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# THE NUTRITIVE AND THERAPEUTIC VALUES OF BARLEY BREAD

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## ABSTRACT

In this work the bread produced from wheat, barley flours and wheat/barley flour blends were evaluated from nutritional, therapeutic, technological and organoleptical stand points. Results revealed that, the addition of 50% barley flour; normal and gelatinized (40% and 10% respectively) to wheat flour 82% extraction gave : 1) Bread of high nutritive value (Protein, corbohydrates and total caloric values of 14%, 80% and 390.7 cal. / 100 gm. Respectively). 2) Bread of high theropeutic functionality (15.5% dietary fibers and 5.8% B- glucan), compared with wheat bread. 3) Produced bread which has high techological and organoleptical properties. Therefore we advice to use this bread in therapy of diebitics and deseases of blood artery clots due to high cholesterol and triglycerides in human serum blood.

## INTRODUCTION

To fullfil world expanding requirement for food, especially developing countries, can only be met by increasing the use of local grains such as barley. Consumption of barley in food now incloudes flour for bread are quite limited. Study of the composition and functional properties of barley fractions should indicate new food uses (Matthews and Douglass, 1978). Barley now gaining renewed intrest as a food component because of its soluble dietary fiber and B-glucan. Compared with other cereals, barley has relatively high levels of B-glucan of 2-11 gm./100 gm (on dray weight baisis) (Mac Gregor and Fincher 1993). Hulled barley may tipically contain 3-7% -B- glucan (Aman and Graham1987) and hull-less barley as much as 16% (Newman *et, al* 1989). Knuxkles, *et, al.*, (1992) reported that dry milling and sieving of barley and Oat produced fractions that were enriched in B-glucan. They also mentioned that the dehulled barley contained 7.2, 2.5 and 4.8% for total, insoluble and soluble B-glucan respectively. They found that water soluble B-glucan ranged from 55-70% of total B-glucan in tested barley. The ratio of soluble dietay fiber (SDF) to total dietary fiber (TDF) in barley 1 : 3. Barley flour had higher ash 1.8%, ethar extract 2.5%, B- glucan 4.5%, TDF 8.7%, SDF 2.7% and insoluble dietary fiber 4.7% than wheat flour, (Bhatty 1993). Faqir and Ali (1991) studied proximate composition of some barley lines and found that the protein content ranged from 11.72 to 15.87%, fat content from 2.20 to 3.99%, ash content from 2.29 to 2.68 and fiber content from 4.68 to 6.05%.

Mixed linked (1→3), (1→4) B-glucan enriched bread was shown to be useful for reducing serum cholesterol levels in hypercholesterolemic rats and the effect survived the baking process (Klopfenstein and Hoseney, 1987). Beta glucan enriched bread could be useful in dietary control of blood cholesterol levels and human glycemic control. (Symons and Brennan (2004).

By icorporating barley at suitable levels, it is possible to formulate breads that could be efficient for the theropeutic needs of various patients population such as diabetics and persons suffering from coronary heart disease or disorders with impaired carbohydrate / lipid metabolism. (Uroog *et, al.* 1998). Due to the nutritive quilities of barley, it affects human health and possibe use as functional foods, and due to the high production of barley grain in Egypt; 1.274 million arddab (153000 ton) produced from 121300 feddan (Minestry of Agriculture 2004). This research aims to ;

1) decreasing importing of wheat and wheat flour for supporting national economy by using of local barley in production of bread.
2) making balady bread using barley with wheat flours in order to improve nutritional and functional properties of bread.

## MATERIAL AND METHODS

**1- Materials :**

5 Kg husked barley grain variety Giza 2000 and 5 Kg naked barley grain variety Giza 129 were provided by barley research section-crops research. Institute - ARC - Giza. Also 5 Kg wheat kernels variety Giza 168 obtained from wheat research section-Crops Research institute ARC - Giza, Egypt.

**2- Methods :**

1- The cleaned husked and naked barley grains were not tempered before ground using a laboratory mill (Model 3100 which is a hummer type mill), equiped with 0.450 mm screen. (70% extration).
2- Wheat kernels were cleaned, conditioned to (14%moisture 24 hr.) then milled in quadramat senior laboratory mill and the flour was prepared at 82% extraction rate.
3- Every kind of barley flour and wheat flour was kept separately in closed containors at 3 - 5C° through this study.

