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FORTIFIED BISCUITS BAKED BY MICROWAVE OVEN

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ABSTRACT

Microwave baking is an interesting alternative method for preventing nutrient degradation. The present study was carried out to evaluate a new biscuit that was obtained by partially replacing of wheat with ground peanut, chickpea and sesame flours at 0, 10, 15 and 20% to improve nutritive value of biscuits with different flavours. Such products will reduce the price and save a part of hard currency spent on wheat, besides improving taste and nutritive value.

In the present work thirty different kinds of biscuits were evaluated chemically, nutritionally and organoleptically. Such replacement at 15% and 20% levels led to an acceptable quality and high nutritional value due to the complimentary nature of the amino acids derived from these raw materials, than those made from wheat flour alone. Fortification with 20% chickpea, peanut or sesame was the best treatments. Essential amino acid contents, amino acid scores (AS), pointed out that fortification of biscuit with 20% chickpea, sesame and peanut upgraded the nutritive values of biscuits.

key words: Microwave - biscuit products - wheat flour - peanut- sesame – chickpea - nutritive value- amino acid scores- flavorings- sensory properties

INTRODUCTION

Social changes that have taken place over recent years have altered considerably the pattern of Egyptian eating habits. These changes have been facilitated by the increasing use of microwave ovens, which is more uniform and efficient, permitting the product baking in a much shorter time than conventional baking, which causes significant nutritional losses through thermal degradation (Lorenz *et al*., 1973; Tsen, 1980; Galan *et al*., 1991; Fox and Cameron, 1995).

Some Egyptian raw peanut varieties had (5.36- 9.9) moisture; (24.7-29.0) protein; (38.5-51.2) fat; (5.6-6.0) starch; (17.5-24.5) carbohydrates; (2.0-2.9) ash and (1.7-2.5) fiber (gm / 100gm DW) according to El- Gendi (1981) and Gad (1985). Also, the amino acids content of raw peanut were 4.8; 1.3; 11.4; 5.6; 18.2; 3.8; 4.3; 3.8; 5.0; 4.2; 3.5; 1.1; 2.6; 1.1; 6.4; 3.4; 2.4 and 11.2 (gm/ 100gm) for serine, cystine, aspartic, glycine, glutamic, alanine, proline, tyrosine, phenylalanine, valine, lysine, methionine, threonine, tryptophan, leucine, isoleucine, histidine and arginine, respectively, Gad (1985).

Local varieties of chickpea flour in Egypt, contained 7.0 - 9.2% moisture; 23.7-28.0% protein; 4.8-6.6% fat; 1.4-3.0% ash and 68.0-70.3% carbohydrates (Nasser, 1985; and El- Akary, 1986). Chickpea belongs to

legumes which are rich in protein. Amino acid composition of chickpea protein (gm/ 16 gm N) showed that it had valine 4.43; isoleucine 4.10; leucine 7.93; threonine 3.63; methionine 1.34; phenylalanin 4.11; tyrosine 4.9; lysine 6.99; histidine 4.65 and arginine7.30 (El- Akary, 1986).

It could be observed that sesame is widely used in Egyptian products for decoration and flavour (El- Shahaly *et al*., 1983). These nutrients in Egyptian chickpea, sesame or peanuts were comparable to those obtained in other parts of the world. According to Ranhotra *et al*. (1980) the minerals content in cooked biscuits were Ca 49.1, P 182.0, Mg 59.6, Zn 1.22, Fe 2.76 and Cu 0.47 mg/100g. Also, Dodok *et al*., (1993) compared between chickpea grown in Slovakia and Iraq, and stated that both varieties had relatively high protein (27.37 and 23.18%) and lipid (5.8 and 6.2%) contents. Both varieties contained 34 - 36% of essential amino acids, and mineral content was dominated by P and K.

Cookies made with 100% wheat flour had fiber content of 2.70g/100g according to Tangkanakul *et al*., (1995) who published that fiber enrichment of cookies decreased density and generally increased spread ratio, and water absorption index (WAI) of all fiber enriched biscuits.

The objectives of this study are: (1) Produce biscuits with maximum nutritive value content by suggesting new formulas using peanut, chickpea and sesame. (2) Assess changes in dough with various concentrations. (3) Determine the correlation exists between physical properties and consumer acceptance of sensory properties of various formulations. (4) Studying the effect of baking in a microwave oven on nutritional value, with the main aim that no chemical substances or preservatives are used. It should be mentioned that biscuits are prepared to be used for all ages specially children as nutritive snacks instead of low value snacks for filling their nutrient gaps between meals and maintain normal growth and health.

