J. Food and Dairy Sci., Mansoura Univ., Vol. 5 (12): 919 - 942 , 2014

EFFECT OF USING SORGHUM ON THE QUALITY OF WHEAT MIXTURES AND THEIR FLOUR .

El-sisy, T.T.; Jehan, B. Ali and M.S. Masoud
Regional Center for Food and Feed, Agriculture Research Central.

ABSTRACT

Two wheat kernels Ukrainian hard red wheat, Egyptian hard red wheat (Masr1) local wheat cultivars and Egyptian yellow sorghum (Sakha 80) local sorghum cultivars were subjected to physico-chemical properties. Results indicated that the Egyptian hard red wheat grains had higher total physical properties. Flour yields were about 70 % for all tested wheat samples except for the Egyptian hard red wheat and Mix (1) wheat, which were as low as 64.0%. A wide range of protein content (8.20 - 10.20 %) of flours was recorded. The Egyptian hard red wheat flour had the highest protein content and the Egyptian yellow sorghum flour was the lowest in protein content. Wet and dry gluten contents of wheat flour samples were consistent with their protein contents. Data indicated that Mix (1) and Mix (2) flours had more suitable properties for bread- making than the Mix (3) flours. From the different tested wheat flours indicated that those made from Egyptian hard red wheat (Masr1) and Ukrainian hard red wheat flours were superior but physico-chemical and rheological characteristics as well as phytate contents of wheat, sorghum and it's mixtures flour approve that sorghum flour decreased the water absorption. Composite flour containing 10% sorghum and 90% mixture wheat flours (Mix 2) showed maximum improvement in dough development time, dough stability, tolerance index and softening of dough**.** Tannin acid had significant lowest value (0.185%) for sorghum grains however sensory evaluation results showed that 10% wheat replacement with whole sorghum flour produced (Mix 2) acceptable pan and balady breads than the other mixtures.

Keywords:Wheat, Sorghum, Flour, Bread, Physical, Chemical and Rheological properties, Quality evaluation.

INTRODUCTION

Most of wheat varieties presently culivated are grouped under the bread wheat (*Triticum aestivum*), which account for approximately 95% of world production, and durum wheat (*Triticum durum*), which often used for pasta production (Peressini et al., 1999). In Egypt 10.9 million tons of different wheat varieties are milled per year 2003 (FAO, 2005). About 4,057,234 tons (37.2%) of imported wheat and 6,844,692 tons (62.8%) of local wheats were used during the season of 2003 (FAO, 2005).

Egypt remains the world’s largest wheat important**.** Accordingly, cereal important requirements in the next 2014/15 marketing year (July/June) are forecast at about 18.2 million tons, about 5 percent higher than the previous year and almost 10 percent higher than five year average. Wheat imports for the just ending 2013/14 marketing year are estimated at 17.4 million tons, about 22 percent and 8 percent respectively higher than the previous year and average. Available trade data indicate that until March 2014, 8.2 million tons of wheat was imported. The General Authority for Supply Commodities (GASC) announced, in mid-May 2014, that Egypt’s strategic reserves of wheat are enough until the end of July 2014 and that the level of reserves would increase after the expected purchase of domestic wheat from farmers which started in mid-April and should last July. The government expects to purchase 4.25 million tons of wheat from local farmers in 2014/15 (FAO, 2014).

Mixing two or more of wheat flours may depend on the economical aspect and this could be helpful to overcome the inferior quality for one of them and to enhance the total quality of the blend.

Despite the fact that different wheat varieties have been developed to suit different applications, inconsistency of wheat quality is one of the big problems of flour millers. Blending different wheat batches and adjusting the milling parameters can help to solve one problem but not all problems related to the final flour quality and this may be because the damage is too great or because no suitable raw material is available for blending. Accordingly, the use of improvers may be a solution to achieve the desired quality from affected flour (Popper, 2003).

Several developing countries have encouraged the initiation of programs to evaluate the feasibility of alternative locally available flours as a substitute for wheat flour. Many efforts have been carried out to promote the use of composite flours, in which a portion of wheat flour is replaced by locally grown crops, to be used in bread, thereby decreasing the cost associated with imported wheat (Olaoye et al., 2006). Most of the research conducted on the use of composite flour for bread making purposes (Dhingra and Jood, 2004); (Hsu *et al*., 2004); (Khalil *et al*., 2000) and (McWatter *et al*., 2004) were devoted to studying the effects of different flour substitutions on bread making quality. Acceptability studies conducted at the Food Research Centre in Khartoum, Sudan, indicated that breads made with composite flour of 70% wheat and 30% sorghum were acceptable (FAO, 1995). Consumer acceptance trials in Nigeria indicated that breads made with 30% sorghum flour were comparable to 100% wheat bread. Bread with 30% sorghum and 70% wheat was also prepared in Senegal (FAO, 1995).

Sorghum [*Sorghum bicolor* (L.) Moench], a tropical plant belonging to the family of Poaceae, is one of the most important crops in Africa, Asia and Latin America (Anglani, 1998). More than 35% of sorghum is grown directly for human consumption. The rest is used primarily for animal feed, alcohol production and industrial products (FAO, 1995) and (Awika and Rooney, 2004). The current annual production of 60 million tons is increasing due to the introduction of improved varieties and breeding conditions. Several improved sorghum varieties adapted to semi-arid and tropic environments are released every year by sorghum breeders. Selection of varieties meeting specific local food and industrial requirements from this great biodiversity is of high importance for food security. In developing countries in general and particularly in West Africa, demand for sorghum is increasing. This is due to not only the growing population, but also to the countries policy to enhance its processing and industrial utilization (Akintayo and Sedgo, 2001). More than 7000 sorghum varieties have been identified (Kangama and Rumei, 2005); therefore there is a need of their further characterization to the molecular level with respect to food quality. The acquisition of good quality grain is fundamental to produce acceptable food products from sorghum. Sorghum while playing a crucial role in food security in Africa, it is also source of income of house-hold (Anglani, 1998).

Sorghum (S. bicolor) is the fifth most important cereal crop after wheat, rice, maize, and barley in terms of production (FAO, 2005). Total world annual sorghum production is about 60 million tons from cultivated area of 46 millions hectares. Most important producers are the United States, Nigeria, Sudan, Mexico, China, India, Ethiopia, Argentina, Burkina Faso, Brazil, and Australia.

Bread is an important staple food for several countries. Wheat flour (*Triticum aestivum*) is more popular than other cereal grains for bread making. Its popularity has stemmed from the gluten and its mild, nutty flavor. Gluten is an essential structure-forming protein which contributes to the elastic characteristics of dough and good appearance of bread (Abdelghafor et al., 2011). However, a number of people have celiac disease (CD) which is defined as an inflammatory response in the small intestinal mucosa exacerbated by prolamin proteins in the cereal grains i.e. wheat (gluten), rye (secalin), and barley (hordein) (Ciclitira et al., 2005). As a result, there has been a great interest in development of gluten free breads. Part of this interest gets involved with the replacement of wheat flour with other flour.Among the other grain cereals, sorghum (*Sorghum bicolor*) is a rich source of various phytochemicals, including tannins, phenolic acids, anthocyanins, phytosterols and policosanols (Awika and Rooney, 2004), the physico-chemical properties of sorghum flour are also found similar to those of wheat flour. Thus, sorghum flour is likely to have the potential to replace wheat flour for those allergic to gluten (Taylor et al., 2006) and (Chanapamokkhot and Thongngam, 2003). However, the absence of gluten in sorghum flour may cause a liquid batter and baked bread with quality defects post baking poor color and crumbling texture (Chanapamokkhot and Thongngam, 2003). A number of studies have focused on improving the quality of cereal-based flour for bread making. (Hugo et al., 2003), applied the fermentation to decrease the pH of sorghum flour from 6.2 to 3.4, to reduce total starch and water-soluble proteins, and to increase enzyme-susceptible starch and total protein. Consequently, blending fermented sorghum flour with wheat flour was able to increase volume of bread loaf, weight of bread, and reduced crumb firmness . In the studies of (Onyango et al., 2011), bread was made from pregelatinized cassava starch and sorghum flour. It was found that crumb firmness and chewiness declined with increasing pregelatinized starch concentration whereas crumb adhesiveness increased with increasing the starch content. In addition, enzyme combinations e.g. *trans*-glutaminase, alpha amylase, xylanase and protease were alternative methods to improve dough rheology, bread quality and bread shelf-life (Caballero et al., 2007). The process of germination has been used successfully to improve the nutritional properties of legume seeds by removing several antinutrients (phytates and trypsin inhibitor), increasing oligosaccharides, and improving digestibility of starches and proteins in legumes. The results of studies by (Elkhalifa and Bernhardt, 2010), indicated that germination improved the functional properties of sorghum and it would be possible to design new foods, gluten free bread, using germinated sorghum. The technique of germinating legumes before consumption is a common practice to produce a natural product. In order to further expand the use of this grain, the effect of grain germination on physical and physico-chemical properties of red sorghum flour was investigated and its application to make gluten free bread was also evaluated through several aspects of physico-chemical and physical properties compared with those made from ungerminated sorghum flour and wheat flour (Elkhalifa and Bernhardt, 2010).