**3- Analitical Methods**

Analitical methods were conducted on husked barley flour, naked barley flour, wheat flour and produced bread to determined.

Moisture, protein (N×5.7 for wheat and N×5.83 for barley), oil, fiber and ash by methods AO AC 1995. Soluble dietary fiber (SDF) and insoluble dietary fiber (IDF) were quantitively estimated by enzemdtic gravimetric procedures of Prosky *et al.*, (1988) and methods AOAC (1995). Total carbohydrate were calculated by difference. B-glucan (soluble, insoluble) was determined according to methods discribed by Carr *et, al.* (1990).

**4- Technological Methods**

**A) Gilatinization of barley flour :**

Barley flour was slurried in water at concentration of 15%. The flour slurry was heated at 100 C° for 30 min. With continuous stirring until gelatinization of starch granules was complete. The gelatinized barley was then dehydrated using ethanol and acetone successively.

**B) Preparation of wheat / barley flour mixtures.**

The wheat / barley flour mixtures were prepared as discribed in table (A) for producing balady bread

**Table (A) wheat flour mixtures ratio with barley without or with pregelatinized barley flour for producing balady bread.**

| No. Samples | Wheat flour% | Husked barley flour% | Naked barley flour% | Pregilotinized husked barley flour % | Pregelatinized Naked barley flour % |
|---|---|---|---|---|---|
| 1 | 100 | - | - | - | - |
| 2 | - | 100 | - | - | - |
| 3 | - | - | 100 | - | - |
| 4 | 50 | 50 | - | - | - |
| 5 | 50 | - | 50 | - | - |
| 6 | 50 | 40 | - | 10 | - |
| 7 | 50 | 40 | - | - | 10 |

**C) Preparation of balady bread.**

Balady bread was prepared by mixing 100 gm. Flour with other ingridient 1.0 gm. compressed yeast, 1.0 gm. sodium choloride and 70-75% water. The mixture was well mixed in mixer (250rpm) for 20 min. The dough was left for fermentation at 30 C° and 85% relative humidity for 15 min. After fermentation the dough was dvided 160 gm. pieces. Each piece was molded on wooden board previously covered with fine layer of bran and left to ferment about 15 min. At the some mentioned temperature and relative humidity. The fermented dough pieces were then flattened to about 20 cm. diameter. The flattened loaves were proved at 30 – 33 C° and 85% relative humidity for one hour, then baked at 450 – 500 C° for 1 – 2 min. in electric oven. Bread loaves were allowed to cool on racks for about one hour before organoleptical evaluation (Attia 1986).

**D) Organoleptic evaluation of produced bread.**

Bread quality parameters were evaluated. Fifteen staff members of food technology Inst. Carried out the test after one hour of baking for freshness (20), layer separation (10), crust color (10), crumb color (10), crumb distribution (20), Oder (10) and taste (20) with total scores (100).

**5- Energy calories of produced bread**

Energy value was calculated by multiplying protein and carbohydrates percentage by 4.0 and fat percentage by 9.0 .

## RESULTS AND DISCUSION

Barley is one of the important cereal grains it's importance increased much nowadays because of containing dietary fibers and B- glucans higher than any cereal grean. These components decrease cholesterol and glucose of human serum blood. Moreover these comopounds improved quality properties in bread products. The B-glucan in addition to it's therapeutic

function emulsifye fats possess and hydrocollids properties, hence it improve sensory properties and freshness in bread containing barley flour.

**Table (1) Chemical composition of wheat, husked and naked barley flours ( %, dry weight )**

| Samples | Moisture | protein | Oil | Ash | Crude fiber | Tatal corbohy-drates |
|---|---|---|---|---|---|---|
| Wheat flour 82% ext. | 10.9 | 11.5 | 1.8 | 1.1 | 1.5 | 84.1 |
| Husked barley flour | 8.3 | 14.2 | 2.5 | 2.3 | 2.7 | 78.3 |
| Noked barley flour | 8.6 | 11.9 | 2.0 | 1.5 | 1.6 | 83.0 |

