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EFFECT OF PARTIAL REPLACEMENT OF WHEAT FLOUR BY BARLEY AND OAT FLOUR ON THE CHEMICAL AND RHEOLOGICAL PROPERTIES OF TOAST BREAD DOUGH

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ABSTRACT: The aim of this study was to investigate the effect of replacement of wheat flour by barley or oat flour and the both together on the rheological properties of the toast bread dough. Wheat flour was substituted by six levels of barley and oat flour at a ratio of (5, 10 and 15% oat flour, 5, 10 and 15% barley flour) and were used in manufacture toast bread. The results showed that the bread containing 10% barley flour or 5% oat flour or both at ratio of 15 % gave the highest scores of sensory properties than the other treatments as well as the control. Therefore, these treatments (replacement of wheat flour by 10% barley flour or 5% oat flour or both by 15%) and their effect on rheological properties of toast dough were studied. The results obtained from farinograph showed that toast dough containing 10% barley increased the rate of absorption and duration of kneading dough and consistently for maximum strength and the weakness of the dough. However, the addition of 5% oats lowered the rate of absorption, while the access time and the stability of the dough and the dough weakness were increased. In the case of adding, both of barley and oat together as a replacement of wheat flour at a ratio of 15%, the results obtained of farinograph led to low rate of water absorption, while the arrival time, dough development, the dough stability and dough weakness were increased. Also, results of extensograph showed that adding barley at 10% led to a decline in rubber dough, flatten the resistance, the relative number and energy resulting dough. Moreover, addition of oats at 5% declined the rubber dough; figure the relative energy and the resulting dough while increasing resistance to flatten. Also in the case of mixing barley and oats together at ratio of 15% led to a decline in rubber dough. From the results, it can concluded that addition of barley at rate of 10% and oats at rate of 5% in the case of mixing barley and oats were the best ratio of 15% and replacement of water dough by sweet whey improved the rheological properties of dough.

Key words: Bread dough, extensograph, farinograph, oat, barley.

INTRODUCTION

Bread is one of the least expensive most important staples in the world, because of their high popularity and large consuming. Bread is considered one of the simplest foods manufactured and its properties may differ from country to country (**Abreu *et al.,* 1994**).

The cereals grains are harvested over one billion tons annually. The barley accounts for 12% of the world's total cereal production and occupies the fourth position with respect to grain production after wheat, rice and corn, whereas, oats are the fifth largest cereal crop in the world (**Jadhav *et al.,* 1998**).

In Egypt, the average total annual areas cultivated with barley grains are 87752 hectare which produced annually 117113 tons (**FAO, 2010**).

The use of barley and barely component is in extensive than that for other grains. Barley has high soluble fiber and has the potential to

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greatly increase soluble fiber intake and improve insulin sensitivity and glucose metabolism (**Hallfrisch and Behall, 2000; Fistes *et al*., 2014**). Wheat could be used as flour when mixed with hulls barley flour. It could be used for bakery product making by the traditional Egyptian method and palatable for the consumer with excellent chemical, technical and biological properties (**Mekhael, 2004**). Oat grain is characterized by especially valuable chemical composition, and the combination of nutritional compounds present in this raw material makes it a profitable constituent of human diet (**Gambus *et al*., 2011**). Oat grain contains protein with beneficial amino acid composition, advantageous profile of fatty acids, with high amount of poly unsaturated fatty acids (PUFA), and large quantity of water soluble β-glucans and antioxidants (**Sadiq *et al*., 2008**).

Sweet whey is a by-product of cheese production (pH 5.8–6.6) whereas acid whey is obtained from cottage cheeses (pH 3.6–5.1) (**Anand *et al*., 2013**). Regulations about the use of whey are based on Codex Alimentarius concerning milk and milk products launched by the World Health Organization and Food and Agriculture Organization of the United Nations (**WHO, 2011**).

The present study was carried out to evaluate the chemical composition of raw materials (wheat flour 72% extraction, barley flour and oat flour and sweet whey). The effect of partial replacement on wheat flour by barley flour and oat flour on the chemical composition and rheological properties of dough was also evaluated.

