Egypt. J. Food. Sci. **Vol. 51,** No.1, pp. 139-150 (2023)

Egyptian Journal of Food Science
http://ejfs.journals.ekb.eg/

Preparation of Pan Bread Supplemented with Amaranth Cereal and Soybean Flour

CrossMark

Wael Mospah Mospah[1], Adly Samir Abd El-Sattar[1] and Gamal Saad El-Hadidy[2*]
[1]*Crops Technology Department, Food Technology Research Institute,Agriculture Research Center, Giza, Egypt.*
[2]*Bread and Pastry Department, Food Technology Research Institute,Agriculture Research Center, Giza, Egypt.*

THE research discusses the impact of blending amaranth flour (AF) and defatted soybean flour (DSBF) on pan bread production from refined wheat flour (WF). The chemical composition of AF, DSBF and WF was investigated. AF had high protein, fat and carbohydrate contents 16.40, 08.20 and 65.40%, respectively. Different proportions of AF (5, 10, 15 and 20%) and DSBF (ratio fixed 5% for all blends) was replaced with WF comparison with control sample WF (100%) were blended to make pan bread. Addition of AF and DSBF in comparison to WF lead to slight increase in rheology properties (water absorption, arrival time, dough development, stability and proportional number). On contrary, degree of softening, elasticity, extensibility, and energy value decrease compared to the values with dough WF. The physical characteristics of all blends pan bread such as weight and density were increased but the specific volume and volume were decreased compared with control. Pan bread prepared using AF and DSBF exhibited high crude protein, fat, and fiber with improved minerals contents and revises in sensory properties. Textural characteristics like cohesiveness, resilience, gumminess and chewiness of pan bread increased with added AF and DSBF. Used the AF and DSBF in pan bread preparation improved the nutritional and some of the physical properties of pan bread. All prepared pan bread was fresh and suitable for human consumption, especially up to 20 % AF substitution. Hence AF and DSBF could be used to improve the nutritional and some physical characteristics of pan bread.

Keywords: Amaranth, soy bean, pan bread, Texture, color, Sensory attributes.

Introduction

Amaranthus is a member of the *Amaranthaceae* family, which has over 60 known species Anjali et al. (2013). Furthermore, amaranth is a desirable source of protein due to its favorable amino acid profile. AF is frequently used in as a cereal or their flours because it is a balanced supply of proteins when consumed with other cereals (Alvarez-Jubete et al., 2010). The popped amaranth grain had the following properties: cellulose (60.0 g/kg), neutral detergent fiber (NDF) (111.8 g/kg), ether extract (69.4 g/kg), and crude protein (168.5 g/kg) (Herzig et al., 2005). Amaranth was content high ratio of minerals such as Ca, Mg, K, P, Fe, and Na (Shukla et al., 2006).

Amaranth is one of those uncommon plants whose seeds are used to produce cereal and whose leaves are eaten as a vegetable. Due to the rising demand for gluten-free products, amaranth is a gluten-free cereal that may be used in baked products (Shyam & Raghuvanshi, 2015). It is used in preparation of foods like breakfast cereals, cookies, gluten-free flour, and biscuits (Cioanca et al., 2015). Amaranth grain is a high protein, high fiber and dietary-acceptable alternative to WF that is simple to use into traditional Asian cuisine. Amaranth seeds are said to have a number of health advantages in addition to their nutritional advantages, for example stimulating the immune system, reducing blood glucose levels, decreasing

*Corresponding author: e-mail: gamalftri1982@arc.sci.eg
Received: 6/12/2022; Accepted: 30/4/2023
DOI : 10.21608/EJFS.2023.174704.1150

plasma cholesterol levels, antitumor activity, anemia, and enhancing conditions of hypertension.

Due to its abundance of bio- and technologically useful compounds and the lack of allergenic proteins such as gluten, amaranth opens up new possibilities. It can be used in a variety of baked goods, including bread and pastries like cookies, biscuits, and cakes. By enhancing the product's lipid, mineral, dietary fiber, and protein contents as well as its nutritional qualities, agreeing to Dixit et al. (2011) and C hauhan et al. (2016). With their exceptional nutritional profile, amaranth seeds offer several essential components that are frequently challenging to include in a restrictive diet. The seeds are rich in dietary fiber, calcium, and iron. They also include significant levels of lysine, methionine, and cysteine along with a fine balance of amino acids, giving them a superior source of complete protein compared to that found in most cereals. Amaranth has exceptional nutritional value, and it also has a very low sodium content and no saturated fat (Emire & Arega, 2012).

Additionally, different techniques have been employed under various circumstances, which make it challenging to compare and assess the research findings. Bakeries are among the food producers who are interested in using protein preparations to raise the nutritional content of breads and develop new specialist breads without compromising baked products' quality requirements (Tomoskozi et al., 2011). The flowering plant species *Amaranths cruentus* produces the nutritious staple amaranth grain. Results showed that the grains cotain lipid, protein, Zinc, Fe, Ca, Mn, Mg, Kriboflavin, niacinand; thiamine.To support efforts to address food security, nutritional, medical needs of vulnerable people, and poverty reduction, more study is required on cultivation, inclusion in market-acceptable foods, and consumer behavior of Amaranth currents-based products. Amaranth benefits included better health, the healing of extremely malnourished children, and a rise in people's body mass index (Williams et al., 2017). Tocopherols, sterols, and squalene are among the grain lipid fraction's non-saponifiable components (Gamel et al., 2007). The comprises for grain Amaranth revealed that the moisture content of grain Amaranth was found to be 10.69 - 12.22%, with an ash content of 4.4 - 8.7%. On a dry weight basis, the most abundant minerals were Fe (3.61 to 22.51), Mg (44.31 to 97.38), K (267.8 to 473.6), Zn (0.53 to 1.20), and Ca (78.3 to 1004.6) (Kachiguma et al., 2015).