**Values were means of 3 replicates.**

From table ( 1 ) it may be said that there is abvious differences in moisture content in wheat flour and barley both husked and naked barley (10.9, 8.3 and 8.6%) in wheat, husked and naked barley flour respectively. This phenomenon in moisture distribution may be due to the function of protein and starch granules structures; in wheat the systimized protein structure with the starch granules premit more absorption of water in the flour. In barley the protein is attached with starch granules without a systimized arrangment, which hinder the regular absorption of water in flour. Protein content in husked barley is higher than both wheat and naked barley flours 14.2, 11.5 and 11.9% respectively. The higher protein content in husked barley may be due to the thicker alurone layers in the kernels of husked barley. Concerning oil content it is observed that the husked barley flour has also higher content compared with wheat and naked barley flours. This may be due to the larger weight of the germ in husked barley. Ash and crude fiber of husked barley flour are higher than wheat and naked barley flours (2.3, 2.7), (1.1, 1.5) and (1.5, 1.6 ) respectively. This may be due to the higher minerals and fibers in husked barley. As it known there is a negative correlation between protein and carbohydrates content, therefore the husked barley flour gave the lowest carbohydrate content ( 77.37% ).

Regarding table (2) we find that soluble fiber content in HBF and NBF are higher than in wheat flour ( 5.0, 4.7 and 2.3% respectively). It was found also that NBF and HBF were higher in soluble B- glucan content than wheat flour (5.6, 4.6 and 1.7% respectively). Since it was found from previous research–work that soluble dietary fiber decreas the serum glucose, while soluble B- glucan lowers serum cholesterol (Kahlon and Wood Ruff 2003). Therefore it is advised to use barley flour (HBF and NBF) especially the first one in humen foods especially bread.

**Table ( 2 ) Dietary fiber and B- glucans content ( %, dry weight, basis)**

| Samples | Dietary fiber | | | B – glucans | | |
|---|---|---|---|---|---|---|
| | Total | Soluble | in soluble | Total | Soluble | In Soluble |
| Wheat flour 82% ext (wf) | 10.8 | 2.3 | 8 5 | 3.5 | 1.7 | 1.8 |
| Husked barley flour (HBF) | 18.6 | 5.0 | 13 6 | 8.9 | 4.6 | 4.3 |
| Naked barley flour (NBF) | 12.7 | 4.7 | 8 0 | 10.4 | 5.6 | 4.8 |

**Values were means of 3 replicates**

From table (3) it may be observed that the baked loaves of wheat flour (WF) 82% extraction, husked barley flour (HBF) and Naked barley flour (NBF) behaved in the same trend, concerning chemical components, as in wheat flour, husked and naked barley flours as mentioned in table (1).

**Table (3) chemical composition of produced bread from wheat or / and barley floura blends (on d.w.b.).**

| M | Samples | Mosture | Protein | Oil | Ash | Crude fiber | Total carbohy-drates | Total Calories |
|---|---|---|---|---|---|---|---|---|
| 1 | Wf 82% extr | 9.9 | 12.3 | 1.2 | 1.2 | 1.8 | 83.5 | 394.0 |
| 2 | HBF | 7.8 | 15.9 | 1.8 | 2.5 | 3.8 | 76.8 | 387.0 |
| 3 | NBF | 7.5 | 13 1 | 1.5 | 1.8 | 2.0 | 81.6 | 392.3 |
| | Treatments: | | | | | | | |
| 4 | 50%WF+ 50% HBF | 9.0 | 14 2 | 1.6 | 1.9 | 2.5 | 79.8 | 390.4 |
| 5 | 50%WF+ 50% NBF | 8.8 | 13.0 | 1.3 | 1.6 | 2.0 | 82.1 | 392.1 |
| 6 | 50%WF+ 40%HBF+ 10%GHBF | 10.0 | 14.3 | 1.5 | 1.8 | 2.4 | 80.0 | 390.7 |
| 7 | 05%WF+ 40%NBF+ 10%GHBF | 9.8 | 13 2 | 1.3 | 1.5 | 1.9 | 82.4 | 394.1 |

**Values were means of 3 replicates**
**WF = wheat flour, HBF = Husked barley flour, NBF = Naked barley flour, GHBF = Gelatinized husked barley flour and GNBF = Gelatinized Naked barley flour.**

When treatments were composed from 50% wheat flour and 50% of HBF or 50% wheat flour and 50% NBF repetively it is obvious that the first treatment (50% WF + 50% HBF) was the superior treatment concerning the nutritional effect because of the increase of protein content, oil, ash and fibers. In the some time the decrease of corbohydrates and calories in this treatment gave it superiority for diabetics. When the treatment of 50% WF + 40% HBF + 10% glelatinized husked barley flour (GHBF) was used it was also superior than the other treatments. It is more superior than the ungelatinized treatment because it has more decrease in calorific value.