The aim of research is to evaluate the most common imported wheat (Ukrainian), as well as a local wheat cultivars Egyptian wheat (Masr1) with sorghum grains to make mixture for bread - making. The physical, chemical physicochemical and rheological as well as the manufactured bread quality characteristics were examined.

MATERIALS AND METHODS

Materials

Wheat and Sorghum samples.

one imported wheat grains *(Triticum aestivum)* different cultivars were obtained from Ukrainian hard red wheat which were obtained from one locations (Alexandria) and Egyptian hard red wheat grains (Masr1) and Egyptian yellow sorghum grains (Sakha 80), *(Sorghum bicolor)* were obtained from El-Ghrbia. They were taken from three different Companies since 2013.

Methods

Preparation of wheat and sorghum flours

A twenty kg of each wheat sample used in this investigation was stored 90 days at temperature 25°c and relative humidity less than 62% According to the methods described in U.S. Department of Agriculture, (1995). At the end of storage period wheat sample was cleaned mechanically to remove dirt, dockage, imparters and other strange grains by Carter Dockage Tester According to the methods described in U.S. Department of Agriculture, (2002). The wheat samples were tempered to 16.5 % moisture and allowed to conditioning for 24 hours, then milled by Laboratory mill CD1 auto Chopin According to the methods described in AACC method (2000 A). The extraction rate of any flour sample was adjusted to recurred rate (72% extraction) but sorghum had milled by laboratory mill 3100 Perten According to the methods described in AACC method (2000 A) for whole meal flour.

Mixture flour

(Mix 1) = 50% Egyptian wheat flour (72% extraction) + 45% Ukrainian wheat flour (72% extraction) + 5% Egyptian sorghum flour (100% extraction).

(Mix 2) = 50% Egyptian wheat flour (72% extraction) + 40% Ukrainian wheat flour (72% extraction) + 10% Egyptian sorghum flour (100% extraction).

(Mix 3) = 50% Egyptian wheat flour (72% extraction) + 35% Ukrainian wheat flour (72% extraction) + 15% Egyptian sorghum flour (100% extraction).

Analytical methods

Physical properties

Cleanliness, dockage, shrunken and broken, foreign materials, total damaged kernels and total defects were separated and determined manually (hand picking). Test weight pound per bushel**,** Test weight P/B = (Kg ⁄ Hectoliter) ÷1.278 according to U.S. Department of Agriculture, (2006 D). A thousand kernel weight was determined by counting the kernels in a 10 g wheat sample AACC method, (2000 B). Wet and dry gluten, and falling number were determined according to A.O.AC., (2005).

Bread fraction % of total fresh weight

Bread fraction % of total fresh weight was determined according to the method described in AACC method (2000 A) liguefaction no. is calculated as follow:

Crumb= water absorption /10

Inner crust=100 – (Crumb + Out crust)

Out crust= $\frac{\text{Loss of weight after baking}}{\text{water absorption \%}} \times 100$

Chemical properties

Moisture, crude protein, ash, crude fiber, fat and tannin acid were determined according to A.O.AC., (2005) and U.S. Department of Agriculture, (1999). The nitrogen free extract(N.F.E) was calculated by difference.

Rheological properties

All samples were tested by macro Farinograph and alveograph. (in Regional Center for Food and Feed, Agri. Res. Center, Cairo, Egypt.) to determine the rheological properties of the different types of flour according to the methods described by AA.C.C.(2000A).

Bread processing

Different samples of flours were used to produce Pan bread and Balady bread according to the formula showed in Table (1).

Table (1):

Type of bread	Flour	Moisture	Yeast	Salt Nacl	Sugar Sucrose	Shortening Vegetarian
Pan	1000gm	14%	20gm	10gm	30gm	30gm
Balady	1000gm	14%	20gm	5gm	non	non

Pan Bread

Pan bread was prepared According to the methods described in AACC method (2000 A). All ingredient of Pan bread (shown in Table (1)) were mixed with water to Farinograph Chopin test. The dough was mixed for 5-10 min. until the correct consistency was obtained. Dough fermentation and branding of the dough for 7 min were performed. dough were divided to 165 gm pieces and put in pan (No. 17) where fermentation for 2 hours at 30°c and relative humidity 80% was done. All samples were baked at 230°c for 20 min. at electric oven (Futurci oven 220 Perten) in Regional Center for Food and Feed, Agri. Res. Center, Cairo, Egypt.

Balady bread

Wheat flour (82% extraction) from wheat flour (72% extraction +10% Fin Bran) was baked into Balady bread loaves using straight dough methods *Rashaed et al. (1996).* Balady formula consists shown in Table (1). The ingredient were mixed for 20 min. after mixed with water according to Farinograph Chopin test by using Gostol-Gopan Perten Mixer and then the dough was left for 30 min. , dough was divided in to 150gm . Pieces that were arranged on a wooden board previously sprinkled with fine layer of bran and kept for 20 min at 30°c and 85% relative humindty. The pieces were flattened to about 20 cm diameter proofed at 30°c and 85% relative humidity for 30 min. and then baked at 400-500°c for 1-2 min. in a pilot oven in Regional Center for Food and Feed, Agri. Res. Center, Cairo, Egypt.

Baking mixture

Samples of wheat flour (82% extraction) were used to produce balady bread and (72% extraction) Pan bread only. For addition each sample of mixture wheat flour were mixed with Egyptian sorghum flour (100% extraction) by three percentage (5, 10 and 15%) to produce three mixtures.

Sensory evaluation

***Pan Bread and* Balady bread**

Pan bread and Balady bread loaves were orgaolpticaly evaluated According to the method described in AACC method (2000 A). The fresh sample was delivered to 10 panelists 2 hours after baking.

Economic Evaluation

A mill management, economic model was developed and consists of seventeen major components or steps according to Wingfield, (1985) and Bunn, (1998):

(1) wheat price L.E/Tons.
(2) Secondary production price L.E/ Tons.
(3) Moisture Content of wheat %.
(4) Moisture Content of flour%.
(5) Flour yield %.
(6) Reduction of flour extraction %= (0.6).
(7) Quantity of wheat to produce one ton flour Tons = (100 / Flour yield %) .
(8) Increase in mill feed% = ((Moisture Content of flour% - Moisture Content of wheat %) x100 / (100 - Moisture Content of flour%) - Reduction of flour extraction %).
(9) Total production of flour Tons= (Quantity of wheat to produce one ton flour Tons x (100+ Increase in mill feed%) /100).
(10) Quantity of Secondary production Tons= (Total production of flour Tons - 1).
(11) Wheat cost to produce one ton flour L.E/Tons= (Total production of flour Tons x wheat price L.E/Tons).
(12) Secondary production cost to produce one ton flour L.E/Tons= Quantity of Secondary production Tons x Secondary production price L.E/ Tons.
(13) Total flour cost L.E/Tons= (Wheat cost to produce one ton flour L.E/Tons + Secondary production cost to produce one ton flour L.E/Tons).
(14) High quality %= ((100 – (Bread loaf volume gm/cm3 / total addition of Bread loaf volume gm/cm3 x 100)).

(15) Low cost %= ((100 – (Total flour cost L.E/Tons / total addition of Total flour cost L.E/Tons x 100)).
(16) Storage effect on grading %= ((100 – (grade / total grade x 100)).
(17) Average of quality, cost and storage %.
Not : total addition of Bread loaf volume gm/cm^3**= (**2.5)
total addition of Total flour cost L.E/Tons= (31732.614)
total grade= (1+2+3+ 0= 6)
sample grade = (0)

Linear relationships were explored between the High quality %, the variation in flour sale price, wheat transportation cost and the Storage effect on grading %.

Statistical analysis

Data of three replicates were computed for the analysis of standard division (S.D) among the means were determined by Duncan's multiple range test using SAS programs **SAS, (1999)**.

RESULTS AND DISCUSSION

Physical and chemical properties of wheat, sorghum, mixture kernels and their flours.

Chemical composition of different wheat and sorghum kernels used in these study is given in Table (1) The moisture content of the different wheat varieties and sorghum ranged from (10.4 to 12.3%) for all studied samples. Ukrainian hard red wheat had the highest value while (Mix1) had lowest value among all samples. As regards protein content, (Mix 2) had the highest protein (11.60%) followed by Ukrainian hard red wheat and (Mix 3) (11.0%), while Egyptian yellow sorghum(Sakha 80) and (Mix 1) had the lowest protein content (10.40%). On other hand, nitrogen free extracts (NFE)% ranged from 68.21% (Egyptian yellow sorghum(Sakha 80)) to 72.86% (Mix 1). Additionally Ukrainian hard red wheat had lower fat (1.30) than other samples and was lower in Ash content (1.45) than the other samples. Ash content of all wheat varieties was found quite close to each other. However, highest ash content was observed in Egyptian yellow sorghum(Sakha 80) (1.79%).The ash content of flour is related to the amount of bran in the flour and therefore to flour yield. The results of fiber showed that Egyptian yellow sorghum(Sakha 80) had the significant highest value (6.50%) while Ukrainian hard red wheat had lowest value (2.7%). The Egyptian yellow sorghum (Sakha 80) had the significant lowest value (0.185%) of tannic acid than the maximum level (3.0%) according to U.S. Department of Agriculture, (2006 D).

