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Physicochemical properties of wheat bread supplemented with orange peel by-products

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Abstract: This study aimed to find out the effects of supplementation of wheat bread with food industry by-products, orange peels, at 5%. 7.55 and 10% levels. The results show that orange peels contained: 1.41%, 2.1%, 3.33%, 6.78% and 86.38% protein, lipids, fiber, ash and carbohydrates, respectively. The rheological analysis showed that maximum resistance to extension was found to be increasing from 420 in wheat flour to 531 mm in wheat flour containing 5% orange peels powder, while increasing the addition of orange peels to 7.5% and 10% caused an increase in dough resistance to extension to 660 and 798 B.U, respectively. The results also indicated that addition of orange peels to wheat flour caused an increase in arrived time and a decrease in dough stability. The bread samples prepared by adding orange peels have lead to increase in the water absorption while the arrival time and dough stability were decreased. So fiber as a food industry by product is recommended to be used as food additives to gain nutritional and healthy benefit.

Keywords: Food Processing, Rheological Properties, Extensibility, Farinogram

1. Introduction

Food processing by-products have become an important sanitary problem material to be studied. Such efforts have been made for converting these refused materials into valuable products [2]. There are some nutritional wastes such as orange peels that are considered important factors of therapeutic diets and nutrient effect supplying essential nutrient elements such as fiber, vitamin, and mineral to human body.

Dietary fibre is sometimes called bulk or roughage, it is the non-digestible portion of fruits, vegetables and grains. Fiber helps to make stool soft and easily passed, so it does not become too hard, which could lead to constipation; or too watery, which could lead to diarrhea [2].

Orange peels are a waste product of orange fruits used for processing. They represent <5% of fresh fruit and have a hard horny shell containing an oily kernel. Khalifa et al., [3] found that the crude protein, crude oil, crude fiber and carbohydrate contents of Guava peels were 15.73%, 18.48%, 20.18% and 44.27% (on a dry weight basis), respectively. However, the available data about orange peel are scarce.

Bread and baked products are the most important sources of dietary fiber in the total food consumption. Bread with high fiber addition in general is cereal diet and is more effective than low carbohydrate diabetic diet in the control of maturity-onset diabetes. Many studies on high non soluble fiber bread are available but there are not sufficient works on high fiber bread with low phytic acid content, to reduce serum cholesterol. In Egypt, usually commercial types of bread contain bran (shorts) as a soluble fiber source, soluble fibers are more effective in lowering serum cholesterol from the economical point of view of pomegranate peel are a by-products and inexpensive [3].

This study aimed to find out the effects of supplementation of wheat bread with various levels of the food industry by-products, orange peels, those new types of bread will be beneficial especially as therapeutic products.

2. Materials and Methods

2.1. Preparation of Samples

The materials used in the present study were brought form the local market. These materials were food industry by-products, orange (Citrus sinenis) peels. Organe peels were well washed and dried at 63˚C using a fan oven. A laboratory mill was used to give powder. The ingredients which were used in bread making were bought from local market. These ingredients included: wheat flour (72% extraction rate), compressed baker's yeast, sucrose, salt and shortening.

2.2. Chemical Composition

The chemical composition of the different samples was determined. These analyses included the contents of moisture, protein, ash and crude fibre using AOAC [4] methods, while fat contents was determined using AOAC [5] method and carbohydrates content was determined according to FAO [6] by difference as follows:

Carbohydrate %=100–(moisture % + protein % + ash % + fat %+ crude fiber).

2.3. Rheological Properties of Bread Dough

2.3.1. a- Farinograph Test

Water absorption (amount of water required for the dough to have consistency of 500 Brabender units line), arrival time (the time in minutes required for the curve to reach the 500 Brabender unit line after the mixer will be started and water will be added, mixing time (the time in minutes from the first addition of the water to development of dough's maximum consistency), stability (the time in minutes elapsing when the top of the curve interacts first 500 B.U. line leaves that line) and softening of wheat flour dough and its blends with orange peel or peanut red skin or pomegranate peel were determined according to AACC [7] methods using a Farinograph type (PL) (Barbender Farinograph, Germany). 300 grams of tested samples (14% moisture basis) were used.

2.3.2. b- Extensograph Test

Extensograph test was carried out according to the method described by AACC [7] to measure the following data: dough extensibility (E) (the total length of the base of the extensogram measured in millimeters), dough resistance to extension (R) (the height of the extensograph curve was measured in Brabender units after 5 minutes from the start, dough energy (represented by the area in Cm^2 out lined the curve) and the peak height (the maximum height of the extensograph curve measured in Brabender units).

