the highest value (524.50±4.50 FU). Beni Suef 7 and Sohag 4 had the lowest results of WA (64.00 and 63.90 %), while Beni Suef 6 had the maximum water absorption (6.25 %). The results obtained correspond with those released by Tawfeuk and Gomaa (2017), who found that the amount of protein in the flour samples boosted the amount of water absorption in the samples. Of the durum wheat assessed samples, variety ACSAD 65 had the highest value of both protein (15.62%) and water absorption (68.90%). Compared to, the control sample's protein (12.14%) and water absorption (58.66%) were the lowest. The cultivars with the greatest stability (2.02, 2.15 and 2.16 mm.ss) were Beni Suef 6, Beni Suef 7, and Sohag 5 respectively. The cultivars with the lowest stability (0.79 mm.ss) were Beni Suef 5. Comparing Beni Suef 1 and Beni Suef 6, Beni Suef 5 showed a greater degree of softening (10 min after beginning) (FU). Regarding the degree of softening (ICC / 12 min after max) (FU) Beni Suef 5 performed best of all. The lowest values were recorded by Beni Suef 1, Beni Suef 6, and Sohag 5 (95.50, 92.50±, and 111.50, respectively). The most significant Farinograph quality number (FU) values (36.50, 45.00 and 40.00) were observed in Beni Suef 1, Beni Suef 7, and Sohag 5 respectively.

Figures (2 - 8) showed the variation between farinograph measures for the seven tested cultivars.

Table 3. Farinograph Properties of doughs made from tasted durum wheat cultivars

Sample	SDS-Sedimentation Test	development time	Consistency	water absorption
Beni Suef 1	5.00±0^{bc}	2.82±0.64^{ab}	506.50±20.50^{ab}	66.25±20.50^{a}
Beni Suef 4	5.50±1.00^{bc}	1.34±0.12^{c}	495.00±11.00^{b}	64.70±0.70^{ab}
Beni Suef 5	5.00±0.50^{bc}	1.10±0.03^{c}	496.50±14.50^{b}	65.50±1.50^{ab}
Beni Suef 6	5.25±0.25^{bc}	2.82±0.60^{ab}	524.50±4.50^{a}	65.50±0.50^{ab}
Beni Suef7	6.08±0.52^{ab}	3.18±0.16^{a}	521.50±2.50^{ab}	64.00±1.00^{b}
Sohag 4	4.50±1.00^{c}	1.82±0.38^{bc}	516.50±17.50^{ab}	63.90±1.10^{b}
Sohag 5	6.50±0^{a}	2.61±1.41^{ab}	506.50±18.50^{ab}	65.65±0.65^{ab}

Sample	Stability	Degree of Softening (10 min after beginning)	Degree of Softening (ICC / 12 min after max)	Farinograph Quality Number
Beni Suef 1	1.47±0.07^{ab}	76.50±49.50^{b}	95.50±43.50^{b}	36.50±0.57^{a}
Beni Suef 4	1.42±0.099^{ab}	123.00±0^{ab}	129.50±2.50^{ab}	28.50±0.50^{ab}
Beni Suef 5	0.79±0.21^{b}	172.00±21.00^{a}	187.00±2.00^{a}	18.00±0^{b}
Beni Suef 6	2.02±0.49^{a}	78.00±48.00^{b}	92.50±36.50^{b}	33.00±2.00^{ab}
Beni Suef7	2.15±0.86^{a}	102.00±19.00^{ab}	126.50±11.50^{ab}	45.00±7.00^{a}
Sohag 4	1.81±0.53^{ab}	135.00±60.00^{ab}	163.50±74.50^{ab}	34.00±11.00^{ab}
Sohag 5	2.16±1.01^{a}	102.50±29.50^{ab}	111.50±26.50^{b}	40.00±18.00^{a}

*Average and standard Deviation of three replications
*Means within a column with different letters are significantly different at $P \leq 0.05$.