Table 1: Proximate analysis for two different wheat, sorghum and mixtures kernels.

kernels	EgyW	UkW	EgyS	Mix 1	Mix 2	Mix 3
M.C%	11.30±0.5	12.30 ±0.1	11.60±0.1	10.40 ±0.1	10.50±0.07	10.70±0.1
Protein%	10.90±0.1	11.0 ±1.0	10.40±1.0	10.40 ±0.1	11.60±0.1	11.0 ±0.1
Fat %	1.70±0.01	1.30±0.01	1.50 ±1.0	1.51 ±0.01	1.52 ±0.01	1.53±0.01
Ash%	1.49 ±0.1	1.45 ±0.1	1.79 ±0.1	1.52 ±0.1	1.57±0.1	1.59 ±0.1
Fiber%	3.54±0.01	2.70±0.01	6.50 ±0.1	3.31±0.58	3.50 ±0.01	3.69 ±0.01
NFE%	71.07±0.01	71.25 ±0.01	68.21 ±0.1	72.86 ±0.01	71.31±0.01	71.49 ±0.01
Total caloric values%	343.18±0.01	340.70±0.01	332.74±0.1	346.63±0.01	346.52±0.01	343.73±0.01
Tannic acid%	*	*	0.185 ±0.1	0.01 ±0.1	0.019 ±0.1	0.028 ±0.1

NFE = Nitrogen free extracts, UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum (Sakha 80), * = Not detected, M.C = Moisture Content, (Mix 1) = 50% Egyptian wheat flour+45% Ukrainian wheat flour+5% Egyptian sorghum flour, (Mix 2) = 50% Egyptian wheat flour+ 40% Ukrainian wheat flour+10% Egyptian sorghum flour, (Mix 3) = 50% Egyptian wheat flour + 35% Ukrainian wheat flour+ 15% Egyptian sorghum flour.

Mean value of physical properties of two different wheat and sorghum kernel cultivars are presented in Table (2). Moisture content among all samples which was ranged from 11.3 to 12.3%. the highest moisture content noticed for Ukrainian hard red wheat while the lowest moisture content noticed for Egyptian hard red wheat (Masr 1). It can be concluded that the test weight for all samples ranged from 52.44 to 61.64 pound per bushel. The same trend was observed in test weight where Egyptian hard red wheat (Masr 1) was the highest and followed by Ukrainian hard red wheat and Egyptian yellow sorghum(Sakha 80). More ever the foreign material among all samples ranged from 0.14 to 0.30%, either Ukrainian hard red wheat have highest percentage of shrunken and broken kernels followed by Egyptian hard red wheat (Masr 1). For damage kernels which contest of heat damage and total damage, specially Egyptian hard red wheat (Masr 1) have highest total damage kernels percentage (5.70%) while Egyptian yellow sorghum(Sakha 80) have lowest percentage of total damage kernels (1.32%). It can be noticed that the Egyptian hard red wheat (Masr 1), Ukrainian hard red wheat and Egyptian yellow sorghum (Sakha 80) haven't heat damage. More ever from the same table, it could be noticed that all samples are free from insect and ok odor. The Egyptian stander no. 1601/1986 and it's modification on 23/4/2002 has obligation that the dockage % (first separated from sample) not exceed 1%, foreign material % not exceed 1%, total damage kernels % (heat damage ,sprout damage, insect damage and mould damage kernels) not exceed than 4%. However that difference between wheat samples, all wheat samples had grade one according to U.S department of agriculture, (2006).

Table 2: Grading of two different wheat and sorghum kernel cultivars.

Kernels		EgyW	UkW	EgyS
M.C%		11.30±0.5	12.30±0.1	11.60±0.1
T.W p/b		61.65±0.01	59.59±0.01	52.44±0.01
F.M%		0.14±0.01	0.30±0.01	*
BNFM		*	*	1.09
Sh.& B.N%		0.30±0.01	1.02±0.01	*
D.K%	H.D	0.0	0.0	0.0
	T.D	5.70±1.0	4.10±0.1	1.32±1.0
Odor		Ok	Ok	Ok
Insect		Free	Free	Free
Grade		3	3	4

T.W = Test weight, p/b= Pound per Bushel (American unit), M.C = Moisture Content, F.M = Foreign Material, Sh. & B.N = Shrunken &Broken kernels, D.K = Damage Kernels, H.D = Heat Damage, T.D = Total Damage, BNFM = Broken kernels & Foreign Material, UkW =Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum (Sakha 80), * = Not detected

Results in Table (3) showed that 1000 kernels wheat ranged from 33.5 to 50.0 gm. Egyptian hard red wheat (Masr 1) have highest value (50.0gm) while Egyptian yellow sorghum (Sakha 80) have lowest value(33.5gm). for addition the kernel colour in all samples are red wheat whereas Egyptian yellow sorghum (Sakha 80) are yellow sorghum. Additionally it showed that wet, dry gluten, hydration ratio and gluten index ranged from (21.8 to 27.0%), (7.1 to 8.4%), (187 to 223%) and (56.9 to 87.2%) respectively. From the same table results showed that the highest wet and dry gluten was observed in Egyptian hard red wheat (Masr 1) (27.0% and 8.4%) whereas lowest value was observed in (Mix 3) samples. On the other hand, Egyptian hard red wheat (Masr 1) have highest gluten index moreover the other samples are different between that Egyptian hard red wheat (Masr 1) and Ukrainian hard red wheat for the gluten properties. Falling number which indicted enzyme activity of Alfa amylase. In case of falling number, (Mix 2) have highest falling number (471 sec.) or (7.85 min) and lowest enzyme activity. From Table (3) it can be concluded that Egyptian hard red wheat (Masr 1) have the good quality for physical properties in all different wheat samples followed by (Mix 1), (Mix 2), Ukrainian hard red wheat and (Mix 3) respectively.

Table 3:physical properties of two different wheat, sorghum and mixtures kernels.

Kernels	EgyW	UkW	EgyS	Mix 1	Mix 2	Mix 3
Veigh per 1000 ernels gm	50.0 ±0.1	39.50 ±0.1	33.50 ±0.1	*	*	*
Hardness%	63 ±1.0	61 ±1.0	61±1.0	*	*	*
Colour	Red	Red	Yellow	*	*	*
Wet gluten %	27.0±0.1	23.60±0.1	*	22.60±0.1	21.80±0.1	21.80±0.1
Dry gluten %	8.40±0.1	7.30±0.1	*	7.70±0.1	7.60±0.1	7.10±0.1
Hydration ratio	221±0.1	223 ±0.1	*	194 ±0.1	187 ±0.1	206 ±0.1
Gluten index %	87.20±0.1	56.90 ±0.1	*	86.70±0.1	86.10±0.1	77.10±0.1
Falling Number in Sec.	384 ±1.0	371 ±1.0	324 ±1.0	389 ±1.0	471 ±1.0	443 ±1.0
in Min.	6.4±1.0	6.2±1.0	5.4±1.0	6.5±1.0	7.9±1.0	7.4±1.0

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum (Sakha 80), * = Not detected

Results of Table (4) showed that the flour yield was different slightly among test samples and ranged from 56.28 to 69.8 %. So data present indicated that Ukrainian hard red wheat had highest flour yield (69.8) while (Mix 3) and (Mix 2) had lowest flour yield (56.28%) and (59.74%) respectively. On the other hand Egyptian hard red wheat (Masr 1) had the highest coarse bran (19.55%) while (Mix 3) had lowest coarse bran (15.61%). However Ukrainian hard red wheat and (Mix 1) had highest fin bran (14.81%) and (9.73%), respectively while Egyptian hard red wheat had the lowest fine bran (8.35%) and highest semolina (8.4%). However, these differences may be partly attributed due to different growing and environmental conditions prevailed during growing periods (Randhawa *et al.,* 2002).

Table 4: Extraction of different flour obtained from two different wheat, sorghum and mixtures kernels.