2.4. Bread Making

Bread was made using the 100 - g straight dough method. The basic formula included 100 g of flour, 2 g of compressed baker's yeast 1 g of sucrose , 2 g of salt, 1 g of shortening , water as needed, and different concentrations of orange peel, which has been added at 5, 7.5 and 10 % concentration on a flour replacement basis. The dough was fermented for 60 min. at 30 °C followed proof period for 15 min. Breads were baked at 230 °C for 25 min.

2.5. Bread Baking Characteristics

The average weight of loaves was recorded after cooling the loaves. The loaf volume was measured by rapeseed displacement method according to AACC [7] method. The specific volume (cm^3/g) was calculated by dividing volume of the loaf by its weight [8].

3. Results and Discussion

3.1. Chemical Composition

Wheat flour and orange peels were analyzed for their chemical composition, the obtained results are shown in Table (1) on dry weight basis. The wheat flour (72% extraction) contained, 13.19%, 1.24%, 0.56%, 0.68% and 84.34% protein, lipids, fiber, ash and carbohydrates, respectively. Concerning orange peels, it contained: 1.41%, 2.1%, 3.33%, 6.78% and 86.38% protein, lipids, fiber , ash and carbohydrates, respectively. These results confirmed those obtained by El- Badrawy [9] who found that wheat flour (72% extraction) contained 84.35% carbohydrates, 13.11% protein, 1.51% lipids and 0.42% fiber. The results were also not far from those of other food industry by-products as stated by Block et. al. [10] who found that peanut skin contains 10.5% protein, and 5.0% ash. However, Kelawala et. al. [11] reported that pomegranate peels contain 15.20 % protein, 20.12 % fiber and 16.01% ash.

Table 1. *Chemical composition of orange peels and wheat flower.*

Material	Protein	Fat	Fiber	Ash	Total carbohydrates
Orange peels	1.41	2.10	3.33	6.78	86.38
Wheat flour (72%)	13.19	1.24	0.56	0.68	84.34

3.2. Rheological Properties

Table 2. *Extensogram properties of dough prepared from control wheat flour, and dough supplemented with orange peels (DOP) at different levels.*

Dough type	Extensibility (B.U.)	Resistance to extension(B.U)
Control wheat flour	250	420
DOP 5%	237	531
DOP 7.5%	210	660
DOP 10%	190	798

On 14% water basis. B.U. : Brabender unit.

From the results presented in Table (2) it could be noticed that, extensibility of the dough decreased from 250 mm in wheat flour to 237 mm in wheat flour containing 5% orange peels powder, while increasing the addition to 7.5% and 10% caused a decrease in dough stability to 210 and 190 mm, respectively. Maximum resistance to extension was found to be increasing from 420 in wheat flour to 531 mm in wheat flour containing 5% orange peels powder, while increasing the addition of orange peels to 7.5% and 10% caused an increase in dough resistance to extension to 660 and 798 B.U., respectively.

The extensibility of the dough decreased and maximum resistance to extension increased by increasing the levels of nutritional wastes in all samples.

The results presented in Table (3) showed the effect of addition of orange peels to wheat flour on farinograph readings. From these results it could be noticed that, addition of orange peels, to wheat flour increased dough water absorption, from 55.5, 60.5, 63.4 and 67.5%, for wheat flour and with addition of 5, 7.5 and 10% of orange peels, respectively. The results also indicated that addition of orange peels to wheat flour caused an increase in arrived time and a decrease in dough stability. Arrived time was found to be 1.5, 2.45, 2.75 and 3.40 min, dough stability was found to be 11.5, 11.67, 12.51 and 12.57 min at the levels 0%, 5%, 7.5% and 10%, respectively. However, softening of dough after 20 min was found to be 40, 36, 30 and 28, while after 10 min was 0 at different levels of orange peel addition.

Table 3. *Farinogram parameters for dough prepared from wheat flour and wheat flour containing orange peel.*

Dough type	Water absorption (B.U.)	Arrived time (min)	Stability (min)	Softening after 10 min	Softening After 20 min
Control wheat flour	55.5	1.5	11.5	0	40
DOP 5%	60.5	2.45	11.67	0	36
DOP 7.5%	63.4	2.75	12.51	0	30
DOP 10%	67.5	3.40	12.57	0	28

3.3. Chemical Composition of Bread

The protein, lipids, fiber , ash and carbohydrates, were determined for the control bread (100% wheat flour) and the bread supplemented with different levels of orange peels is indicated in Table (4). I could be noticed that supplementation of bread with orange peels associated with the increasing of protein, lipids, fiber and ash than that of bread without supplementation. These increases in protein, lipids, fiber and ash may be due to relative increase of these nutrients in orange peels.

