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PRODUCTION OF SOME BAKERY PRODUCTS AS BLENDS INTENDED FOR SENSITIVE PERSONS TO GLUTEN

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ABSTRACT: *Celiac disease (C.D.), the most common form of malabsorption in Europe, as the result of intestinal mucosal damage caused in susceptible subjects to the gluten content of some cereals such as wheat. In this study we used corn and rice flours to produce pies for celiac disease patients either the adults or children. We supplemented this pies with dates and skimmed milk to enrich those pies with Iron.*

Some antioxidants such as zinc, calcium, glutamic acid, and essential amino acids were found in the raw materials that used in this investigation. The pies were analyzed physically and chemically and the results showed that the protein and fat contents decreased with the substitution with corn and rice flours comparing with the control. Meanwhile, total carbohydrates, crude fibers and ash content increased with this substitution.

Also amino acids for blend A recorded a slightly increase comparing with blend B. Of these amino acids, methionine, glutamic acid and alanine are being very important antioxidants.

Sensory evaluation showed that, all pies prepared from different blends being substituted with corn and rice flours recorded low scores compared with control pies.

Meanwhile, the blends prepared from 60 and 40% corn and rice flours, respectively record the highest scores compared with another blends, except control blend.

Key Words: *Bakery products, Celiac disease, intestinal mucosal damage, sensitive to gluten.*

INTRODUCTION

Many kinds of grains have not been subjected to controlled testing or to the same scrutiny as wheat, rye, barley, oat, rice, and corn in relation to the celiac disease.

In fact, only wheat and oat have been extensively studied in controlled experiments using the most up to date methods. If we accept corn and rice as safe. Certain cereal grains such as various millets, sorghum, teff, ragi, and Job's tears, are close enough in their genetic relationship to corn to make it likely that are safe for celiac patients to eat. In recent years there has been as low and steady increase in consumer interest in wheat. Free foods, driven in part by an increasing awareness of the relatively unfamiliar condition known as celiac disease (Lovis, 2003). Also, known as gluten - sensitive

enteropathy, is characterized by inflammation of the small – intestinal mucosa that results from a genetically based immunologic intolerance to ingested gluten (Murry, 1999).

In Europe, the prevalence of CD has been estimated to be (1) in (300) to "1" to "500" persons but recent population based screening studies suggest that the prevalence may be as high as 1 in 100 (Mustalahti *et al*, 2002).

The person with CD is unable to consume some of the most common products on the market today including bread, baked goods, and its products made from wheat flour (Lovis, 2003). To satisfy the demand for high quality bread, gluten free bread must have quality characteristics similar to those of wheat flour bread (Ylimaki *et al*, 1991).

MATERIALS AND METHODS

Materials:

Wheat flour (72% extraction) was obtained from Cairo Co. for Milling and Baking, Cairo, Egypt.

Rice, corn flour, sugar, shortening, dates, skimmed milk, and other ingredients were obtained from local markets, Giza, Egypt.

Methods:

Preparation of pies:

Different blends of pies were prepared according to the method described in A.A.C.C. (1983). The levels of used ingredients are shown in Table1.

Analytical methods:

All analysis were carried out in triplicate. Moisture, crude fiber, crude protein "N x 5.7", crude oil and ash contents were estimated according to the methods of A.O.A.C. (1995). Carbohydrates were calculated by difference. Minerals were determined by using an atomic absorption spectro photometer (Perkin Elmer 3300) according to the method adopted in A.O.A.C. (1995). Amino acids were determined according to the method described by Anderson, *et al* (1977).

Table (1): Different blends to produce the intended pies (%)

Ingredients	Blends				
	Control	A	B	C	D
Wheat flour (72%)	100	-	-	-	-
Rice flour	-	60	50	40	70
Corn flour	-	40	50	60	30
Sugar	10	10	10	10	10
Salt	1	1	1	1	1
Shortening	10	10	10	10	10
Yeast powder	1.5	1.5	1.5	1.5	1.5
Improvers	1	1	1	1	1
Date as filler	20	20	20	20	20
Skimmed milk	3	3	3	3	3

Sensory Evaluation of Pies

Sensory evaluation of pies was conducted by 10 panelists according to the method of Renzo (1975). Pies were evaluated for various quality parameters such as crust and crumb colors, odor, taste, and texture.

STATISTICAL ANALYSIS

Data were analyzed by analysis of variance (SAS, 1995) when a significant main effect was detected, the means were separated with Student – Newman – Keuls test. Significant differences were calculated at $P \leq 0.5$.