MATERIALS AND METHODS

Materials

Wheat flour was obtained from local market. Wheat flour (*Triticum sativum* L.), barley cultivar Giza 123 (*Hordeum vulgare* L.) grains, (B) and oat (*Avena sativa*) grains were obtained from Field Crops Institute, Agricultural Research Center, Giza, Egypt; barley and oat grains were milled using Buhler laboratory pneumatic flour mill.

Sweet whey was prepared from coagulation of milk by rennet.

Methods

Preparation of toast bread dough

Table 1 shows the preparation of toast bread dough. Flour blends were prepared using the straight–dough method according to **Chauhan *et al.* (1992)** with little modification. Wheat flour was substituted by six levels of barley and oat flour (5,10 and 15% oat flour, and 5,10 and 15% barley flour). The baking formula was 500 g of flour, 9 g of compressed baker's yeast, 5 g of NaCl, 13 g of cane sugar, 10 g of vegetable shortening and approximately 280 ml of sweet whey. All the ingredients were mixed in a Kenwood mixer (ModelA907D) for 3.5 min. The dough was fermented at 28±1°C for 90 min then punched, scaled to 250 g dough pieces, proofed for 90 min at 30°C, 85% relative humidity and baked at 250°C, for 30 min.

Chemical analyses of raw materials

Moisture content was determined by using an air oven at 105± 2°C until reaching a constant weight according to **AACC (2000)**. Total nitrogen was determined by kjeldahel method according to **AACC (2000)**. Crude protein content was calculated by multiplying total nitrogen (%) by factor of 5.70 for all flours. Crude fat was determined by extracting the fat by ethyl ether using soxhlet apparatus as described by the method of the **AACC (2000)**. Ash content was determined in an electric muffle at 525-550°C until reaching the complete ashing according to **AACC (2000)**. Crude fiber was determined according to **Proskey *et al.* (1984)**. Total carbohydrates were calculated by difference as follows:

Total carbohydrates (%) = 100- [Protein (%) + Fat (%) + Ash (%) + Fiber (%)].

Determination of mineral contents

Calcium (Ca), magnesium (Mg), iron (Fe), phosphorus (P), and potassium (K) were determined according to the method of **AOAC (2002)**. The Perkin Elmer 3300 (USA) atomic absorption spectrophotometer was used for minerals determination.

Table 1. Blends formulation of wheat flour and its mixtures containing barely and oat flour for toast bread dough

Sample No.	Blends (%)		
	wheat flour (WF)	barley flour (BF)	Oat flour(OF)
C	100	0	0
T1	95	5	0
T2	90	10	0
T3	85	15	0
T4	95	0	5
T5	90	0	10
T6	85	0	15

C: Blend 100% wheat flour (72% extraction)
T1: Blend 95% wheat flour (72% extraction) + 5% barley flour.
T2: Blend 90% wheat flour (72% extraction) + 10% barley flour.
T3: Blend 85% wheat flour (72% extraction) + 15% barley flour.
T4: Blend 95% wheat flour (72% extraction) + 5% oat flour
T5: Blend 90% wheat flour (72% extraction) + 10% oat flour.
T6: Blend 85% wheat flour (72% extraction) + 15% oat flour

Determination of the rheological properties

The rheological properties were determined for each of the above mentioned dough mixtures under investigation using extensograph and farinograph (**AACC, 2000**).

RESULTS AND DISCUSSION

Chemical Composition of Raw Materials

Chemical composition (on dry weight basis) of raw materials (wheat flour (WF) 72% extraction, barley flour (BF), and oat flour (OF) is presented in Table 2. The results showed that wheat flour had the highest value of protein content (12.49%) followed by barley (12.32%) then, oat flour (11.0%). Whereas, oat flour contained the highest fat content (8.0%) followed by barley flour (1.54%) and at least wheat flour (1.40%). Ash content of the raw materials showed that oat flour had the highest value of ash content (4.50%), whereas, wheat flour had the lowest content (0.51%).

The highest value of total carbohydrates was found in wheat flour (73.41%), whereas, oat flour was the lowest one (60.0%).

Sweet whey contained 1.94% total protein, 4.94% lactose, 0.32 fats, 0.63% ash, and 92.6% moisture. The obtained results are in agreement with (**Yousif, 2006; Abou-Raya *et al*., 2014; Fistes *et al*., 2014 ; Huma *et al*., 2015**).

