

Effect of barley and oat flours on sensory and biological properties of loaf bread.

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Abstract:The bread is an important staple food consumed all over the world, wheat (*Triticum aestivum*) Strong flour of (72% extraction) was replaced by 10, 15 and 20% barley or oat flour. The results indicated that barley or oat flour had a higher contents of chemical composition than that in wheat flour, lead to decrease wet gluten and gluten index with increasing the replacement level with barley or oat flour. Falling number values of all blends were decreased with increasing oat flour, but increased at levels of 10 and 15% barley flour. Barley or oat flour recorded higher vitamins content thiamin, riboflavin and tocopherol. Minerals contained higher in barley and oat flour than wheat flour by sodium, potassium, Iron and phosphorus, zinc, manganese, calcium and magnesium. The results revealed that total dietary fiber were higher in barley and oat flour in composition than that in wheat flour. Barley was contained the highest amount of B-glucan and followed Oat flour than wheat flour (8.65, 5.67, 0.34). From the results, it could be observed that, total phenolic contents and antioxidant were the higher in barley and oat flour, while decrease in wheat flour. From results showed a real significant differences than the other sensory parameters. On the other hand, there were no significant differences between control pan bread these containing 10 and 15% barley flour, results indicated that there were no significant differences observed for crust color, symmetry of form and texture between control pan bread sample these containing 10% level of barley flour. Generally, it could be concluded that, pan bread produced by using 10 and 15% barley flour or 10% oat flour gave bread loaves with sensory acceptable. Biological experiment was conducted to study the effect of pan bread made from barley or oat flour on 35 male rats with height of cholesterol in the blood. At the end of the experiments, rats with high in cholesterol can feeding with pan bread made from barley and oats to reduce both of cholesterol and blood sugar, because it was high contained of fiber, β -glucan, some minerals, vitamins and natural antioxidants.

Keywords: Barley flour, Oat flour, Wheat flour, Biological properties, Pan bread, Sensory evaluation

INTRODUCTION

Wheat is one of the world largest edible cereal crops (Atwell, 2001). Many

efforts have been carried out to promote the use of composite flours, in which a portion of wheat flour is replaced by locally grown crops, to be used in bread. In a multigrain

approach, the use of other cereals is a recent trend in the baking industry to obtain multiple functional benefits in bakery products (Bhatty,1986).

Barley is widely consumed cereal, because of its dietary and technological properties, barley meals and fractions are now gaining renewed interest as ingredients for the production of functional foods due to its bioactive compounds . Blending of barley with human diets is being intensively studied due to the presence of β -glucan and phenolic compounds which have the potential to lower cholesterol and blood glucose levels (Cavallero *et al.*, 2002). Barley proteins have been recognized as a rich source of the limiting essential amino acids such as, lysine, threonine, methionine and tryptophan, (Newman and Newman, 2006). The interest in barley has increased due to its many beneficial constituents and there is a desire to increase the amount of barley in the human diet. This can be achieved by incorporating barley in bread formula (Charalampopoulos *et al.*, 2002).

Oat (*Avena sativa*) is one of the most adventurous cereal grains for human diet since it contains naturally high amounts of valuable nutrients such as soluble fibers, proteins, unsaturated fatty acids, vitamins, minerals and phytochemical (Flander *et al.*, 2007). Oats protein was characterized by significantly higher proteins content in comparison to wheat flour. Oat grains are good source of β -complex vitamins, and

heart healthy soluble fiber β -glucan. Moreover, it also useful for the control of diabetes and lipid profile. The incorporation of oat in daily diet is not only important from the nutrition stand point, but also for its therapeutic potential (Masood *et al.*, 2008). Oat β -glucan has been showed to lower reduced blood cholesterol. Also, the Food and Drug Administration (FDA) recognized the efficiency of oat β -glucan in reducing the risk of coronary heart disease (McIntosh *et al.*,1991) . Oat grains are rich in lipids with a high content of unsaturated fatty acids (Youngs *et al.*, 1982). Whole oat flour was added to white wheat flour at a replacement of different level to observe the effects of fibers on phenolic compounds, antioxidant capacity, dietary fiber fractions and starch digestibility in vitro. When incorporation level increased, free and bound phenolic and antioxidant capacity increased of cereal products, such bread. Soluble, insoluble and dietary fiber fractions and total minerals also increased (Ragaei *et al.*, 2011). The present study was carried out to investigate the feasibility of replacement wheat flour with different levels from barley or oat flour to produce pan bread.

MATERIALS AND METHODS

Materials

wheat flour (*Triticum aestivum*),was used for pan bread making ,and. Around 50 kg of each product . Hull-less barley grains

(*Hordium vulgare* L.), and oat grains (*Avena sativa*). Around 25 kg of each product was stored in plastic container at (25°C) for further processing.

Methods

The grains of barley were milled by perten laboratory mill 3100 to whole barley meal. Then, sieved through 35-mesh screen to obtain flour (85% extraction rate). Oat grains milled by hammer mill to whole oat flour and sieved through 35-mesh to obtain flour (82 % extraction rate). Different samples of composite flour were prepared by partially substituting of wheat flour by different ratios of Hull-less barley or oat flour. Moisture, ash, crude fiber, lipid, total protein (N \times 5.7), and total carbohydrates (NFE) are given by difference. Vitamins were determined According to A.O.A.C (2000). Minerals (K, Na, Fe, Ca, Cu, Mn, p and Zn) content was estimated using Atomic Absorption (GBC 932/933-England). Total dietary fibers were measured according to the methods described by A.O.A.C. (2000). β -glucan was determined according to the method described by Carr *et al.* (1990).

