Journal of Home Economics
Volume 30, Number (1), 2020
http://homeEcon.menofia.edu.eg
Journal of Home Economics
ISSN 1110-2578

Quality of Bread Fortified with Some Cereals Mixture

Laila A. El-Bedewy, Emad M. El-Kholie , Amina El-Sayed Teer El-Bar
Nutrition and Food Science Depart, Faculty of Home Economics, Menoufia University

Abstract:

This study aims to find out the rehological and physico-chemical properties of wheat, quinoa and barley flours. Baladi bread prepared with different concentrations (10% and 20%) of quinoa and barley flour. Determination of chemical composition of cereals and fortified bread, and study the effect of storage conditions like freezing on the sensory properties of the produced bread carried out. The results showed that wheat flour contained the highest value of protein and carbohydrates, which were 14.20% and 74.49%, respectively. But, quinoa flour contained the highest values of fat and ash, which were 8.69% and 3.69%, respectively. While dietary fiber reached 3.17% in barley flour. There was no difference between the types of flour in rehological properties. No significant difference was observed in fortified bread for protein content. The fortified bread with 10% and 20% quinoa flour recorded a high level of fat and calories which were 3.24%, 400.52 (Kcal/100g), 3.40% and 400.40 (Kcal/100g), respectively. While the fortified bread with 10% and 20% barley flour contained the highest level in both fiber and ash recording 6.93%, 1.35%, 8.07% and 1.57%. The nutritional value of bread decreased as a result of freezing. It is noticeable that with increasing reinforcement, the bread yield and the total baking loss increased. As conclusion, bread prepared with 10% and 20 % quinoa and barely flour recorded the high nutritional value and quality properties.

Key words: Quinoa, Barley, Baladi bread, Fortified bread and Quality.

Introduction

The major nutritional problem in most of the developing world countries is protein-energy malnutrition. This acute problem is due to factors such as high birth rates, insufficiencies of agricultural products and a limited supply of high-quality proteins. Therefore, identification of inexpensive high protein materials is an important task in these countries such materials would be able to improve and upgrade the nutritional quality of the diets and the health of the people **(Mubarak, 2001)**.

In comparison with meat, plant protein is much economical to produce, but when used as a source of dietary protein for humans and mono-gastric livestock, most plant proteins are nutritionally incomplete due to their deficiency in several essential amino acids. Deficiency in certain amino acids reduces the availability of others present in abundance. In general, cereal proteins are low in lysine (1.5-4.5 vs 5.5% of WHO recommendation), tryptophan 0.8-2.0% vs. 1.0% and thronine 2.7-3.9% vs 4.0% deficient the essential amino acids became the limiting amino acids in cereals. It is thus of economic and nutritional significance to enhance the essential amino acids in plant proteins **(Bicar *et al*., 2008).**

Serna, (2003) reported that cereal based foods are by far the major source of energy, protein, B vitamins, and minerals for the world population. In most countries, diets have a single cereal as the primary staple. The most widely used cereals are rice, wheat, and maize, which provide 93% of the total cereal calories. These grains constitute the main staple food for Asia, Europe, and America, respectively. In Africa and India, sorghum and millets are widely grown and consumed According to FAO, the amount and proportion of food energy and protein provided by cereals in human diets in 1997 were 1384 kcal (5796 kJ), nearly 50% of the average per capita caloric intake. Likewise, cereals provided 33.8 g of protein of the total estimated daily intake of 73.9 g of protein.

Quinoa flour has also been used to strengthen WF and there are many examples of this, QF substitution in wheat bread (25g/100g) showed small depreciation in bread quality in terms of loaf, volume, crumb firmness, and acceptability, whereas the nutritional value increased in dietary fiber, minerals, protein and healthy fats **(Iglesias *et al*., 2015).**

Now, BF can be mixed with WF to provide baladi bread that is acceptable to the consumer by 15 and 30%. There is also a better quality of unified WF compared to Zero WF, which was mixed with barley flours, produced a better overall bread quality that was acceptable to the consumer. **(Ereifej, 2005)**

Wheat:

Pawan, (2011) showed that wheat provides nearly 55% of carbohydrate and 20% of the food calories. It contains carbohydrate 78.10%, protein 14.70%, fat 2.10%, minerals 2.10% and considerable proportions of vitamins (thiamine and other B vitamins) and minerals (zinc, iron).Wheat is also a good source of traces minerals like selenium and magnesium, nutrients essential to good health. Wheat grain precisely known as caryopsis consists of pericarp or fruit and the true seed. In the endosperm of the seed, about 72% of the protein is stored, which forms 8-15% of total protein per grain weight. Wheat grains are also rich in pantothenic acid, riboflavin and some minerals, sugars etc. The bran, which consists of pericarp testa and aleurone, is also a dietary source for fiber, potassium, phosphorus, magnesium, calcium, and niacin in small quantities.