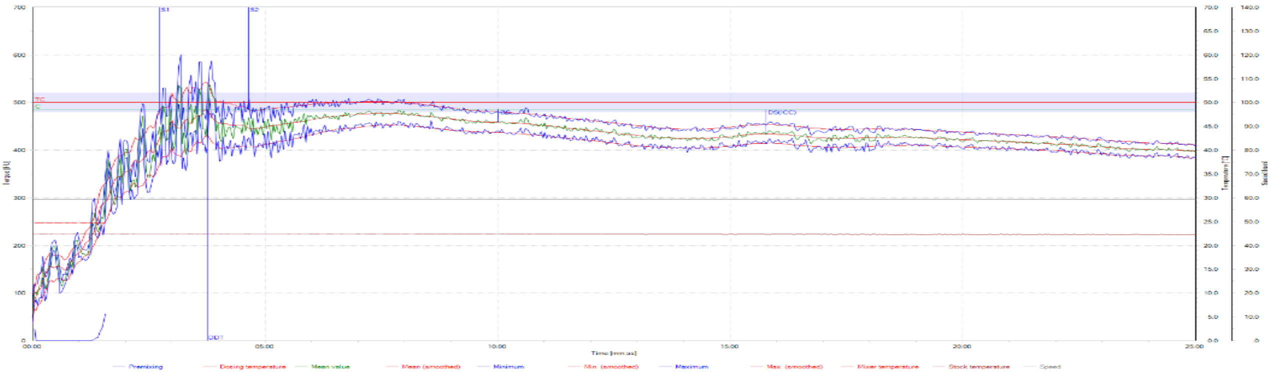

Figure 2. Farinograms of 72% extract of the experimental Beni Suef 1 wheat samples

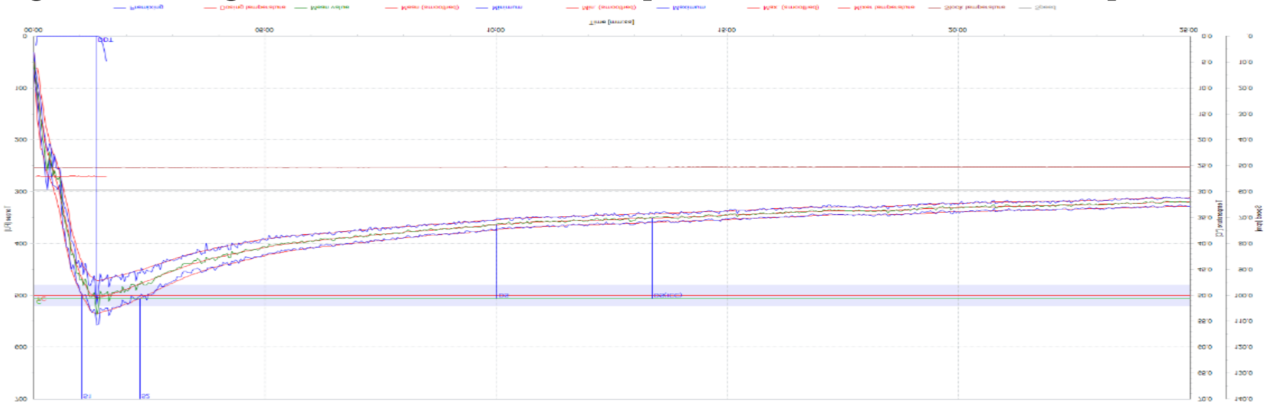

Figure 3. Farinograms of 72% extract of the experimental Beni Suef 4 wheat samples

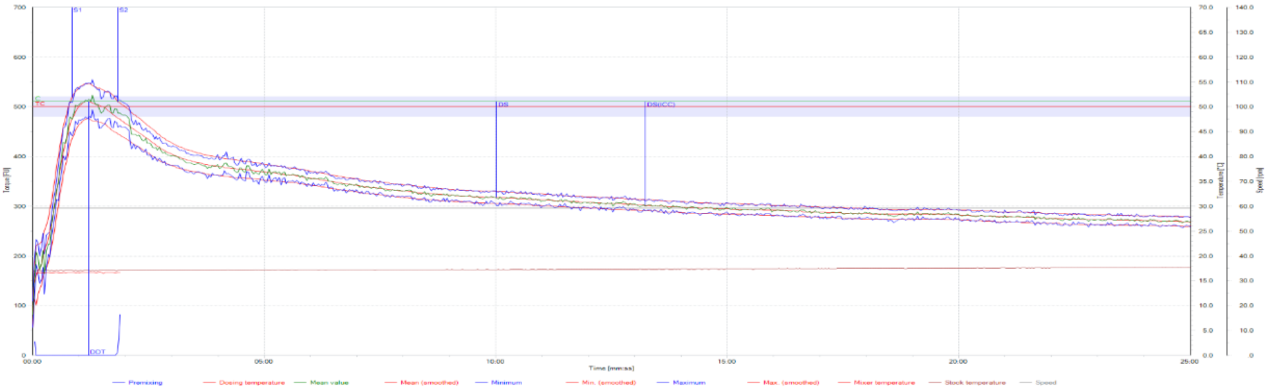

Figure 4. Farinograms of 72% extract of the experimental Beni Suef 5 wheat samples

