

Physico-Chemical and Technological Properties of some New Durum Wheat Varieties.

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ABSTRACT

This study was carried out to compare and evaluate different varieties of durum wheat physically, chemically and technologically as well as to investigate the possibility of using their semolina durum wheat varieties in preparing Pasta. The obtained results revealed that, physical properties of durum wheat varieties varied from one variety to another. It was found that Bane suif 1 had the highest weight among all wheat varieties that recorded 57.58 g/1000 grains. Whereas, hectoliter was higher in Sohaga 4 variety than those of all wheat varieties. Bane suif 4 contain the highest content of extraction percentage which was (65%) followed by Bane suif 5 which recorded (58.10%). However, semolina variety of Bane suif 5 contain the highest content of crud protein which was (14.30%) followed by Sohago 4 which recorded (13.95%) while the lowest value of crud protein was (12.50%) for Bane suif 1. Furthermore, the highest gluten content was found in Bane suif 5 (12.50 %) compared with another semolina varieties. In addition, Pasta made from semolina variety of Bane suif 5 had the highest water absorption value among all of the tested Pasta samples. Furthermore, Pasta made from semolina variety of Sohaga4 had the highest value of cooking time, cooking losses, cooking weight and swelling percentage among all of the tested Pasta samples. Results of Organoleptic evaluation indicated that, overall acceptability scores of cooked Pasta made from semolina variety of Bane suif 1 gave the highest scores The Pasta made from semolina variety of Sohaga 4 gave approximately the lowest scores for all characteristics.

INTRODUCTION

Wheat is the most widely grown crop in the world and approximately one sixth of the total arable land in the world is cultivated with it (Abdul Sattar *et al.*, 2003). Durum wheat (*Triticum turgidum* ssp. durum Desf. em.Husn.) accounts for around 6% of total wheat production (37.7 million tones in 2013; Guzmán *et al.* (2016). Durum grains used for the preparation of diverse food products, including bread, couscous, frekeh, bulgur, and most importantly, pasta. Pastas generally recognized worldwide as beneficial to a nutritionally balanced diet (Ames *et al.*, 1999), and consumer demand is reflected in the upward trend in pasta production. Although the environmental conditions and the geno-type, i.e. the choice of variety, are fundamental for the technological behaviour of the derived dough, the agricultural practices, and in particular nitrogen nutrition, also influence the flour quality to a greater extent. Dough (Olanca *et al.*, 2009). High levels of proteins as well as gluten quantity and strength are the predominant factors associated with superior bread- and pasta-making quality. Therefore, these traits are desirable for the marketability of both common and durum wheat in several supply chains (Brown and Petrie, 2006 and Foca *et al.*, 2007). Pasta is a popular worldwide and is used as a staple food in many countries. Conventional pasta is manufactured using durum wheat semolina as the primary ingredient. Compared to other starchy foods such as bread, pasta has beneficial physiological effects, inducing low postprandial glycaemic and insulinaemic responses (Aston, *et al.*, 2008).

Pasta is a widely consumed food because of its low cost, easy preparation, and long shelf life. High quality pasta are manufactured using durum wheat semolina because of its very good cooking quality and high consumer acceptance (Kim, *et al.*, 2016). Pasta color depends both used raw materials but also from the parameters of processing, especially drying. Maillard reactions occur during pasta drying caused the color of pasta more darker than color of carob fiber (Anese, *et al.*, 1999). The present study was carried out to compare and evaluate some varieties of durum wheat physically,

chemically and technologically for selecting high quality varieties for pasta production

MATERIALS AND METHODS

Materials:

Five durum wheat varieties namely Bane suif 1, Bane suif 4, Bane suif 5, Bane suif 6 and Sohag 4 were obtained from fields crops Research Institute, Agric. Research Center, Giza. Egypt.

Preparation of Durum wheat semolina:

The cleaned samples of wheat were soaked up to 16.5% humidity, conditioned for 24 h (AACC, 2000) and then milled to produce whole meal, another were used to produce semolina. The yield of semolina is expressed relative to the total amount of durum wheat based on the moisture content of 16.5%. The determination of hectoliter index and the grain index, weight of 1000 grains from each variety of durum wheat were counted randomly in triplicate and weighted separately as described by (AACC, 2000),

Chemical analysis of samples:

Chemical analysis including moisture, ash, protein and ether extract were determined according to A.O.A.C. (2005). Carbohydrates content was calculated by difference. Gluten content (g/100g on dry weight basis) was determined by the hand washing method (AACC, 2000).