MATERIALS AND METHODS

(1) Raw materials:

Commercial wheat flour at 72% extraction, ground peanut, sesame or chickpea were used to produce blended flours, all ingredients used were obtained from the local market in Cairo- Egypt.

(2) Technological methods:

2-a: Dough preparation:

Sugar (sucrose) and butter were creamed for 8 minutes in a planetary mixture. Then, eggs with vanillin were added with mixing for a 5 min., salt, baking powder and flour were added. After addition of all ingredients, mixing continued another 15 min. then the dough put in refrigerator for about 20 min., then flattened manually using a wooden roller to about 2-2.5 cm thickness, then cut into spherical pieces.

2-b: Different treatments and flavours:

Types of biscuits were prepared using, only 100% wheat flour (as control), then the second type was made from a mixture of wheat and peanut flours at ratios of 90:10; 85:15 and 80:20% respectively. The third and fourth type of biscuits were made from a mixture of wheat and sesame flours or from a mixture of wheat and chickpea flours at the same ratios. Each type of biscuits (standard and other treatments) were prepared in three different flavours (cocoa, orange and cinnamon).

2-c: Microwave baking:

Microwave (Gold Star) Model No ER-535MD in put 220 v-50Hz, frequency 980-2450Hz, power level (high 100%), Baking times were 210, 230, 240 and 270 seconds for control peanut, chickpea and sesame respectively. The final product should have brown or golden sides and a white center. Baked biscuits were cooled and placed in polyethylene bags until analysis.

(3) Nutritional evaluation:

Chemical constituents of thirty selected formulas of biscuits were analyzed to determine moisture, protein, ether extract, ash, carbohydrates and vitamin C as described by A.O.A.C. (1994). Crude fibers determined according to Pearson (1971).

Mineral contents: Sodium (Na), Potassium (K), Calcium (Ca), Iron (Fe), Zinc (Zn) and Magnesium (Mg) (mg/ 100g) were assayed as recommended by A.O.A.C. (1994) using atomic absorption spectrophotometer. While, Phosphorus (mg/100g)) was determined using the Unican SP 1800 spectrophotometer, at wavelength 650 nm.

Amino acids composition (AA) were determined by Amino Acid Analyzer according to Pellet and Young (1980). Grams that would be consumed to cover the daily requirements (GDR) of essential amino acids for child (7 -10) years old also were calculated using RDA (1989).

Amino acid scores (AS) were calculated compared to FAO reference protein FAO/ WHO/ UNU (1991).

(4) Organoleptic evaluation:

Organoleptic evaluation of biscuits was carried out according to (Steel and Torrie 1980), who recommended the following scores: (0-2) extremely poor, (3-4) very poor, (4-5) poor, (5-6) fair, (6-7) medium, (7-8) good, (8-9) very good and (9-10) excellent. Colour, taste, odour, size, texture, Shape and overall acceptability of biscuits using the above scale scores. Mean values were calculated then data statistically analyzed using the analysis of variance by the software of HDSS.

RESULTS AND DISCUSSION

Chemical composition of wheat flour, peanut, sesame or chickpea grown in Egypt were investigated and compared with those products made from unsupplemented flour. Results in Table (1) pointed out that wheat flour had the highest content of moisture and carbohydrates and lowest content of protein, ether extract, ash, crud fiber, sodium, calcium, iron, zinc, copper and

potassium. On the contrary with peanut, sesame or chickpea which had the highest contents of these nutrients. On the other hand, the ground peanut had the highest protein and magnesium, followed by chickpea and sesame. Also, wheat and sesame flours had similar fiber and ash contents.

Table 1: Chemical composition of wheat, peanut, sesame and chickpea flours.

Chemical composition (g/100g DW)	Wheat	Peanut	Sesame	Chickpea
Moisture (%)	11.04	04.6	05.20	10.5
Protein (%)	10.20	26.4	19.20	19.6
Ether extract (%)	01.30	44.9	51.80	05.4
Ash (%)	00.50	02.4	04.80	03.1
Crud fiber (%)	00.40	02.9	04.56	03.4
Total carbohydrates (%)	76.60	21.7	19.00	61.4
Vitamin C (mg/ 100g DW)	00.00	00.0	00.00	02.0
Na (mg/ 100g DW)	4	4	55	34
K (mg/ 100g DW)	110	570	560	855
Ca (mg/ 100g DW)	15	55	980	155
Mg (mg/ 100g DW)	22	180	174	130
Fe (mg/ 100g DW)	0.90	2.50	12.60	5.80
Zn (mg/ 100g DW)	1.50	2.60	3.60	3.40
Cu (mg/ 100g DW)	0.13	0.29	1.30	1.30
P (mg/ 100g DW)	90	380	515	430

Micronutrient of biscuits made from wheat flour compared with the other types of biscuits after addition of peanut, sesame or chickpea which replaced at 10%, 15%, and 20% with various flavours. Results in Tables (2, 3, 5 and 7) indicated that all these replacements exhibited dough handling properties much like those of the 100% wheat flour. Addition of peanut, sesame or chickpea substantially improved the macro- and micronutrients profile of the biscuits.