Quinoa:

Koziol (1991) reported that quinoa contains 14.6% protein D/W. This protein is of an exceptionally high quality and is particularly rich in histidine and lysine (3.2 and 6.1% of protein composition, respectively). Raw debittered quinoa shows PER values 78-93% those of casein, and when cooked its PER values can reach 102-105% those of casein. The albumins + globulins are the major protein fraction of quinoa (44-77% of total protein) and a low percentage of prolamins (OS-7.0%) indicates that quinoa may be free of gluten. The fat content of quinoa is 5.6% D/W with the essential fatty acids, linoleic and a-linolenic acids, accounting for 55-63% of the lipid fraction. Quinoa oil is particularly stable due to relatively high concentrations of natural antioxidants, namely 690-754 ppm of a- tocopherol and 760-930 ppm of y-tocopherol in the raw oil, falling to 450 and 230 ppm, respectively, in the refined oil. Given the high quality of its oil, and the fact that some varieties show fat concentrations up to 9.5%, quinoa could be considered as a potentially valuable new oil crop. Starch accounts for 52-60% of grain weight, but the amylose content of this starch is low, 11-12%. The majority of the starch granules are between 0.7 and 3.2 pm, but unlike other small granules starches such as rice, quinoa initiates gelatinization at a much lower temperature (about 58°C). Polyamine concentrations in quinoa at 2218-2690 nmol/g fresh D/W may contribute to, but are unlikely to be solely responsible for, its "earthy" taste. On the basis of 100g D/W, quinoa has more riboflavin (0.39mg), a-tocopherol (5.37mg), and carotenes (0.39mg) than barley, rice, or wheat, but only a fifth as much niacin (1.06mg). In terms of a 100-g edible portion, quinoa supplies 0.20 mg B6 (10% of RDA), 0.61 mg pantothenic acid (9-15% RDA), 23.5 pg folic acid (12% RDA), and 7.1 pg biotin (7-24% RDA); other vitamins are present at levels below 10% RDA. On the basis of 1 kg wt, quinoa has more Ca (1487mg), Fe(132mg), K (9267 mg), Mg (2496 mg), Cu (51 mg), MN (100 mg) and Cl- (1533 mg) than other cereals; the Na: K ratio is 1:76. In terms of RDAs and depending on age and sex, a 100-g edible portion of quinoa supplies 27-40% Fe, 23-76% of Mg, 47-200% of Cu, 11-16% of P, 15-19% of K, 10-15% of Ze, and only 1-2% of Na. The major anti-nutritional factors in quinoa are saponins, which can be removed by washing or abrasive dehulling, they do not exceed 0.01g in a 100-g edible portion.

Lorenz *et al* (1991), evaluated the performance of QF-WF blends (5/95, 10/90, 20/80, 30/70) in breads, cakes and cookies. The results indicated that breads baked with 5% and 10% QF were of good quality. Loaf volume decreased, crumb grain became more open and the texture slightly harsh at higher usage levels of QF. A bitter after taste was noted at the 30% level. Cake quality was acceptable with 5% and 10% of QF. Cake grain became more open and the texture less silky as the level of quinoa substitution increased. Cake taste improved with either 5% or 10% QF in the blend. Cookie spread and top grain scores decreased with increasing levels of QF blended with high-spread cookie flour. Flavor improved up to 20% QF in the blend. Cookie spread and cookie appearance was improved with a quinoa/low-spread flour blend by using 2% lecithin.

Barley:

Farooqui (2018) investigated the chemical and nutritional characteristics of BF. Results showed that protein and fiber content varied significantly to be 14.87%, 12.69% and 3.28%, 1.74% for germinated and non-germinated BF, respectively. Mineral composition of germinated and non-germinated BF showed that Ca content was 130 and 110 mg/100g, P 500 and 320 mg/100g, Mg 180 and 160 mg/100g, respectively. Further, the nutritional properties indicated that antioxidant activity and total flavonoids shown to increase for germinated flour.