Flour	EgyW	UkW	EgyS	Mix 1	Mix 2	Mix 3
Coarse Bran%	19.55	16.68	*	17.28	16.44	15.61
Fin Bran %	8.35	14.81	*	9.73	9.10	9.06
Semolina %	8.40	1.29	*	4.73	4.72	4.05
Flour yield %	63.70	69.80	100.0	63.26	59.74	56.28

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum (Sakha 80), * = Not detected

Chemical composition of flour prepared from different wheat, sorghum and mixtures kernels are showing from Table (5). Results indicted that chemical composition of flour are different in all investigated samples. Moisture content are ranged from 13.5% (Mix 1) flour to 14.5% (Ukrainian hard red wheat flour) while (Mix 3) flour contain highest protein (10.3%) and lower nitrogen free extract (73.85%) than other samples, however Egyptian yellow sorghum flour showed the highest fat content compared with other studied samples. On other hand, the (Mix 1) flour had the lowest ash content.

Table 5: Proximate analysis of different flour obtained from two different wheat, sorghum and mixtures kernels

Flour	EgyW	UkW	EgyS	Mix 1	Mix 2	Mix 3
M.C	14.3	14.50	13.70	13.50	13.80	13.65
Protein%	10.20 ±0.1	9.40 ±0.1	9.80 ±0.1	10.0 ±1.0	9.60 ±0.1	10.30 ±0.1
Fat %	1.10 ±0.1	0.65 ±0.5	1.15 ±0.01	1.0 ±1.0	1.22 ±0.01	1.10 ±0.1
Ash%	0.65 ±0.01	0.68 ±0.1	0.51 ±0.01	0.48 ±0.01	0.59 ±0.1	0.90±0.1
Fiber%	0.20 ±0.01	0.11 ±0.01	0.12 ±0.01	0.11 ±0.01	0.16 ±0.01	0.20 ±0.1
NFE%	74.65 ±0.3	74.66 ±0.1	74.72 ±0.01	74.91±0.01	74.63 ±0.16	73.85±0.1
Total caloric values%	349.30 ±0.01	342.09 ±0.01	333.48 ±0.01	344.71 ±0.01	345.91 ±0.01	339.51 ±0.01

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum (Sakha 80)

The data in Table (6) showed that the highest starch damage was in Egyptian hard red Wheat (Masr 1) flour (5.65%) while Egyptian yellow sorghum(Sakha 80) flour was the lowest (1.5%). The rheological properties of wheat flour dough were tested by farinograph, alveograph and mixolab and the results of the wet and the dry gluten and hydration ratio of different flour samples are given in Table (6). Results from Tables (5) and (6) indicated that the increases in protein content was accompanied by an increase in the wet and the dry gluten contents. The Egyptian hard red wheat (Masr 1) flour showed protein content of 10.20% have higher wet , dry gluten and hydration ratio than other samples 30.1, 11.30 and 162 % respectively, while Ukrainian Hard Red Wheat flour had the lower protein content 9.4% than other samples. Additionally, all samples investigated a good characteristics to production of bread except the (Mix 2) flour and (Mix 3) flour, while Egyptian hard red Wheat (Masr 1) flour can be used to produce pasta and bread ,but the (Mix 3) flour it can be used for biscuits and breakfast food . The same table reviewed that the falling number values were ranged from 324 to 430 sec. (Mix 2) flour had the highest value (430 sec.) and the Egyptian yellow sorghum(Sakha 80) flour had lower values (324 sec.). Economic European community recommended that the falling number of flour should exceed than 230sec Milatovie and Mondelli, (1991). Egyptian standard no. 1419/2006 of white flour for production of bread has the following requirement: protein content not less than 10.2% Ash content not exceed than 0.9% And the falling number showed exceed than 200 Sec. Also, Egyptian standard no. 1649/2004 for durum wheat has obligation that protein content of durum wheat not less than 10.5% and ash content not exceed than 1.3%. From the same Table (6) it can be concluded that the percentage of sediment ranged from 9.0 to 35.0%. Egyptian hard red Wheat (Masr 1) flour was highest sediment ratio which had good characteristics to produce bread. It could be also seen that the wheat had the highest value of whiteness colour for flour colour (Ukrainian Hard Red Wheat flour and Egyptian hard red Wheat (Masr 1) flour) 44.0 and 38.3% than the Egyptian yellow sorghum(Sakha 80) flour which is less in whiteness. Starch damaged are ranged from 1.50 to 5.65%. Egyptian hard red Wheat (Masr 1) flour had the highest value while Egyptian yellow sorghum(Sakha 80) flour had the lowest value.

Table 6: physicochemical properties of different flour obtained from two different wheat, sorghum and mixtures kernels.

Flour		**EgyW**	**UkW**	**EgyS**	**Mix 1**	**Mix 2**	**Mix 3**
Starch damage %		5.65	2.85	1.50	4.45	4.27	4.36
Gluten quantity	Wet%	3o.10	26.40	*	25.90	24.10	23.80
	Dry%	11.30	10.10	*	10.80	10.60	10.0
	Hydration ratio	163.0	161	*	1.40	1.30	1.38
	Index%	94.10	89.70	*	93.80	92.10	89.90
Protein sediment %		35.0	16.0	9.0	25.0	24.0	22.0
Falling Number Sec.		355±1.0	330±1.0	324±1.0	360±1.0	430±1.0	410±1.0
flour Colour %	White	38.30	44.0	7.50	32.80	30.70	28.10
	yellow	14.40	11.90	21.90	15.20	15.50	15.90

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum(Sakha 80), * = Not detected

Rheological properties from two different wheat, sorghum and mixtures flour samples.

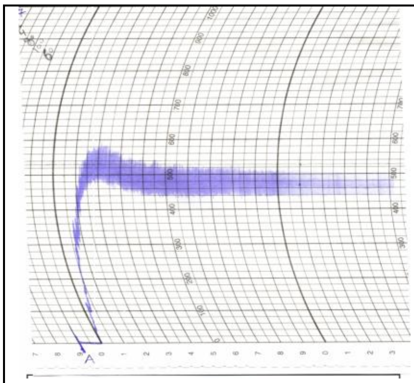
Farinograph studies were conducted to determine the rheological properties of wheat, sorghum and mixture flour for different wheat varieties and sorghum variety (Table 7) and Fig(1). Highest water absorption (57.0%) was observed in Egyptian hard red Wheat (Masr 1) flour followed by Ukrainian hard red wheat flour (56.50%) while (Mix 3) flour had the lowest water absorption (47.0%). Water absorption is considered to be an important characteristic of flour. Stronger wheat flours have the ability to absorb and retain more water as compared to weak flours. Higher water absorption is required for good bread characteristics which remain soft for a longer time. In considering the Farinograph mixing properties for the samples, it was found that arrival time ranged from 1.0 to 1.25 min. (Mix 2) flour had the highest arrival time among all samples and Egyptian hard red Wheat (Masr 1) flour, Ukrainian hard red wheat flour, (Mix 1) flour and (Mix 3) flour had the lowest. As regards the Dough Development Time (mixing time), the time in minutes need to mix flour and water to form dough of suitable consistency was ranged from 1.5 to 2.5 min and the Egyptian hard red Wheat (Masr 1) flour had the highest value of Dough Development Time and Ukrainian hard red wheat flour and (Mix 3) had lowest values. Higher Dough Development Time reflects strong flour while its lower value is an indication of weak flour. Usually the decrease of Dough Development Time is associated with weaker gluten, regarding dough stability which indicates dough strength and it's resistance for mechanical action and degree of weakening, it was found that (Mix 2) flour showed long period of dough stability (5.5 min) with low value of dough weakening 90.0 B.U. ,on the other hand the (Mix 1) flour and (Mix 3) flour had lowest period of dough stability (2.5min) and the highest value of dough weakening (150 and 240 B.U), receptivity. In case of Mixing Tolerance Index (TI), highest value (140 B.U) was observed in (Mix 3) flour followed by (Mix 1) flour (110 B.U). standard white wheat flour had the lowest mixing tolerance index value(30B.U) Generally, higher mixing tolerance index value, weaker is the flour. For softening of dough (S.D), Egyptian hard red Wheat (Masr 1) flour and (Mix 2) flour had the lowest value (60 BU), which indicates strong flour since flours that have lower softening of dough S.D are stronger and the ones having higher softening of dough S.D values are weaker. Differences in farinographic characteristics among different wheat flour varieties may be due to variations in protein quantity and quality. Results in (table 7) for different wheat flour varieties were comparable to the earlier findings of (Raman *et al.,*2000), (Rehman *et al*., 2001) and (Huma (2004).