It could be noticed that all fortified products especially biscuits prepared with 20% of the ground peanut had higher protein, ether extract, ash and crude fiber as the 100% wheat flour control. The results were in agreement with those obtained by Taha *et al*., (1986) who used three peanut products to replace the wheat flour in production of biscuits, and found that, protein content was increased by 7 - 65% in biscuits. While, biscuit supplemented with 20% ground chickpea had higher moisture, protein, ash, crude fiber and carbohydrate contents and lower content of ether extract than the corresponding control sample.

Biscuit supplementation in our study with three different flavours, resulted more protein content as compared with Darwish *et al.* (1991) they supplemented wheat flour with skimmed milk powder at 10.2%. Protein content is also higher than 3 types of biscuits distributed in the Egyptian market according to Abdel Ghany and Sahloul (1993). Also, peanut was recommended as safe snacks for children (Adel and Mursi, 1997). Recently it was recommended for children to increase peanut snack foods (Abdalla and Halaby 1998). All fortified biscuits showed deficiency in vitamin C except products fortified with vitamin C (as orange).

Table 2: Chemical composition of the biscuits prepared from wheat flour with different flavours.

Chemical composition (g/100g DW)		Cocoa Flavour	Orange Flavour	Cinnomin Flavour
Moisture	(%)	03.46	03.67	03.58
Protein	(%)	10.24	10.21	10.25
Ether extract	(%)	17.22	17.10	17.18
Ash	(%)	00.59	00.63	00.65
Crud fiber	(%)	00.41	00.51	00.48
Total carbohydrates	(%)	69.84	69.68	69.76
VitaminC	(mg/ 100g)	00.00	01.17	00.00
Na	(mg/ 100g)	16.49	16.56	16.81
K	(mg/ 100g)	76.53	80.99	84.64
Ca	(mg/ 100g)	18.01	16.45	26.33
Mg	(mg/ 100g)	13.45	13.60	14.52
Fe	(mg/ 100g)	00.81	00.71	01.01
Zn	(mg/ 100g)	00.81	00.95	01.00
Cu	(mg/ 100g)	00.08	00.09	00.05
P	(mg/ 100g)	79.91	67.71	62.01

It could be noticed that (Tables 2, 4, 6 and 8) addition of 20% ground sesame improved the contents of (P, Cu, Zn, Fe, Mg, Ca, K and Na) and more than twice as much minerals as the 100% of wheat flour control.

Data presented in tables (9 and 10) pointed out that concentration of essential amino acids (gm/ 16gm N) of flours and biscuits after baking with different ground of (peanut, sesame or chickpea), amino acid scores (AS) and GDR for child (7-10) years old were made. It could be recorded that higher increase for all fortified biscuits in all essential amino acids specially argenin and leucine and more than four times of other fortified biscuits with dry milk, and amino acid scores showed also an increase than Darwish *et al*. (1991) and than control biscuits.

Samples of 100% wheat flour (without substitution) showed deficiency in four amino acids (Tryptophane, Methionine, Histidine and Cystine), but fortified biscuits still had a deficiency on lysine amino acid. It could be observed from Table (10) that GDR values for all essential amino acids decrease by incorporation of grained peanut, sesame and chickpea which indicating higher nutritive value than control biscuits.

Organoleptic evaluation:

Egyptians were able to identify intensity levels of these flavour enhancing food additives such as cocoa, cinnamon or orange in biscuits. Taste, colour, texture, size and odour scores (Table 11) indicated that this sensory characteristics can be affect by the efficiency of flavoring agents in dough. Biscuits with cinnamon and orange flavours were acceptable to most members regarding taste and odour. Colour became lighter as more orange was replaced and darker with cinnamon addition. While, biscuits with cocoa had no unacceptable flavour, and changes in dough properties were greater with cocoa, which caused significant differences for all sensory properties.

Table 3: Chemical composition of chickpea biscuits with chickpea under different flavours (g/ 100g dry weight).