From table (4) it was found that the best treatment which lead to the most favorable technological, organolyptical and nutritional values in produced bread were treatments no. 6 and 7 which contain soluble fibers 4.5% and 4.4% respectively, in the some time it contained the highest value of soluble B- glucan 2.4% and 2.5% compared with the control. This means that the increase in soluble fibers in treatments 6 and 7 were 180 and 176% respectively, also soluble B- glucan was increased by 218, and 227% compared with the control (Wheat bread).

These findings show that the bread produced from treaments 6 and 7 have intresting amount of bioactive compounds (dietary fiber and B- glucan), therefore it concidered to be desirable for human consumption due to reported health benefits (Per Aman, *et, al.* 2004). Total dietary fiber (TDF) (15.5, 12.5%) and B- glucan (5.8, 5.9%) contents in treatment of bread 6 and 7 much higher than wheat bread (control) 11.3, 2.8% respetively. These characteristics meet the FDA requirements of 5 gm. TDF and 0.75gm. of

B- glucan per serving) which could allow this bread to deserve the health claims "good source of dietary fiber" and may reduce the risk of heart disease (FDA 1998).

**Table ( 4 ) Dietary fiber and B- glucan contents of produced bread from wheat or / and barley flour blends. (% d.w.b.)**

| M | Samples | Dietary fiber | | | B- glucans | | |
|---|---|---|---|---|---|---|---|
| | | Total | Soluble | insoluble | Total | Soluble | insoluble |
| 1 | WF 82%extr | 11.3 | 2.5 | 8.8 | 2.8 | 1.1 | 1.7 |
| 2 | HBF | 19.1 | 5.7 | 13.4 | 8.2 | 3.8 | 4.4 |
| 3 | NBF | 13.2 | 5.6 | 7.6 | 9.1 | 4.3 | 4.8 |
| | Treatments | | | | | | |
| 4 | 50%WF+50%HBF | 15.4 | 4.3 | 11.3 | 5.6 | 2.1 | 3.5 |
| 5 | 50WF+50%NBF | 12.3 | 4.2 | 8.3 | 5.7 | 2.2 | 3.5 |
| 6 | 50%WF+40%HBF+10% HBF | 15.5 | 4.5 | 11.4 | 5.8 | 2.4 | 3.4 |
| 7 | 50%WF+40%NBF+10%GNBF | 12.5 | 4.4 | 8.5 | 5.9 | 2.5 | 3.4 |

**Values were means of 3 replicates.**
**WF = Wheat flour, HBF = Husked barley flour, NBF = Naked barley flour, GHBF = Gelatinized husked barley flour, and GNBF = Gelatinized Naked barley flour**

Actual the FDA has authorised a health claim for B- glucan from oat and psyllium products only (FDA 1998). However many recent studies have shown that barley B- glucan has similar or even greater physiological benefits (Marconi, *et, al.* 2000).

Actual, it may be concluded that treatment no. 6 and 7 have the best effect on technological, orgonoleptical and nutritional values which was due to the gelatinization treatment of 10% HBF and NBF. Moreover the most important effect was the highest efficiency of soluble fiber and soluble B-glucan in the treatments of diabetics since it permit the free action of these components in lowering cholesterol glucose of human serum.

From table (5) it is clear that there is agreat difference between the bread which is produced from wheat flour 82% extraction and bread produced from both barley flours (HBF and NBF). All organoleptic properties of wheat bread were superior than of Husked and naked barley bread. The superiority was very great as reflected from total score (90, 53, and 57) for wheat, husked and naked barely bread respectively.