Wet gluten and gluten index of wheat flour and wheat flour substituted with different levels of barley or oat flour were determined using (glutamic perten instruments AB types 2200 No. 005092, Hudding, Sweden) as according to the following equations, The falling number of different flour samples

was determined by using falling number instruments type 1400 No. 44044 (Perten) according to the methods described in A.A.C.C. (2000). The total phenolic content was determined according A.A.C.C (2000). The total flavonoid content was determined according to Zilic *et al.*, 2012. Free radical scavenging capacity of extracts were determined using the stable DPPH according to Hwang and Dothi (2014). The conventional straight-dough method for pan bread was performed according to the procedure developed by A.A.C.C (2000).

. Sensory evaluation of pan bread .

Pan bread were organoleptically evaluated for their external and internal properties by ten staff members of Food Science and Technology Dept., Fac. of Agric. Ain Shams Univ; according to the method of Lawless and Heymann (1999).

Biological experiment:

Thirty five male albino rats weighting about 170 to 180 g were individually in polypropylene cages under normal healthy conditions in a temperature and relative humidity controlled room at (25°C \pm 2) and 60-65%, respectively for one week fed on normal diet (basal diet)

Statistical analysis:

Data were analyzed by analysis of variance using (ANOVA) is test of significant which used to compare several groups. Means were separated using Duncan's test

at a degree of significance ($p \leq 0.05$) **Gomez and Gomez (1984)**. Statistical analysis were made using the producer of the SPSS software system program (**SPSS, 2000**).

RESULTS AND DISCUSSION

The proximate chemical composition of wheat, barley and oat flour are presented **Table (1)**. The results showed that, no significant differences ($P \leq 0.05$) in moisture content between wheat flour (72% ext.) and barley or oat flour (85 and 82% ext.) respectively. The moisture content ranged from 12.40 to 13.22%. These data are similar with **Salem (2005)**. The oat flour had significantly higher protein content than both of the wheat flour and barley flour. The protein content recorded 15.97, 13.63 and 12.26 % for oat, barley and wheat flour, respectively. The obtained data are in line with **El-Yamlahi and Ouhsine (2013)**, they reported that the protein content of barley flour was 13.74%. Also, the oat flour had significantly higher lipid content than both of the barley flour and wheat flour. The lipid content of wheat flour was 1.21%, but the lipid content of barley flour or oat flour was higher than of the wheat flour, 2.77 or 6.05%, respectively. As in **Table (1)** Oat flour contained the highest ash content 4.16%, followed by barley flour 2.40%. Meanwhile, wheat flour had the lowest ash content being 0.49%. These results are in agreement with **Anderson et al. (1999)**, reported that, the ash content in barley flour was 2.31%. No significant differences could

be noticed in crude fiber between barley flour and oat flour. These results agreed with **Mushtay et al. (2014)**. **Table (1)** shows that the nitrogen free extract (NFE) content of wheat flour was 85.53% is higher than reported by **Zucco et al. (2012)** on wheat flour (Robin Hood). On the other hand, oat flour recorded the lowest NFE, being 68.84%. Also, the obtained results revealed that barley flour which being 76.67%, this value is higher than that reported by **El-karmany et al. (2013)**. From the results in **Table (1)** it could be noticed that, in all vitamins. Barley flour recorded the highest content of thiamine followed by oat flour being 7.0 and 5.7 mg/100 mg respectively. Meanwhile, the wheat flour had the lowest thiamine, being 1.4 mg/100g. The barley flour recorded the highest content of riboflavin 1.53 mg/100g, followed by oat flour which 1.37 mg/100 g. On the other side, wheat flour had the lowest riboflavin content being 0.83 mg/100 g. Barley and oat flour contained 350 and 260% more than wheat flour, respectively for tocopherol. Data in **Table (1)**. noticed that barley flour contained the highest content of potassium (K), phosphorus (P), zinc (Zn) and magnesium (Mg), compared with oat or wheat flour. It was recorded 537.00, 360.00, 3.26 and 107 mg/100g, respectively. On the other hand, oat flour contained the highest content of Na, Fe, Mn and Ca compared with barley or wheat flour, it was recorded 67.00, 5.35,

4.64 and 52.00 mg/100 g, respectively. Wheat flour recorded the lowest content of Na, K, Fe, P, Zn, Mn and Mg. The obtained results confirmed with those obtained by Mekhael (2005) who found that, barley flour contained more amounts of potassium, calcium, sodium, Manganese, and Zinc than wheat flour (82% ext.). The results in **Table (1)**. Total phenolic contents were the higher in barley flour, 12.58 mg gallic acid equivalent (GAE) / gram sample. On the other hand, the total phenolic contents of oat flour than that of wheat flour being 7.78 and 1.13 mg, respectively. **Data in Table (1)** showed that the total flavonoid contents of barley or wheat flour, 0.36 and 0.36 mg, respectively. Meanwhile, oat flour recorded 0.32 mg which, lower than the afore mentioned sample. In conclusion, barley or oat flour had a higher contents of phenolic compounds in comparison with wheat flour. These results are in agreement with Nordkvist et al. (1984), they reported that barley grains contain much greater amounts of phenolic compounds than other cereal grains. The results of antioxidant activity as shown in

Table (1) revealed that barley flour had high antioxidant activity, 97.31 mg. Also, oat flour had high radical scavenging activity on DPPH with value 89.35 mg, whereas wheat flour showed lower DPPH value 55.33 mg. These results are in agreement with obtained by Ragaee et al. (2011) found that, the addition of oat flour to wheat flour at ratio 30 g/100 g, the free and bound phenolic and antioxidant capacity increased.