Types of biscuits	Moisture	Protein	Ether extract	Ash	Crude fiber	Carbohyd -rates	Vitamin C (mg/100g)
10%chickpea (Fl. cocoa)	3.64	11.61	16.03	1.01	0.97	68.996	0.15
10%chickpea (Fl. orange)	3.65	11.58	16.01	0.98	0.96	68.869	1.27
10%chickpea (Fl. cinnamon)	3.63	11.64	16.04	1.02	0.99	68.911	0.11
15%chickpea (Fl. cocoa)	3.85	11.81	16.58	1.13	1.07	68.574	0.26
15%chickpea (Fl. orange)	3.90	11.73	16.38	1.10	1.00	68.480	1.29
15%chickpea (Fl. cinnamon)	3.81	11.79	16.45	1.15	1.09	68.520	0.16
20%chickpea (Fl. cocoa)	4.12	12.28	16.78	1.17	1.14	71.644	0.28
20%chickpea (Fl. orange)	4.13	12.29	16.69	1.11	1.12	71.380	1.39
20%chickpea (Fl. cinnamon)	4.10	12.25	16.67	1.18	1.16	74.570	0.27

Table 4: Mineral contents of chickpea biscuits with different flavours (mg/100g dry weight).

Types of biscuits	**Na**	**K**	**Ca**	**Mg**	**Fe**	**Zn**	**Cu**	**P**
10%chickpea (Fl. cocoa)	18.09	216.26	25.48	19.21	1.07	1.65	0.15	098.04
10%chickpea (Fl. orange)	18.16	220.12	23.92	19.36	0.97	1.66	0.15	085.84
10%chickpea (Fl. cinnamon)	18.41	224.37	33.80	20.28	1.27	1.60	0.15	086.13
15%chickpea (Fl. cocoa)	18.89	236.13	29.21	22.09	1.20	1.80	0.18	108.71
15%chickpea (Fl. orange)	18.96	239.98	27.65	22.24	1.10	1.81	0.17	094.91
15%chickpea (Fl. cinnamon)	19.21	244.24	37.53	23.16	1.39	1.85	0.18	095.21
20%chickpea (Fl. cocoa)	19.69	255.99	39.94	24.97	1.33	1.85	0.21	116.18
20%chickpea (Fl. orange)	19.76	259.86	31.39	25.12	1.23	1.86	0.21	103.97
20%chickpea (Fl. cinnamon)	20.01	264.10	41.26	26.04	1.53	1.81	0.22	104.27

Table 5: Chemical composition of peanut biscuits with different flavours (g/100g dry weight)

Types of biscuits	Moisture	Protein	Ether extract	Ash	Crude fiber	Carboh yd-rates	Vitamin C (mg/100g)
10%Peanut (Fl. cocoa)	3.68	11.85	19.98	0.83	0.61	65.02	0.00
10%Peanut (Fl. orange)	3.78	11.66	19.85	0.81	0.56	64.98	1.11
10%Peanut (Fl. cinnamon)	3.66	11.77	19.93	0.85	0.63	65.05	0.00
15%Peanut (Fl. cocoa)	3.65	12.66	21.36	0.94	0.70	62.61	0.00
15%Peanut (Fl. orange)	3.80	12.57	21.28	0.90	0.68	62.56	1.20
15%Peanut (Fl. cinnamon)	3.69	12.63	21.25	0.95	0.73	62.70	0.00
20%Peanut (Fl. cocoa)	3.60	13.47	22.75	1.01	0.82	60.21	0.00
20%Peanut (Fl. orange)	3.77	13.36	22.73	0.98	0.78	60.13	1.12
20%Peanut (Fl. cinnamon)	3.61	13.41	22.70	1.03	0.85	60.28	0.00

Table 6: Mineral contents of peanuts biscuits with different flavours (mg/ 100g dry weight).

Types of biscuits	**Na**	**K**	**Ca**	**Mg**	**Fe**	**Zn**	**Cu**	**P**
10%Peanut (Fl. cocoa)	5.11	199.4	15.88	51.40	0.93	1.50	0.15	92.02
10%Peanut (Fl. orange)	5.41	242.7	16.20	51.61	0.95	1.53	0.17	92.12
10%Peanut (Fl. cinnamon)	5.01	199.1	15.90	51.31	0.92	1.56	0.14	93.30
15%Peanut (Fl. cocoa)	5.21	220.1	17.10	57.61	0.97	1.61	0.16	93.66
15%Peanut (Fl. orange)	5.61	258.7	17.23	57.19	0.98	1.58	0.17	93.18
15%Peanut (Fl. cinnamon)	5.11	224.3	17.16	57.51	0.97	1.54	0.18	93.27
20%Peanut (Fl. cocoa)	5.13	236.7	18.11	59.56	1.01	1.78	0.19	94.60
20%Peanut (Fl. orange)	5.16	268.9	18.22	59.41	1.04	1.77	0.21	94.51
20%Peanut (Fl. cinnamon)	5.10	241.4	18.18	59.81	1.00	1.73	0.19	94.61