RESULTS AND DISCUSSION

The results in Table (2) showed that, moisture contents of raw materials namely skimmed milk, dates, rice flour and corn flour were 1.9, 2.2, 10.1, and 11.4%, respectively. These results are in agreement with those of Wang *et al.* (2000).

Meanwhile, protein contents of these raw materials were 24.7, 2.3, 7.2, and 8.6%, which agree with the results obtained by Jarquin (1970).

In the other hand, fat contents of the same raw materials were 23.1, 0.4, 0.5, and 3.9%, ash contents reached 2.7, 1.7, 0.4, and 1.4%, respectively.

Crude fiber contents in the same sequence were 0, 3.4, 0.5, and 2.2%, respectively.

Furthermore, carbohydrates contents were 49.5, 92.2, 91.9, and 84.9%, respectively.

These results are in agreement with those obtained by Watanable *et al.* (2004).

From the present data it is clearly noticed that combination of raw materials (free gluten) will cause an increase in the nutritional value of produced pies such as protein, Fe, Zn, Mn, Pb, Ca, in addition reducing the gluten content and consequently avoid the symptoms of celiac disease.

Table (2): Chemical composition of raw materials (%, on dry wt. basis)

Ingredients	Moisture	Protein	Fat	Ash	Fibers	Carbohydrates
Corn flour	11.4	8.6	3.9	1.4	2.2	84.9
Rice flour	10.1	7.2	0.5	0.4	0.5	91.9
Dates	2.2	2.3	0.4	1.7	3.4	92.2
Skimmed milk	1.4	24.7	23.1	2.7	0	49.5

Mineral contents of such ingredients (raw materials) were summarized "in Table (3)" as it recorded 1.2, 33.1, 290, 0.49, 180, 1.3, and 2.1 mg/100g for Na, Ca, Pb, Mn, Zn, K, and Fe in corn while, meanwhile in rice flour they were 4.1, 9.6, 120, 0.22, 120, 0.7, and 1.4 mg/100g, respectively. These results are in agreement with those mentioned by Watanable *et al.* (2004).

On the other hand, the mineral content of dates recorded 1.1, 60, 63, 49, 744, 1.8, and 6.7 mg/100g for the same elements against the highest contents for skimmed milk, i.e., 326, 330, 204, 201, 1200, 3.1, and 6.9 mg/100g, respectively.

No one can deny the importance of zinc as an antioxidant (Phyllis and James, 1998).

The data were presented in Table (3) showed that, the addition of skimmed milk and dates to corn flour and rice flour increase the nutritional value of pies such as Fe, Zn, Mn, Ca, Pb, Na, and K.

Table (3): Minerals content of raw materials (mg/100g)

Ingredients	Na	Ca	Pb	Mn	Zn	K	Fe
Corn flour	1.2	33.1	290	0.49	180	1.3	2.1
Rice flour	4.1	9.6	120	0.22	120	0.7	1.4
Dates	1.1	60	63	49	744	1.8	6.7
Skimmed milk	326	330	204	201	1200	3.1	6.9

Chemical composition of different prepared pies

The results in Table (4) illustrated that, pies as a control which made from wheat flour (72% extraction) recorded the highest percentage of protein 14.1 followed by that made from 50% rice plus 50% corn flour which recorded 10.3 whearas the lowest percentage of protein was found in pies made from 30% corn flour and 70% rice flour.

On the other hand control pies recorded the highest percentage of fats (3.7%) followed by pies that made from 60% corn flour plus 40% rice flour (3.6%).

Concerning the ash content of pies, the results showed that pies made from 60% corn flour and 40% rice flour recorded the highest percentage of ash (1.8%) followed by pies made from 50% corn flour and 50% rice flour with the lowest percentage (1.1%).

Pies made from 60% corn flour and 40% rice flour recorded 1.46% crude fibers meanwhile control pies recorded (0.84%).

With regard to carbohydrates control pies recorded the lowest percentage (81.3%), meanwhile pies made from 40% corn flour and 60% rice flour recorded the highest one (85.7%) followed by those made from 30% corn flour and 70% rice flour which recorded 85.5%.

Energy values of different pies ranged from 405 to 415 k cal. for pies made from 60% corn flour and 40% rice flour and control pies.

These results are in agreement with those mentioned by Darweesh *et al*, (1992) and Hafez *et al*, (1994). It is noticed that the energy value derived from fat of various pies contained higher than 30% of total calories, especially with a high protein of corn flour.

Although, these products were not nutritionally complete, they might be good regarding the health aspect for celiac disease patients, as well as those suffered from gluten sensitivity.