Afshan *et al* (2014) studied some of physical properties of oats and barley viz. The average of the principle diameters was found to be 4.96 ± 0.50, 5.34 ± 0.31, 6.00 ± 0.26 and 5.41 ± 0.44 mm and 1,000-grain weight was 41.9 ± 0.2, 40.06 ± 0.02, 36.66 ± 0.01 and 36.51 ± 0.02 g for hulled barley, hulless barley, Sabzaar oats and SkO-20 oats, respectively. The grains were narrow and elongated having an average sphericity of 50.55 ± 3.7, 47.923 ± 1.8, 32.578 ± 1.3 and 35.69 ± 2.1 %. The value of angle of repose was found to be 50.44 ± 0.270, 63.45 ± 0.340, 46.86 ± 0.250 and 44.49 ± 0.100 for the flour of hulled barley, hulless barley, oats Sabzaar and SKO-20, respectively. The flours had poor flowability having a compressibility index of 33.69 ± 0.12, 34.32 ± 0.87, 27.94 ± 1.23 and 27.5 ± 0.74 and (Hausner's ratio) 1.58, 1.52, 1.38 and 1.37, respectively.

Materials And Methods

1-Materials:

1-1. Preparation of raw materials:

1- Quinoa was ground (the kilo took 20 minutes while grinding).
2- Barley was ground (the kilo took 4 minutes while grinding).
3- The fortified bread was produced with both of QF and BF at concentrations (10-20-30-50-100%), then sensory testing was done to estimate the quality of the produced bread and as a result of this test concentrations of (10-20%) for QF and BF were chosen to be the subject of the study.

1-2. The bread production:

Quinoa (QF) and barely flour (BF) were added to wheat flour (WF) in the required concentrations as well as salt and yeast were added in a fixed weight for all concentrations (10 g salt, 10 g yeast) and the water was added as dough needed. Dough was kneaded for 10 minutes and then brewing for 1.5 hour and the dough were put in the form of Small discs in the sauces covered with apostasy and it left for 10 minutes (the loaf takes about 10 to 12 g of apostasy) then individual and bake at 200° C for 3.5:4 minutes and cold at room temperature for 20:25 minutes.

2. Analytical methods:

2.1. Nutritional value of wheat-quinoa- barley flour

2.1.1. Moisture content:

The moisture was determined according to the method recommended by **A.O.A.C. (2005)** using air oven at 100-102° C for about 3 hours.

2.1.2. Total nitrogen and crude protein:

The total nitrogen was determined using **Marco Kjeldahl** methods, according to **A.O.A.C. (2005),** crude protein then calculated as T.N. X 6.25.

2.1.3. Fat content:

The fat content was determined following the method given by the **A.O.A.C. (2005).** Soxhlet apparatus was used. The extraction continued for 16 hours with n-hexane as the extraction solvent.

2.1.4. Ash content:

Ash content was estimated according to the method described by the **A.O.A.C. (2005)** after charring. The samples were placed in a muffle furnace at 525°C until white or light grey ash was obtained.

2.1.5. Crude fiber:

Crude fiber was determined according the method of **Pearson (1971).** Sample was digested in boiling 0.128 M. sulphuric acid for 45 minutes, washed with distilled water three times, digested with boiling 0.223 M potassium hydroxide, washed with distilled water three times, followed by washing with acetone (cold extraction) three times, then dried at 150°C for one hour and finally weight.

2.1.6. Carbohydrates content:

The carbohydrate was calculated by the difference as follows:

% Carbohydrates = 100 - (% moisture + % protein + % fat + % ash + % fiber).

2.1.7. Energy value:

Total calories were calculated by multiplying 1g protein and carbohydrates by 4.0 and 1g fat by 9.0 according to **FAO (1982).**

The nutritional value of control bread and quinoa, barley- fortified bread was also estimated after baking directly and after storage for a month.

2.2. Determination of anti-nutrition:

2-2-1. Tannin:

The tannin content was determined using the Vanillin-HCl reagent method of **Burns (1971).**

2-2-2. Oxalate:

The oxalate content of the samples was determined using the potassium permanganate titration method of (Dye, 1956).

2-2-3. Phytic acid:

While the phytic acid content was determined using the method of **McCance and Widdowson (1935).**

2-2-4. Determination of trypsin inhibitor:

According to **AOCS (2005**), used solutions contain sodium hydroxide, trypsin, acetic acid and BAPA, by method colorimetric in absorption at 410 nm.

2-2-5. Determination of saponins:

Saponins assessments were carried out as described by **Domengza *et al*, (2009).**

3. Physical properties:

3. Physical properties of bread:

Bread characteristics or baking qualities were evaluated as method described of **See *et al.,* (2007**).

3.1. Weight:

Pan of bread was weighted on Electronic Balance Model (Precisa 205 A Super Bal. series, Swiss Quality) and repeated triple.

3.2. Volume:

Bread volume was measured by rapeseed displacement after cooling the bread for 1hr. at room temperature (25ºC).

