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NUTRITIONAL AND RHEOLOGICAL STUDIES ON SOME TYPES OF BALADY BREAD

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ABSTRACT

The aim of study present work was to assess the nutritional value of balady bread (82% extract rate wheat) supplemented with fiber and/or protein rich material (barley bran, wheat bran, wheat germ, soybean hull and tofu).

The wheat flour mixtures were prepared and used for balady bread making. Two levels of barley bran and wheat bran (10, 20%), two levels of soybean hull and wheat germ (5, 10%) and two levels of tofu (2.5, 5%). Dough rheological properties of wheat flour blends were determined by means of farinograph and extensograph. Baked bread was subjected to the organoleptic properties. Raw materials and all prepared bread samples were evaluated for chemical composition. The biological of gain in body weight, feed intake, feed efficient, blood glucose; serum cholesterol, griglyceride, total lipids, serum uric acid, blood urea and transaminase enzyme (AST & ALT).

The results revealed that:

Addition of tofu increased the protein, fat and ash content of the mixture, when the mixtures contained soybean hull, the results appeared the highest in fiber content followed by braley bran and tofu.

Farinograph and extensograph results indicated that water absorption dough development time, and dough extensibility value were increased as levels of barely bran, wheat bran, soybean hull and wheat germ increased. While the blends caused a decease in dough stability and resistance to extension values.

For organoleptic quality lower level of all supplements used were more acceptable than high level.

Bread supplemented with barley bran at level 20 and 10% gave the best blood and serum parameters in diabetic animals compared to diabetic control.

INTRODUCTION

Several factors are important for a desirable diabetics diet, it must be low in calories, adequate in all nutrients, give a satiety feeling, of reasonable cost, and can be used over along period (Foda et al. 1987).

On the other hand, protein malnutrition is a serious problem of people whose diets consist mainly of cereals or starchy foods.

The fortifications of wheat flour with protein and fiber currently practiced in many parts of the world including the United States. Accumulating evidence demonstrates that the amount of protein and fiber potentially available from foods depends not only upon the amount of protein supplied but also on the nature of that protein and fiber of the meal with which it is consumed.

In Egypt bread is generally consumed in relatively large amounts and some companies produce toast bread regime and short bread as special dietary bread. These products could contribute to considerable low amount of calories and protein compared to other foods.

Therefore this study was carried out to investigate the produce of some kinds of balady bread for diabetics and regime by replacement of flour either by fiber or by rich protein source.

MATERIALS AND METHODS

American wheat flour (W.F) (82% extraction), wheat germ (W.g) and wheat bran (W.b) were obtained from local flour mills company, Cairo.

Soybean hull (S.h), tofu (T) and barley bran (B.b) were obtained from, Food Technology Research Institute, Agricultural Research Center, Giza. The sample after milling sieved throw sieve No. 100 micrometer.

Ten wheat flour blends mixture were prepared and used for balady bread making to include. Two levels of each barley and wheat bran (10, 20%), two levels of each soybean hull and wheat germ (5, 10%) and tofu (2.5, 5%). The modified traditional baking, methods (FTRIPS) was used according to Abd-El Rahim et al., (1999).

Chemical Analysis:

Moisture, protein, ether extract, ash, crude fiber and total hydrolyzable carbohydrates were determined according to A.O.A.C. (1995).

Rheological properties:

The characteristics of dough prepared from wheat flour blends were measured using farinograph and extensograph according to the method described in A.A.C.C. (1983).

Oragnoleptic evaluation:

It was carried out according to the method of Kramer and Twigg (1974). The test was made by 10 semi trained subjects to evaluate, color, odor, taste, general appearance, roundness, separation of layers and crumb distribution using scoring scales the average score for each character was calculated and statistically analyzed using L.S.D. and multiple range test.

Biological investigation:

A total of 72 male, adult healthy albino rats (100-120 gm) were randomly assigned into 12 groups of six rats each. One group (control) All the other 11 groups were injected with recrystalized alloxan to induce hyperglycaemia (Lazarow and Palay 1954), then one group was kept as diabetic control, while the ten groups were assayned for the ten bread made from different blends. Animal were housed individually in metabolic cages and were given the experimental diets and water ad libitum. Each rat was weighed every two days and its food consumption was determined. At the end of experimental period, animals were fasted overnight before sacrifice and serum samples were separated and used to determine of glucose (Trinder 1969), blood urea and uric acid in blood (Caraway, 1963).

Total serum cholesterol and triglycerides were determined according to (Royer 1969) and total lipids (Knight et al. 1972). AST (Aspartate amino transferase) and ALT (Alanine amino transferase) were determined according to (Ritman and Franke, L. 1957).