Table (4): Chemical composition of different prepared pies (%, on dry weight basis)

Pies made from		Protein	Fats	Ash	Fibers	Carbohydrates	Energy (kcal)*
wheat flour (72%) as control		14.1	3.7	1.1	0.84	81.3	415.8
Pies made from							
Corn flour (%)	Rice flour (%)						
40	60	9.8	3.1	1.3	1.35	85.7	411.2
50	50	10.3	3.4	1.6	1.46	83.2	405.5
60	40	10.1	3.6	1.8	1.7	82.8	405
30	70	9.5	2.8	1.1	1.1	85.5	406

*Energy value (cal/100g) = % carbohydrates x 4.01 + % protein x 4.01 + % fat x 9.01.

Amino acids content of pies made from wheat flour 72% extraction and those made from 60% corn flour (A) and 40% rice flour (B) are presented in Table (5). The results showed that, amino acids content of pies A recorded nearly an increase in all amino acids compared with pies (B).

In contrast, amino acid [alanine] recorded 0.981 g/100g protein for pies (B) and 0.892 g/100g protein for pies (A).

Table (5): Amino acids content in pies prepared from wheat flour (72%) and those made from 60% corn flour and 40% rice flour (g/100g Protein)

Amino acids content	Wheat flour pies (control) (A)	Pies made from 60% corn flour + 40% rice flour(B)
Aspartic acid	1.23	1.08
Therionine	0.683	0.668
Serine	1.411	1.32
Glutamic acid	12.3	11.1
Proline	3.8	3.5
Glycine	0.669	0.663
Alanine	0.892	0.981
Cysteine	0.262	0.259
Valine	0.66	0.63
Methionine	0.586	0.509
Iso-leucine	0.666	0.62
Leucine	1.3	1.1
Tyrosine	0.61	0.573
Phenylalanine	0.649	0.575
Histidine	0.518	0.431
Lysine	0.38	0.34
Arginine	5.094	5.013
Tryptophane	0.119	0.116

Glutamic acid in pies (A) and (B) recorded the highest value compared to another amine acids which recorded 12.3 g/100g protein and 11.1 g/100g protein in pies (A) and (B), respectively where it is known that glutamice acid is essential for activating the memory and nourishment of the brain and also alanine is also an antioxidant where is being slightly higher in blend (B)

compared with blend (A) (Graves, 2003). These results agree with those of Chibber *et al*, (1977) who found that, the discovery of high lysine mutants of maize, followed by those of barely and sorghum and these results agree with those of Hafez *et al*, (1994), Evangelista *et al* and Johnson (2003), and Watanable *et al*, (2004).

Results in Table (6) which represents the sensory evaluation of different prepared pies showed a significant difference in all parameters of sensory qualities.

Control samples made from wheat flour 72% extraction recorded the highest score compared with other samples. We were found slightly difference between control sample and other samples made from blends A and B.

The samples made from blend A and B recorded the highest score compared with other samples made from blends C and D.

Table (6): Sensory evaluation of pies made from different blends.

Samples	Sensory evaluation					
	Crumb color (15)	Crust color (15)	Odor (20)	Texture (20)	Appearance (15)	Taste (15)
Control (wheat flour 72%)	13.600[a]	13[a]	18.600[a]	18.00[a]	13.800[a]	13.600[a]
Blend A	11.200b	12b	16.600b	16.00[a]	12.400b	11.400b
Blend B	11.000b	12b	15.400c	15.200b	12.200bc	10.800b
Blend C	10.900bc	11cb	14.00d	14.400b	11.400cd	10.800b
Blend D	10.300bc	10c	12.400e	12.800c	10.600d	10.400b
LSD*	0.6977	0.9695	0.7693	1.2376	0.894	1.0718

*LSD, Least Significant Differences. Means in same row with different letters are significantly different ($p \leq 0.05$).

REFERENCES

A.A.C.C (1983). American Association of Cereal Chemists. Inc. St. Paul. Minn. USA.

Anderson, R., D. Annette and N. Jackson (1977). Ion-exchange chromatographic study of amino acid dogradation during hydrolysis of animal protein J. Chromatogr. 135:447-454.

A.O.A.C. (1995). Official Methods of Analysis. 15th E.D., Association of Official Analytical Chemist, Arlington, Virginia, 2301, USA.

Chibber, B.A.K., E. Niocu, and E.T. Mertz (1977): Studies on corn protein. XI. distribution of lysine during germination of normal and paque.2 maize. Cereal Chem. 54(3) 558 - 564.

Darweesh, Z. H., S. M. Abd El Salam, R. I. Fasisal and A. S. Gauda (1992). Selection of some Egyptian maize in bread lines due to growth properties, yield and chemical compositlon J. of Appl. Sci. 7 – 4.