Minerals Content of Raw Materials

Minerals contents of wheat flour (72%), oat flour, barley, and sweet whey are presented in Table 3. Oat flour (OF) had the highest values of iron (4.71 mg/100g), magnesium (176.92 mg/ 100 g), phosphorus (107.92 mg/100 g), and potassium (428 mg/100 g). Whereas wheat flour contained the lowest amount of iron, magnesium, and calcium (2.22, 45.63, 22.13 mg/ 100 g), respectively. These results agree with those reported by **Lovis (2003), Mekhael (2004) and Sangwan *et al*. (2014)**.

Sweet whey contains iron (0.06 mg/100 g), magnesium (10.0 mg/100 g), calcium (60 mg/ 100 g), and potassium (150 mg/100 g). These results are in agreement with **Huma *et al*. (2015)**.

Total Dietary Fiber

Table 4 shows the dietary fiber content of raw materials. Oat flour contained the highest

Table 2. Chemical composition of wheat, oat and barley flours, (on dry weight basis) and fresh sweet whey (%)

Sample	Moisture	Protein	Fat	Ash	Total carbohydrates
WF	11.41	12.49	1.40	0.51	73.41
OF	8.10	11.00	8.00	4.50	60.00
BF	7.29	12.32	1.54	1.22	76.10
W	92.20	1.94	0.32	0.63	4.98

WF = Wheat flour (72% ext.) OF = Oat flour. BF = barley flour. W = Whey

Table 3. Minerals content of WF, OF, BF and Whey (mg/100g)

Sample	Iron (Fe)	Magnesium (Mg)	Calcium (Ca)	Phosphor (P)	Potassium (K)
WF	2.22	45.63	22.13	72.40	67.38
OF	4.71	176.92	53.84	107.92	428
BF	3.42	66.14	282	98.18	65.78
W	0.06	10.00	60.0	50.0	150

WF = Wheat flour (72% ext.). OF = Oat flour. BF = barley flour. W = Whey

Table 4. Total dietary fiber of wheat, oat and barley flours (mg/100g)

Sample	Total dietary fiber	Soluble dietary fiber	Insoluble dietary fiber
WF	0.97	0.40	0.57
OF	9.00	5.00	4.00
BF	1.94	0.74	1.20

WF= Wheat flour (72% ext.) OF = Oat flour. BF = barley flour. W = Whey

values of total dietary fiber (9.00 mg/100g), soluble dietary fiber (5.00 g/100 g), and insoluble dietary fiber (4.00 g/100 g) followed by barley (1.94 g/100 g), (0.74 g/100 g) and (1.20 g/100 g) for total, soluble and insoluble dietary fiber, respectively, .Meanwhile, wheat flour had the lowest values of total (0.97 mg/ 100 g), soluble (0.40 g/100 g) and insoluble dietary fibers (0.57 g/100 g). The increase in total, soluble and insoluble dietary fibers of oat may be due to the high content of β-glucan. These values are similar to those previously reported by **Lovis (2003), Mekhael (2004) and Sangwan *et al.* (2014)**.

Sensory evaluation of toast bread formulas

Sensory evaluation of toast bread containing different levels of barley and oat flour is presented in Table 5. Treatment containing 10% barley flour and 5% oat flour (T2 and T4) had the highest scores for all quality attributes (appearance, flavour, texture, crust colour, crumb colour and over all acceptability). All treatments ranged from "like slightly" to "like moderately". Incorporation of barley and oat flours recorded highest scores for all quality attributes of substitution higher than the control treatment. Moreover, colour appeared to be a very important criterion for initial acceptability

Table 5. Sensory evaluation of toast bread at different levels of wheat flour substitution with barley and oat flours

Treatment	Appearance 10	Flavour 10	Crust colour 10	Crumb colour 10	Texture 10	Overall acceptability 50
C	8.38	7.32	8.08	8.12	7.96	43.80
T1	8.42	7.84	8.16	8.20	8.14	40.76
T2	8.98	8.12	8.38	8.52	8.46	45.32
T3	8.84	7.96	8.22	8.42	8.36	41.80
T4	9.12	8.42	8.52	8.62	8.78	45.84
T5	8.98	8.34	8.45	8.54	8.62	42.93
T6	8.92	8.38	8.46	8.58	8.66	43.00