Results in (Table 7) and Fig (2) showed that the Tenacity (P) values were highly different between all cultivars which ranged from 58 mm H2O to 139mm H2O, Egyptian hard red wheat (Masr 1) flour (139 mm H2O) had the highest value while (Mix 2) flour (58 mm H2O) was the lowest. For L, a value of 100 mm is generally regarded as good, but for some applications like biscuit making, it is the minimum accepted so that the (Mix 1) flour (114mm H2O) was the highest value while Egyptian hard red wheat (Masr 1) flour (54mm H2O) was the lowest value. G can be interpreted in the same way as L which ranged between (16.4 ml) to (23.8 ml). The P/L value is increasingly used in the wheat trade. A value of 0.50 corresponds either to resistant and very extensible dough or dough that is less resistant and only moderately extensible (the most common case). A value of 1.50 corresponds to very strong and moderately extensible dough. The milling industry requires balanced wheat, i.e. with a P/L in the 0.50–0.80 range so that the Ukrainian Hard Red Wheat flour (1.60%) had the highest value while (Mix 1) flour (0.52%) was the lowest. Baking strength (W) showed that the Egyptian hard red wheat (Masr 1) flour (277 jol) had the highest value while (Mix 1) flour and (Mix 3) flour (104 jol) was the lowest. The different alveograph curve measurements give information about the strength and extensibility of dough. The P values of standard wheats range from 60 to 80 mm H2O and of very good quality wheats from 80 to 100 mm H2O; the values for extra strong wheats are higher than 100 mm H2O. W is the most widely used characteristic because it summarises all the others. The very different shapes of the curves from ‘extreme’ individuals indicate the great variation in dough strength and extensibility present in the core collection. The relationships between grain characteristics, flour and dough properties and from resultes in Table 3, 5, 6 and 7.

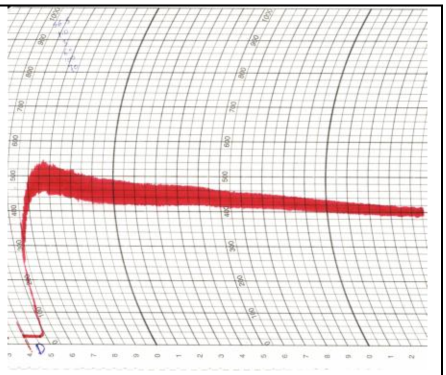
Table 7: Rheological properties of different flour obtained from two different wheat, sorghum and mixtures kernels.

	Flour	EgyW	UkW	EgyS	Mix 1	Mix 2	Mix 3
Farinograph test	Water absorption %	57.0	56.50	*	48.50	49.50	47.0
	Arrival Time min	1.0	1.0	*	1.0	1.25	1.0
	Dough stability Min	4.0	3.0	*	2.50	5.50	2.50
	Development time min	2.50	1.50	*	2.0	2.0	1.50
	Mixing tolerance index Brabender	80	60	*	110	50	140
	Dough w eaking Brabender	100	100	*	150	90	240
	Softening Brabender	60	70	*	90	60	170
Alveograph test	Tenacity mm H2o (p)	139	88	*	59	58	62
	Expandability mm (L)	54	55	*	114	92	59
	Sw elling ml (G)	16.4	17.2	*	23.8	21.4	17.1
	Baking strength Jol (w)	277	156	*	104	167	104
	Configuration rate % (P/L)	1.57	1.60	*	0.52	0.63	1.05

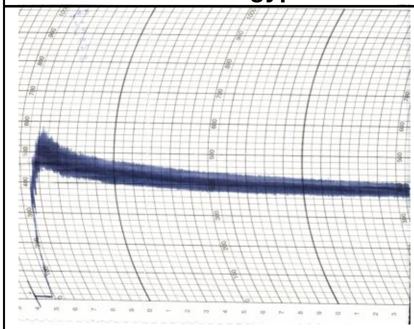
UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum(Sakha 80), * = Not detected



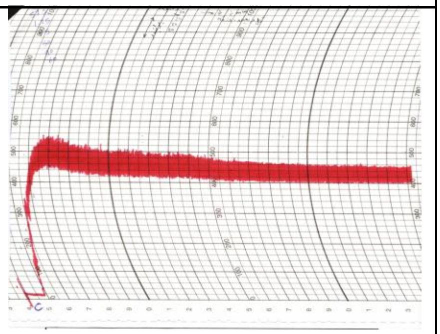
Egyptian flour



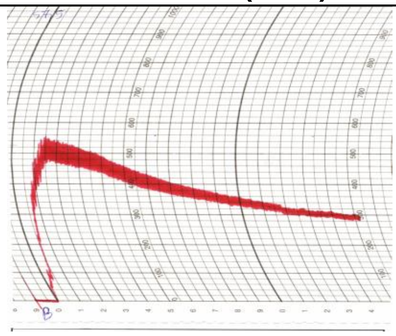
Ukrainian flour



(Mix 1) flour



(Mix 2) flour



(Mix 3) flour

No graph test

Egyptian sorghum flour

Fig. (1): Effect of wheat flour and it's mixtures on Farinograph parameters.

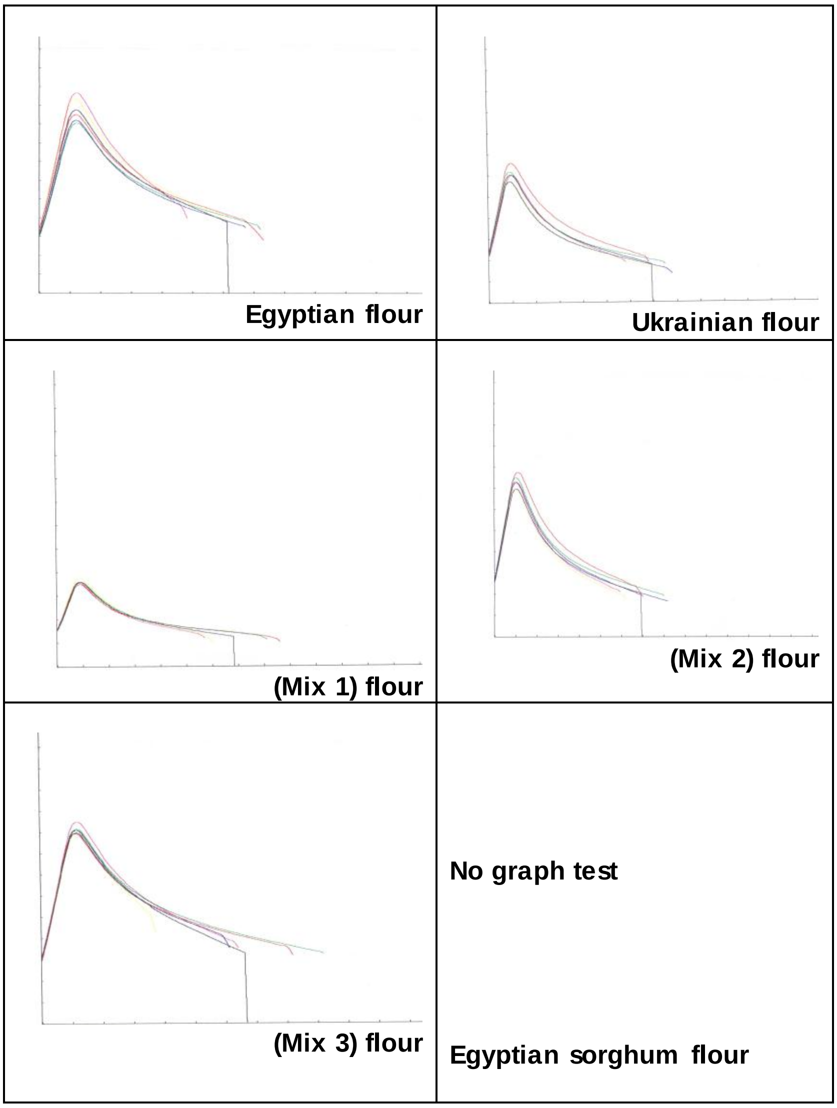


Fig. (2): Effect of wheat flour and it's mixtures on Alveograph test.

Physical properties of Pan and Balady bread made from wheat, sorghum and mixture flours.

Pan Bread

The obtained results (Table 8) showed the different values were observed on physical properties of Pan bread made from wheat, sorghum and their mixture flour such as crust colour, weight after baking, volume, specific volume and loaf volume. For crust colour different colours were observed between white and yellow which ranged from (-33.81 to -39.80) for the whiteness and (55.30 to 69.70) for yellowness, Egyptian Pan bread had the shine golden yellow colour 65.1 while (Mix 3) pan beard had less yellow colour 55.3 on the other hand, (Mix 1) Pan bread had golden red colour 69.7 which is not good ability to panelists. Additionally Table (8) presented that the weight after baking for among of Pan bread were ranged from 152 to 156 gm, Egyptian Pan bread had the heaviest weight 156 gm while (Mix 1), (Mix 2) and (Mix 3) Pan bread had the lightest weight 154, 152 and 152 respectively. In the other side, the volume after baking is different because the Egyptian Pan bread had the highest volume 920 cm^3 followed by Ukrainian Pan bread 913 cm^3 while (Mix 3) Pan bread had the lowest volume 832 cm^3. So the specific volume is related to the volume too because the Egyptian Pan bread had the highest volume 5.9 cm^3/g followed by Ukrainian Pan bread 5.89 cm^3/g while (Mix 3) Pan bread had the lowest volume 5.47 cm^3/g, however loaf volume for Ukrainian Pan bread had the lowest loaf volume 0.169 g/cm^3 and more cells of air followed by Egyptian Pan bread 0.170 g/cm^3 while (Mix 3) Pan bread had the highest loaf volume 0.182 g/cm^3 and less cells of air.