Results in **Table (1)** showed that, barley flour contained the highest percentage of TDF amount 19% and the oat flour contained 18.9. These results are in accordance with (**Blandino et al., 2013**). Concerning the β -glucan content, results presented in the same **Table (1)** showed that, barley flour contained the highest amount of β -glucan being 8.65% and followed oat flour was recorded 5.67%, while wheat flour which contain 0.34%. These results are in agreement which those obtained by **Henry, (1987)** found that, barley flour contained 9.70% total β -glucan.

Table 1. Chemical composition (vitamins, minerals, dietary fiber, β -glucan, phytochemical and antioxidant activity) of wheat, barley and oat flour (on dry weight basis).

Parameters	Wheat flour (72% ext.)	Barley flour	oat flour
Chemical composition* (%)			
Moisture	12.40 ^a	12.88	13.22
Crude protein	12.26 ^c	13.63	15.97
Lipids	1.21 ^c	2.77	6.05
Ash	0.49 ^c	2.4	4.16
Crude fiber	0.59 ^b	4.53 ^a	4.94

nitrogen free extract	85.53 ^a	76.67 ^b	68.84
Vitamins* (mg/100g)			
Thiamine (vit. B ₁)	1.40 ^b	7.00 ^a	5.70
Riboflavin (vit. B ₂)	0.83 ^b	1.53 ^a	1.37
Tocopherol (vit. E)	0.33 ^b	1.16 ^a	0.86
Minerals (mg/100g)			
Sodium (Na)	36.76	61.19	67.00
Potassium (K)	126.70	537.00	508.00
Iron (Fe)	2.10	4.27	5.35
Copper (Cu)	0.88	0.25	0.34
Phosphorus (P)	117.50	360.00	250.00
Zinc (Zn)	1.89	3.26	2.68
Manganese (Mn)	1.09	2.39	4.64
Calcium (Ca)	38.10	36.60	52.00
Magnesium (Mg)	16.80	107.00	103.70
Dietary fiber (%)			
Total dietary fiber	4.88	19.00	18.90
β-glucan	1.78	2.30	5.67
Phytochemicals*			
Total phenol	1.13	12.58	7.78
Total flavonoids	0.36	0.34	0.34
Antioxidant	55.33	97.31	89.35

obtained results revealed that wheat flour recorded the gluten index being 95.50%. The replacement of wheat flour with 10 and 15% of barley flour caused slightly significantly decreased of gluten index, but these values were decreased for wheat flour samples containing 25 or 30% barley flour. Also, the data presented in **Figure (1)** shown that, recorded between control wheat flour sample and wheat flour sample replacement with 10% oat flour. Oat flour had an identical effect on the percentage of washed gluten, whereas their successively increased contents by 15, 20 and 25% in the blends led to a progressive decrease in the amount of gluten by 6.6, 30.9 and 39.4%, respectively. These results are in harmony

Wet gluten and gluten index values of wheat flour and its blends

with barley and oat flour:

Wet gluten and gluten index of wheat flour and its blends with 10, 15, 20, 25 and 30% of barley or oat flour were determined and the results are presented in **Figure (1)**. Wheat flour showed a high wet gluten content being 31.7%. The gluten index of wheat flour was 95.50%. These results are in the same with Sulieman et al. (2013). The percentage of wet gluten decreased being 29.0, 28.4, 23.4, 19.8 and 16.5 % for wheat flour replacement with 10, 15, 20, 25 and 30% of barley flour, respectively compared with control wheat flour (31.7%). On the other hand, the

respectively. It may be concluded that an appreciable amount of gluten in the flour enriched with as much as 20% of barley product may be sufficient to obtain good-quality baking products (Czubaszek and Sharadzinska, 2005)

with Czubaszek and Sharadzinska (2005). Generally, baking standards require the wheat flour used for bread making to contain at least 25% of wet gluten. In our experiment, an average of 27.1 and 29.6 of wet gluten was recorded for the blends containing 20% barley or 15% oat flour,