In the food and animal feed industries, soybean is an important protein source and fat. In addition, soybean has a variety of other chemicals, including minerals, which are good for the body and lower the risk of many diseases. In soybean seeds, it was observed that the concentrations of potassium, phosphorus, calcium, copper, calcium, and nickel were much greater (Biel et al., 2018).

The staple food on people's dinner tables is now all forms of flour products made from WF. The quality requirements for flour products have gradually improved as the standard of living has increased. The quality of WF as the raw material, in addition to the production method, is significant for the quality of flour products. The findings of the regression analysis on the quality data for WF and flour foods showed that the water absorption of flour decreased with an increase in total starch content, gluten index, and dry gluten content, the water solubility of flour increased with an increase in the ratio of amylose to amylopectin, and the radial expansion rate of the flour products decreased with an increase in wet gluten content (Zhang, 2020).

Using whole grain flour and bran changes the rheology of the dough and makes it difficult to produce bakery goods. Whole grain wheat flour or wheat bran increases the hardness, firmness, and moisture content of the crumb while decreasing the specific volume of pan bread. The same extensor-graphic and farino-graphic standards used for wheat bran must be replaced with new ones for whole grain wheat flour and wheat bran in order to properly correlate rheology and bakery product quality characteristics (Schmiele et al., 2012). El-Hadidy (2020) showed that wheat flour and other materials that used to produce pan bread such as fresh egg, instant active dry yeast, salt (sodium chloride) and shortening. The aim of the current research was to study the impact of partial substitution of AF and DSBF with WF on the dough characteristics and pan bread preparing, and determined of its proximate composition, bread quality, sensorial and physical characteristics.

Materials and Methods

Materials

AF (*Amaranthus* sp.), and DSBF were purchased from Agriculture Research Center, Giza, Egypt. WF (72% extraction), was obtained from the North Cairo Flour Mills Company, Egypt. Active dry yeast (*Saccharomyces cerevisiae*) was purchased from the Egyptian Sugar and Integrated Industries Company (ESIIC), Chemicals Factory, El-Hawamdia City, Giza, Egypt. Salt (sodium chloride), sugar (sucrose), and shortening were purchased from the local market, Egypt.

Preparation of pan bread

The straight dough method was performed in pan bread preparation according to the method outlined byAACC (2000). The materials were: 100 g WF, 1.5 g instant active dry yeast, 2.0 g salt, 2.0 g sugar, 3.0 g shortening and water (according to farinograph test). Blends (0, 1, 2, 3 and 4) containing AF, and DSBF as partially substitute for WF at different levels (0, 5, 10, 15, and 20 %) and 5% of DSBF, respectively. Then were placed in a mixing bowl at 28 ± 2.0°C and mixing for 6 min, after mixing, the formulated dough was rounded manually by folding for 20 times, then the bulk dough was leaved to rest for 10 min. The prepared dough was placed in lightly greased a baking pan. The dough was proved for 80 min in a cabinet at 30 ± 0.5°C and 85% relative humidity then baked for 20 min at 250°C in an electrical oven sharp (42 litre). Before measurements, the baked pan bread was cooled at room temperature (25 ± 2.0°C) for 60 min and then packed in polyethylene bags.

Proximate chemical analyzes

Crude protein, crude lipids, crude fiber, and total ash were determined as proximate chemical parameters using AOAC (2012). Carbohydrates were estimated by subtracting the difference from initial weight of the samples as follows:

% Carbohydrates = 100 – (crude protein + ash + crude fat + crude fiber)

Calorie values were determined according to the Atwater method (FAO, 2002).

Calorie value (kcal/100g) = (% carbohydrate × 4.1) + (% protein×4.1) + (% fat× 9.1).

Determination of Minerals

In accordance with theUS EPA (1994) minerals were measured in ash solution using ICP-OES Agilent 5100 VDV.

Rheological properties

The various mixes' rheological properties were assessed using the Brabender Farinograph and Extensograph apparatus in accordance with AOAC (2012).

Color parameters

Objective evaluation of color for pan bread was measured. Hunter *a**, *b** and *L** parameters were measured with a color difference meter using a spectrocolourimeter (Tristimulus Color Machine) with the CIE lab color scale (Hunter, Lab Scan XE - Reston VA, USA) in the reflection mode. The instrument was standardized each time with white tile of Hunter Lab Color Standard (LX No.16379): X= 72.26, Y= 81.94 and Z= 88.14 (L*= 92.46; a*= -0.86; b*= -0.16).

Sensory properties of pan bread

Twenty panellists from the staff of the Sakha Food Technology Research Laboratory, Agriculture Research Centre Egypt was asked for sensorial parameters of pan bread appearance, volume, crumb grain, crumb texture, crust color, odor taste, and overall acceptability, agreeing to the process outlined byAACC (2000). Panelists estimated pan bread recipes on a 10-point hedonic scale.

Texture characteristics analysis

Texture qualities of pan bread were determined by using penetrometer instrument, Texture properties of bread blends were estimated by using a Texture analyzer TVT-300XP (Tex Vol Instruments AB, Viken, Sweden),according to AACC(2000).

TABLE 1.Pan bread preparation.

Constituents	Control	Blend1	Blend2	Blend3	Blend4
WF (72%)	100	90	85	80	75
AF (%)	0	5	10	15	20
DSBF (%)	0	5	5	5	5
Salt (g)	2	2	2	2	2
Yeast (g)	1.5	1.5	1.5	1.5	1.5
Sugar (g)	2	2	2	2	2
shortening (g)	3	3	3	3	3

Physical parameters of pan bread

The displacement of rapeseed was used to calculate the bread volume technique as outlined by AACC (2000). After cooling the loaves for three hours, the average weight of the loaves was determined. Specific volume (cm^3/g) was estimated bydividing the volume of the loaf by its weight.