Figure 5. Farinograms of 72% extract of the experimental Beni Suef 6 wheat samples

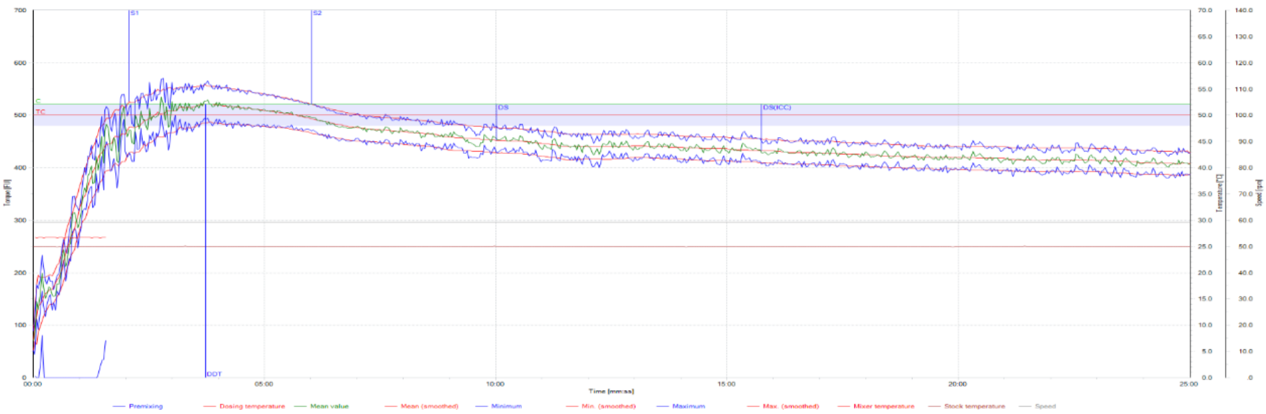

Figure 6. Farinograms of 72% extract of the experimental Beni Suef 7wheat samples

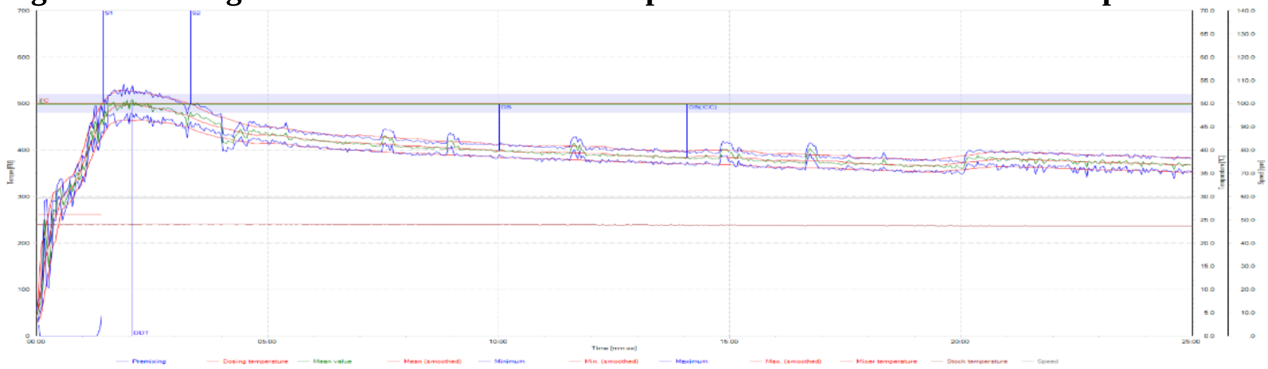

Figure 7. Farinograms of 72% extract of the experimental Sohag 4 wheat samples

Figure 8. Farinograms of 72% extract of the experimental Sohag 5 wheat samples

Beni Suef 1 had the highest cooking loss value, (4.50 g/100 g), according to Table 4. Nonetheless, Beni Suef 4 (4.26 g/100 g) had the lowest value thus, considering a significant cooking loss indicates increased starch solubility along with produces opaque cooking water and stickiness pasta, it is unfavorable (Baah, et al., 2022). Scanning electron microscope illumination (Fig.1.C) revealed visible particles of starch attached to the protein structure, indicating the decreased starch gelatinization and protein breakdown leading to longer hydration, a longer cooking period, and enhanced water absorption (261.66 %) during preparation (Baah, et al., 2022). The greatest volume values were recorded by Beni Suef 1, Sohag 4, and Sohag 5 (111.66, 133.33 and 121.66 cm^3), while the lowest values were recorded by Beni Suef 4 - Beni Suef 5- Beni Suef 6- Beni Suef 7 (106.66, 113.33, 115.0 and 110.0 cm^3).