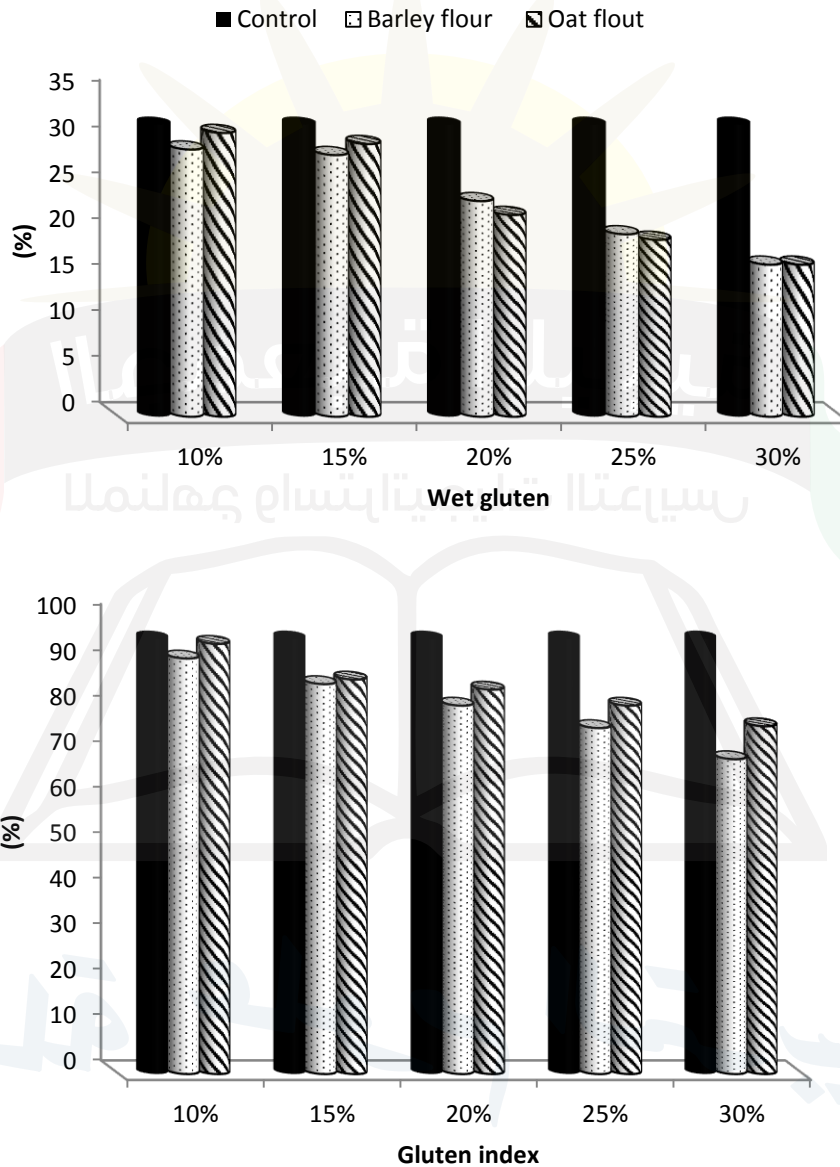


Figure (1). Wet gluten and gluten index of wheat flour and its blends with barley and oat flour

Falling number of wheat flour replacement with different levels of barley and oat flour:

The results illustrated in **Figure (2)** showed that the falling number for wheat, barley and oat flour were 449, 408 and 287 sec, respectively. From the results it could be observed that the activity of α -amylase

enzyme in oat flour is in optimum level. (**Emire and Aaga, 2012**) mentioned that, wheat with falling number below 300 sec. are suspected having some sprout damage. In the same time, wheat and barley flour were lower than oat flour for α -amylase activity (had higher falling number values).

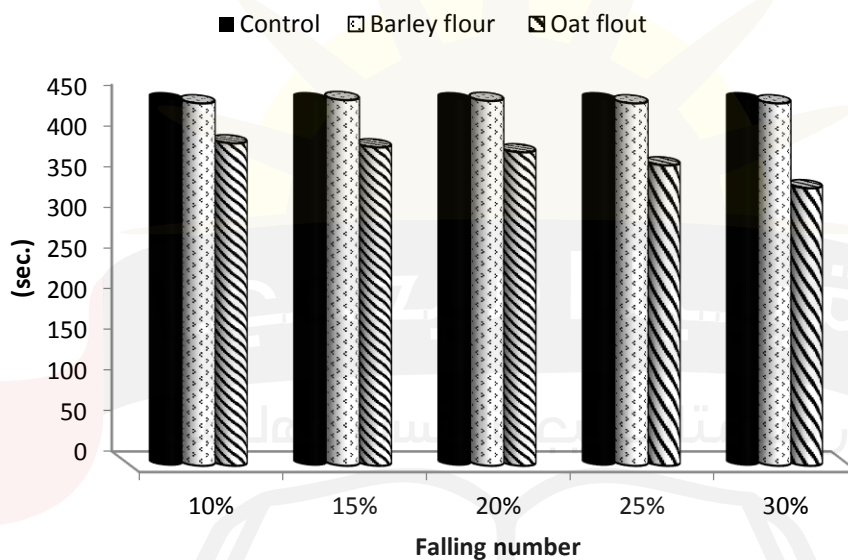


Figure (2): Falling number (sec.) and liquefaction number of wheat flour and its blends with barley and oat flour

No significant differences between control wheat flour and wheat flour replacement with 10, 15, 20, 25 and 30% barley flour in **Figure (2)**. The falling number values were ranged from 445 to 449 sec. for all wheat flour replacement with barley flour. But, a slightly decrease of falling number was noticed when wheat flour replaced with oat flour, falling number of wheat flour, replacement with 10, 15, 20, 25 and 30% oat flour were 396, 391 385, 369 and 341 sec., respectively.