Statistical Analysis

SPSS software (version 26) was employed for the statistical analysis, and Duncan's multiple range tests were employed for mean comparison. To compare between means, Duncan's multiple range tests were performed at the ($P \leq 0.05$) level according to Mc Clave & Benson (1991).

Results and Discussion

Proximate Chemical Composition of AF, DSF, and WF

Table 2 summarizes the approximate chemical compositions of AF, DSBF, and WF. The findings of chemical comprise showed that AF is significantly superior in crude protein, fat and crude fiber (16.40, 8.20 and 6.50%, respectively) compared with WF. On the contrary, WF comprised significantly greater quantities of available carbohydrates and energy values (84.44%, and 413.92 Kcal/100g, respectively), whereas the crude protein, ash, and crude fiber in DSBF were 50.30, 7.35, and 9.85%, respectively).

Table 2 summarizes the mineral compositions of AF, DSF, and WF. The findings of mineral contents revealed that AF and DSBF is significantly superior in K, Ca, P, Na, Fe, Mn, and Fe compared with WF. On the contrary, DSBF contained significantly higher amounts of K, P, Na, Fe, and Zn compare with AF. These findings nearly agree with those found by Chauhan et al. (2016) and Gebreil et al. (2020) showed that the moisture, protein, fiber, ash and fat in AF were 8.13-8.62, 15.05 -15.38, 3.00- 3.55, 2.93 - 2.54 and 6.68-4.22%, respectively). The findings are in a harmony with the work of El-Dreny and El-Hadidy (2018) who exposed that WF had 11.69% crude protein, 1.40% fat, 0.60% ash, 85.66% total carbohydrates, and 411.88 kcal/100g caloric value. Moreover, El-Hadidy (2020) explained that WF comprises 11.81% crude protein, 0.45% ash, 0.84% crude fiber, and 86.13% carbohydrates. Also, Shahin & Sakr (2016) explained that DSBF comprises 51.60% crude protein, 7.93% ash, 10.71% crude fiber, and 5.22% lipids.

Rheological characteristics of pan bread dough

The farinograph and extensograph parameters of WF and its blends with AF are obtainable in Table 3. From the obtained data, it could be observed that the water absorption of WF gradually increased as the level of substitution with AF increased. The high fiber levels of AF than WF may be the cause of the WF dough's increased water absorption. These results are in harmony with Abd El-Moniem & Yaseen (1993)

TABLE 2. Proximate composition of AF, DSBF and WF.

Compounds	AF	DSBF	WF
Crude protein%	16.40[b] ±0.30	50.30[a] ±0.80	12.30[c] ±0.03
Crude lipids%	8.20[a] ±0.08	4.50[b] ±0.05	1.90[c] ±0.01
Ash%	3.50[b] ±0.05	7.35[a] ±0.05	0.54[c] ±0.01
Crude fiber%	6.50[b] ±0.03	9.85[a] ±0.04	0.82[c] ±0.02
Total carbohydrates%	65.40[b] 0.90±	27.80[c] ±0.50	84.44[a] ±0.40
Caloric value (kcal/100g)	410[b] ±0.30	361.16[c] ±0.40	413.92[a] ±0.50
Minerals (mg /100g)			
K	380[b] ±0.75	400[a] ±1.50	155[c] ±1.30
Ca	250[a] ±2.00	240[b] 1.90±	21[c] ±0.50
P	510[b] ±1.70	720[a] ±2.50	150[c] ±1.00
Na	20[b] ±0.50	23.50[a] ±0.40	5.20[c] ±0.04
Fe	9.40[b] ±0.80	15.50[a] 0.01±	2.30[c] ±0.01
Mn	3.50[a] ±0.02	3.20[b] ±0.03	1.50[c] 0.04±
Zn	3.80[c] ±0.05	6.40[a] ±0.06	5.30[b] ±0.01

-Means with different letter in the same row are significantly different at *($p \leq 0.05$)*.

- Each value was an average of three determinations ± there are a difference between Average and standard deviation.

They revealed that increasing the amount of fiber sources added to WF resulted in the produced dough absorbing more water. This may be due to fiber's high water hydration capacity Chen et al. (1988). The dough development time is the interval between adding water and when the dough reaches its maximum torque. The water hydrates the components of the flour during this mixing period, and the dough develops. The farinograph results revealed that adding AF lengthened the time needed for dough to develop; this could be because the presence of the aforementioned plant sources delayed the hydration and development of gluten. Dough stability time is an important index for the dough strength based on the quantity and quality of dough gluten, so it could be noticed that, the stability time of the control was 8.50 min, which increased by adding AF to pan bread reached about 9, 10.5, 11.5, and 12.0 min for B1, B2, B3, and B4 respectively.

Concerning the extensograph characteristics, the results presented in the same table show that the resistance to extension of blends significantly decreased the elasticity of pan bread to 105–75(B.U) respectively in comparison to control 115 B.U. In comparison to the control, blending with various AF amounts considerably reduced the elasticity of the pan bread dough (220 B.U). Replacement of WF with AF decreased the elasticity from 180 to 155 B.U, respectively. On the contrary, substituting with different extents of AF significantly ($P \leq 0.05$) rise the proportional number dough of pan bread in comparison to control 1.60. Substituting of WF with AF increased the proportional number to 3.00–10.33 respectively. Supplementing with different extents of AF significantly reduced the energy dough ofpan bread in comparison to control (50 cm). Supplementing of WF with AF reduced the energy dough of pan bread to 40–30, respectively.