C: Blend 100% wheat flour (72% extraction).
T1: Blend 95% wheat flour (72% extraction) + 5% barley flour.
T2: Blend 90% wheat flour (72% extraction) + 10% barley flour
T3: Blend 85% wheat flour (72% extraction) + 15% barley flour.
T4: Blend 95% wheat flour (72% extraction) + 5% oat flour.
T5: Blend 90% wheat flour (72% extraction) + 10% oat flour.
T6: Blend 85% wheat flour (72% extraction) + 15% oat flour.

of the baked product by the consumer. The colour of the toast bread was significantly affected ($P<0.05$) by the addition of barley and oat. These results are in the same line with **El-Demery (2011)**.

From the sensory characteristics of blends it could be concluded that toast bread dough containing 10% barley flour (T2) and 5% oat flour (T4) had the highest score of chemical composition dough than control and other treatments. Therefore this treatment was further utilization for toast bread manufacture and analyzed for rheological characteristics.

Rheological Properties of dough blends

Effect of partial replacement of wheat flour by 10% barley flour on farinograph parameters

Results in Table 6 indicate that rheological properties of wheat flour and blends containing barely and oat flours. Results showed that the water absorption, arrival time, dough development time, stability and degree of weakening of wheat flour showed that replacement of wheat flour by 10% barley flour increased the water absorption from 60.8% to 62.4 in control sample. An increase in water absorption has been reported in the literature for various fiber blended (**Goldstein *et al*., 2010**). It is believed that incorporated fiber in dough are known for their ability to absorb significant amounts of water. The presence of a large number of hydroxyl groups which allow more water interactions through hydrogen bond plays a major role for more water absorption (**Rosell *et al*., 2001**).

The results revealed also that arrival time increased from 0.5 min to 1.5 min. in control sample. Also, replacement of wheat flour by 10% barley flour increased dough development time, from 1 min in control sample, to 3 min. Stability time increased from 4.0 min in control sample to 4.5 min when 10% of barley flour was added. Weakening of the dough increased 75 BU at levels 10% of barley flour.

The influence of dough containing 5% `of barley flour on the proofing stability was significant. The proofing time was not prolonged as significantly as the dough elasticity in all samples. But individual differences were found between separate samples in accordance with **Dogan (2003)**.

Table 6. Effect of addition barley and oat flours as partial substitute of wheat flour (72% extraction) on farinograph parameters

Blends	Water absorption (%)	Arrival time (min.)	Dough development time (min.)	Stability time (min.)	Weakening dough (BU)
C	60.8	0.50	1.00	4.00	60.0
T1	62.4	1.50	3.00	4.50	75.0
T2	64.3	1.00	2.00	5.00	95.0
T3	63.6	0.50	1.50	6.00	85.0

C: Blend 100% wheat flour T1: Blend 90% wheat flour + 10% barley flour.
T2: Blend 95% wheat flour + 5% oat flour. T3: Blend 85% wheat flour + 5% oat flour + 10% barley flour.

Effect of partial replacement of wheat flour by 5% oat flour on farinograph parameters

Water absorption, arrival time, dough development time, stability and degree of weakening of wheat flour and wheat flour substituted with 10% barely 5% oat flour are given in Table 6. Water absorption of control sample was 60.8% and it was 64.3% for dough containing 5% oat flour. Arrival time of control sample was 0.5 and it was 1 min at replacement by 5% oat flour. Also, dough development increased from 1 min in control sample to 2 min and it was stability time at 5 min at replacement by 5% oat flour. Weakening of the dough increased by increasing the addition of oat flour at the level of 5%. Arrival time and dough stability were higher with the increase of oat flour added to wheat flour 72% extraction. This increase in dough stability was attributed to the increase in protein level which leads the dough to be more stable **Salehifar and Shahedi (2007)**. Among cereals, oats are unique for their benefiting from high protein as well as lipid contents. According to the results obtained from farinograph readings, water absorption capacity and the duration of the dough development increased with addition of oat. These results agree with **Peymanpour *et al.* (2012)**.