3.2.3. Height:

The height (cm^3) was measured by the ruler in the center of the bread.

3.3. Specific gravity:

Specific volume was determined as follows:

$$\text{Specific volume} = \frac{\text{Bread volume } (cm^3)}{\text{Bread weight (g)}}$$

Physical properties of bread carried out as described by **Hussein *et al* (2011).**

3.4. Bread yield:

$$bread\ yield = \frac{Dough\ weight\ befor\ baking\ (g)}{Loaf\ weight\ 1\ hr.after\ baking\,(g)}$$

3.5. Total baking loss:

The total baking loss (%) is calculated according to the following formula:

The total baking loss (%) = 100- bread yield= (%)

4. Sensory evaluation:

Bread was organoleptically evaluated for its sensory characteristics .The evaluation was carried out according to the method of **Faridi and Rubenthaler (1984).**

Results And Discussion

1. Chemical composition of WF (85% extraction), QF and BF:

The results (Table 1) showed that the highest protein & carbohydrates, and energy value recorded with WF. The values were 14.20 & 74.49% & 365.47 (kcal/100g), respectively, while, QF and BF recorded 12.33% & 64.36% & 384.97 (kcal/100g), 13.82% & 67.35% and 344.93 (kcal/100g), respectively. The highest fat content was recorded for QF, BF then WF and the results were 8.69% & 2.25% and 1.19%, the fiber ratio was higher in BF, QF then WF whereas the main value were 3.17%, 2.90% and 0.63%. The highest value of ash recorded with QF, BF, and WF the values were 3.69%, 2.90% and 0.59%.The results showed that WF contained the highest values in carbohydrates, recording 74.49%, while QF recorded the highest values in fat and ash, the results were 8.69% and 3.69%, respectively, but BF recorded the highest values in dietary fiber where it reached 3.17%.

Table (1): Chemical composition of WF (85% extraction), QF and BF.

Components %	WF (D/W)	BF (D/W)	QF (D/W)
Moisture	8.90	10.51	8.03
Protein	14.20	13.82	12.33
Fat	1.19	2.25	8.69
Fiber	0.63	3.17	2.90
Ash	0.59	2.90	3.69
Carbohydrates	74.49	67.35	64.36
Energy value (Kcal/100g)	365.47	344.93	384.97

(D/W)=Dry weigh

2. Anti-nutritional factors of WF, BF, and QF:

From the following results (Table 2), it is clear that the content of WF and BF from tannins and phytates are closed, as they recorded 2.71, 41.80, 2.43, and 39.25 (mg/100g) respectively, while the QF contained 0.38, and 1.16

(mg/100g), respectively. QF is the highest flour in its oxalate content which recorded 6.45 (mg/100g). As for the saponins, its quantity was close to that of both QF and BF, as it was estimated by 3.24 and 3.11(mg/100g), respectively. It means the difference between them is only about 0.13 (mg/100g), whereas WF contained the least amount of saponins, which was 2.40(mg/100g). All flours contained high levels of trypsin inhibitor, which were recorded 53.85, 50.17 and 41.21(TIU/g) for WF, BF and QF, respectively. The results showed that the anti-nutritional factors readily available in WF are tannins, phytates and trypsin inhibitor, whereas BF distinguished by the availability of all types of anti-nutritional factors in high levels. Oxalates and saponins increased in the QF. As for the percentage of tanins and phytates in QF, they are almost non-existent, as they recorded 0.38 and 1.16 (mg/100g), respectively.

Table (2): Anti-nutritional factors of Wheat flour, Quinoa flour and Barley flour

Anti- nutritional factors	Wheat flour	Quinoa flour	Barley flour
Tannins (mg/100g)	2.71	0.38	2.43
Phytates (mg/100g)	41.80	1.16	39.25
Oxalates (mg/100g)	0.43	6.45	0.23
Saponins (mg/100g)	2.40	3.24	3.11
Trypsin inhibitor (TIU/g)	53.85	41.21	50.17

3. Rheological properties of dough:

3-1. Farinograph values of WF (85%), (WF 50%+ QF50%), (WF50%+ BF 50%):

The results indicated the water absorption (%), dough development (min), degree of softening (B.U) and the arrival time (min) which recorded for WF (100%) and the mixture of (WF + QF), (WF + BF). The values for the mixture of (WF + QF) were 67%, 2 min, the values for (WF + BF) were 69%, 9 min and, respectively. When WF recorded 66%, 2min and the WF was similar to WF mixed with QF in the same degree of softening that they recorded 70 (B.U) whereas the degree of softening for BF was 50 (B.U). It is noted that WF, WF mixed with QF as well as WF mixed with BF have the same value of arrival time (min) they all registered 1.5 (min). While, the dough stability for the mixture of (WF + QF), (WF + BF) was recorded as the follows, (WF + QF) was 7.5 min, (WF + BF) was 13.5 min, respectively. On the other hand, WF recorded 8 min for the dough stability.