Table 8: Physical properties of Pan bread made from different wheat, sorghum and mixture flours.

Pan Beard	Crust colour		Weight after baking gm	Volume after baking gm	Specific volume cm3/g	Loaf volume g/cm3
	White	yellow				
EgyW	-38.70	65.10	156	920	5.90	0.170
UkW	-36.75	62.00	155	913	5.89	0.169
EgyS	*	*	*	*	*	*
Mix 1	-39.80	69.70	154	866	5.62	0.177
Mix 2	-36.50	60.10	152	836	5.50	0.181
Mix 3	-33.81	55.30	152	832	5.47	0.182

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum(Sakha 80), * = Not detected

Data of baking are presented in Table (9) It can be observed that crumb of Pan bread ranged between 47.0 to 57.0 % , inner crust ranged between 24.7 to 28.3% and out crust ranged between 15.8 to 27.7% for bread fraction percentage of total fresh weight. Egyptian and Ukrainian Pan bread had highest value of crumb 57.0 and 56.5% respectively while (Mix 3) Pan bread had lowest value 47.0%. On the other hand, inner crust for (Mix 2) Pan bread is lightest value 24.7% and out crust of Egyptian Pan bread had lightest value 15.8% while (Mix 3) Pan bread had thickness value for inner and out crust 25.3% and 27.7% respectively. The incorporation of gluten bread baking quality of Egyptian hard red Wheat (Masr 1) flour and (Mix 2) flour are presented in Table (9). The baking time increased with addition of gluten. Increase in baking percent, decrease in mixing time (2.5) and (2.0)min respectively. Crust and crumb colour decreased with increasing Egyptian yellow sorghum(Sakha 80) flour. From Tables (2,3) it can be concluded that the (Mix 2) Pan bread was the better Pan bread making from 50% Egyptian hard red Wheat (Masr 1) flour, 40% Ukrainian Hard Red Wheat flour and mixing by 10% with Egyptian yellow sorghum(Sakha 80) flour.

Table 9: Bread fraction of Pan bread made from different wheat, sorghum and mixture flours.

Pan bread	Bread fraction percentage of total fresh weight%		
	Crumb	Inner crust	Out crust
EgyW	57.0	27.2	15.8
UkW	56.5	25.8	17.7
EgyS	*	*	*
Mix 1	49.5	28.3	22.2
Mix 2	48.5	24.7	26.8
Mix 3	47.0	25.3	27.7

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum(Sakha 80), * = Not detected

Results of Sensory evaluation of Pan bread which made from different wheat, sorghum and mixture flour are shown in Table (10). From obtained results it can be noticed that the Statistical analysis for total score was significantly differences between all Pan bread making from different cultivars which ranged from 61.6 to 85.4, the Egyptian Pan bread had highest total scores than the Ukrainian and (Mix 2) Pan bread 85.4, 80.6 and 71.0%, respectively until the lowest one is (Mix 3) Pan bread 61.6%. The Statistical analysis for crust colour was significantly different between all Pan bread making from different cultivars which ranged from 4.2 to 7.8. Highest mean score for crust colour (7.80) was obtained by Egyptian Pan bread whereas (Mix 1) and (Mix 3) Pan bread got the lowest score (4.20). The low score of (Mix 3) and (Mix 1) Pan bread may be due to high ash content, which affect the crust colour of bread since consumers prefer creamy colour and not dark brown bread. For appearance, Egyptian Pan bread was at the top (17.6) followed by Ukrainian Pan bread (16.6) and found to be least (13.6) for (Mix 3) Pan bread. Maximum aroma score (8.60) was attained by Egyptian Pan bread while (Mix 3) Pan bread received the minimum score (4.0). For crumb texture, highest mean score (16.8) was obtained by Egyptian Pan bread followed by Ukrainian Pan bread (16.2). As regards eating quality, Egyptian Pan bread got the maximum score (18.4) and (Mix 3) Pan bread obtained the minimum score (12.8). (Mix 3) Pan bread obtained the least score (13.2) for crumb grain whereas Egyptian Pan bread received the highest score (16.2). With respect to overall acceptability of bread, highest score (85.4) was obtained by Egyptian Pan bread and thus regarded as more acceptable than other wheat and mixture flour while the lowest score (61.6) was obtained by (Mix 3) Pan bread thus considered least acceptable. This results are parallel with the results obtained by (Dhaliwal *et al.,* 1996) and (Farooq *et al.,* 2001).

Table 10: Sensory evaluation of Pan bread made from different wheat, sorghum and mixture flours.

Pan bread	Appearance 20	Crumb texture 20	Crumb Grain 20	Crust colour 10	Aroma 10	Eating quality20	Total scores 100
EgyW	17.6^{a}	16.8^{a}	16.2^{a}	7.8^{a}	8.6^{a}	18.4^{a}	85.4
UkW	16.6^{ab}	16.2^{ab}	15.6^{ab}	7.2^{a}	7.2^{b}	17.8^{a}	80.6
EgyS	*	*	*	*	*	*	*
Mix 1	14.2^{d}	14.6^{cd}	13.8^{bc}	4.2^{c}	4.6^{de}	14.0^{c}	65.4
Mix 2	14.8^{cd}	15.2^{bc}	14.2^{bc}	5.4^{b}	5.6^{cd}	15.8^{b}	71.0
Mix 3	13.6^{d}	13.8^{d}	13.2^{c}	4.2^{c}	4.0^{e}	12.8^{c}	61.6

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum(Sakha 80), * = Not detected

Balady Bread

Data of baking in Table (11) showed that Egyptian balady bread had the golden yellow colour 50.0 while Ukrainian and (Mix 1) balady bread had some browning with golden yellow colour 50.14 and 50.20 respectively. On the other hand, the (Mix 2) balady bread had golden red colour 48.78 which is not good ability to panelists. Additionally the weight after baking for among of balady bread were ranged between 120 to 135 gm. Which the Ukrainian balady bread had heaviest weight 135 gm followed by Egyptian and (Mix 1) balady bread 130 gm while (Mix 3) balady bread had less weight 120 gm. In the other side the volume after baking is different because the Egyptian balady bread had a highest volume 883 cm^3 followed by Ukrainian balady bread 644cm^3 while (Mix 3) balady bread had lowest volume 262 cm^3, so the specific volume is related to the volume too because the Egyptian balady bread had highest volume 6.79 cm^3/g followed by Ukrainian balady bread 4.77 cm^3/g while (Mix 3) balady bread had lowest volume 2.18 cm^3/g, however loaf volume for Egyptian balady bread had lowest loaf volume 0.14 g/cm^3 and more air in side it, then followed by Ukrainian balady bread 0.20 g/cm^3 while (Mix 3) balady bread had highest loaf volume 0.46 g/cm^3 and less air in side it.

Table 11: Physical properties of Balady Bread made from different wheat, sorghum and mixture flours.

Balady Bread	Crust colour		Weight after baking gm	Volume after baking	Specific volume cm3/g	Loaf volume g/cm3
	White	yellow				
EgyW	-30.88	50.00	130.0	883	6.79	0.14
UkW	-30.66	50.14	135.0	644	4.77	0.20
EgyS	*	*	*	*	*	*
Mix 1	-27.50	50.20	130.0	349	2.68	0.37
Mix 2	-26.72	49.78	125.0	453	3.62	0.27
Mix 3	-25.68	48.78	120.0	262	2.18	0.46

UkW= Ukrainian Hard Red Wheat, EgyW= Egyptian hard red Wheat (Masr 1), EgyS= Egyptian yellow sorghum(Sakha 80), * = Not detected

Sensory evaluation

Data in Table (12) showed the Sensory evaluation of Balady Bread made from different wheat, sorghum and mixture flour. It can be noticed that

Egyptian balady bread had highest total scores than the Ukrainian and (Mix 2) balady bread 79.0, 75.5 and 69.5% respectively until the lowest one is (Mix 3) balady bread 57.0%. Bread prepared from different wheat cultivars and mixture flour were subjected to sensory evaluation for crust colour, crust characteristic, crumb colour, taste and flavour, grain and texture and chewing each their mean scores were calculated (Table 12). Highest mean score for crust colour (8.0) was obtained by Egyptian and Ukrainian balady bread whereas (Mix 1) balady bread got the lowest score (5.0). The low score of (Mix 1) balady bread may be due to high fiber and ash content, which affect the colour of bread since consumers prefer creamy colour and not dark brown bread. In case of taste and flovour, Egyptian balady bread was at the top (15.0) followed by Ukrainian and (Mix 2) balady bread (14.0) and found to be the least (12.0) for (Mix 3) balady bread. Maximum crust characteristic score (8.0) was attained by Egyptian balady bread while (Mix 1) and (Mix 3) balady bread received the minimum score (6.50). (Mix 3) balady bread obtained the least score (10.0) for crumb colour whereas Egyptian and Ukrainian balady bread received the highest score (16.0). The differences in colour, taste and flavour of all the bread were attributed to the differences in hardness/softness of wheat grains and other factors like wheat varieties and milling characteristics of wheat. For grain and texture, highest mean score (16.0) was obtained by Egyptian balady bread followed by Ukrainian balady bread (15.0). As regards chewing, Egyptian balady bread got the maximum score (16.0) and (Mix 3) balady bread obtained the minimum score (12.0). A wheat aroma and taste is desirable with a non sticky, soft chewing feel in mouth**.** With respect to overall acceptability of chapattis, highest score (79.0) was obtained by Egyptian balady bread and thus regarded as more acceptable than other wheat and mixture flour while lowest score (57.0) was obtained by (Mix 3) balady bread thus considered least acceptable. This results are parallel with the results obtained by Rabie, (1992), (Dhaliwal *et al.,* 1996) and (Farooq *et al.,* 2001).