Table 7: Chemical composition of sesame biscuits with different flavours (g/100g dry weight)

Types of biscuits	Moisture	Protein	Ether extract	Ash	Crude fiber	Carbohyd -rates	Vitamin C (mg).
10% sesame (Fl. cocoa)	3.79	11.22	20.67	1.50	1.04	64.79	0.00
10% sesame (Fl. orange)	3.82	11.32	20.81	1.30	1.01	64.77	1.11
10% sesame (Fl. cinnamon)	3.76	11.38	20.70	1.32	1.08	64.74	0.00
15% sesame (Fl. cocoa)	3.45	11.74	22.35	1.35	1.07	63.11	0.00
15% sesame (Fl. orange)	3.65	11.76	22.44	1.38	1.04	63.18	1.13
15% sesame (Fl. cinnamon)	3.51	11.71	22.42	1.40	1.11	63.16	0.00
20% sesame (Fl. cocoa)	3.53	12.12	24.61	1.48	1.08	60.52	0.00
20% sesame (Fl. orange)	3.67	12.18	24.56	1.47	1.06	60.55	1.10
20% sesame (Fl. cinnamon)	3.51	12.23	24.63	1.50	1.11	60.51	0.00

Table 8: Mineral contents of the sesame biscuits with flavours (mg/ 100g dry weight).

Types of biscuits	Na	K	Ca	Mg	Fe	Zn	Cu	P
10% sesame (Fl. cocoa)	36.0	188.5	130.3	40.4	2.70	1.99	0.28	192.3
10% sesame (Fl. orange)	36.3	195.7	127.4	40.7	2.50	2.00	0.28	169.4
10% sesame (Fl. cinnamon)	36.6	203.7	145.9	42.4	3.10	2.10	0.29	170.0
15% sesame (Fl. cocoa)	38.6	211.0	178.6	48.0	3.24	2.10	0.36	213.6
15% sesame (Fl. orange)	38.7	218.1	175.7	48.3	3.09	2.10	0.36	190.7
15% sesame (Fl. cinnamon)	39.2	226.2	194.2	50.0	3.65	2.20	0.37	191.3
20% sesame (Fl. cocoa)	41.1	233.5	226.8	55.6	3.82	2.92	0.39	234.8
20% sesame (Fl. orange)	41.2	240.7	223.9	55.9	3.67	2.93	0.39	211.9
20% sesame (Fl. cinnamon)	41.7	248.7	242.4	57.6	4.23	2.3	0.40	212.5

Table 9: Amino acids composition of wheat, peanut, sesame and chickpea flours (g/ 16g-N).

Amino acids	Wheat Control	Peanut	Sesame	Chickpea
Arginine	4.15	11.3	12.8	3.22
Cysteine	2.43	1.3	1.9	1.68
Histidine	1.98	2.3	2.6	2.40
Isoleucine	3.42	4.1	3.8	4.99
Leucine	6.97	6.7	7.1	6.74
Lysine	1.75	3.0	2.8	6.73
Methionine	1.71	0.9	3.0	1.24
Phenylalanine	5.01	5.2	4.6	6.62
Tyrosine	2.76	4.1	3.3	3.31
Threonine	3.03	2.5	3.8	4.75
Valine	4.05	4.5	4.9	4.84
Tryptophane	1.21	1.0	1.6	1.25
Proline	0.00	1.0	0.8	0.80
Serine	0.00	1.1	1.1	0.99

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Table 11: Essential amino acids (gm/ 16 gm N), calculated amino acid scores (AS) and calculated GDR (for child 7-10 years)of biscuits fortified with peanut, sesame and chickpea.