The obtained data were statistically analyzed according to the method outlined by Snedecor and Cocheran (1973). LSD test was used to compare the significant differences between means of treatments.

RESULTS AND DISCUSSION

Chemical composition:

Chemical composition of the different fiber and protein rich materials used (Table 1) showed that the percentages of crude fiber were high in soybean hull, barley bran, wheat bran being 44.7, 20, and 12.3% respectively while both tofu and wheat germ showed to contain a relatively high percentage of protein being 50.1 and 22.8% respectively as well as high percentage fat (13-16%). The aforementioned results coincide with those obtained by Donangelo et al., (1995) and Hamza (1999).

Table (1): Chemical composition of raw materials.

Tested samples	Moisture %	Protein (g)	Fat (g)	Ash (g)	Fiber Crude (g)	Carbohydrate (g)	Energy K.cal (100 gm)
Wheat flour 82%	11.50	14.5	1.36	1.08	1.47	81.6	351
Barley bran	8.17	18.31	3.72	7.74	17.20	53.03	319
Soybean hull	8.80	9.21	1.21	3.95	44.70	40.9	193
Tofu*	82.30	50.10	16.10	9.20	15.4	9.20	282
Wheat germ	9.75	22.83	13.07	4.32	2.11	57.65	440
Wheat bran	8.90	19.65	5.38	5.38	12.29	57.3	325

* On dry basis.

On the other hand, the chemical composition of balady bread supplemented with different levels of fiber and protein rich materials (Table 2) showed that tofu at both levels (2.5 and 5%) and wheat germ at 20% increased the protein contents of the bread, compared with control, meanwhile wheat germ supplement resulted in increasing bread fat and ash content with respect to crude fiber level of the supplemented bread, the content of crude fiber was varied according the level of supplement. The highest crude fiber content was observed for barley bran (3.2-3.9%), and wheat bran (2.7-3.1%) compared to control (1.2%).

Rheological properties:

Table (2): The chemical composition of balady bread made from wheat flour (82% ext) supplemented with different level of some ingredients *(on dry basis).

Tested bread	Moisture	Protein*	Fat*	Ash*	Fiber*	Carbohydrate	Values of Energy K.cal (100 gm)
Wheat flour (control) W.f.	34.0	13.2	1.28	1.10	1.2	83.22	396
90% W.f. + 10% B.b	34.0	14.8	1.36	2.71	3.2	77.93	383
80% W.f + 20% B.b	36.0	15.7	1.43	2.84	3.9	76.13	380
90% W.f + 10% W.b	35.0	15.3	1.33	2.50	2.7	78.17	386
90% W.f + 20% W.b	36.0	16.1	1.39	2.71	3.1	76.70	384
95% W.f + 5% S.h	36.0	14.36	1.29	2.25	2.4	79.70	388
90% W.f + 10% S.h	37.0	14.45	1.30	2.31	2.8	79.14	386
95% W.f + 5% W.g	34.0	15.81	2.60	2.82	2.8	75.97	390
90% W.f + 10% W.g	35.0	16.20	2.90	2.96	3.2	74.74	372
99% W.f + 2.5% T.	36.0	16.75	1.31	1.60	1.9	78.44	393
95% W.f + 5% T.	36.0	17.23	1.33	1.80	1.5	77.54	391

W.f = Wheat flour B.b. = Barley bran W.b = Wheat bran
S.h = Soybean hull W.g = Wheat germ T. = Tofu curd

Rheological properties of dough measured for evaluating mixing characteristics (farinograph data) and for shaping parameters (extensograph data) are recorded in Table (3).

Table (3): Rheological properties of different blends used in bread making.

Flour blends	Farinograph data					Extensograph data			
	Water absorption %	Mixing time (min)	Dough development (min)	Dough stability (min)	Dough weakening (B.U.)	Resistance to extension (B.U.)	Extensibility (min)	Preparation number R/S	Energy (Cm^2)
Wheat flour (control)	61.1	2.0	4.0	8.0	90	580	90	6.4	53.0
90% W.f. + 10% B.b	69.2	2.5	4.5	4.5	100	400	145	2.8	37.7
80% W.f. + 20% B.b	71.0	3.0	5.0	4.0	120	300	150	2.0	34.2
90% W.f + 10% W.b	68.0	2.5	4.5	4.0	100	400	120	3.3	39.5
80% W.f + 20% W.b	70.4	3.5	5.0	3.5	120	300	150	2.0	33.9
95% W.f + S.h	65.3	3.5	4.5	5.5	95	500	95	5.3	48.2
90% W.f + 10 S.h	67.2	4.5	6.0	4.5	100	540	85	6.4	50.1
95% W.f + 5% W.g	63.2	2.5	4.5	5.0	95	200	145	1.4	26.6
90% W.f + 10% W.g	66.1	3.0	4.5	4.0	100	140	110	1.3	22.4
97.5% W.f + 2.5% T.	59.1	2.0	3.5	4.5	90	450	110	4.1	46.6
95% W.f + 5% T.	57.6	2.0	3.5	4.0	95	500	140	3.6	44.2