Furthermore, no significant difference ($p<0.05$) was seen in the whole cooking duration among the cultivars. On the other hand, Beni Suef 7 required more to cook (11.83) than Beni Suef 6, which lasted less (7.33).

Table 4. Cooking quality made from tasted durum wheat cultivars

Sample	Cooking Loss	Water absorpation	Volum	Aldante time	Full cooking time	Over cooking time
Beni Suef 1	4.50±0.43[a]	229.80±20.32[b]	111.66±2.88[a]	9.83±4.80[a]	9.66±3.88[a]	10.16±4.36[ab]
Beni Suef 4	4.26±0.80[d]	259.33±16.77[a]	106.66±2.88[b]	4.33±0.57[a]	5.83±0.28[a]	11.83±0.28[ab]
Beni Suef 5	4.90±0.36[cd]	261.66±18.92[c]	113.33±2.88[b]	5.83±0.28[a]	6.33±0.28[a]	6.33±0.28[ab]
Beni Suef 6	4.23±0.25[cd]	259.33±5.03[b]	115.0±0[b]	7.33±4.16[a]	6.86±3.89[a]	7.33±4.16[b]
Beni Suef7	5.40±0.40[bc]	275.0±15.0[c]	110.0±10.0[b]	4.33±0.28[a]	5.83±0.28[a]	11.83±0.28[a]
Sohag 4	5.10±0.17[ab]	283.16±1.75[b]	133.33±2.88[a]	7.60±4.25[a]	8.10±4.45[a]	8.10±4.45[ab]
Sohag 5	2.96±0.55[cd]	273.40±8.19[b]	121.66±7.63[a]	8.66±4.85[a]	8.0±4.58[a]	8.16±4.36[ab+]

*Average and standard Deviation of three replications
*Means within a column with different letters are significantly different at P≤ 0.05.

Food's sensory attributes are significantly influenced by its flavor, smell, texture, and appearance. When evaluating pasta quality, sensory factors including appearance, flavor, texture, and smell that are detectable by the human senses are usually used. These characteristics can also be used as a guide to select foods (Koli, et al., 2022).

Table 5 demonstrates that Bani Suef 5 and Bani Suef 7 (4.96 - 1.41) produced the brightest colour, whereas Bani Suef the average in Bani Suef 6 was (5.57). The greatest taste ratings (7.10 - 7.28) went to Bani Suef 4 and 7, respectively. The highest scores were obtained by Bani Suef 7 (7.10), while the lowest scores were obtained by Bani Suef 5 and 6 (5.60 and 6.0).

With a Flavour score of (6.92), Bani Suef 7 was found to have the highest, while Bani Suef 5 had the lowest result (5.39). In contrast to Bani Suef 1 and 5, which had appearance values of (5.64 and 5.35), Bani Suef 4 and 7 showed higher values (7.46and 7.53). The mouth feel of Bani Suef 4 and Bani Suef 7 was comparable (7.10 and 7.10), however Bani Suef 5 had a lower value (5.39). Tenderness values for Bani Suef 7 and Bani Suef 6 were (7.50) and (6.07), respectively, the highest and lowest, respectively.

Table 5. Means of sensory attributes of cooked pasta made from tasted durum wheat cultivars