Amino acids	FAO		DR	Control			Peanut			Sesame			Chickpea	
				10%	15%	20%	10%	15%	20%	10%	15%	20%		
Lysine (g)	5.8	1.232	0.20	0.48	0.62	0.76	0.46	0.59	0.72	0.85	1.18	1.51		
AS			3.44	8.27	10.7	13.1	7.93	10.2	12.4	14.7	20.3	25.9		
GDR			616	257	199	162	268	209	171	145	104	82		
Isoleucine	2.8	0.784	0.31	0.70	0.88	1.07	0.66	0.83	1.01	0.78	1.01	1.25		
AS			11.1	24.6	31.2	38.1	26.4	29.8	36.0	27.8	36.1	36.0		
GDR			253	112	89	73	119	94	78	101	78	63		
Leucine	6.6	1.232	0.53	1.15	1.46	1.76	1.19	1.52	1.84	1.15	1.46	1.77		
AS			8.03	17.4	22.0	26.7	17.9	22.9	27.9	17.4	22.1	26.8		
GDR			233	107	84	70	104	81	67	107	84	70		
Threonine	3.4	0.784	0.22	0.45	0.56	0.68	0.58	0.76	0.94	0.67	0.90	1.09		
AS			6.47	13.2	16.5	19.9	17.0	22.3	27.5	19.8	26.4	32.2		
GDR			356	174	140	115	135	103	83	117	87	72		
Tryptophane	1.1	0.252	0.10	0.19	0.24	0.28	0.25	0.33	0.40	0.22	0.27	0.33		
AS			9.09	17.3	21.3	25.5	22.7	29.5	36.4	19.5	24.7	30.0		
GDR			252	133	105	90	101	76	63	115	93	76		
Valine	3.5	0.700	0.33	0.75	0.96	1.17	0.79	1.02	1.24	0.78	1.01	1.23		
AS			9.42	21.3	27.3	33.3	22.5	29.0	35.5	22.3	28.7	35.2		
GDR			212	93	73	60	89	69	56	90	69	57		
Methionin + Cystine	2.5	0.616	0.31	0.50	0.60	0.68	0.77	0.85	1.22	0.57	0.71	0.83		
AS			12.4	19.9	23.7	27.5	30.8	33.8	49.1	22.8	28.0	33.3		
GDR			199	123	103	91	80	72	50	108	87	74		
Phenylalanin + Tirosine	6.3	0.616	0.60	1.47	1.90	2.34	1.33	1.69	2.06	1.53	2.00	2.47		
AS			9.52	23.3	30.2	37.1	21.1	26.9	32.7	24.3	31.7	39.1		
GDR			103	42	32	26	46	36	30	40	31	25		

PER (Protein efficiency ratio) = 0.468 + 0.454 (Leucine) - 0.105 (Tyrosine)
Limiting amino acid (L.A) = Lysine.
Reference amino acids (FAO/ WHO/ UNU. 1991) (gm/ 16 gm N).

CONCLUSION

The addition of peanut, sesame or chickpea to the formula could improve markedly dough handling, which are highly acceptable after processing. This study proved that nutritional values, chemical composition and organoleptic evaluation were influenced by fortification with 20% (without restriction) and were more acceptable qualities particularly concerning for the nutritive values than 100% wheat flour control. Significant correlation existed between physical properties and consumer acceptance of sensory properties of various types of biscuits.

We can recommended that the replacement a part of wheat flour with ground chickpea, sesame and peanut at 20% could be recommended for production on a commercial biscuits in large scale in the Egyptian market for improving the nutritive value. Such products are suggested for pre-school and school children, factories and some people who are suffering from malnutrition in Egypt.

REFERENCES

A.O.A.C. (1994). Official Methods of Analysis of the Association of Official Analytical Chemists. 14.ed. Washington, D.C. Published by the Association of Official Analytical Chemists.

Abdalla,E.S. and Halaby,M.S. (1998). Children and snacks. Bulletin of High Instit. of Public Health. vol.28 (2) 227-244.

Abdel Ghany,R.R. and Sahloul,T.M. (1993). Studies on chemical and bacteriological properties of some biscuits distributed in the local market. Home Econ. J. vol.(9) 39 - 53.

Adel,H.A. and Mursi,F.A. (1997). Effect of various carbohydrate snacks on salivary PH, streptococcus nutant and lactobacillus counts. Mansoura Univ. Fac. of Oral and Dental Med.

Darwish,A.M.; Rakaybi,A.M. and Noor,E.F. (1991). Nutritional evaluation of fortified biscuits. Biochemical Evaluation: Home Econ J. vol.(7) 18 - 39.

Dodok,L.; Modhir,A.A.; Hozova,B.; Halasova,G. and Polacek,I. (1993). Importance and utilization of chickpea in cereal technology. Acta-Alimentaria; 22 (2) 119 - 129, 18 ref.

El-Akary,M.O. (1986). The technology and characteristics of beefburger containing plant substitutes, M.Sc. Thesis, Faculty of Agric., Alexandria Univ.