The process of dough formation, from the initial addition of water to flour up to the formation of compact dough with desired qualities (consistency, resistance to deformation, stability), according to Bojňanská et al. (2013), it goes through various phases during which fluidity, firmness, and elasticity gradually change. The amount of time needed for dough to develop depends on the quantity and quality of gluten, the size of the flour granules, and the degree of milling. Dough stability is the amount of time needed for dough to maintain its maximum consistency, and high dough stability is considered to be a good quality from the perspective of future baking use Bojňanská et al. (2013) and Skendi et al.(2009).

Proximate composition of pan bread

Table 4 shows the chemical composition of pan bread prepared from blends containing AF, DSBF, and WF. The proximate composition of blends Pan bread were significantly affected by blending with various AF and DSBF ratios. The protein content of pan bread was significantly higher after blending with various AF and DSBF ratios (compared to control, 11.48%).The protein content of pan bread was raised to 13.41 and 13.99 (g/100g), respectively, by replacing AF and DSBF with WF. Pan bread's fat content was significantly higher after blending with various AF and DSBF ratios compared to the control 4.56

TABLE 3. Rheological characteristics parameters of pan bread dough

Samples	Farinograph					Extensograph			
	Water Absorption (%)	Arrival time (min)	Dough development (min)	Stability (min)	Degree of softening (B.U.)	Elasticity (B.U.)	Extensibility (mm)	P.N	Energy (cm^2)
Control	61.80	1.0	2.0	8.5	70	220	115	1.60	50
Blend (1)	63.10	1.5	2.5	9.0	65	180	105	3.00	40
Blend (2)	65.10	1.5	3.5	10.5	60	170	90	4.88	45
Blend (3)	68.10	2.0	3.9	11.5	55	160	80	6.5	40
Blend (4)	71.20	2.5	4.7	12.0	50	155	75	10.33	30

(g/100g). The ratio of fat was raised to 04.98 and 05.87 (g/100g), respectively, by replacing AF and DSBF with WF. In comparison to the control level of 0.49%, the ash content of pan bread was dramatically enhanced when AF and DSBF were replaced with WF.Substituting with different Extents of AF and DSBF significantly (P ≤ 0.05) reduced the carbohydrate content of pan bread in comparison to control (81.79%). Replacing AF, and DSBF with WF reduced the carbohydrate content to 78.11–75.30% respectively.

Blending with different proportions of AF and DSBF significantly (P ≤ 0.05) increased the energy content of pan bread in comparison to control (423.96%). Blending AF, DSBF with WF increases the energy content to 420.60–419.55 kcal respectively. Blending with AF and DSBF significantly increased the energy content of blends as the AF proportion increased.These results are in harmony with those found by Gebreilet al.(2020) who stated that AF incorporation to some bakeries increased crude fiber, protein, lipid, contents as well as ash contents, however, decreased carbohydrate content.

The mineral composition of pan bread prepared from blends containing AF, DSBF and WF are presented in Table 4. Blending with different proportions of AF and DSBF had a significant effect on mineral composition of blended pan bread. Blending with different proportions of AF and DSBF significantly increased the potassium, calcium, phosphor, sodium, iron and content of pan bread in comparison to control .Replacement of AF, DSBF with WF increased the Fe content of Pan bread to 3.31–4.37 respectively. On the contrary, Blending with different proportions of AF significantly (P ≤ 0.05) decreased the zinc content of pan bread in comparison to control (5.01mg/100g). Banerji et al. (2018) showed that AF replacement at 40% significantly increased Mg, Ca, Cu, Zn and Fe in the produced Chapatti bread.

TABLE 4. Chemical analysis of Pan bread prepared from AF, DSBF and WF

	Control	Blend 1	Blend 2	Blend 3	Blend 4
Protein%	11.48[e] ± 0.01	13.41[d] ± 0.04	13.60[c] ± 0.04	13.80[b] ± 0.05	13.99[a] ± 0.04
Total lipids%	4.56[e] ± 0.05	4.98[d] ± 0.01	5.27[c] ± 0.05	5.57[b] ± 0.05	5.87[a] ± 0.01
Ash%	0.49[e] ± 0.05	0.93[d] ± 0.05	1.07[c] ± 0.05	1.21[b] ± 0.01	1.35[a] ± 0.05
Crude Fiber%	0.75[e] ± 0.05	1.42[d] ± 0.05	1.70[c] ± 0.02	1.97[b] ± 0.01	2.23[a] ± 0.01
Available Carbohydrates%	81.79[a] ± 0.02	78.11[b] ± 0.05	77.17[c] ± 0.06	76.24[d] ± 0.06	75.30[e] ± 0.06
Caloric Value (kcal/100g)	423.96[a] ± 0.06	420.60[b] ± 0.06	420.22[c] ± 0.12	419.92[d] ± 0.08	419.55[e] ± 0.06
Minerals (mg/100g)					
K	142.92[e] ±0.05	165.95[d] ±0.04	178.46[c] ±0.03	177.63[b] ±0.03	185.56[a] ±0.05
Ca	19.70[e] ±0.04	40.64[d] ±0.05	51.34[c] ±0.03	62.06[b] ±0.05	72.77[a] ±0.03
P	140.18[e] ±0.05	183.62[d] ±0.04	200.43[c] ±0.02	217.24[b] ±0.05	234.07[a] ±0.05
Na	4.96[e] ±0.05	6.49[d] ±0.05	7.18[c] ±0.05	7.87[b] ±0.05	8.56[a] ±0.04
Fe	2.16[e] ±0.05	3.09[d] ±0.05	3.43[c] ±0.03	3.76[b] ±0.04	4.08[a] ±0.04
Mn	1.43[e] ±0.03	1.59[d] ±0.05	1.69[c] ±0.03	1.77[b] ±0.04	1.86[a] ±0.04
Zn	5.01[a] ±0.06	4.97[ab] ±0.06	4.89[bc] ±0.05	4.82[cd] ±0.05	4.75[d] ±0.05

-Means with different letter in the same row are significantly different at LSD at *($p \leq 0.05$)*.