Table 12: Sensory evaluation of Balady Bread made from different wheat, sorghum and mixture flours.

Balady Bread	Crust colour 10	Crust characteristics 10	Crumb colour 20	Grain and texture 20	Taste and flavor 20	Chewing 20	Total scores 100
EgyW	8.0^{a}	8.0^{a}	16.0^{a}	16.0^{a}	15.0^{a}	16.0^{a}	79.0
UkW	8.0^{a}	7.5^{a}	16.0^{a}	15.0^{a}	14.0^{a}	15.0^{a}	75.5
EgyS	*	*	*	*	*	*	*
Mix 1	5.0^{b}	6.5^{a}	11.0^{ab}	14.0^{a}	13.0^{a}	13.0^{a}	62.5
Mix 2	6.5^{ab}	7.0^{a}	15.0^{ab}	13.0^{a}	14.0^{a}	14.0^{a}	69.5
Mix 3	5.5^{b}	6.5^{a}	10.0^{b}	11.0^{a}	12.0^{a}	12.0^{a}	57.0

ArW=Argentine Soft Red winter Wheat, GeW=Germany Soft Red Wheat, UkW Ukrainian Hard Red Wheat, AmW=American Soft Red Winter Wheat, AuW=Australian Stander White Wheat, ESW=Egyptian soft White Wheat (gamaza 7)

Economic evaluation

The data in Table (13) showed that the lowest price of wheat was the Ukrainian Hard Red Wheat (2000 L.E/Tons) while Egyptian hard red wheat

(Masr 1) was the highest price (3850 L.E/Tons). However the lowest quantity of wheat to produce one ton flour was the Ukrainian Hard Red Wheat (1.433 Tons) while the (Mix 3) Wheat was the highest quantity of wheat (1.777 Tons). On the other hand, the Egyptian hard red wheat (Masr 1) had the highest value of increasing in mill feed percentage, total production of flour and quantity of Secondary production (4.51%), (1.639 Tons) and (0.639Tons) respectively which performance high cost of secondary production (926.55 L.E/Tons) while Ukrainian Hard Red Wheat had the lowest value of increasing in mill feed percentage, total production of flour and quantity of Secondary production (2.573%), (1.47Tons) and (0.47Tons) respectively which performance low cost of secondary production (283.88 L.E/Tons). From the result in Table (13) it can be noticed that the highest wheat cost to produce one ton flour was Egyptian hard red wheat (Masr 1) Wheat (6040.65 L.E/Tons) which performance highest Total flour cost (6967.2 L.E/Tons) while Ukrainian Hard Red Wheat was the lowest value (2866L.E/Tons) and (3149.88 L.E/Tons) respectively. At the end we can concluded that the high quality, low cost and storage effect on grading present the most suitable wheat for us which was (Mix 1) Wheat (72.84%) for pan bread and (72.2%) for balady bread. These results are parallel with the results obtained by Wingfield, (1985) and Bunn, (1998).

Table 13:Economic evaluation of different wheat flour milling operations obtained from six different wheat kernels

Performance		EgyW	UkW	EgyS	Mix 1	Mix 2	Mix 3
Wheat price L.E/Tons		3850	2000	1500	2900	2875	2850
Secondary production price L.E/ Tons		1398	604	1500	1065.46	1171.28	1147.41
M,c of wheat %		11.3	12.3	11.6	10.4	10.5	10.7
M,c of flour %		14.3	14.5	13.7	13.5	13.8	13.65
Flour yield %		63.7	69.8	100.0	63.26	59.26	68.0
Reduction of flour extraction %		0.6	0.6	0.6	0.6	0.6	0.6
Quantity of wheat to produce one ton flour Tons		1.565	1.433	1.0	1.581	1.674	1.777
Increase in mill feed %		4.51	2.573	2.433	3.584	3.828	3.416
Total production of flour Tons		1.639	1.47	1.024	1.638	1.738	1.838
Quantity of Secondary production Tons		0.639	0.47	0.024	0.638	0.738	0.838
Wheat cost to produce one ton flour L.E/Tons		6040.65	2866	1500	4584.9	4812.75	5064.45
Secondary production cost to produce one ton flour L.E/Tons		926.55	283.88	36.0	679.76	864.40	961.52
Total flour cost L.E/Tons		6967.2	3149.88	1536	5264.66	5677.15	6025.97
High quality %	Of Pan bread	88.5	88.67	*	88.03	87.76	87.69
	Of Balady bread	90.3	86.11	*	86.11	74.30	68.05
Low cost %		76.09	89.19	94.72	81.36	79.88	78.72
Storage effect on grading %		50.0	50.0	33.33	49.15	48.30	47.45
Average of quality, cost and storage %	Of Pan bread	71.53	75.92	64.03	72.84	71.98	71.28
	Of Balady bread	72.03	75.10		72.20	67.49	64.74

ArW=Argentine Soft Red winter Wheat, GeW=Germany Soft Red Wheat, UkW Ukrainian Hard Red Wheat, AmW=American Soft Red Winter Wheat, AuW=Australian Stander White Wheat, ESW=Egyptian soft White Wheat (gamaza 7), M.c = Moisture Content, * = Not detected.

CONCLUSION

Data indicated that (Mix 1) and (Mix 2) flours had more suitable properties for bread- making than the (Mix 3) flours and (Mix 1) was low cost and storage effect on grading percent which is more suitable flour to us than the other mixtures. From the different tested flours indicated that those made from Egyptian hard red Wheat (Masr 1) flour and Ukrainian Hard Red Wheat flours were superior.

REFERENCES

AACC, (2000 A). American association of cereal chemists, Approved method of the AACC 10th ed., vol. 1, AACC, St Paul, MN.

AACC, (2000 B). American association of cereal chemists, Approved method of the AACC 10th ed., vol. 2, AACC, St Paul, MN.

Abdelghafor, O. R.F.; Mustafa, A.I.; Ibrahim, A.M.H. and Krishnan, P.G., (2011). Quality of Bread from Composite Flour of Sorghum and Hard White Winter Wheat," Advance Journal of Food Science and Technology, vol. 3, no.1, pp.9-15.

Akintayo, I. and Sedgo, J. (2001). Towards sustainable sorghum production and utilization in West and Central Africa; Akintayo I.; Sedgo J. Eds.; ASRN/ICRISAT, 19-22 April 1999, Lomé, Togo. ISBN 92-9066-4330-9. p. 162.

Anglani, C. (1998). Sorghum for human food: a review. Plant Foods Hum. Nutr. 52: 85-89.

A.O.A.C., (2005). Association of Official Analytical Chemists. Official Methods of Analysis. 18th Ed. Published by A.O.A.C. W.Horwitz. North Frederick, U.S.A.

Awika, J. M. and Rooney, L. W., (2004). Sorghum phytochemicals and their potential impact on human health, Phytochemistry, vol. 65, pp.1199–1221.

Bunn, J. (1998). Assessment of milling quality of wheat. Association operative millers bulletin 44, 25-30

Caballero, P.A.; Gomez, M. and Rosell, C.M. (2007). Improvement of dough rheology, bread quality and bread shelf-life by enzymes combination, Journal of Food Engineering, vol, 81, pp. 42-53.

Chanapamokkhot, H. and Thongngam, M. (2003). The Chemical and Physico-Chemical Properties of Sorghum Starch and Flour, J. Nat. Sci. vol. 41, pp. 343 – 349.

Ciclitira, P. J.; Ellis, H. J. and Lundin, K. E. A. (2005). Gluten-free diet—what is toxic?, Best Practice & Research Clinical Gastroenterology, Vol. 19, No. 3, pp. 359–371.

Dhaliwal, Y.S. ; D.W. Hatcher, K.S. Sekhon and J.E. Kruger, (1996). Methodology for preparation and testing of chapattis produced from different classes of Canadian wheat. Food Res. Int., 29: 163-168.

Dhingra, S. and S. Jood, (2004). Effect of flour blending on the functional, baking and organoleptic characteristics of bread. Int. J. Food Sci. Technol., 39: 213-222.