Sample	Color	Taste	Aroma	Flavor
Beni Suef 1	5.75±1.62[cd]	5.89±1.54[b]	6.21±1.83[ab]	5.78±1.61[bc]
Beni Suef 4	1.42±0.26[ab]	7.10±1.25[a]	6.89±1.44[ab]	6.71±1.58[ab]
Beni Suef 5	4.96±2.06[e]	5.53±1.87[b]	5.60±2.13[c]	5.39±1.93[c]
Beni Suef 6	5.57±2.28[de]	5.82±2.21[b]	6.0±2.0[c]	5.75±2.01[bc]
Beni Suef7	1.41±0.26[a]	7.28±1.62[a]	7.10±1.66[a]	6.92±1.69[a]
Sohag 4	6.42±1.73[cd]	6.50±1.64[ab]	6.89±1.59[ab]	6.07±1.74[ab]
Sohag 5	6.64±1.54[bc]	5.96±1.68[b]	6.57±1.54[b]	6.03±1.57[ab]
Sample	**Apperance**	**Mouthfeel**	**Tenderness**	**Overall**
Beni Suef 1	5.64±1.78[c]	6.07±1.71[bc]	6.21±1.83[bc]	6.71±1.46[b]
Beni Suef 4	7.46±1.42[a]	7.10±1.39[a]	7.17±1.86[ab]	7.64±1.09[a]
Beni Suef 5	5.35±2.11[c]	5.39±1.87[c]	6.71±1.60[ab]	6.57±1.39[b]
Beni Suef 6	5.71±1.88[bc]	5.96±1.73[bc]	6.07±1.92[c]	6.57±1.70[b]
Beni Suef7	7.53±1.47[a]	7.10±1.66[a]	7.50±1.55[a]	7.71±1.15[a]
Sohag 4	6.17±1.86[bc]	6.50±1.89[ab]	6.64±1.87[ab]	7.03±1.40[ab]
Sohag 5	6.64±1.49[ab]	6.10±1.66[bc]	6.53±1.91[ab]	6.85±1.48[b]

*Average and standard Deviation of three replications
*Means within a column with different letters are significantly different at P≤ 0.05.
*The acceptance of the pasta was assessed using a hedonic scale with a score of 9, with 1 indicating "dislike extremely" and 9 indicating "like extremely ".

Overall, the values of Bani Suef 4 and 7 were the most significant (7.64 and 7.71). According to the results, all measurements from the Sensory Cooked Pasta tests show no significant internal variations ($p<0.05$) between the seven types.

4. CONCLUSION

The characteristics of pasta produced from wheat durum cultivars were assessed in the study. According to the findings, Beni Suef 5 cultivars had superior sensory characteristics, while Sohag 4 cultivars had the optimal cohesion between protein and starch. The chemical composition of durum wheat varied, with Sohag 5 cultivars having the highest zinc content and Beni Suef 4 cultivars having the highest iron content. Beni Suef 1 cultivar of pasta had the highest cooking loss and water absorption values. Thus, in the end, Beni Suef 6 is superior in nutrition due to its higher protein and mineral content, while Sohag 5 surpasses it in manufacturing, despite not showing significant differences.

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الملخص العربي

تقييم جودة المكرونة المصنعة من بعض أصناف قمح الديورم في مصر

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لقد اجريت هذه الدراسة وذلك بهدف المقارنة بين الاصناف المختلفة من قمح المكرونة حيث استخدم في ذلك ٧ أصناف محلية. تم دراسة الاختلاف في الخواص التكنولوجية للمكرونة المصنعة من هذه الاقماح المختلفة حيث تم دراسة الخواص الكيميائية والفيزيائية والريولوجية بالإضافة الى خواص الطهي المختلفة. ومن ابرز النتائج التي تم الحصول عليها ان افضل تركيب لخواص العجين المستخدم في تصنيع المكرونة من خلال الفحص المجهري الإلكتروني كان بصنف بنى سويف ٥ وذلك يرجع الى قوة التماسك الواضح بين كل من البروتين والنشا مقارنة بباقي الأصناف. كما يتضح في حالة الخواص الحسية التفوق الملحوظ لصنف بنى سويف ٧ حيث تم الحصول من خلاله على أمثل مكرونة بين مختلف الأصناف المستخدمة وذلك من حيث كلا من المظهر العام واللون الاصفر الزاهي مع السطح الأملس الى جانب الطعم الجيد. وعند دراسة الخواص الكيميائية نجد زيادة في المحتوى من الحديد (51.34±2.49 mg/kg) في صنف بنى سويف ٤ مع ارتفاع ملحوظ في نسبة الزنك (38.92±1.32 mg/kg) وذلك في صنف سوهاج ٥ بالمقارنة مع باقي الأصناف. مع الاخذ بعين الاعتبار ان أفضل خواص للطهي للمكرونة قد ظهرت في المكرونة المصنعة من صنف بنى سويف ١ حيث كان أفضل معدل لامتصاص الماء(229.80±20.32) % الى جانب نسبة الفاقد من الطهي(4.50±0.43).