- Each value was an average of three determinations ± standard deviation.

Sensory analysis of pan bread

Table 5 summarizes the sensory evaluation of pan bread prepared from AF, DSBF, and WF. Pan bread blends (AF, DSBF with WF) were affected significantly (p < 0.05) on the sensory attributes. Addition pan bread prepared of AF and DSBF reduced the general appearance value to 13.21 and 12.13, respectively compared with control was 13.42. Also, addition pan bread prepared of AF and DSBF decreased the taste value to 13.12and11.85, respectively compared with control was 13.64. Also, Pan Bread prepared of AF and DSBF with WF significantly (P ≤ 0.05) reduced odor to 12.71 and 12.23, respectively compared with control was 13.28. Also, Adding of AF and DSBF with WF blends significantly (P ≤ 0.05) decreased the sponge score of the pan bread from 14 in control to 13.05–12.70 in blended pan bread respectively. Also, addition of AF and DSBF with WF decreased the distribution of crumb value to 8.51 and7.51, respectively compared with control was 8.82. While, pan bread preparade of AF and DSBF with WF significantly (P ≤ 0.05) decreased overall acceptance value to 86.75 and 80.51, respectively in compared with control was 89.90. The overall acceptability of pan bread made of amaranth flour, defatted soy bean flour blends decreased as the extent of substitute of AF increased.These results agreement with these reported by Gebreil et al. (2020) who found that when using AF in blends the overall acceptability, odor, taste, color, and appearance, were reduced. This may be caused the AF is a good source of protein and fiber.

Color analysis

The perceived acceptability of the pan bread is significantly influenced by color. Table 6 displays the $L*$, $a*$, and $b*$ values for pan bread supplemented with AF, DSBF at various supplementation ratios. The positive "$b*$" value indicated the yellowness, the "$L*$" value indicated the lightness, and the "$a*$" value indicated the intensity of the redness. The results showed an increase in a dark tone with a decrease in L* in both the crust and the crumb, a decrease in yellowness with an increase in b* and an increase in AF in pan bread in the crust color, but the opposite results were found in the crumb color, where decreased $b*$ values meant the yellowness increased. Negative $-a*$ values for slight greenness were saw in data of crumb color. The white plain wheat flour's color tone has significantly changed as a result of the addition of AF. Similar color changes have been discussed in the works of El-Kherbawy & Omaima (2019) and Alshehry (2019).This may be related to the higher protein and phytochemical content of dough. While changes in protein during baking have also been related to changes in the lightness of baked products, specifically increased protein percentages in cooking led to darker muffins, pigments in phytochemicals may have raised the dark tone Alshehry (2019) and Fagundes et al. (2018). This work confirms the great importance of applied science in bakeries foods (El-Hadidy et al., 2022 and Nassef et al.,2023).

TABLE 5. Sensory evaluation for pan bread

Blends	General appearance (15)	Taste (15)	Odor (15)	Sponge (15)	Crust color (15)	Crumb color (15)	Distribution of crumb (10)	Overall acceptability (100)
Control	13.42[a] ±0.08	13.64[a] ±0.07	13.28[a] ±0.07	14.00[a] ±0.08	13.21[a] ±0.07	13.52[a] ±0.09	8.82[a] ±0.08	89.90[a] ±0.09
Blend (1)	13.21[b] ±0.07	13.12[b] ±0.07	12.71[b] ±0.06	13.05[b] ±0.08	13.14[a] ±0.06	13.01[b] ±0.07	8.51[b] ±0.08	86.75[b] ±0.09
Blend (2)	12.77[c] ±0.06	12.42[c] ±0.05	12.34[c] ±0.05	12.54[c] ±0.09	12.86[b] ±0.07	12.94[b] ±0.08	8.17[c] ±0.08	84.07[c] ±0.09
Blend (3)	12.27[d] ±0.05	12.06[d] ±0.03	12.06[d] ±0.06	12.36[c] ±0.08	12.86[b] ±0.09	12.73[c] ±0.09	7.97[c] ±0.09	82.32[d] ±0.09
Blend (4)	12.13[e] ±0.05	11.85[e] ±0.04	12.23[c] ±0.05	12.05[d] ±0.09	12.00[c] ±0.09	12.70[c] ±0.08	7.51[d] ±0.09	80.51[e] ±0.09

-Means with different letter in the same row are significantly different at LSD at *($p \leq 0.05$)*.

- Each value was an average of twenty determinations ± standard deviation.

TABLE 6. Color characteristics of pan bread

Blends	Crust color			Crumb color		
	L	*a*	*b*	*L*	*a*	*b*
Control	54.20[a] ±0.01	0.50[de] ±0.08	13.36[b] ±0.02	58.45[a] ±0.03	-3.17[a] ±0.04	14.52[a] ±0.09
Blend (1)	49.78[b] ±0.03	2.08[a] ±0.02	18.08[a] ±0.02	54.20[b] ±0.08	-2.01[c] ±0.06	10.48[ab] ±0.01
Blend (2)	49.49[c] ±0.04	0.46[e] ±0.06	8.97[de] ±0.01	53.47[c] ±0.01	-2.80[b] ±0.05	6.23[b] ±0.08
Blend (3)	46.64[d] ±0.01	0.69[c] ±0.05	8.48[e] ±0.01	47.29[e] ±0.05	-1.98[d] ±0.04	7.80[b] ±0.07
Blend (4)	43.59[e] ±0.02	1.90[b] ±0.07	9.29[c] ±0.01	46.63[d] ±0.09	-1.93[e] ±0.07	9.48[b] ±0.04

-Means with different letter in the same row are significantly different at LSD at *($p \leq 0.05$)*.