Sensory evaluation of fresh pan bread prepared by replacement of wheat barley or oat flour

The organoleptic properties of pan bread were evaluated to select the best substitution level for produce high quality pan bread. The results in **Table (2)** showed that there were no significant differences in all the organoleptic properties (crust color, summity of grain, crumb color, texture and taste) of produced pan bread between the control sample (WB) and bread sample

continued 10% barley flour (10% BB) except the taste. The obtained results indicated that, there were significant differences between bread control samples (WB) and bread samples contained 20% barley flour (20% BB) for all organoleptic properties.

The results demonstrated that the mean total score values of control bread sample (WB) by using 100% wheat flour was higher than those of other sample and decreased gradually with increasing replacement levels of barley flour. The total score of WB was 93.71, this value decrease about 4.3% for pan bread containing 10% barley flour (10% BB) comparing to WB. Generally, it could be concluded that the pan bread produced by replacement with 10% barley flour (10% BB) gave bread loaves more sensory acceptable rather than the pan bread produced by added 20 %

barley flour . From data in **Table (2)**, it could be seen that with the increase in the level of the oat flour in pan bread making, the all sensory scores of bread decreased. Significant differences in all sensory properties of pan bread between the control samples (WB), 10, 15 and 20% OB could be observed. Some sensory characteristics such as (crust color, summity of form, crumb color, texture and taste) of 10% OB1 was decreased about 5.0, 5.7, 8.6, 10.5 and 13.0%, respectively compared to WB . Generally, it could be concluded that, the pan bread produced by replacement with (10% OB) gave bread loaves acceptable rather than 15% or 20% OB .In contrast to the above, **Czubaszek and Sharadzinska (2005)** reported that, the wheat flour may be replaced with up to 10% of oat products without deteriorating its quality.

Table (2): Sensory characteristics of Pan bread prepared by partial replacement of wheat flour with barley or oat flour:

Pan bread samples	Crust color	Summitry of form	Grain	Texture	Taste	Total score
(100 % wheat flour) Control	18.30	19.01	19.18	18.33	18.40	92.30
90 % W F + 10 % B F(BB)	18.31	18.64	18.31	17.26	17.3	86.93
85 % W F + 15 % B F(BB)	16.92	17.62	17.33	17.23	18.23	88.10
80 % W F + 20 % B F(BB)	15.73	17.20	16.63	18.23	16.70	83.86
90 % W F + 10 % O F(OB)	17.42	17.22	14.88	16.46	18.33	84.70

85 % W F + 15 % O F(OB)	15.07	15.44	13.73	17.23	17.46	90.80
80 % W F + 20 % O F(OB)	11.63	13.65	10.44	16.50	18.30 ^a	88.10

Biological evaluation of barley and oat enriched pan bread in hypercholesterolemic rats.

According to the sensory evaluation of different pan bread samples, are presented in **Table(3)**.The obtained data indicated that the initial body weight of all rats groups were ranged from 171.10 to 180.00g. While, after feeding of hypercholesterolemic diet for six weeks. Followed by feeding on the experimental diet of pan bread for six weeks, the rats of different groups were increased in weight,

but it could be observed that the hypercholesterolemic group which was fed only on hypercholesterolemic diet during all experimental period (plus positive control) had a higher significant differences 272.03g as compared to the group fed only on basal diet 246.16g. The hypercholesterolemic rats were fed on barley or oat pan bread had higher in final body weight than those of healthy rats negative control.

Table (3): Initial body weight, final body weight, body weight gain, feed consumption and feed efficiency of normal control and hypercholesterolemic rats groups fed on prepared pan bread.

Treatments	Initial body weight (g)	Final body weight (g)	Body weight gain(g)	Feed Consumption(g)	Feed efficiency(%)
Negative control	180.00	246.16	66.16	475.20	13.93
Positive control	175.16	272.03	96.87	477.20	20.29
Control pan bread (100% wheat flour)	177.50	268.06	90.56	481.03	18.82
Panbread (90%WF+10%BF)	180.00	256.93	76.93	455.20	16.90
Pan bread(85%WF+15% BF)	176.50	250.33	73.83	445.26	18.58
Pan bread (90%WF+10% OF)	178.46	252.80	74.34	428.63	17.34
Pan bread(85%WF+15% OF)	171.10	243.36	72.26	412.53	17.51

Also, from the same Table, it could be observed that, pan bread which prepared by partial replacement of wheat flour by 15% barley or oat flour significantly increased both of final body weight, body weight gain and feed efficiency, while both of groups which fed on hypercholesterolemic basal diet and the group which fed on diet

containing control pan bread samples were significantly increased both of final body weight, body weight gain, feed consumption and feed efficiency compared with normal control which on basal diet. The decrement of body weight gain may be due to the higher containing of dietary fiber and β -glucan in the diet. These results are

agreement with those reported by Zhou and Erdman (1995) who mentioned that, the fed on fiber had a lower daily gain weight

Serum lipid profile of normal and hypercholesterolemic rats fed on different prepared pan bread diets.

The results in Table (4), it could be noticed that the total lipid and triglyceride were increased in control positive (621.44 mg/dl

and 76.00 mg/dl) than control negative was (434.40 mg/dl and 48.00 mg/dl, respectively). Generally , the groups which fed on hypercholesteroleic diet of pan bread which prepared by partial replacement of wheat flour by 10 and 15% barley or oat flour significantly reduced total lipids and triglycerides level compared to hypercholesterolemic groups.

Table (4). Serum lipid profile of normal and hypercholesterolemic rats fed on different prepared pan bread diets.