Rheological properties:

The rheological behavior of the dough obtained from durum semolina during kneading and heating was monitored by utilization of Mixolab (Chopin Technologies, France), with application of "Chopin" protocol for ICC 173, (ICC Standards, 2010).

processing of Pasta:

Pasta samples were prepared by the method of Matsuo *et al.* (1972) and dried by conventional low temperature (450 c) drying cycle oven for 20 hours as described by Dexter *et al.* (1981).

Cooking quality of pasta:

Cooking quality i.e. (water absorption (%), cooking time (min), cooking loss (%), cooking weight (%) and swelling (%)) of all pasta samples were using the method described by Ficca *et al.* (2016).

Sensory evaluation of pasta:

Color, shininess, Surface smoothness, firmness, chewiness, elasticity, taste and over all acceptability of cooked pasta were evaluated organoleptically as described by (Padalino *et al.*, 2013).

Statistical analysis:

Data evaluation were executed with SPSS Inc. software (model 19.0; SPSS Inc., Chicago, IL .(and statistically different groups were determined by the DUNCAN's Multiple Range test (Steel and Torrie1980)

RESULTS AND DISCUSSION

Physical properties of some new durum wheat varieties :

The grain index (weight of 1000 grains) of some new durum wheat varieties is presented in Table (1). The results indicate that Bane suif 1 had the highest weight among for all samples that recorded 57.58 g/1000 grains. Bane suif 5 was the second (57.10g).while the lowest weight of The 1000 grains was (52.88%) for Bane suif 6. In addition the data in the same table revealed that, hectoliter index was higher in Sohaga 4 variety than those of all wheat varieties. It is noteworthy from the same table that, Bane suif 4 contain the highest content of extraction percentage which was (65%) followed by Bane suif 5 which recorded (58.10%) , while the lowest value of extraction percentage was (50%) for Sohag4. These results are in the same trend of those reported by (Boggini *et al.*, 1995 ; Aalami *et al.*, 2007 and Borrelli, *et al.*.,2008)

Table 1. physical properties of some new durum wheat varieties.

Varieties	The grain index=	hectoliter index	extraction percentage
Bane suif 1	57.58a	85.80b	57.80c
Bane suif 4	55.47c	83.20c	65.0a
Bane suif 5	57.10b	85.40b	58.10b
Bane suif 6	52.88e	85.40b	56.50d
Sohag 4	53.84d	86.60a	50.0e

The grain index: weight of 1000 grains=

Means of values between samples having the same case letter in a Colum are not significantly different at p < 0.05

Chemical analysis of some semolina durum wheat varieties (g/100g on dry weight basis):

The results in Table (2) revealed that ,moisture content of some semolina durum wheat varieties were ranged from (11.51 to 13.40%). However ,Bane suif 5 contain the highest content of crud protein which was (14.30%) followed by sohago 4 which recorded (13.95%) while the lowest value of crud protein was (12 (%57.for Bane suif .1 High levels of proteins as well as gluten quantity and strength are the predominant factors associated with superior bread- and pasta-making quality. Therefore, these traits are desirable for the marketability of both common and durum wheat in several supply chains)Brown and Petrie, 2006 .Furthermore ,Besides ,as previously commented, the environment and the field management will influence quality traits, as protein content, which has a key role in processing and end-use quality .Magallanes-Lopez *et al.* (2017) .The highest gluten content was found in Bane suif (% 12.50) 5 followed by Sohago ,(% 11.31) 4 while the lowest content was detected in Bane suif .(% 8.32) 1 These results are in line with those of) Giannone *et al* 2016 ,.and Ficco *et al.* ,. (2016They reported that, good values for gluten quantity

and gluten index are expected to lead to excellent pasta in terms of consistency and cooking performances .Apparent also from the same table that, semolina durum wheat varieties contain (0.49 to 0.82%) crud fat, (1.41 to 1.65%) ash content and (83.26 to 84.96%) total carbohydrate .

These results are in line with those) Raffo ,*et al* :2003, Pasqualone .*et al* ; 2004, Khan *et al*; 2013 , Ficco , *et al* 2016 ,.and Giannone *et al.* , 2016.