Table (3): Farinograph values of Wheat flour, (wheat flour 50%+ quinoa flour 50%), (wheat flour 50% + Barley flour 50%)

NAME OF SAMPLE	WATER ABSORPTION (%)	ARRIVAL TIME (MIN)	DOUGH DEVELOPMENT (MIN)	DOUGH STABILITY (MIN)	DEGREE OF SOFTENING (B.U)
WF	66.0	1.5	2.0	8.0	70
WF+QF (50%)	67.0	1.5	2.0	7.5	70
WF+BF (50%)	69	1.5	9.0	13.5	50

5-3-2. Extensograph values of Wheat flour, (Wheat flour50%+ quinoa flour50%), (wheat Flour 50%+ Barley flour 50%).

There is a clear difference in energy (Cm2), where WF is recorded the highest value, followed by WF mixed with BF, then WF mixed with QF. The values were as follows 76, 45, and 15(Cm2).Mixed flour scored the highest value in P.N value the highest values were in favor of WF mixed with QF followed by WF mixed with BF registered 3.2 and 2.48, respectively. There is a slight difference between WF and the mixed flour (WF50% + QF50%) in the elasticity. But there is a noticeable difference between WF and WF mixed with BF in the elasticity, where WF has been recorded 230 (B.U), WF mixed with BF has been recorded 260 (B.U). A large difference can also be observed between the three types of flour in the extensibility, the highest value was recorded for WF followed by WF mixed with BF then WF mixed with QF and the values were as follows 250, 105, 75 (mm), respectively.

Table (4): Extensograph values of Wheat flour, (Wheat flour 50%+ quinoa flour 50%), (wheat Flour 50%+ Barley flour 50%).

NAME OF SAMPLE	ELASTICITY (B.U)	EXTENSIBILITY (MM)	P.N	ENERGY (CM^2)
WF	230	250	0.92	76
WF+ QF (50%)	240	75	3.2	15
WF+ BF (50%)	260	105	2.48	45

4-1. Chemical composition of fresh bread fortified with QF as (D/W):

The chemical composition for the fresh bread which fortified with QF at 10% and 20% were studied, the results (Table 5) showed that there was no significant difference in protein content between quinoa fortified bread and control bread, but the fat content of bread showed that the percentage of fat increased significantly in fortified bread than control bread. The results indicated that protein content was 11.50% for the control while it was 11.44% for 10% QF and 11.35% for 20% QF, respectively. Fat has been recorded 3.24% for 10% and 3.40% for 20% so the fat content increased by about (1.6%) more than the control which recorded 1.6 %. The control bread contained the highest percentage of dietary fiber and carbohydrates recording 3.61%, 82.52% and the fortified bread was3.12%, 81.40%, 3.24%, 81.10%, respectively. The fortified bread had the highest energy value content and the results indicated that it contains 400.52 (Kcal/100g), 400.40 (Kcal/100g) while the control contains 390.48 (Kcal/100g), this increase is due to its high fat content. It is also noticeable that by increasing the level of fortification it increases fat, fiber and ash.

Table (5): Chemical composition of fresh bread fortified with QF (D/W):

COMPONENTS	CONTROL BREAD (100% WF)	BREAD WITH 10% QF	BREAD WITH 20% QF
Moisture	-----	-----	-----
Protein	11.50	11.44	11.35
Fat	1.60	3.24	3.40
Fiber	3.61	3.12	3.24
Ash	0.77	0.80	0.91
Carbohydrates	82.52	81.40	81.10
Energy value (Kcal/100g)	390.48	400.52	400.40

(D/W) = Dry weight

4-2. Chemical composition of fresh bread fortified with BF:

The results (Table 6) show a significant convergence in the proportion of protein in all types of bread, but for the fat content of bread the highest proportion was found in bread which fortified with 20% BF followed by 10% BF the results were as follows 2.95% in 20% BF, 2.70% for 10% BF, while the content of barley fortified bread increased in both fiber and ash, and the results were as follows 6.93 ,1.35g in 10% BF, 8.07, 1.57g in 20% BF, respectively. Whereas Wheat bread scored the following results 1.60, 3.61 and 0.77g for fat, fiber and ash, respectively. The highest carbohydrate content was found in the control bread which recorded 82.52% followed by the subsidized bread 10% and then 20% the results were 77.54% and 75.96%, respectively. Also, the control bread contained the highest energy value recorded 390.48 (Kcal/100g), 380.38 and then 376.19 (Kcal/100g) for bread with BF, respectively.