Effect of partial replacement of wheat flour by 10% barley flour and 5% oat flour on farinograph parameters

Table 6 shows the water absorption, arrival time, dough development time, stability and degree of weakening of wheat flour. The replacement of wheat flour by 10% barely flour and 5% oat flour increased the water absorption from 60.8% in control to 63.6 in (T3). Whereas the arrival time of dough in treatment containing 10% barley flour and 5% oat flour (T3) was found to be similar to control sample.

Also, the addition of 5% oat flour plus 10% barley flour (T3) increased dough development time from 1 in control sample to 1.5 min. The stability time was 4.0% in control sample while it was higher (T3). Weakening of the dough increased from 60 BU in control sample to 95 BU in T2. From the results, it could also be noticed that the blend contained 10% barley flour plus 5% oat increased the water absorption time and stability time. These results could be due to high fiber, protein and ß- glucan in barley and oat flours. The incorporation of fiber into wheat flour interacts directly with structural elements of the three dimensional gluten networks and disrupts the starched gluten matrix, and finally affects the rheological behavior of blended dough during mixing, fermentation and baking. However, the addition of these fibers sometime causes a negative effect on the final bread quality. The most notable change is the reduction of loaf volume (**Lai *et al.*, 1989**). The obtained results are in agreement with those of **Abou-Raya *et al.* (2014)**. Generally, replacement of dough water by whey enhanced rheological properties of dough (**Munaza *et al.*, 2012**).

Table 7. Effect of addition barley and oat flours as partial substitute to wheat flour on extensograph parameters

Blend	Resistance to extension (BU)	Extensibility (mm.)	Proportional (No.)	Energy (cm^2)
C	480	102	4.54	62
T1	450	97	4.22	48
T2	180	105	1.68	30
T3	240	98	2.80	33

C: Blend 100% wheat flour T1: Blend 90% wheat flour + 10% barley flour.
T2: Blend 95% wheat flour + 5% oat flour. T3: Blend 85% wheat flour + 5% oat flour and 10% barley flour.

Effect of partial replacement of wheat flour by barley and oat flour on extensograph parameters

Table 7 shows the resistance to extension, extensibility, proportional number and energy of wheat flour. Resistance to extension of blends decreased from 480 BU in control sample to 450 BU in (T1) and 180 BU (T2). Dough extensibility of control sample was 102 mm and it was 97 mm, in the dough (T1). Proportional number of blends decreased from 4.54 in control sample to 4.22 in (T1) and the lowest value was 1.68 in (T2). Energy of blends decreased from 62 cm^2 in control sample to 48 cm^2 in (T1) and the low value was 5% in (T2). From the results of extensograph, it could be observed that the fortified wheat flour with barley flour at a ratio of 10% gave the best blend by increasing the parameters of extensograph when barley flour was increased. These results are in agreement with (**Ashour and El-Faham, 2003 ; Abou-Raya *et al*., 2014**).

The results obtained from the extensograph readings showed that the dough energy increased but extensibility property decreased with increase in the proportion of oat in the dough. However, from a sensory point of view, the 5% formula was found to be inferior to control .These results are in agreement with **Peymanpour *et al*. (2012) and Abou-Raya *et al.* (2014)**.

Conclusion

Barley and oat contain high protein, fiber and ß- glucan. The fortification of wheat flour with 10% of barley, 5% of oat and 15% from barley and oat mixture gave the best blends. Also, it could be recommended to replacement of water dough by sweet whey and use barley and oat for fortified wheat flour to produce bakery products safe, high nutrition value and beneficial health.

REFERENCES

AACC (2000). American Association of Cereal Chemists. Approved Methods of the AACC Published by the Ame. Ass. Cereal Chem., 8th Paul. Minnesota. USA.

Abou-Raya, M.A., M.M. Rabiae, A.S. El-Shazly and E.S. El-Fadaly (2014). Effect of adding barley and oat flour on the rheological properties of bread dough. J. Food and Dairy Sci., Mansoura Univ., 5 (8): 641 – 652.