Table 2. Chemical composition (%) of some semolina varieties (on dry weight basis) and Gluten%

Semolina Varieties	Moisture %	Protein %	Fat %	Ash %	Total carbohydrates %**	Gluten %
Bane suif 1	11.51 e	12.50 c	0.49 a	1.65 a	84.96 a	8.32 d
Bane suif 4	11.91 d	13.50 b	0.57 a	1.41 a	84.52 ab	11.11 b
Bane suif 5	12.10c	14.30 a	0.82 a	1.62 a	83.26 c	12.50 a
Bane suif 6	12.90 b	13.40 b	0.53 a	1.51 a	84.56 ab	9.61 c
Sohag 4	13.40 a	13.95a	0.61 a	1.44 a	84.0 b	11.31 b

Means of values between samples having the same case letter in a Colum are not significantly different at p > 0.05

**Total carbohydrates was calculated by difference.

Rheological properties of dough from some new semolina durum wheat varieties:

Rheological properties of dough from some new semolina durum wheat varieties were measured by Mixolab and the results are given in table. (3) The results revealed that ,water absorption, dough development time, stability time, dough weakening and CMAX of different semolina wheat varieties ranged from 65.7 to 75.3 (%), 2.0 to 5.0 (min), 1.5 to 4.0 (min)60.0 (. to 106.0)U.f (.and 502.73 to 516.36)U.f (.respectively. Water absorption was observed to be the highest for semolina Sohaga 4 variety (%75.3) and the lowest for semolina Bane suif 1 variety (65.7%). The present results are in accordance with those of) Cauvain and Young, 2000 and Rosell *et al.* (2002 ,. They reported that, the quality of gluten, as well as the quantity, has a clear impact on dough water absorption and development time .

Table 3. Rheological properties of dough from some new semolina durum wheat varieties.

Parameters	Mixolab				
	Water absorption (%)	Dough development (min)	Stability time (min)	Dough weakening (U.f.)	CMA X (U.f.)
Bane suif 1	65.7	2.0	1.5	94.0	510.00
Bane suif 4	466.	2.0	1.5	94.0	502.73
Bane suif 5	70.3	3.0	1.5	087.	512.27
Bane suif 6	74.0	5.0	1.5	106.0	512.27
Sohag4	5.37	5.0	4.0	60.0	516.36

Cooking quality of Pasta:

Cooking performances are concerned, good quality pasta is characterized by minimal cooking losses and stickiness, and high firmness and springiness (Sozer, *et al.*, 2007),The values of water absorption for different Pasta samples are presented in Table (4). It should be noted from these table that , Pasta made from semolina variety of Bane suif 6 had relatively the highest water absorption value among all of the tested Pasta samples. Apparent also from the same table that, cooking time reflects the water absorption. Furthermore, faster rate of water absorption indicates a shorter cooking time. In addition , Pasta made from

semolina variety of Bane suif 5 had the shorter cooking time value among all of the tested Pasta samples.

The results in Table (4) indicated that, cooking losses values was higher in Pasta made from semolina variety of Sohaga 4 among all of the tested Pasta samples. This parameter theoretically reflects the quantity of starch and other biochemical components that are released from the pastaprotein matrix, and are subsequently lost in the cooking medium. The swelling is an indicator of the water that is absorbed by the starch and protein during cooking, which is used for gelatinization of the starch and hydration of the protein. Pasta made from semolina variety of Sohaga 4 had the highest swelling value among all of the tested Pasta samples. Furthermore, Pasta made from semolina variety of Sohaga 4 had the highest value of cooking time, cooking losses, cooking weight and swelling percentage compared with all samples. Those results are in line with the ones found by using Ficco, *et al.*, 2016; Pasqualone, *et al.*, 2016 and Padalino *et al.*, 2017).