- Each value was an average of three determinations ± standard deviation.

L (lightness with L = 100 for lightness, and L = zero for darkness), a [(chromaticity on a green (–) to red (+)], b [(chromaticity on a blue (–) to yellow (+)], 90˚= yellow, 180˚= bluish to green and 270˚= blue scale. .Values are mean of three replicates followed by ± SD, the number in the same column followed by the same letter are not significantly different at 0.05 level .

The physical properties of pan bread

Table 7 presents the findings of the physical characteristics of pan bread made from AF, DSBF, and WF. The weight, volume, specific volume, and density were affected significantly (P ≤ 0.05) in all prepared pan bread weight values were increased significantly (P ≤ 0.05) to 450 and 466 g, respectively compared with control was 445 g. On contrary, volume values decreased to 864.66 and 723.33 cm^3, respectively compared with control was 1066 cm^3. Also, addition of AF and DSBF increased the specific volume values to 1.92 and 1.55, respectively compared with control was 2.39 cm^3/g. On contrary, density values significantly increased (P ≤ 0.05) to 0.52 and 0.64, respectively compared with control was 0.42g/cm^3. These results harmony well with those described by Man et al. (2017) who found that when increase AF the weight, was increased in cookies. Higher protein concentration in AF compared with WF, which results in AF's ability to hold more water, may help to explain this as exposed by Martinez et al. (2014).

Texture characteristics of pan bread

The texture characteristics of pan bread prepared from blends comprising AF,DSBF and WF are offered in Table 8. Blending with different extents of AF and DSBF had a significant effect on texture parameters of pan bread, the hardness of pan bread increased significantly by increasing AF and DSBF level from 21.29 to 27.65 (N) in compared with control pan bread was 16.15 N. While, resilience of pan bread increased to 0.27 and 0.29, respectively compared with control pan bread was 0.26. Also, substituting with different extents of AF and DSBF significantly reduced the adhesiveness of pan bread to 0.20 and 0.50, respectively, in comparison to control (0.10Nmm).

Also, cohesiveness of pan bread increased significantly to 0.50 and 0.60 respectively in comparison to control 0.42, and springiness of pan bread was increased significantly (P ≤ 0.05) 7.07 and 8.90 mm, respectively compared with control (5.05mm). While, gumminessof pan bread increased to 11.80–14.72 respectively in comparison to control pan bread (8.71N). Also, chewinessof pan bread increased to 73.90 and 113, respectively in comparison to control pan bread (61Nmm). Blending with AF and DSBF significantly increased the texture parameter of pan bread as the level of AF increased. These findings harmony well with those described by Shahin& Sakr, (2016) who found that when increase AF the hardness, adhesiveness, cohesiveness, springiness, and chewiness, were increased. This can be because AF is a good source of protein and dietary fiber.

TABLE 7. Organoleptic of pan bread

Blends	Weight (g)	Volume (cm³)	Specific volume (cm³/ g)	Density (g /cm³)
Control	445.00[e] ±1.15	1066[a] ±3.55	2.39[a] ±0.07	0.42[e] ±0.02
Blend (1)	450.00[d] ±1.15	864.66[b] ±1.32	1.92[b] ±0.05	0.52[d] ±0.01
Blend (2)	454.66[c] ±0.88	807.00[c] ±0.52	1.77[c] ±0.01	0.56[c] ±0.04
Blend (3)	460.00[b] ±1.73	774.66[cd] ±0.17	1.68[c] ±0.04	0.59[b] ±0.02
Blend (4)	466.33[a] ±1.45	723.33[d] ±0.60	1.55[d] ±0.01	0.64[a] ±0.01

-Means with different letter in the same row are significantly different at LSD at *($p \leq 0.05$)*.

- Each value was an average of three determinations ± standard deviation.

TABLE 8. Texture characteristics of pan bread

Blends	Hardness (N)	Resilience	Adhesiveness (Nmm)	Cohesiveness	Springiness (mm)	Gumminess (N)	Chewiness (Nmm)
Control	16.15[e] ±0.03	0.26[d] ±0.01	0.10[e] ±0.01	0.42[e] ±0.02	5.05[e] ±0.03	8.71[e] ±0.06	61.00[e] ±0.04
Blend (1)	21.29[d] ±0.05	0.27[c] ±0.01	0.20[d] ±0.01	0.50[d] ±0.02	7.07[d] ±0.01	11.80[d] ±0.04	73.90[d] ±0.05
Blend (2)	23.76[c] ±0.06	0.28[b] ±0.02	0.30[c] ±0.01	0.56[c] ±0.03	7.78[c] ±0.02	12.50[c] ±0.05	77.60[c] ±0.04
Blend (3)	24.52[b] ±0.04	0.29[a] ±0.03	0.40[b] ±0.02	0.57[b] ±0.04	8.03[b] ±0.01	13.85[b] ±0.03	93.50[b] ±0.06
Blend (4)	27.65[a] ±0.02	0.29[a] ±0.02	0.50[a] ±0.03	0.60[a] ±0.01	8.90[a] ±0.03	14.72[a] ±0.05	113.00 ±0.06

-Means with different letter in the same row are significantly different at LSD at ($p \leq 0.05$).

- Each value was an average of three determinations ± standard deviation.