Table (36). Serum lipid profile of normal and hypercholesterolemic rats fed on different prepared pan bread diets.

Treatments	Total lipids (mg/dl)	Triglycerids (mg/dl)	Total Cholesterol (mg/dl)	HDL (Mg/dl)	LDL (mg/dl)	vLDL (mg/dl)	Tc/HDL	LDL/HDL	HTR (%)	AI
Negative control (Normal group)	434.40 ^d	48.00 ^c	179.66 ^d	53.00 ^b	117.06 ^d	9.60 ^c	3.38 ^b	2.20 ^b	29.50 ^a	2.38 ^b
Positive control (hypercholstrolmic group)	621.44 ^a	76.00 ^a	284.91 ^a	50.36 ^b	210.35 ^a	15.20 ^a	5.66 ^a	4.17 ^a	17.67 ^c	4.65 ^a
Control pan bread (100 % wheat flour)	428.45 ^e	44.63 ^d	266.32 ^a	57.00 ^a	200.45 ^a	8.92 ^c	4.67 ^a	3.51 ^a	21.40 ^b	3.67 ^a
Pan bread (90%WF+10%BF)	524.80 ^b	64.67 ^b	205.40 ^b	60.33 ^a	132.00 ^c	12.93 ^b	3.40 ^b	2.18 ^b	29.37 ^a	2.40 ^b
Pan bread (85%WF+15%BF)	424.20 ^f	44.37 ^d	199.81 ^c	58.33 ^a	139.33 ^{bc}	8.87 ^c	3.42 ^b	2.38 ^b	29.19 ^a	2.42 ^b
Pan bread (90%WF+10%OF)	509.61 ^c	66.33 ^b	210.00 ^b	58.56 ^a	138.17 ^{bc}	13.26 ^b	3.59 ^b	2.35 ^b	27.88 ^a	2.58 ^b
Pan bread (85%WF+15%OF)	430.70 ^e	51.00 ^c	211.06 ^b	57.66 ^a	148.14 ^{bc}	10.20 ^c	3.66 ^b	2.56 ^b	27.31 ^a	2.66 ^b

* Means followed by different letters in the same column are significantly different by Duncan's multiple test (P<0.05)
WF=Wheat flour, BF-Barley flour, OF= Oat flour

Total lipids decreased about 31.74 and 30.69% for groups which fed on hypercholesterolemic diet of pan bread which prepared by replacement of wheat flour by 15% barley or oat flour, respectively. Also, triglyceride decreased about 41.28 and 32.84% for the same groups compared to positive control, the decrease in total lipids and triglyceride levels in these groups may be due to the

higher dietary fiber and β-glucan content of bread sample compared to control bread sample. These results are in agreement with those reported by El-Fadaly (2015). Whole barley grains and barley containing products are allowed to carry a claim that they reduce the risk of coronary heart B-glucan in barley, these fibers decreases LDL and increases HDL. This finding was consisted with those of several studies

reporting that an increase in the intake of total dietary fiber benefits lipids metabolism in decreased the degree of blood lipids (Behall *et al.*, 2004).

Liver , kidney functions and Blood glucose level (mg/dl) in hyper cholesterolemic rats fed on pan bread diets

The result presented in **Table (5)** . It could be observed that, ALT and AST activities were significantly increased for the hypercholesterolemic control positive

(13.51 and 45.24 U/L), respectively. The liver enzymes activity of the negative control in basal diet rats was 8.37 and 18.57 U/L in plasma. From the same **Table (5)** the results showed that the feeding on hypercholesterolemic diets of pan bread made from wheat flour replacement with 15% barley, ALT and AST were the lowest value 11.0 and 33.40 U/L compared to other groups.

Table (5): Liver , kidney function and Blood glucose level (mg/dl) in hypercholesterolemic rats on pan bread diets.

Treatments	Liver Function		Kidney Function		Blood glucose		Serum glucose (mg/dl)
	ALT	ASL	Urea	Creatinine	Initial period	Final Period	
Negative control (normal group)	8.37	18.57	33.32	0.71	87.37	98.66	
Positive control (positive group)	13.51	45.24	60.21	0.81	81.00	106.66	
100 % WF pan bread (Control)	13.27	46.10	53.29	0.62	84.41	102.23	
Pan bread (90% WF+10% BF)	13.38	33.51	42.62	0.61	84.87	99.00	
Pan bread (85% WF+15% BF)	11.00	33.40	51.30	0.62	90.27	96.33	
Pan bread (90% WF+10%)	12.44	38.13	54.22	0.74	86.55	96.66	

OF)						
Pan bread (85% WF+15% OF)	11.32	37.32	52.27	0.71	87.34	95.33

G1: Negative control,

G5: Pan Bread (85% WF+15%BF)

G2: positive Control,

G6: Pan Bread (90% WF+10%OF)

G3: Control pan bread

G7: Pan Bread (85% WF+15%OF)

G4: Pan Bread (90% WF+10%BF)

Whereas the hypercholesterolemic rats fed on 15% oat flour was from (11.32 and 37.32 U/L) respectively, compared with positive control group. The hypercholesterolemic rats fed on control pan bread made from 100% wheat flour were increased in ALT and AST, these values were 13.27 and 46.10 U/L compared to normal group fed on basal diet. The decrease in results from ALT and AST may be caused the liver conversion into bile acid increases, hepatic pools of free cholesterol decrease and to reach a new steady state, endogenous cholesterol synthesis will increase. The current results showed a significant increase in the level of enzyme activity of serum ALT, AST in rats after induction of hypercholesterolemic, compared with those received basal diet.