Abreu, R.W., I.R. Olivveira and O. Zenebon (1994). Caloric value of dietetic chocolate evaluation. Revista du Instituto Adofolutz, 54 : 107-109

Anand, S., M. Chenchaiah and S.K. Nath (2013). Whey and Whey Products. in: Milk and Dairy Products in Human Nutrition: Production, Composition and Health (eds. YW Park and GFW Haenlein). John Wiley and Sons, Oxford, 477– 492.

AOAC (2002). Official Methods of Analysis of Association of Official Analytical Chemists. 9th Ed., Washington, DC, USA.

Ashour, H.K. and S.Y.A. El-Faham (2003). Supplementation of Durum wheat flour with naked barley flour to produce balady bread

and pasta. 1. Balady bread. Minufiya J. Agric. Res., 28 (6): 1957 - 1970.

Chauhan G.S., R.R. Zillman and N.A.M. Eskin (1992). Dough mixing and bread making properties of quinoa-wheat flour blends. Int. J. Food Sci. Technol., 27: 701–705.

Dogan, I.S. (2003). Effect of Alpha-amylases on dough properties during turkish hearth bread production Int. J. Food Sci. Technol., 38: 209–216.

El-Demery, M.E. (2011). Evaluation of physico-chemical properties of toast breads fortified with pumpkin flour. The 6th Arab and 3rd Int. Ann. Sci. Conf., Fac. Spec. Ed. Mansoura Univ., Egypt April, 13-14.

FAO (2010). FAO stat. database. Available from httb://faostat.fao.org.

Fistes, A., T. Dosenovi, D´. Raki, B. Pajin, Z˘. Sere, S. Simovi´ and I´. Loncarevi (2014). Statistical analysis of the basic chemical composition of whole grain flour of different cereal grains. Acta Univ. Sapientiae, Aliment., 7 : 45–53.

Gambuś, H., M. Gibiński, D. Pastuszka, B. Mickowska, R. Ziobro and R. Witkowicz (2011). The application of residual oats flour in bread production in order to improve its quality and biological value of protein. Acta Sci. Pol., Technol. Aliment., 10 (3): 313-325

Goldstein, A., L. Ashrafi and K. Seetharaman (2010). Effects of cellulosic fiber on physical and rheological properties of starch, gluten and wheat flour. Int. J. Food Sci. and Technol., 45: 1641e1646.

Hallfrisch, J. and K.M. Behall (2000). Improvement in insulin and glucose responses related to grains. Cereal Foods World, 45 (2): 66 – 69.

Huma, N., I. Pasha, M. Sarwar, S. Ahmad and F.H. Shah (2015). Effect of different filtration membranes on composition of sweet and acid whey protein. PAK. J. Food Sci., 25 (2): 79-85.

Jadhav, S., S. Lutz, V. Ghorpade and D. Salunkhe (1998). Barley: chemistry and value-added processing. Critical Rev. in Food Sci., 38 (2): 123-171.

Lai, C.S., R.C. Hoseney and A.B. Davis (1989). Effects of wheat bran in bread making. Cereal Chem., 66 : 217-219.

Lovis, L.J. (2003). Alternatives to wheat flour in baked goods. Cereal Foods World, 48 (2): 61 - 63.

Mekhael, E.K.S (2004). Biochemical and Technological Studies on Balady Bread Made From Durum Wheat Mixed With Some Cereals and Cereal By-Products. M.Sc. Thesis, Cairo Univ., Egypt.

Munaza, B., S.G.M. Prasad and B. Gayas (2012). Whey protein concentrates enriched biscuits. Int. J. Sci. Res. Publ., 2: 1–4.

Peymanpour, Gh., K. Rezaei, B. Sorkhilalehloo, B. Pirayeshfar and G. Najafian (2012). Changes in rheology and sensory properties of wheat bread with the addition of oat flour. J. Agr. Sci. Technol., 14: 339-348.

Proskey, L., N. Asp, I. Furda, J.W. Dervis, T.F. Scheizer and B.F. Hardland (1984). Determination of total dietary fiber in foods, food products and total diets. Inter laboratory study. J. AOAC, 67 : 1044 - 1052.

Rosell, C.M., J.A. Rojas and C. Benedito de Barber (2001). Influence of hydrocolloids on dough rheology and bread quality. Food Hydrocolloids, 15: 75-81.