Table (6): Chemical composition of fresh bread fortified with BF (D/W)

COMPONENTS	CONTROL BREAD (100% WF)	BREAD WITH 10% BF	BREAD WITH 20% BF
Moisture	-----	-----	-----
Protein	11.50	11.48	11.45
Fat	1.60	2.70	2.95
Fiber	3.61	6.93	8.07
Ash	0.77	1.35	1.57
Carbohydrates	82.52	77.54	75.96
Energy value (Kcal/100g)	390.48	380.38	376.19

(D/W) =Dry weight

5-1. Chemical composition of bread fortified with QF (D/W) after frozen storage for 1 month:

The following table (Table 7) shows the chemical composition of the fortified bread after storage for1 month. The control bread had the highest value of protein 10.38g, while 10% and 20% fortified bread contained 9.10 and 8.24g. The 20% fortified bread contained the highest value of fat, dietary fiber and ash recording 3.50, 4.12 and 1.14g while the control bread and the 10% fortified bread recorded 2, 3.91, 0.85, 3.20, 4, and 1g, respectively. The results showed that there was no significant difference between the fortified bread and control bread in their carbohydrate and energy content where the supplemented bread with 20% QF increased about 6.46 (Kcal/100g) compared to the control. The results showed that the cold storage of bread either control or subsidized for a month led to a significant decrease in the proportion of protein which has ranged from (1.12:3.11g). There is also an increase in the bread content of dietary fiber, ash and carbohydrates. This increase has ranged from (0.8:0.23), (0.3:0.88) for ash and fiber, respectively. The energy value of the fortified bread dropped by about 4 (Kcal/100g).

Table (7): Chemical composition of bread fortified with QF (D/W) after frozen storage for 1 month

COMPONENTS	CONTROL BREAD (100% WF)	BREAD WITH 10% QF	BREAD WITH 20% QF
Moisture	-----	-----	-----
Protein	10.38	9.10	8.24
Fat	2.00	3.20	3.50
Fiber	3.91	4.00	4.12
Ash	0.85	1.00	1.14
Carbohydrates	82.86	82.70	83.00
Energy value (Kcal/100g)	390.96	396.00	396.46

(D/W) = Dry weight

5-2. Chemical composition of bread fortified with BF (D/W) after frozen storage for 1 month.

The chemical composition of bread fortified with BF after frozen storage for 1 month (Table 8) showed that the percentage of protein in the bread fortified with 20% BF was the lowest percentages when compared to control bread or the bread fortified with 10%. But it has the highest percentage of fat, reaching 4.25g while the control bread and the fortified with 10% recorded 2 and 3.40g, respectively. The concentration of 20% consisted of the largest amount of dietary fiber and ash recording 8.92g and 1.66g, while the control bread and the supplemented by 10% included 3.91,7.81, 0.85 and 1.50g, respectively. The control bread had the highest value of carbohydrates and energy reached to 82.86g, 390.96 (Kcal/100g), followed by the bread with a concentration of 10%then 20%, which contained 77.07, 379.76, 76.15 and 378.93(Kcal/100g), respectively. When compared fresh bread with bread stored for 1 month, it is noted that the proportion of protein decreased after storage while there is an increase in the content of bread fat as well as dietary fiber. The decrease in protein ranged from 1.12 to 2.43 g. While, the increase in fat ranged from (0.4 to 1.30g), as well as a slight increase in ash has been observed after storage for a month.

Table (8): Chemical composition of bread fortified with BF (D/W) after frozen storage for 1 month.

COMPONENTS	CONTROL BREAD (100% WF)	BREAD WITH 10% BF	BREAD WITH 20% BF
Moisture	-----	-----	-----
Protein	10.38	10.22	9.02
Fat	2.00	3.40	4.25
Fiber	3.91	7.81	8.92
Ash	0.85	1.50	1.66
Carbohydrates	82.86	77.07	76.15
Energy value (Kcal/100g)	390.96	379.76	378.93

(D/W) = Dry weight

6-1. Physical properties of baladi bread fortified with QF:

These results (Table 9) indicated that the control bread has the largest weight and highest value in volume loaf, and the values were 214g and 779 (cm3), respectively. While quinoa fortified bread with 10% and 20% obtained the following values 201.5g, 624 (cm3), 183.4g and 430(cm3), respectively. It is also evident that the quinoa fortified bread with 20% achieved the highest rate of bread yield recording 213 followed by quinoa fortified bread with 10% then the bread control, where they recorded 185%, 142%. Also, it should be noted that the control bread was characterized by having the lowest percentage in the total baking loss, as it achieved 14.5%, but the bread fortified with quinoa scored 15.2%, 16.1%, respectively.