W.f = Wheat flour B.b = Barley bran W.b = Wheat bran
S.h = Soybean hull W.g = Wheat germ T. = Tofu

Farinograph data showed that water absorption had increased as the levels of (B.b, W.b, S.h and W.g.) increased. However, the dough became more rigid, whereas the time required for dough development and mixing time both were increased meanwhile, increase the levels of (B.b, W.b, S.h and W.g.) cause a decrease with dough stability, compared with control. The decrease in dough stability of the blends may be due to the high fiber content which destroyed the gluten matrix. These results were agreement with Souzan and El-Azab (2000).

It is clear from extensograph data that dough extensibility value markedly increased in the presence of all levels of the flour blends. Moreover, the ability of the dough to regain its shape after extension were progressively decreased among the flour blends which may be due to that wheat blended doughs more extensible because of the hydrolysis of some glutenin subfractions were in agreement with the result of Souzan and El-Azab (2000) Organoleptic evaluation supplemented balady bread:

Organolyptic evaluation of control and balady bread made from wheat flour (82% ext.) fortified with different levels of blends is shown in Table (4). The data shows that, the highest crust, color, taste and odor scores were recorded for the two level of tofu-bread supplements. While among other supplemented materials, better scores were recorded for the low level of all supplements used. Meanwhile, over all acceptability showed similar trend, where by the low level of supplement used gave better score for acceptability.

Table (4): Organoleptic evaluation of balady bread made from wheat flour (82% ex.) fortified with different levels of blends.

Characteristics	Score	Bread samples										L.S.D.
		C	1	2	3	4	5	6	7	8	9	10	0.05
General appearance	20	18	18	16	18	15	18	16	18	16	19	19	0.76
Separation of layers	20	19	19	16	17	14	19	17	18	18	19	19	0.63
Roundness	15	14	14	12	13	13	14	14	14	13	15	14	0.51
Distribution of crumb	15	14	13	12	14	11	13	13	14	12	4	14	0.72
Crust color	10	9	9	8	7	8	9	8	9	7	10	10	0.60
Taste	10	10	9	7	8	7	9	8	9	8	10	10	0.57
Odor	10	10	9	18	8	8	9	9	9	7	10	10	0.50
Overall acceptability	100	94	90	79	85	76	92	85	91	81	97	96	1.20

Sample code C= 100% Wheat flour

1= 90% wheat flour + 10% Barley bran. 6 = 90% wheat flour + 10% soybean hull.
2= 80% wheat flour + 20% Barley bran. 7 = 90% wheat flour + 6% wheat germ.
3= 90% wheat flour + 10% Wheat bran. 8 = 90% wheat flour + 10% wheat germ.
4= 80% wheat flour + 20% Wheat bran 9 = 97% wheat flour + 2.5% Tofu.
5= 95% wheat flour + 5% Soybean hull. 10= 95% wheat flour + 5% Tofu.

Biological effects:

The results of administrated balady bread made from wheat flour (82% Ext.) supplemented with different concentration of some ingredients on rats body weight, feed intake and feed efficiency are recorded in Table 5). It is clear that the wheat germ and wheat bran caused a significant increase in average gain body weight and efficiency compared with normal control.

Table (5): Gain in body weight, feed intake and feed efficiency in rats fed on different diets for (4 weeks).

Group	Gain in body weight (g)	Feed intake (g)	Daily feed Intake (g)	Feed efficiency
Normal control	72	366	13.07	0.20
Diabetic control	21	347	12.39	0.06
90% W.f + 10% B.b	69	351	12.54	0.20
80% W.f + 20% B.b	62	361	12.89	0.17
90% W.f + 10% W.b	79	384	13.71	0.21
80% W.f + 20% W.b	81	388	13.86	0.21
95% W.f + 5% S.h	66	371	13.25	0.18
90% W.f + 10% S.h	73	382	13.64	0.19
95% W.F + 5% W.g	81	370	13.21	0.22
90% W.f + 10% W.g	87	365	13.04	0.24
97.5% W.f + 2.5% T.	68	390	13.93	0.17
95% W.f + 5% T.	71	397	14.18	0.18
L.S.D.	11	23	1.8	0.08

W.b = Wheat bran S.h. = Soybean hull W.g = Wheat germ
T. = Tofu W.f = Wheat flour B.b = Barley bran

Data in Table (6) obviously show that administration of balady bread supplemented with 10% and 20% barley bran caused a significant decrease in serum glucose, total lipids, total cholesterol and triglycerides while caused a significant increase in AST, ALT, serum uric acid and blood urea compared to the control.