El-Gendi,M.M. (1981). The confectionery in food industries, part 7, Dar El-Maarif Pub., Egypt.

El-Shahaly,A.A.; Mohamed,M.S.; El-Zalaki,E.M. and Mohasseb,Z.S. (1983). Microbiological studies on salty and sweet pastry food concentrates, veterinarski, Archiv, 53, 4. 189- 195, C.F., FSTA, 270058, 85-01- C0017 (1985).

FAO/WHO/UNU (1991). Energy and protein requirement, Report of joint FAO/WHO/UNU Expert Consultation, World Health Organization, Technical Report Series 724, WHO, Geneva.

Fox,B.A. and Cameron,A.G. (1995). Food science, nutrition and health. 6th. Edit. British Library Cataloguing in Pubication Data.

Lorenz,K.; Chharman,E. and Dilssver,A.W. (1973). Baking with microwave energy. Food Technol. 27: 28.

Gad,S.S. (1985). Technological and chemical studies on peanut, Ph.D. Thesis, Faculty of Agric., Suez Canal University.

Galan,A.G.; Wang,S.H.; Sgarbieri,V.C. and Moraes,M.A.C. (1991). Sensory and nutritional properties of cookies based on wheat-rice-soybean flours baked in a microwave oven. J. Food Sci., 56 (6) 1699: 1706.

Nasser,E.H.(1985). Chemical and technological studies on some meat products using different additives of plant proteins, M.Sc. Thesis, Faculty of Agric., Monofia Univ.

Oser,B.L. (1959). An integrated essential amino acid index for predicting the biological value of protein and amino acid nutrition, Ed. A.A. Albanase, Academic press, New York.

Pearson, D. (1971). The chemical analysis of foods, Chemical Publ. Company, Inc., 6th. Edition, New York.

Pellet,P.L. and Young,V.R. (1980). Nutritional evaluation of protein foods: Food and nutrition Bulletin, published by the United Nations Univ.

Ranhotra,G.S.; Lee,C. and Gelroth,J.A. (1980). Nutritional characteristics of high - protein cookies. J. Agric. and Food Chem., 28 (3) 507 - 509, 14 ref.

RDA (1989). Recommended Dietary Allowances, Food and Nutritive Board, National Academy of Science, National Research Council, Washington, DC.

Steel,R.G.D. and Torrie,J.H. (1980). Principles and procedures of statistics. 2nd. Edit. Mc Graw Hill Book Co. Inc., New York.

Taha,F.S.; Hamouda,A.A. and El-Rayes,F. (1986). Composition and sensory evaluation of bread and aniseed biscuits enriched with peanut protein. Getreide,-Mehl-und-Brot; 40 (7) 213 - 215, 18 ref.

Tangkanakul,P.; Tungtrakul,P.; Vatanasuchart,N.; Auttaviboonkul,P. and Niyomvit,B. (1995). Physical and chemical properties of high fiber breads and cookies. Food, 25 (2) 95 - 107, 22 ref.

Tsen,C.C. (1980). Microwave energy for bread baking and its effect on the nutritive value of bread; a review. J. Food protect, 43:638.

البسكويت المدعم والمخبوز باستخدام فرن الميكروويف

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خبازَة المايكروويفِ هي طريقةُ بديلةِ تعمل على منع تدهور وهدم العناصر الغذائية. أجريت هذه الدّراسة لتُقيِّمَ بسكويت جديد منتج باستبدال جزئى لدقيق القمح بدقيق الفول السوداني، والحمص والسمسمِ بنسب ١٠, ١٥ و٢٠% بهدف تُحسيّن القيمة الغذائية للبسكويت المنتج مع استخدام نكهات مختلفةِ. مثل هذه المنتجات يمكن أن تعمل على خفض السعر وتوفر جزء من العملة الصعبةِ المنصرفة على استيراد القمح ، بالإضافة الى تحسين الطعم والقيمة الغذائية.

فى هذه الدراسة قيم ثلاثون نوع من مختلف أنواع البسكويتِ كيميائياً، وغذائياً وحسياً. ووجد أن الاستبدال عند مستوى ١٥% و٢٠% قد أدت إلى نوعيةِ مقبولةِ وذات قيمةِ غذائية عاليةِ بسبب طبيعة الأحماض الأمينية المستمدة من تلك المواد الخامِ، وذلك إذا قورن بتلك المنتجات المصنعة من دقيق قمح فقط. ووجد أن أفضل معاملات كانت عند الاستبدال بنسبة ٢٠% حمص، فول سوداني أو سمسم. مكونات الأحامض الأمينية الأساسية، والـ Amino acid scores، أشارت إلى أن تدعيم البسكويتِ بنسبة ٢٠% حمص، سمسم أو فول سوداني قد أدى إلى تحسين القيمة الغذائية للبسكويت.