Conclusion

The incorporation of AF, DSBF with WF improved the nutritional, sensorial properties and color of obtained pan bread. Textural characteristics such as cohesiveness, resilience, gumminess and chewiness of pan bread were increased when added AF and DSBF to WF. AF is considered as a good support food for the preparation of fortified pan bread however DSBF improved consumer acceptance of pan bread. Finally, it could be preparing some high-quality bakery products using AF, DSBF with WF that are suitable for consumers.

Acknowledgements

The authors thank Prof. Dr. Manal Fahmy Ibrahim., for prepared pan bread and providing language corrections.

References

AACC (2000) International Methods approved of the American Association of Cereal Chemists, 11th ed., American Association of Cereal Chemists, INC., St. Paul, Minnesota, USA.

AOAC (2012) Official Methods of Analysis of the Association of Official Analytical Chemists. 19th ed, Arligton.

Abd El-Moniem, G. M. and Yaseen, A. A. (1993) High dietary fibre cookies from several sources of bran or husk. *Egypt Journal Food Science*, **21**(2), 157-170.

Alshehry, G. A. (2019) Technological and sensory characteristics of biscuits fortified with garden cress (*Lepidum sativum*) seeds. *Life Science Journal*, **16**(8), 28–35.https://doi.org/10.7537/marsl sj160 819.03.Keywords

Alvarez-Jubete, L., Arendt, E. K. and Gallagher, E. (2010) Nutritive value of pseudocereals and their increasing use as functional gluten-free ingredients. *Trends in Food Science & Technology,* **21**, 106–113.

Anjali, K., Joshi, A., Maloo, S. R., and Sharma, R. (2013) Assessment of the morphological and molecular diversity in Amaranthus spp. *African Journal of Agric. Research,* **8**(19), 2307-2311.

Banerji, A., Ananthanarayan, L. and Lele, S. (2018) Rheological and Nutritional Studies of Amaranth Enriched Wheat Chapatti (Indian Flat Bread). *Journal of Food Processing and Preservation,* **42**, e13361. https://doi.org/10.1111/jfpp.13361

Biel, W., Gaweda, D., Jaroszewska, A. and Hury, G. (2018) Content of minerals in soybean seeds as influenced by farming system, variety and row spacing. *Journal of Elementology*, **23**(3).

Bojňanská, T.,Tokár, M., Mocko, K., Balková, H., Frančáková, H., Ivanišová, E. and Roháčik, T.(2013).Evaluation of new varieties of summer wheat *Triticum Aestivum* L. considering selected parameters of technological quality. *Journal of Microbiology, Biotechnology and Food Sciences,* **2**(1),1281- 1292.

Chauhan, A., Saxena, D. C. and Singh, S. (2016) Physical, Textural, and Sensory Characteristics of Wheat and Amaranth Flour Blend Cookies. *Cogent Food & Agriculture,* **2**, 1125773. https://doi.org/10.1080/23311932.2015.1125773

Chen, H., Rubenthaler, G. L. and Schamus, E.C.(1988) Effect of apple fiber and cellulose on the physical properties of wheat flour. *Journal of Food Science,***53**(1),304-306.

Cioanca, B., Luca, E., Budiu, V., Bumb, F. and Hoble, A. (2015) Research regarding the influence of some technological factors on the amaranthus sp. Yields obtained in Teiuș area, Alba County, *Agriculture-Science and Practice*, **4**(3), 34–9.

Dixit, A. A., Azar, K. M. J. and Gardner, C. D. (2011) Palaniappan LP. Incorporation of whole, ancient grains into a modern Asian Indian diet to reduce the burden of chronic disease. *Nutrition Reviews*, **69**(8), 479–88.

El-Dreny, E.G. and El-Hadidy, G.S.(2018)Utlization of young green barley as a potential source of some nutrition substances. *Zagazig Journal Agriculture Research*, **45**(4), 1333-1344. https://doi.org/10.21608/ZJAR.2018.48580

El-Hadidy, G., Nassef, S., and El-Sattar, A. (2022) Preparation of some functional bakeries for celiac patients. *Current Chemistry Letters*, **11**(4), 393-402.

El-Hadidy, G.S.(2020) Preparation and Evaluation of Pan Bread Made with Wheat flour and Psyllium Seeds for Obese Patients. *Journal Current Science International,* **9**(2),369-380. https://doi.org/10.36632/csi/2020.9.2.32.

El-Kherbawy, G. M. and Omaima, D. M. (2019) Nutritional evaluation of brioche bread made from Egyptian wheat and enriched with garden cress seeds (GCS) powder as a functional food. *Suez Canal University Journal of Food Sciences*, **6**(1), 27–41. https://doi.org/10.21608/scuj.2019.60153

Emire, S. A. and Arega, M. (2012) Value added product development and quality characterization of amaranth (*Amaranthus caudatus L.*) grown in East Africa. A*frican Journal of Food Science Technology*, **3**, 129–41.

Fagundes, G. A., Rocha, M., and Salas-Mellado, M. M. (2018) Improvement of protein content and effect on technological properties of wheat bread with the addition by cobia(*Rachycentron canadum*). *Food Research*, 2(3), 221–227. https://doi.org/10.26656/fr.2017.2(3).275

FAO (2002) Food energy. Methods of analysis and conversion factors. Food and Nutrition Paper 77. Report of a technical workshop, Rome 3-6 December. ISSN 0254-4725.

Gamel, T. H., Mesallam, A. S., Damir, A. A., Shekib, L. A.and Linssen, J.P.(2007) Characterization of amaranth seed oils. *J. Food Lipids*, **14**, 323–334.

Gebreil, S. Y., Ali, M. I. K., and Mousa, E. A. M. (2020) Utilization of amaranth flour in preparation of high nutritional value bakery products. *Food and Nutrition Sciences*, **10**(05), 336.