Table 4. Chemical composition of control bread and bread supplemented with orange peels (OPB).

Bread type	Protein (%)	Fat (%)	Fiber (%)	Ash (%)	Total carbohydrates (%)
Control	32.70	8.54	0.51	0.864	57.39
5% OPB	33.70	8.54	0.52	1.020	56.22
7.5% OPB	33.80	8.54	0.54	1.140	55.98
10% OPB	34.01	8.54	0.54	1.150	55.76

Results are average of two replicates.

3.4. Bread Characteristics

The results presented in Table (5) show the effect of replacement of wheat flour by orange peels at 5%, levels 7.5% and 10% on baking characteristics of bread. Loaf volume and specific volume decreased by increasing orange peels addition. Loaf volume decreased from 400 cm 3 in the control sample to 399, 398 and 397 cm in breads supplemented with 5%, 7.5% and 10% orange peels, respectively. These decreases may be due to the dilution of gluten [12]. The specific volume of bread decreased from 2.660 cm/g in control sample to 2.657, 2.651 and 2.643 cm/g. with 5%, 7.5% and 10% addition of orange peels, respectively.

Table 5. *Effect of replacement of wheat flour by orange peels on load bread weight, volume and specific volume.*

Blend		Loaf weight (g)	Loaf volume cm^3	Specific volume (cm^3/g)
Wheat Flour	Orange peels			
100	0	150	400	2.660
95	5	151	399	2.657
92.5	7.5	153	398	2.651
90	10	154	397	2.643

From the results, it could be concluded that fiber of orange peel have a real weakness effects on dough blends, attributed to the dilution of gluten by fibers. Same conclusion was found by Sharaf et. al., [13] for wheat bran fiber and by Yaseen et. al., [14].

4. Conclusion

Generally, it could be concluded that the poor baking quality of high bread produced from orange peels supplements has been attributed to the dilution of the functional gluten proteins and/or the interaction between fibrous materials and gluten which can partly explain the poor baking quality.

Nutritional education programs about the importance of these wastes for health must be conducted at all culture media. Further studies are needed to investigate the effects of these wastes and their products on chronic diseases.

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References

[1] Abd-E l Aal, S. S. Emarn; Siham, M. M. Faheid and ElRakaybi, M. A. (1987): Nutritional wastes as a source of dietary, Am. J. of Clinical Nutrition. 61 :1129- 1139.

[2] Tresca J. Amber (2012). About.com Guide. About.com Health's Disease and Condition. http://ibdcrohns.about.com/od/dietandnutrition/g/fiber.htm.

[3] Khalifa, A.H.; EL-Dengawy, R.A. and Remadan, B.R. (1998): Chemical composition of pomegranate peel, Assiut Journal of Agricultural Sciences, 29(3): 11-18.

[4] A.O.A.C. (1990).Official Methods of Analysis, 14th ed. Association of Official Analytical Chemists. Washington, D.C., USA.

[5] AOAC. (2000). Association Of Official Analytical Chemists, Official Methods of Analysis (17th Ed.). Arlington, VA. USA.

[6] FA0. (1982) : Natural additives from industrial wastes. Research Continues, Ain Chams University , 31(1) : 567- 577 .

[7] A.A.C.C. (1987). Approved Methods of the American Association of Cereal Chemists . Published by American Association of cereal Chemists, Ins. St. Paul, Minnesota, U. S. A.

[8] Collins, J. L.; Kalantari, S. M. and Post A. R., (1982).Peanut hull flour as dietary fiber in wheat bread.J. food Sci. 47:1899.

[9] El-Badrawy. A. K. (1994).Utilization of refused bread in Egyptian Bread Making. M.Sc., Thesis. Faculty of Agric. Cairo University.Egypt.

[10] Block F; Brown, G. E., and farkos, D.F. (1973). Utilization of alkaline orange peel waste by fermentation amylase production by “Aspergillus foetidus NRRL 337” and alcoholic fermentation. P . 50: 357.

[11] Kelawala ,L.; Tosi, E.A.; Ciappini, M.C. and Masciarelli, R. (2004). Use of whole meal amaranthus (Amaranthus cruentus) flour in manufacture of biscuits for coeliac disease patients. Alimentaria, 269: 49-51.

[12] Pomorenze, 1., Shogren, M.D., Finney, K.F., and Bechtel, D.B. (1977). Fiber in Bread-making- Effects on Functional properties. Cereal chem- 54: 25-41.

[13] Sharaf , D.P, Buritta., A., Towell , H.C.(2002). Refined Carbohydrate Food and Disease. Academic press , London.

[14] Yassen,H. J. (1990) Resistant starch: metabolic effects and potential health benefits. Journal of AOAC International 87:761-767.