Elkhalifa, A. E. O. and Bernhardt, R. (2010). Influence of grain germination on functional properties of sorghum flour; Food Chemistry, vol, 121, pp. 387-392.

ES, (1986). Egyptian Standard of wheat grains. Egyptian Organization for Standardization and Quality Control, No. 1601, and its modification No. 2/2002. Arab Republic of Egypt.

ES, (2006). Egyptian Standard of white flour for production of bread. Egyptian Organization for Standardization and Quality Control, No. 1419. Arab Republic of Egypt.

(FAO, 1995). Food and Agricultural Organization Food and Agricultural Organization, Sorghum and millet in human nutrition. FAO Food and Nutrition Series No. 27. ISBN 92-5-103381-1.

FAO, (2005). Food and Agriculture Organization. FAO Statistics Database. Accessed on: Feb. 14, 2005; Available at: http:// a pps.fao.org/faostatl.

FAO, (2014). Food and Agriculture Organization. FAO Statistics Database. Accessed on: April, 2014; Available at: http:// a pps.fao.org/faostatl.

Farooq, Z.; Rehman, S. and Bilal, M.Q. (2001). Suitability of wheat varieties/lines for the production of leavened flat bread(naan). J. Res. Sci., 12: 171-179

Hsu, C.L., S.L. Hurang, W. Chen, Y.M. Weng and C.Y. Cheng, (2004). Qualities and antioxidant properties of bread as affected by incorporation of yam flour in the formulation. Int. J. Food Sci. Technol., 39: 231-238.

Hugo, L. F.; Rooney, L. W. and Taylor, J. R. N. (2003). Fermented Sorghum as a Functional Ingredient in Composite Breads, Cereal Chem. vol. 80, no. 5, pp. 495– 99.

Huma, N. (2004). Fortification of whole-wheat flour with iron for the production of unleavened flat bread (Chapattis). Ph.D. Thesis, Dept. Food Technol. Univ. Agric. Faisalabad

Kangama, C.O. and Rumei, X. (2005). Introduction of sorghum (Sorghum bicolor (L.) Moench) into China. Afr. J. Biotech. 4 :575-579.

Khalil, A.H., E.H. Mansour and F.M. Dawood, (2000). Influence of malt on rheological and baking properties of wheat-cassava composite flours.

Lebensmittel Wissenchaf Technol., 33: 159-164.

McWatter, K.H., R.D. Philips, S.L. Walker, S.E. McCullough, Y. Mensah-Wilmot, F.K. Saalia, Y.C. Hung and S.P. Patterson, (2004). Baking performance and acceptability of raw extruded cowpea flour breads. J. Food Qual., 27: 337-351.

Milatovie, L. and Mondelli, G. (1991). Pasta Technology Today. Ed. by ChiriottiPoinerolo (To) - Italy.

Olaoye, O.A. ; A.A. Onilude and O.A. Idowu, (2006). Quality characteristics of bread produced from composite flours of wheat, plantain and soybeans. Afr. J. Biotechnol., 5: 1102-1106.

Onyango, C.; Mutungi, C.; Unbehend, G. and Lindhauer, M. G.,(2011). Rheological and textural properties of sorghum-based formulations modified with variable amounts of native or pregelatinised cassava starch, LWT - Food Science and Technology, vol, 44, pp. 687-693.

Peressini, D.; A. Sensidoni; C.M. Pollini and B. De Cindio, (1999). Improvement of wheat fresh pasta-making quality: influence of sodium chloride on dough rheological properties. Italian Food & Beverage Tech. 17: 20-23,33.

Popper, L., (2003). Resolving common flour problems, pp. 24-25. Food Additives & Cereal Fortification Conf., 13-16 Sep., 2003, Cairo, Egypt.

Rabie, Samir Mohamed Hussein , (1992) Soft wheat quality factors that influence the quality characteristics of Egyptian Balady bread, Ph.D., Theses Michigan State University, 244 pages; AAT 9233925

Raman, R., H. Allen, S. Diffey, H. Raman, P. Martin, and K. McKelvie (2000). Localisation of quantitative trait loci for quality attributes in a doubled haploid population of wheat (*Triticum aestivum* L.). NRC Research Press, genome 52: 701–715

Randhawa, M.A., F.M. Anjum and M.S. Butt, (2002). Physico-chemical and milling properties of new spring wheats grown in Punjab and Sind for the production of pizza. Int. J. Agric. Biol., 4: 482-484.

Rashed, M.M.; A.A.Atia and A.A.Hassein (1996). Effect of wheat flour and yeast on balady bread characterisitics. Egypt.J.Food Sci.,24(1):81-92.

Rehman, S., Y. Nazir, S. Hussain and N. Huma, (2001). Study on the evaluation of wheat varieties of Sindh Province for the production of ring doughnuts. JAPS, 3: 135-138.

SAS, (1999). SAS / Stat. User's Guide: statistics, system for windows, version 4.10 (releasa 6.12 TS level 0020), SAS Inst., Inc. Cary, North Carolina, USA.

Taylor, J. R. N.; Schober, T. J. and Bean, S. R. (2006). Review :Novel food and non-food uses for sorghum and millets," Journal of Cereal Science., Vol. 44, pp. 252–271.

U.S. Department of Agriculture, (1995). GRAIN INSPECTION HANDBOOK I. Grain Inspection, Packers and Stockyards Administration ,Federal Grain Inspection Service Probe Sampling, Washington, D.C. 20090-6454.

U.S. Department of Agriculture, (1999). MOISTURE HANDBOOK Grain Inspection, Packers and Stockyards Administration 1400 Independence Ave., S. W. Washington, D.C. 20250-3600.

U.S. Department of Agriculture, (2002). EQUIPMENT HANDBOOK. Grain Inspection, Packers and Stockyards Administration,1400 Independence Ave., S.W. Washington, D.C. 20250-3600.

U.S. Department of Agriculture, (2006). GRAIN INSPECTION HANDBOOK II Grain Inspection, Packers and Stockyards Administration, Federal Grain Inspection Service.

Wingfield, J. (1985). Flour mill performance. Association operative millers bulletin 44, 25-30

تأثير استخدام الاذرة الرفيعة علي جودة مخاليط القمح والدقيق.

تامر توفيق السيسي و جيهان بسطامي على و محمد سيد مسعود
المركز الإقليمي للأغذية و الأعلاف، مركز البحوث الزراعية

تم في هذا البحث دراسة الخصائص الطبيعية والكيماوية لنوعيين من الإقماح الأوكراني و المصري المحلى (مصر ١) و نوع من الاذرة الرفيعة المصرية المحلية (سخا ٨٠) وأوضحت النتائج المتحصل عليها أن حبوب القمح المصري المحلى (مصر ١) أعطى أعلى قيم في الخصائص الطبيعية ولقد تراوح محصول الدقيق الناتج من كل عينات القمح المختبرة حوالي ٧٠% ماعدا القمح المصري المحلى (مصر ١) والمخلوط رقم ١ اللذين انخفضا إلى 64% وأوضحت نتائج المحتوى البروتيني وجود مدى واسع من المحتوى البروتيني لأنواع الدقيق المختلفة (٨.٢ : ١٠.٢ %) ، وسجلت أعلى قيمة في المحتوى البروتيني لدقيق القمح المصري المحلى (مصر ١) واقل قيمة للدقيق الاذرة الرفيعة المصرية المحلية (سخا ٨٠). كذلك وجد أن المحتوى من الجلوتين الرطب والجاف يرتبط بالمحتوى من البروتين ، أوضحت النتائج أن دقيق (المخلوط رقم ١) و (المخلوط رقم ٢) أعطى أفضل النتائج من حيث ملائمتها لصناعة الخبز عن (المخلوط رقم ٣). وأشارت كذلك نتائج تقييم الجودة للخبز المصنع من دقيق الأقماح المختلفة أن الخبز المصنع من دقيق القمح المصري المحلى (مصر ١) و الأوكراني كانت ممتازة ولكن الخصائص الفيزوكميائية و الريولوجية لدقيق الإقماح المختلفة والاذرة الرفيعة ومخاليطها أعطت أقل قيمة في محتويها من نسبة الامتصاص المائي للدقيق، وأعطى (المخلوط رقم ٢) المحتوى على نسبة ١٠ % من الاذرة الرفيعة و٩٠ % من مخلوط القمح (المصري الأوكراني) أعلى قيمة في وقت العجن وثبات العجين و معامل الخلط ومرونة العجين. كذلك وجد أن حبوب الاذرة الرفيعة في اقل مستويتها من حمض التانيك (٠.١٨٥) وعلى الرغم من ذلك أظهرت نتائج الخواص الحسية ان نسبة الـ١٠ % من دقيق الازرة الرفيعة الكامل والتي حلت محل دقيق القمح فى منتج خبز القالب والبلادى قبولا عن المخاليط الاخرى.