From the results in **Table (5)** it could be noticed that urea and creatinine were increased in control positive 60.21 and 0.81 mg/dl than control negative was 33.32 and 0.72 mg/dl, respectively. Moreover, the results observed that the hypercholesterolemic rats fed pan bread made from 10% barley; urea and creatinin were the lowest 42.62 and 0.61 mg/dl than

other groups. Whereas, the hypercholesterolemic rats fed pan bread made from 10% oat was the highest 54.22 and 0.73 mg/dl than other groups of pan bread. These results showed that all groups were fed on pan bread during experimental period, the urea and creatinine were decreased at the end of experimental due to the barley and oat had contained higher fiber amount and antioxidant have been suggested to have a role in protection against disease (**Thompson, 1994**). The results presented in **Table (5)** show the levels of glucose in blood of rats fed on pan bread diets. It could be observed that, the initial level of serum glucose recorded in average 81.00-90.27 mg/dl for all groups. Concerning to the blood glucose level of all groups at end of experimental period, it could be noticed that the positive control was the highest 106.66 mg/dl followed by rats fed on hypercholesterolemic diet of control pan bread was 102.23 mg/dl blood glucose level compared with control group fed only on basal diet. This increase may be due to the increase in serum concentrations of which may be have inhibited glycolysis as mentioned by **Hue et al. (1988)**. The

groups which fed on hypercholesterolemic diet of pan bread sample which prepared by partial replacement of wheat flour with 15% barley flour and 10% oat flour both of them were significant reduced blood glucose level compared to hypercholesterolemic group. The decrease in blood glucose level in pan bread sample which prepared by partial replacement of wheat flour by 15% barley flour or 10% oat flour may be due to the higher dietary fiber and β -glucan content of bread sample compared to control pan bread. These results are in agreement with **Lazaridou and Biliaderis (2007)** they mentioned that the functional properties of β -glucans have always been attributed to their ability to delay carbohydrate digestion and absorption from the gut by increasing the viscosity of the stomach and intestinal contents and forming a protective digestible carbohydrates .

CONCLUSION

Barley and oat flour were incorporated successfully for preparation of value added functional foods like bread. Organoleptic evaluation concluded that bread and moderately desirable up to 10 and 15% replacement of wheat flour with barley flour and 10% oat flour, respectively. Significant increases in protein, ash, crude fat and crude fiber contents with increasing the level of barley or oat flour. The partial replacement of wheat flour with barley or oat flour is not improving the rate of bread staling in

comparison to control sample. Incorporation of barley flour or oat flour in wheat flour increased levels may be to increased the nutritional value from vitamins ,dietary fibers, β -glucan, minerals and antioxidants. Biological experiment was conducted to study the effect of pan bread made from barley or oat flour on 35 male rats with height of cholesterol in the blood. At the end of the experiments, rats with high in cholesterol can feed with pan bread made from barley and oats to reduce both of cholesterol and blood sugar.

REFERENCES

- A.A.C.C. (2000)**. Approved method of the AACC. 10th ed., American Association of Cereal Chemists. Inc. St., Paul, Minnesota, USA.
- Anderson, A.A.M.; Andersson, R; Autio, K. and Aman, P. (1999)**. Chemical composition and micro structure of two naked barleys. J. cereal Sci., 30: 183-191.
- A.O.A.C. (2000)**. Association of Official Analytical Chemists International, William, 17th ed., Gaithersbuy MD, USA.
- Atwell, W.A. (2001)**. Wheat flour. Eagan Press. Handbook Series. St. Paul., Minnesota, USA,p,231-234.
- Behall, K.M.; Scholfield, D.J. and Hallfrisch, J. (2004)**. Lipids significantly reduced by diets containing barley in moderately hypercholesterolemic men. Am J Clin Nutr., 23,55-62.