Table (10): Organoleptic evaluation of biscuits supplemented with chickpea, sesame and peanut.

	Control	Chickpea + Flavor			Sesame + Flavor			Peanut + Flavor			LSD
		10%	15%	20%	10%	15%	20%	10%	15%	20%	0.5
Texture											
Cinnamon	7.8^{B}	9^{AB}	9^{AB}	10^{A}	9^{AB}	9^{AB}	10^{A}	8^{B}	9^{AB}	10^{A}	1.2649
Orange	7.8^{B}	9^{AB}	10^{A}	10^{A}	9^{AB}	10^{A}	10^{A}	8^{B}	9^{AB}	9^{AB}	1.2639
Cacao	5^{BC}	5^{BC}	4^{C}	5^{BC}	6^{AB}	6^{AB}	6^{AB}	5^{BC}	6^{AB}	7^{B}	2.0040
Odor											
Cinnamon	9.8^{A}	10^{A}	10^{A}	10^{A}	9^{B}	10^{A}	10^{A}	10^{A}	10^{A}	10^{A}	1.0411
Orange	9.8^{A}	10^{A}	10^{A}	10^{A}	9^{B}	9^{B}	10^{A}	10^{A}	10^{A}	10^{A}	1.0641
Cacao	5.8^{BC}	7^{A}	7^{A}	6^{B}	7^{A}	7^{A}	6^{B}	6^{B}	6^{B}	7^{A}	1.0091
Taste											
Cinnamon	9^{B}	10^{A}	10^{A}	9.8^{AB}	9^{B}	10^{A}	10^{A}	9^{B}	10^{A}	10^{A}	1.0363
Orange	9^{B}	9^{B}	10^{A}	10^{A}	9^{B}	10^{A}	10^{A}	8^{C}	10^{A}	10^{A}	1.0023
Cacao	6^{A}	6^{A}	5^{B}	5^{B}	5^{B}	6^{A}	6^{A}	5^{B}	5^{B}	6^{A}	1.0013
Color											
Cinnamon	9^{C}	10^{A}	10^{A}	9^{C}	10^{A}	10^{A}	9^{C}	9.8^{B}	10^{A}	10^{A}	0.2641
Orange	6^{C}	7^{A}	7^{A}	6^{C}	6^{C}	6^{C}	6^{C}	5^{D}	6.8^{B}	6^{C}	0.1808
Cacao	6^{C}	7^{A}	7^{A}	6^{C}	6.8^{B}	6^{C}	6^{C}	5^{D}	6^{C}	6^{C}	0.1807
Overall Acceptability											
Cinnamon	8.8^{C}	9^{B}	10^{A}	10^{A}	9^{B}	9^{B}	10^{A}	9^{B}	10^{A}	10^{A}	0.1807
Orange	9^{B}	10^{A}	10^{A}	10^{A}	9^{B}	9^{B}	10^{A}	9^{B}	10^{A}	10^{A}	0.2858
Cacao	6^{A}	5.8^{A}	4_{B}	5^{AB}	4^{B}	5^{AB}	5^{AB}	5^{AB}	6^{A}	6^{A}	0.1973
Size											
Cinnamon	8.6^{B}	8.6^{B}	8.6^{B}	8.6^{B}	8.8^{AB}	9^{A}	8.8^{AB}	8.8^{AB}	8.8^{AB}	8.8^{AB}	0.1928
Orange	8.8^{BC}	9.8^{AB}	9.8^{AB}	10^{A}	9^{B}	9.8^{AB}	9.8^{AB}	7.8^{C}	9^{B}	7.8^{C}	0.2154
Cacao	7^{B}	6.8^{BC}	7^{B}	7^{B}	8^{A}	7^{B}	7^{B}	8^{A}	8^{A}	6^{C}	0.7710
Shape											
Cinnamon	8.6^{DE}	8.8^{D}	9.2^{C}	9.6^{B}	8.8^{D}	9^{CD}	10^{A}	9.8^{AB}	9.8^{AB}	10^{A}	0.2066
Orange	9.8^{A}	9^{B}	9^{B}	9^{B}	9^{B}	9^{B}	10^{A}	10^{A}	10^{A}	10^{A}	1.0449
Cacao	4.8^{AB}	5^{AB}	6^{A}	6^{A}	5^{AB}	6^{A}	6^{A}	5^{AB}	4^{B}	5^{AB}	1.2609

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