Evangelista, M. P. H. and L. A. Johnson (2003). Sequential extraction processing of high-oil corn. Cereal. Chem. 80 (6) 675 - 683.

Graves W.H. (2003): Medicinal benefits of whole foods. http://www.naturalways.com/medva/fd.htm

Hafez, S.A., L.F. Rizk, Z. H. Darwesh and A. S. El Sakr (1994). Technological properties and nutritive value of some Egyptian maize varieties. J. AppL Sci. 9(6): 179 – 190.

Jarquin, R., C. Albertazzi and R. Bressani (1970). Value of Onaque – 2 corn protein for chicks. AGR. Food. Chem. Vol(18) No.2 268 – 271.

Lovis, L.J. (2003). Alternative to wheat flour in baked goods. Cereal Foods World 38:673 – 377.

Murry, J. A. (1999). The widening spectrum of celiac disease. Am.J.Clin.Mitr. 69: 354 – 365.

Mustalahati, K., S. Lphinieni, P. Collin, N. Vuolteenaho, P. Illaippala and M. Markku (2002): Gluten free diet and quality of life in patients with screen-detected celiac disease. Eff.Clin.Pract. 5: 105 – 113.

Phyllis, A. B. and F. R. James (1998): Prescription for dietary wellness using foods to heal. A very Publishing Group, Garden City Park, New York. M.S.A.

Rabie, M.M.A. (2003): Nutritional facts & medicinal usage of dates in clinical & human nutrition. Ph. D. Thesis in Clinical of Human Nutrition. Univ. of Lincolnshire & Humberside UK.

Renzo, D. J. (1975). In "Bakery Products", Yeast leavened. Pub.:- Noyes Data Corporation London, England.

SAS (1995). SAS, Statistical Analysis System "SAS". User's guide:- Statistics, SAS, Institute Inc. Editors, Cary, N.CUA.

Wang, H. H., D. W. Sun, Q. J. Zeng and Y. Lu (2000). Effect of pH, corn starch and phosphates on the pasting properties of rice flour. J. of Food Engineering (46) 133 – 138.

Watanable, M.I., T. Maeela, K. Tsukahara, H. Kayahara and N. Morita (2004). Application of pregerminated brown rice for bread making. Cereal Chem. 81 (4) 1- 450 – 455.

Ylimaki, O., J. Hawrysh, R. Hardin and A. Thomoson (1991). Response surface methodology in the development of rice flour breads sensory evaluation. T.Food Sci. 5:751 – 759.

إنتاج بعض المخبوزات من بعض الخلطات للفئات الحساسة للجلوتين

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الملخص العربى

مرض الحساسية للجلوتين من أكثر الأنواع شيوعاً فى أوروبا والمؤدى لحدوث تحطم لأنسجة الأمعاء الدقيقة منتجة حساسية هذا النسيج للجلوتين الموجود فى بعض الحبوب وهو جلوتين القمح.

وفى هذا البحث أستخدم كل من دقيق الذرة والأرز لإنتاج فطائر لمرضى حساسية الجلوتين لكل من الأطفال والبالغين مع تدعيم هذه الفطائر بالبلح واللبن البودرة لزيادة محتوى هذه الفطائر من الحديد وبعض مضادات الأكسدة مثل الزنك والكالسيوم وحمض الجلوتاميك والأحماض الأمينية الأساسية.

وهذه الفطائر تم التحليل لها طبيعياً و كيميائياً وأظهرت النتائج أن المحتوى من البروتين حدث له إنخفاض مع زيادة الأحلال بدقيق كل من الذرة والأرز بالمقارنة بالكنترول (دقيق القمح ٧٢%).

بينما الكربو هيدرات الكلية والألياف والرماد يحدث لها زيادة مع زيادة الإستبدال فى دقيق الذرة والأرز.

وأظهرت أيضاً النتائج أن الأحماض الأمينية للخلطة (A) سجلت زيادة طفيفة بالمقارنة بالخلطة (B). ومن هذه الأحماض الأمينية (المثيونين وحمض الجلوتاميك والأنين) والتى تعمل كمضادات أكسدة.

وأظهر التقييم الحسى أن كل الفطائر المصنعة من دقيق الذرة والأرز سجلت أقل درجة بالمقارنة بالفطائر الكنترول.

بينما الفطائر المصنعة من ٦٠% دقيق ذرة و ٤٠% دقيق أرز كانت هى الأعلى بالمقارنة بالخلطات الأخرى فيما عدا الكنترول.