Herzig, I., Pisarikova, B., Zraly, Z., Kracmar, S., and Trckova, M. (2005) Nutritional value of amaranth (*Genus amaranthus* L.) grain in diets for broiler chickens. *J. Anim. Sci*., **50**, (12): 568–573.

Kachiguma, N. A., Mwase, W., Maliro, M. and Damaliphetsa, A. (2015) Chemical and mineral composition of amaranth (*Amaranthus* L.) species collected from central Malawi. *Journal of Food Research*, **4**(4), 92.

Man, S., Păucean, A., Muste, S., Chiș, M. S., Pop, A. and Călian, I. D. (2017) Assessment of amaranth flour utilization in cookies production and quality. *J. Agroaliment. Process. Technol*, **23**, 97-103.

Martinez, C. S., Ribotta, P. D., Añón, M. C. and León, A. E. (2014) Effect of amaranth flour (*Amaranthus mantegazzianus*) on the technological and sensory quality of bread wheat pasta. *Food Science and Technology International*, **20**(2), 127-135.

McClave J.T. and Benson P.G.(1991) Statistics for Business and Economics. USA, San Francisco: Dellen Publ.

Nassef, S., El-Hadidy, G. and Abdelsattar, A. (2023). Impact of Defatted Chia Seeds Flour Addition on Chemical, Rheological, and Sensorial Properties of Toast Bread. *Egyptian Journal of Agricultural Sciences*,**73** (4), 55-66. doi: 10.21608/ejarc.2023.174785.1008.

Schmiele, M., Jaekel, L. Z., Patricio, S. M. C., Steel, C. J. and Chang, Y. K. (2012) Rheological properties of wheat flour and quality characteristics of pan bread as modified by partial additions of wheat bran or whole grain wheat flour. *International journal of Food science & Technology*, **47**(10), 2141-2150.

Shahin, F. M. and Sakr, A. M. (2016). Technological and Nutritional Evaluation of Biscuits Fortified Amaranths. *Middle East Journal of Applied Sciences*, **6**(03), 449-459.

Shukla, S., Bhargava, A., Chatterjee, A., Sprivastava, J., Singh, N. and Singh S.P.(2006) Mineral profile and variability in vegetable amaranth (*Amaranthus tricolor*). *J. Plant Foods Hum. Nutr*., **61**, 23–28.

Shyam, S. R. and Raghuvanshi, R. S. (2015) Standardization of Cakes by using Different Levels of Amaranth Flour and its Acceptability, *International Journal of Science and Research*, **4**(6):2013–5.

Skendi, A., Biliaderis, C., Papageorgiou, M. and Izydorczyk, M.(2009) Effects of two barley β-glucan isolates on wheat flour dough and bread properties. *Journal of Food Engineering*, **91**(4), 594-601.

TömöSközi, S., GyeNGe, L., PeLCéder, Á., 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 Journal of Food Sciences*, **29**(2), 109-116.

U.S. EPA (1994) Method 200.7: Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry. Revision 4.4. Cincinnati.

Williams, F. E., Abolaji, G.T., Olooto, F. M. and Ogundele, D. T. (2017) Nutritional characterization of grain amaranth grown in Nigeria for food security and healthy living. *Agrosearch,* **17** (2), 1-10. https://dx.doi.org/10.4314/agrosh.v17i2.1

Zhang, A. (2020) Effect of wheat flour with different quality in the process of making flour products. *International Journal of Metrology and Quality Engineering*, **11**, 6.

إعداد خبز القوالب المدعم بحبوب القطيفة (سالف العروس) ودقيق فول الصويا

الهدف من هذه الدراسة هو معرفة تأثير إضافة دقيق حبوب القطيفة (سالف العروس) وفول الصويا منزوع الدهن علي دقيق القمح استخلاص ٧٢٪ ودراسة التركيب الكيماوي لهذه المواد محل الدراسة .

وأظهرت النتائج ارتفاع نسب البروتين والدهن والكربوهيدرات الذائبه الي ١٦,٤٠، ٨,٢٠ ، ٦٥,٤٠ ٪ علي التوالي في دقيق القطيفة (سالف العروس). حيث تم استخدام نسب ٥ ، ١٠ ، ١٥ ،٢٠٪ من دقيق القطيفة (سالف العروس) ودقيق الصويا منزوع الدهن بنسبه ٥٪ نسبه ثابته في كل الخلطات الي دقيق القمح وأدى ذلك الى زيادة بعد الصفات الريولوجية للعجين مثل كميه الماء الممتص وزمن الوصول و زمن تطور العجينه و زمن ثبات العجينه ونقص في المرونه والمطاطي هو الطاقه مقارنه بالعجينه الكنترول دقيق قمح ١٠٠٪. و اوضحت النتائج ايضا زيادة في الوزن والكثافه ونقص في الحجم والوزن النوعي في كل الخلطات لخبز القوالب المعد من دقيق القطيفه (سالف العروس) ودقيق الصويا منزوع الدهن ودقيق القمح مقارنه بخبز القوالب المعد من دقييق القمح ١٠٠٪ (الرئيسي). واوضحت النتائج ايضا أن خبز القوالب مرتفع في نسب البروتين والألياف والدهن والعناصر المعدنيه مع انخفاض طفيف في الخواص الحسيه واللون في كل الخلطات المعدة من دقيق القطيفه (سالف العروس) ودقيق الصويا مقارنة بخبزالقوالب الكنترول المعد من دقيق القمح فقط . وفي النهاية يمكن اضافة دقيق حبوب القطيفة (سالف العروس) حتي مستوي استبدال ٢٠٪ من دقيق القمح لتحسين الخواص التغذوية والحسية والفيزيائية لخبز القوالب .