The unique exception was in freshness in which HBF and NBF bread was superior than wheat bread (18, 17, and 15 score respectively). When we consider the treatments 4 and 5 in which 50% of HBF and NBF were added to 50% of wheat flour there was a clear improvement in crumb color and crumb distribution, morever in Odor and taste. This improvement was reflected on total scores (90, 68 and 73 in (WF), (WF + HBF) and (WF + NBF) bread respectively). Moreover in treatments 6 and 7 where wheat flour was treated with 40% HBF + 10% GHBF, and 40% NBF + 10% GNBF the improvement was much obvious; total score were 86, and 83 as compared with wheat bread.

The above results may be interpreted on the light of the distribution of protein and starch each of the mentioned flours and breads to which soluble dietary fibers and soluble B-glucan were attached. The most distinguished result in this research is the high rlease of dietary fiber which decrease serum

glucose and B-glucan which lowers serum cholesterol for diabetics and the formation of clots in heart arteries. This release is due to the increased fragility of strong structure of starch granules by gelatinization.

**Table (5) organoleptic properties of bread produced from wheat or / and barley flours.**

| No. | Samples | Fresh-ness | Layer separ-ation | Crust color | Crumb color | Crumb distri-btion | Odor | Taste | Total scores |
|---|---|---|---|---|---|---|---|---|---|
| | | 20 | 10 | 10 | 10 | 20 | 10 | 20 | |
| 1 | WF 82% ext. (control) | 15 | 10 | 10 | 10 | 18 | 9 | 18 | 90 |
| 2 | HBF | 18 | 4 | 4 | 4 | 8 | 5 | 10 | 53 |
| 3 | NBF | 17 | 5 | 5 | 5 | 7 | 6 | 12 | 57 |
| | Treatments | | | | | | | | |
| 4 | 50% WF + 50% HBF | 16 | 6 | 5 | 6 | 15 | 7 | 15 | 68 |
| 5 | 50%WF + 50% NBF | 15 | 7 | 6 | 7 | 14 | 8 | 16 | 73 |
| 6 | 50% WF + 40% HBF + 10% GHBF | 18 | 9 | 7 | 8 | 18 | 8 | 18 | 86 |
| 7 | 50% WF 40% NBF + 10% GNBF | 18 | 6 | 8 | 9 | 15 | 9 | 18 | 83 |

**Values were means of 3 replicates.**
**WF = Wheat flour, HBF = Husked barley flour, NBF = Naked barley flour, GHBF = Gelatinized husked barley flour, and GNBF = Gelatinized Naked barley flour**

## CONCLUSION

From this Researh it could be suggested that we can produce bread with high nutritive value (14.3% protein, 1.5% fat, 1.8% Ash, 80% total carbohydrates, 390.7% cal. / 100 gm.) and good therapeutic functionality (TDF 15.5% and B- glucan 5.8%) by supplementation of wheat flour 82% extr. With 50% barley flour (40% HBFor NBF + 10% GHBF or GNBF). Morever it has good technological and organoleptic properties.

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# القيمة الغذائية والعلاجية لخبز الشعير

السيد عباس مبارك – عبد المنعم صالح إبراهيم الشاذلي
معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية – الجيزة .

في هذا البحث تم تقييم الخبز الناتج من كل من دقيق القمح ودقيق الشعير والناتج من خلطات من دقيق القمح والشعير من ناحية القيمة الغذائية والعلاجية والتكنولوجية وصفات الجودة .

**وكانت نتائج الدراسة :**

١- الخبز الناتج من إضافة ٥٠% دقيق شعير إلى دقيق القمح ٨٢% استخراج (٤٠% دقيق شعير عاري + ١٠% دقيق شعير مجلتن) ذو قيمة غذائية عالية احتوى على ١٤% بروتين ، ٨٠% كربوهيدرات ، ٣٩٠,٧ كيلو كالورى / ١٠٠ جم خبز .

٢- الخبز السابق الإشارة إليه له قيمة علاجية عالية حيث احتوى على ألياف غذائية بنسبة ١٥,٥% وبيتا جلوكان بنسبة ٥,٨% .

٣- الخبز السابق الإشارة إليه أيضاً كانت له خواص تكنولوجية وحسية عالية ولهذا نوحي باستخدام هذا الخبز في علاج مرض السكر ومرض جلطات الدم الناتجة عن زيادة نسبة الكوليستيرول والجلسريدات الثلاثية في سيرم الدم .