Table (6): Means value of serum glucose, cholesterol, triglycerides, total lipids, A.S.T. and A.L.T, uric acid and blood urea in rats fed with different treatment of balady bread.

Group	Blood glucose (mg/dl)	Serum cholesterol (mg/dl)	Serum Trigly-ceride (mg/dl)	Serum total lipids (mg/dl)	Serum A.S.T. U/ml)	Serum A.L.T. (U/ml)	Serum uric acid (mg/dl)	Blood urea (mg/dl)
Normal control	97	115	92	263	27	12	4.3	18.6
Diabetic control	361	256	125	347	48	35	8.5	35.7
90% W.f + 10% B.b	101	130	96	295	36	30	5.9	22.3
80% W.f + 20% B.b	99	122	93	284	35	30	5.2	20.6
90% W.f + 10% W.b	17	195	120	327	32	28	6.7	24.3
80% W.f + 20% W.b	165	182	118	319	33	28	6.1	21.5
95% W.f + 5% S.h	121	149	108	308	40	33	6.2	26.1
90% W.f + 10% S.h	118	141	99	290	40	31	6.2	25.0
95% W.F + 5% W.g	168	205	105	331	36	31	6.5	33.4
90% W.f + 10% W.g	164	190	100	325	34	30	6.4	31.9
97.5% W.f + 2.5% T.	147	155	116	311	38	32	6.9	30.3
95% W.f + 5% T.	141	151	112	301	38	30	6.8	29.7
L.S.D.	4.6	15.8	4.3	42.0	3.8	1.9	1.07	4.35

Generally, it could be concluded that the nutritive value of balady bread can be markedly improved by amendment with some different levels of blends as barley bran, wheat bran, soybean hull, wheat germ and tofu which represent a cheap and good source of fairly high protein, carbohydrate and minerals in human nutrition.

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دراسات تغذوية وريولوجية على بعض انواع الخبز البلدى

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** معهد بحوث تكنولوجيا الاغذية ــ مركز البحوث الزراعية ــ الجيزة.

اجرى هذا البحث بهدف دراسة تأثير القيمة الغذائية للخبز البلدى المدعم بالالياف والمواد الغنية بالبروتين مثل (ردة الشعير ــ ردة القمح ــ جنين القمح ــ قشر فول الصويا والتوفو) لذلك تم تجهيز عشر خلطات وذلك باستخدام النسب التالية من كل من:

١٠ ، ٢٠% ردة شعير وردة القمح.

٥ ، ١٠% قشر فول الصويا وجنين القمح.

٥ر٢ ، ٥% من التوفو.

وتم تقدير الصفات الريولوجية على تلك الخلطات بواسطة الفارينوجراف والاكستنسوجراف.

كذلك تم اجراء الاختبارات الحسية على الخبز الناتج وكذلك التحاليل الكيمائية.

وتم تقدير الاختبارات البيولوجية مثل:

الزيادة فى متوسط وزن الفئران ــ الغذاء المأكول ودرجة الاستفادة منه.

وتم تقدير وظائف الكبد والكلى فى سيرم الدم بعمل التحاليل التالية:

تقدير كل من الكوليسترول ــ الترای جلسريد ــ الليبيدات الكلية ــ حمض اليوريك ــ اليوريا والانزيمات الناقلة لمجموعة الامين.

وقد اظهرت النتائج ما يلى: الخلطات المضاف لها التوفو ادى الى زيادة كل من البروتين ــ الدهون والرماد بينما الخلطات المحتوية على قشر فول الصويا ادت الى زيادة المحتوى من الالياف يتبعها ردة الشعير ثم التوفو.

كما وجد ان نتائج اختبارات الفارينوجراف والاكستنسوجراف اشارت الى زيادة نسبة امتصاص الماء ومدة تكوين العجينة والانسايبية لكل من خلطات ردة الشعير ــ ردة القمح ــ قشر فول الصويا وجنين القمح بينما حدث نقص فى كل من ثبات العجينة والمرونة.

كما اظهرت الاختبارات الحسية ان الخبز الناتج من اضافة كل من التوفو ــ قشر فول الصويا ــ جنين القمح وردة الشعير الى دقيق القمح اعطت درجة عالية من الجودة.

كما اظهرت النتائج ان الخبز المدعم بردة الشعير عند مستوى ١٠ ، ٢٠% اعطى احسن النتائج فى خفض نسبة السكر واليوريا وحمض اليوريك والليبيدات والانزيمات الناقلة لمجموعة الامين فى دم فئران التجارب مقارنة بمجموعة الفئران المريضة بالسكر.