- Bhatty, R.S. (1986).** Physiochemical and functional (Bread making) properties of hull less barley functions. *Cereal Chem.*, 63(1), 31-35.
- Blandino, M.; Sovrani, V.; Marinaccio, F. and Reyneri, A. (2013).** Nutritional and technological quality of bread enriched with an intermediated pearled wheat fraction. *Food Chem.*, 141, 2549-2557.
- Cavallero, A.; Empilli, S.; Brighenti, F. and Stanca, A.M. (2002).** High (1→3), (1→4) β -glucan barley fractions in bread making and their effects on human glycemic response., *J. Cereal Science*, 36, 59-66.
- Carr, J.; Glatter, S.; Jeraci, and Lewis, B. (1990).** Enzymic determination of β -glucan in cereal based food products. *Cereal Chem.*, 67(3), 226-229.
- Charalampopoutos, D.; Wang, R; Pandiella, S.S. and Webb, C. (2002).** Application of cereals and cereals components in functional foods. *Int. J. Food Microbiol.*, 79, 131-141.
- Czubaszek, A., and Sharadzinska, Z.K. (2005).** Effects of wheat flour supplementation with oat products on dough and bread quality. *Pol. J. Food Nutr. Sci.*, 14(3), 281-286.
- El-Fadaly, S. (2015).** Technological and Biological Studies on some food cereal corps. Ph.D. Thesis, Fac. Of Agric, Mansoura Univ., Egypt. pp, 89-102
- El-Karmany, A.M.; Abo-Ella, M.F. and Hossanein, A.M. (2013).** Production of a new yoghurt like products fortified with some legumes and sweet, cereal crops and its evaluation of fungi load. *J. Food and Dairy Sci.*, Mansoura Univ., Vol. 4(4): 133-148
- El-Yamlahi, A. and Ouhssine, M. (2013).** Utilization of barley (*Hordeum vulgare* L.) flour with common wheat (*Triticum aestivum* L.) flour in bread-making. *Annals of Biological Research*, 4(2), 119-129.
- Flander, L.; Samenkallio-Marttia, M.; Suvotti, T., and Autio, K. (2007).** Optimization of ingredients and baking process for improved whole meal oat bread quality. *LWI*, 40, 860-870.
- Gomez, K.A. and Gomez, A.A. (1984).** Statistical procedure for agriculture research. John Willy Amd. Soncinic. U.S.A.
- Henry, R.J. (1987).** Pentosans and (1→3), (1→4) β -glucan concentrations in endosperm and whole grain of wheat, barley, oats and rye. *Journal of Cereal Science*, 6, 253 - 258.
- Hue, L.; Maisin, L. and Rider, M.H. (1988).** Palmitate inhibits glycolysis. Involvement of Fructose 2.6-biphosphate in the glucose/ Fatty acid cycle. *Biochem, J.* 541-545.
- Hwang, E.S. and Dothi, N. (2014).** Effect of extraction and processing methods on antioxidant compound contents and radical

- scavenging activities of laver (*Porphyra tenera*). Preventive Nutrition and Food Science, 19, 40-48.
- Lawless, H. and Heymann, H. (1999).** Sensory syrup in baking and confectionery, Pak. J. Nutr., Evaluation of Food: Principles and Practices, 11(8), 688-695.
- Lazaridou, A. and Biliaderis, C.G. (2007).** Molecular aspects of cereal β -glucan functionality: physical properties, technological applications and physiological effects, Journal of Cereal Science, 46 (2), 101-118.
- Massod, S.B.; Muhammad, T.; Muhammad, K.I.K.; Rabia, S. and Mehmood, S.B. (2008).** Oat: unique among the cereals. Eur. J. Nutr., 47, 68-79.
- McIntosh, G.H., Whyte, J.; Mc-Arthur, R. and Nestel, P.J. (1991).** Barley and oat foods: influence on Plasma cholesterol concentrations in hypercholesterolemic men., Am. J. Clin. Nutr. 53, 1205-1209.
- Mekhael, E.K. (2005).** 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, p.56
- Mushtay, A.; Zaffar, G.Z.A. and Habib, M. (2014).** A review on oat (*Avena sativa* L.) as a dual-purpose crop. Academic Journal, 9(4): 52-58.
- Newman, C.W. and Newman, R.K. (2006).** A brief history of barley food. Cereal Foods World. 51, 4-7.
- Nordkvist, E.; Salomonson, A.C. and Aman, P. (1984).** Distribution of insoluble bound phenolic acids in barley grain. Journal of Science Food and Agriculture, 35, 657-661.
- Ragae, S., Guzar, I., Dholl, N. and Seetharoman, K. (2011).** Effects of fiber addition on antioxidant capacity and nutritional quality of wheat bread. Food Science and Technology, 44(10), 2147-2153.
- Salem, E.M. (2005).** Quality attributes of macaroni substituted with barley meal. Egyptian J. of Nutr., 20(2), 25-43.
- SPSS (2000).** Statistical package for social sciences .spss for windows, version 19, SPSS Inc., Chicago, IL., USA.
- Suliman, A.E.; Sinada, E.A. and Ali, A.O. (2013).** Quality characteristics of wheat bread supplemented with chickpea (*Cicer arietinum*) flour. Int. J. Food Sci. Nut. Eng., 3(5), 85-90.
- Thompson, L.U. (1994).** Antioxidants and hormone-mediated health benefits of whole grains. Crit. Rev. Food Sci. Nutr, 34 , 473-497.
- Youngs, V.L., Peterson, D.M. and Brown, C.M. (1982).** Oats In: Advances in Cereal Science and Technology, Vol., pp. 49-105.

Zhou, J.R. and Erdman, J.W. (1995). Phytic acid in health and disease. Crit. Rev. Food Sci. Nutr., 35,495-508.

Zilic, S.; Serpen, A.; Akillioglu, G.; Jankovic, M. and Gokmen, V. (2012). Distributions of phenolic compounds. Yellow pigments and oxidative enzymes in wheat grains and their relation to antioxidant capacity of bran and dehranned flour. Journal of Cereal Science, 56: 652-658.

Zucco, F.; Borsuk, Y. and Arntifeld, S.D.A. (2012). Physical and nutritional evaluation of wheat cookies supplemented with pulse flours of different particle sizes. J. Food Sci., Technol., 44(10): 2070-2076.

Emire, S.A. and Aaga, M. (2012). Value added product development and quality characterization of amarath (*Amavanthus coudatus* L.) grown in East Africa. African Journal of Food Science and Technology., 3(6),129-141.