Table 4. Cooking quality of Pasta.

semolina Varieties	water absorption (%)	cooking time (min)	cooking losses (%)	swelling (%)	cooking weight (%)
Bane suif 1	54.0e	9.0d	7.00a	164.0b	96.0b
Bane suif 4	55.0d	11.0b	6.40b	151.0d	89.0d
Bane suif 5	59.0c	8.0e	6.10b	146.0e	86.0e
Bane suif 6	68.0 a	10.0c	6.30b	160.0c	90.0c
Sohag4	64.0b	13.0a	7.20a	175.0a	104.0a

Means of values between samples having the same case letter in a Colum are not significantly different at $p < 0.05$

Organoleptic evaluation of pasta:

Evaluation of sensory characteristics of pasta by the panelist is depicted inTable (5). Obtained results indicate that, the highest value for color evaluation and lowest value for firmness were obtained, for Pasta made from semolina variety of Bane suif1 . Food color is an important attribute to food quality. Color of pasta without additives strongly depends on the properties flour or semolina such as carotenoids and composition of protein (Ohm, *et al.*, 2008). Pasta with a bright yellow color is the most acceptable (Debbouz, *et al.*, 1993).

Table 5. Organoleptic evaluation of pasta produced from semolina varieties.

Characters	Bane suif 1	Bane suif 4	Bane suif 5	Bane suif 6	Sohag 4
Colour(7)	6.5a	6.00b	6.00b	6.50a	6.00b
Shininess (7)	6.50a	6.50a	6.00b	6.50a	6.00b
S.S(7)	7.00a	7.00a	6.50b	7.00a	6.00c
Firmness (7)	6.50b	7.00a	7.00a	6.50b	6.50b
Chewiness (7)	6.50a	6.00b	6.50a	6.50a	6.50a
Elasticity (7)	6.50a	6.50a	6.00b	6.00b	5.50c
Taste (7)	6.50a	6.50a	6.50a	6.00b	6.50a
O.A (7)	6.57a	6.50ab	6.36b	6.43b	6.14c

* Each value is an average of ten determinations.

+ Values followed by the same letter in row are not significantly different at $P \leq 0.05$

S.S :Surface Snoothness.

O.A: Overall acceptability .

Generally, Overall acceptability scores of cooked Pasta made from semolina variety of Bane suif 1 gave the highest scores The Pasta made from semolina variety of Sohaga 4 gave approximately the lowest

scores for all characteristics.Our results are in agreement with those of Ficco *et al.*(2016) .

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الصفات الطبيعية والكيميائية والتكنولوجية لبعض أصناف قمح الديورم الجديدة.

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تهدف هذه الدراسة مقارنة و تقييم بعض اصناف قمح الديورم الجديدة من حيث الصفات الطبيعية والكيميائية والتكنولوجية وامكانية الاستفادة من دقيق السيمولينا في صناعة المكرونة. وظهرت النتائج ما يلي: وجد ان هناك اختلاف في الخواص الطبيعية لأصناف قمح الديورم وذلك تبعا للصف ووجد ان صنف بنى سوف 1 اكثر الاصناف في وزن الالف حبة 57.58 جم / 1000 حبة في حين كان مؤشر الهكتوليتير أعلى في سواهج 4 ، علاوة على ذلك يحتوي سواهج 4 على أعلى نسبة استخلاص بلغت (65%) يليها بنى سوف 5 (58.10%) مقارنة بأصناف القمح المختلفة ومع ذلك، فإن السيمولينا صنف بنى سوف 5 يحتوي على أعلى محتوى من البروتين (14.30%)، يليه سواهج 4 الذي يحتوي (13.95%)، بينما كانت أقل قيمة للبروتين (12.50%) لصف بنى سوف 1. وعلاوة على ذلك، وجد ان أعلى نسبة من الجلوتين على اساس وزن جاف لصف بنى سوف 5 (12.50%) مقارنة مع أصناف السيمولينا الأخرى. بالإضافة إلى ذلك اظهرت المكرونة المطبوخة المصنوعة من السيمولينا صنف بنى سوف 5 أعلى قيمة امتصاص الماء بين جميع عينات المكرونة المختبرة بينما اظهرت ، المكرونة المطبوخة المصنوعة من السيمولينا صنف سواهج 4 أعلى قيمة في وقت الطهي، والفاقد اثناء الطهي، ووزن المكرونة المطبوخة ونسبة التشرب بين جميع عينات المكرونة التي تم اختبارها. اظهرت نتائج الخواص الحسية العضوية أن درجات القبول الكلية كانت اعلى المكرونة المطبوخة المصنوعة من السيمولينا صنف بنى سوف 1 بينما أعطت المكرونة المطبوخة المصنوعة من السيمولينا صنف سواهج 4 أقل درجات الخواص الحسية.