Table (9): Physical properties of baladi bread fortified with quinoa flour

Type of bread	Weight of bread (g)	Volume of loaf bread (cm^3)	Yield of bread (%)	Total baking loss (%)
Bread control (100% Wheat flour)	$214.0^{a} \pm 1$	$779.0^{a} \pm 0.2$	$142.0^{c} \pm 0.4$	$14.50^{c} \pm 0.3$
Bread (90 % Wheat + 10% quinoa flour)	$201.5^{b} \pm 0.3$	$624.00^{b} \pm 0.1$	$185.0^{b} \pm 0.1$	$15.20^{b} \pm 0.1$
Bread (80 % Wheat + 20% quinoa flour)	$183.4^{c} \pm 0.5$	$430.0^{c} \pm 0.3$	$218.0^{a} \pm 0.3$	$16.10^{a} \pm 0.4$

6-2. Physical properties of baladi bread fortified with BF:

The control sample (Table 10) has the highest values of some physical properties, Where this sample was recorded 214g in weight of bread, 779 (cm3) for volume loaf and 14.5% for the total baking loss followed by the fortified bread with 10% barley recording the following values175.5g, 440 (cm3) for weigh of bread and volume loaf. While, the fortified bread with 20% barley took the lowest values recording 140.4g and 210 (cm3), respectively. But it took the highest values for bread yield and total baking loss where it recorded 678% and 15.9%, respectively.

Table (10): Physical properties of baladi bread fortified with Barley flour

Type of bread	Weight of bread (g)	Volume of loaf bread (cm^3)	Yield of bread (%)	Total baking loss (%)
Bread control (100% Wheat flour)	$214.0^{a} \pm 2$	$779.0^{a} \pm 2$	$142.0^{c} \pm 0.3$	$14.50^{c} \pm 0.2$
Bread (90 % Wheat + 10% Barley flour)	$175.5^{b} \pm 0.4$	$440.0^{b} \pm 0.3$	$365.0^{b} \pm 0.4$	$15.10^{b} \pm 0.2$
Bread (80 % Wheat + 20% Barley flour)	$140.4^{c} \pm 0.4$	$210.0^{c} \pm 0.3$	$678.0^{a} \pm 0.4$	$15.90^{a} \pm 0.2$

References

Afshan Hamdani; Sajad, A. Rather; Asima Shah; Adil Gani; Wani S. M.; F. A. and Asir Gani; (2014): Physical properties of barley and oats cultivars grown in high altitude Himalayan regions of India, Journal of Food Measurement and Characterization, 8 (pages 296-304).

A. O. C. S, American Association of Cereal Chemists International (2005): Approved methods of analysis, 11th Ed. Method 22-40.01. Measurement of trypsin inhibitor activity of soy products-Spectrophotometric method.

Bicar E. H.; Woodman-Clikeman W.; Sangtong V.; Peterson J. M.; Yang S. S.; Lee M.; Scott M. P., (2008): transgenic Res.17:59-71.

Burns, R.E. (1971): Methods for estimation of tannins in grains. J. Agronomy, 163:511-513.

Domengza, E., Steinbronn, S., Francis, G., Focken, U., and Becker, K. (2009): Investigations on the nutrient and anti-nutrient content of typical plants used as fish feed in small scale aquaculture in the mountainous regions of Northern Vietnam. Animal Feed Science and Technology, 149: 162-178.

Dye, W. B. (1956): Chemical studies on halogetotsgloniieratius. Weeds, 4:55

El-Taib, H. I.; Rizk, I.R.; Yousif, E.I.; Amal, A. and Hassan, S. (2018): Effect of Barley Flour on Wheat Bread Quality, Food Science Dept., Fac. of Agric., Ain Shams Univ., Cairo, Egypt.

FAO, (Food and Agriculture Organization) (1982): Food Composition Tables for the Near East, F.A.O., Food and Nutrition, Paper 26.

Faridi, H. A. and Rubenthaler, G.L. (1984): Effect of baking time and temperature on bread quality. Cereal Chem., 61 (2): 13-20.