Sadiq, B.M., M. Tahir-Nadeem, M.K.I. Khan, R. Shabir and M.S. Butt (2008). Oat: unique among the cereals. Eur. J. Nut., 47: 68-79.

Salehifar, M. and M. Shahedi (2007). Effects of Oat Flour on Dough Rheology, Texture and Organoleptic Properties of Taftoon Bread. J. Agric. Sci. Technol., 9 : 227-234.

Sangwan, S., R. Singh and K. Tomar (2014). Nutritional and functional properties of oats: An update. J. Innovative Biol., 1 (1) : 003-014.

WHO (2011). Food and Agriculture Organization of the United Nations, Codex Alimentarius, Milk and Milk Products. Rome, 2011. Available at: [http:// www. fao.org/ docrep/ 015/ i2085e/i2085e00.pdf].

Yousif, M.R.G. (2006). Effect of using rice, barley and corn flours on cakes quality, M.Sc. thesis. Fac. Agric. Ain Shams Univ. Cairo, Egypt.

تأثير الاستبدال الجزئى لدقيق القمح بدقيق الشعير والشوفان على الخواص الكيميائية والريولوجية لعجينة خبز التوست

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الهدف من هذا البحث هو دراسة تأثير الاستبدال الجزئي لدقيق القمح بدقيق الشعير أو دقيق الشوفان أو الإثنين معا على الخواص الريولوجية لعجينة خبز التوست، حيث استبدال دقيق القمح بستة مستويات من دقيق الشعير ودقيق الشوفان بنسبة (٥% و١٠% و ١٥% دقيق الشعير ٥ % و١٠% و ١٥% دقيق الشوفان)، فى صناعة عجين خبز التوست وأظهرت النتائج أن الخبز المصنع من استبدال دقيق القمح ب١٠% من دقيق الشعير أو ٥% من دقيق الشوفان او ١٥ % من الاثنين معا اعطى أعلى معدلات من الخواص الحسية عن باقى المعاملات وكذلك الكنترول، لذلك تم استخدام هذه المعاملات (استبدال دقيق القمح بنسبة ١٠% من دقيق الشعير او ٥% دقيق الشوفان أو الاثنين معا بنسبة ١٥%) ودراسة تأثيرها على الخواص الريولوجية لعجينة عيش التوست، وأظهرت النتائج أن عجينة التوست المحتوية على ١٠% دقيق شعير زادت من معدل الامتصاص ومدة العجن وثبات العجينة للحصول على أقصى قوام وضعف العجينة، أيضًا أظهرت النتائج أن إضافة ٥% من دقيق الشوفان خفضت من معدل الامتصاص، في حين تم زيادة زمن الوصول وزمن تكوين العجينة وثبات العجينة وضعف العجين، وفي حالة خلط الاثنين معا، أوضحت النتائج التي تم الحصول عليها من خلال الفارينوجراف أن إضافة دقيق كل من الشعير والشوفان معا بنسب مختلفة أدى إلى انخفاض معدل امتصاص الماء، في حين تم زيادة زمن الوصول وزمن تكوين العجينة وثبات العجينة وضعف العجين، وأظهرت النتائج المتحصل عليها من الإكستينسوجراف انه نتيجة لإضافة دقيق الشعير بنسبة ١٠% أدى إلى انخفاض في مطاطية العجين، والمقاومة للشد والرقم النسبى وطاقة العجين الناتجة، في حين أن اضافة دقيق الشوفان بنسبة ٥% أدت إلى انخفاض في مطاطية العجين، والرقم النسبى وطاقة العجين الناتجة بينما زادت المقاومة للشد، وأيضًا في حالة خلط الشعير والشوفان معا بنسبة ١٥% أدى إلى انخفاض في مطاطية العجين والمقاومة للشد والرقم النسبى وطاقة العجين الناتجة، من النتائج السابقة يمكن استنتاج أن إضافة دقيق كلا من الشعير بمعدل ١٠% والشوفان بمعدل ٥% وفي حالة خلط دقيق الشعير والشوفان كانت أفضل نسبة ١٥% واستبدال ماء العجن بشرش اللبن أدى إلى تحسين الخصائص الريولوجية للعجين.

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