Farooqui, A. S.; Syed, H. M.; Talpade, N. N.; Sontakke, M. D. and Ghatge P. U.; (2018): Influence of germination on chemical and nutritional properties of Barley flour, Journal of Pharmacognosy and Phytochemistry 7(2): 3858

Hussein, E. A.; El-Beltagy, A. E. and Gaafar, A. M.; (2011): Production and quality evaluation of low-calorie cake. American Journal of food Technology, 6(9):827-834.

Iglesias-Puig E.; Monedero V.; Haros M.; (2015): Bread with whole quinoa flour and bifidobacterial phytases increases dietary mineral intake and bioavailability. LWT. food Sci Technol 60 (1) 71-7.

Koziol M. J.; (1991): Chemical Composition and Nutritional Evaluation of Quinoa (*Chenopodium quinoa Willd*), Latinreco S.A., Centro Nestk de Desarrollo de Alimentos para America Latina, Casilla 17-I 104053, Quito, Ecuador.

Lorenz K.; and Coulter L.; (1991): Quinoa flour in baked products Plant Foods for Human Nutrition, Volume 41, Issue 3, pp 213–223.

McCance, R.A. and Widdowson, E.M., (1935): Phytin in human nutrition. Biochem. J., 29 (12): 2694-2699.

Miller, R.A. and Maningat, C.C. (2008): Modified wheat starches increase bread yield. Cereal Chemistry, 85 (6):713-715.

Mubarak; (2001): Chemical, nutritional and sensory properties of bread supplemented with lupin seed (*lupinus albus*) products. International journal for Food and Development.

Pawan Kumar; Yadava R. K.; Babita Gollen; Sandeep Kumar, Ravi Kant Verma; Sanjay Yadav; (2011): Nutritional Contents and Medicinal Properties of Wheat: A Review Department of Genetics & Plant Breeding, Department of Zoology & Aquaculture, MD University, Rohtak, Haryana, India.

Pearson. D, (1971): The Chemical Analysis of Food. Nutritional College of Food Technology, University of Reading, Wey bridge, Surry, J. 8 A., Churchill.

See, E.F.; Nadiah, W.A. and Noor Aziah, A.A. (2007): Physico-chemical and sensory evaluation of breads supplemented with pumpkin flour. Asean Food Journal, 14 (2): 123-30.

Serna Saldivar S. O., (2003): Cereals dietary importance, Encyclopedia of Food Sciences and Nutrition, Journal of Science Direct.

Tömösközi, S.; Gyenge, L.; Pelcéder, A.; Abonyi, T. and Lásztity, R. (2011): The effects of flour and protein preparations from amaranth and quinoa seeds on the rheological properties of wheat-flour dough and bread crumb. Czech J. Food Sci., 29: 109-116.

Journal of Home Economics, Volume 30, Number (1,2), 2020

جودة الخبز المدعم ببعض مخاليط الحبوب

ليلي أحمد حلمي البديوي، عماد محمد عبد الحليم الخولي، امينة السيد طير البر
قسم التغذية وعلوم الأطعمة، كلية الاقتصاد المنزلي، جامعة المنوفية، مصر.

الملخص العربي:

في هذه الدراسة تم تقدير التركيب الكيميائي لدقيق القمح (استخلاص٨٥%) ودقيق الكينوا وكذلك دقيق الشعير، كما تم تقدير محتوى هذه الأنواع من مضادات الأغذية (التانينات - الاكسالات - الصابونين - مثبطات التربسين - الفايتات) وكذلك حددت الخصائص الريولوجية (الفارينوجراف والاكستنسوجراف) لكل أنواع الدقيق حيث تم تحديد هذه الخصائص لدقيق القمح فقط بدون خلط ثم حددت هذه الخصائص للأنواع الأخرى بعد إعداد خلطات بنسبة (٥٠% قمح +٥٠% كينوا أو شعير) ثم تم إنتاج الخبز البلدي بنسب (١٠%-٢٠%-٣٠%-٥٠%-١٠٠%) وأعدت استمارات التحكيم لتقدير الخصائص الحسية لتلك التركيزات ومن ثم اختيار التركيزات المناسبة لتكون هي محل الدراسة و كانت افضل النتائج الحسية خاصة بتركيزات (١٠% - ٢٠%) لإنتاج الخبز. ثم تم إنتاج الخبز بتلك التقديرات وبالتالي قدر له التركيب الكيميائي والخواص الطبيعية والحسية وتم تخزين الخبز لمدة شهر كامل وفى نهاية كل أسبوع قدرت الخصائص الحسية للخبز المنتج لتحديد مدى جودته وعموما فان الخبز المجهز مع ١٠% و ٢٠% دقيق كينوا و شعير كانت له اعلى قيمة غذائية وخواص جودة.