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PHYSICAL AND NUTRITIONAL PROPERTIES OF BREAD FROM WHEAT FLOUR FORTIFICATION WITH COWPEA (*VIGNA UNGUICULATA)* FLOUR

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Abstract

In this study, the effect of replacing different levels of wheat flour with cowpea flour on the physical and nutrition properties of bread were studied. Different replacing levels (0, 5, 10, 15, 20 and 30)% of wheat flour with cowpea flour represented as (C, B1, B2, B3, B4 and B5) respectively were evaluated and the produced bread were exposed to sensory evaluated. The chemical compositions results of the flour presented there was a significant variances among a flour treatments compared to the control (100% wheat flour). In addition, as the replacing of wheat flour with cowpea flour increased the protein and ash content increased while the carbohydrates decreased significantly. The sensory evaluation results shown there was a significant variances among the control bread treatment and additional bread treatments for most of the bread attributes and the best replacing level was using 10% cowpea flour with 90% wheat flour. Moreover, the amino analysis results showed that wheat dust had smallest amino acid containing and as the flour replacing increased the amino acids content increased.

Keywords: Wheat flour, Cowpea Flour, Sensory Evaluation of Bread, Flour Amino Acid.

Introduction

Foods influence equally a base for healthful enlargement is regularly misguided. cowpea (*Vigna unguiculata*) are essential raw materials in the intakes of A cheep foods . Although the earlier was appreciated for its calories and content of carbohydrates, minerals, vitamins and protein (Anthony and others, 2014) Cowpea is also one of the most widespread with different uses (Ehlers and Hall, 1997). One of the major sources of protein (24%) is cowpea, in addition to containing 53% carbohydrate and 2% fat (FAO, 2006 . The cowpea is characterized by containing good amounts of lysine and tryptophan, but there is a shortage of methionine and cysteine compared to animal protein, so cowpea production acts notable role in the lives of lots of persons in Africa and other branches of the improving world wherever it is a foremost supplier of protein**,** Which supplements the diet of low-protein grains (Singh and others, 2002; Langyintuo and others, 2003). The cowpea flour imparts a suitable secondary supplier of nutritional proteins with a comparatively great rank of amino acids. One of the fastest style to enhance protein consumption of people as proposed by Anthony *et al*. (2014) is to mature a procedures of formulating protein diets at accommodation equal as protein-rich formula manage to exist commercially too costly for low-revenue employees who stay regulatory an object of protein consumption enhancement (Rachie, 2010). So resumed attempts are existence created generally to increase home-internal consumption of beats for example cowpea across its amalgamation addicted to accessible foods at internal equal, it becomes significant to estimate dietetic assets of several cowpea and enhancebility capacities. Flours and their products are created basically since a size decrease method intended at screeching and extraction constituents of ingredients. Wheat dust making includes contravenation, grazing and the decrease procedures, which are less in collections of braker grinders. The role release the granule and detaches the endosperm from bulk to a tiny degree, although the "scratch" disconnects the spots of bulk from fresh wheat. Equally a effect of this partaking and arguing, starch particles suited substantially damaged, starch loss arises Nonwheat cereals need dry extraction milling to eradicate fat and fiber. Impression grinding has regularly remained expended for, sorghum, millet rice, cowpea and maize (Brown 2000). Due to the nutritional characteristics of cowpea flour, the current study aimed to identify the influence of replacing wheat flour by diverse equals of cowpea flour by some chemical compositions of the products flour, moreover, to studying the effect of substitution on some of the sensory characteristics of the bread through amino acids estimation.

Materials & Methods

Material

Wheat dusts and cowpea were purchased from a market in the holy city of Najaf the flour then was kept at cool storage.

Location of the experiment

The test was possessed out at the Food Science lab at Kufa University, Agriculture College in 2018.

Preparation of cowpea flour

The cowpea flour was prepared according to the method recommended by Okafor and others (2015) by soaking of the cowpea after removing the impurities and the stones in the distilled water by 1.5% (V / W) for 2 hours. After two hours of soaking, the cowpea seed shell was removed manually and the shelled cowpea was dried by using an electric oven at 60 ºC for 8 hours before grinding using the electric grinder. After grinding, the flour was sifted using a sieve (0.5 mm) for the cowpea flour, which was filled with polyethylene carriers and stored at 4C till to analysis.

Laboratory Preparation of bread

The bread was prepared in a laboratory using the method mentioned by Imran Pasha and his collages (2011). Wheat flour was replaced by cowpea flour according to the levels in Table (1).

Preparation of wheat- cowpea flour blends: Wheat cowpea flour blends were prepared by regular replacement of

wheat flour. For the reason, following levels of supplementations were exercised like 0, 5, 10, 15, 20 and 30% cowpea flour (Table 1).

Table 1 : Proximate wheat flour replacement proportions with cowpea flour blends

Weight of cowpea flour (g)	Weight of wheat flour (g)	Flour type Replacement rate	Treatments
-	100	0	C
100	-	0	B
5	95	5	B1
10	90	10	B2
15	85	15	B3
20	80	20	B4
30	70	30	B5

Proximate Analysis of Prepared Flour Samples

Determination of Moisture Content

The moisture content in the flour samples was valued in the wheat flour and wheat flour replaced part of it with cowpea flour according to the method in AOAC (2005). Place 2-3 gm of the flour sample in a crucible of a known weight in an oven of 105 °C until the weight is stabilized then cooled and weighted.

Determination of Ash

Ashes flours were produced in the samples according to the method described in A.O.A.C (2005) by burning the sample in the muffle furnace at 525 °C until the color changed to gray to white.

Determination of Protein

Protein content was estimated in the flour samples using the Kjeldahl method described by Pearson and others (1981). The total nitrogen ratio was estimated and multiplied by factor 6.25 to extract the protein percentage.

Determination of Fat

The percentage of fat samples was estimated using the Soxhlet method described by Pearson (1981).

Amino Acid profile (mg/g) in Wheat Flour with Different Level of Cowpea Flour

Amino acid extraction

The amino acids were extracted according to the method mentioned by (Rasmus Dahl-Lassen, 2018), where the weight of (5 g) of the sample and placed in a bottle (10 ml) and add to it (3 ml) of hydrochloric acid (6M) with 0.1% of sodium hydroxide and 0.1 mg tartaric acid and mix well for 15 min, The sample was sprayed using a plastic filter (0.45um) and taken to the apparatus for injection.

Amino acid Derivation

1 ml of the extracted sample add to 200 µl of Dihydronaphthalene (5%). The sample is used for 2 min. Then, 100 microliters of the last mixture were taken and injected into the HPLC, The test was carried out in the laboratories of the Ministry of Science and Technology / Environment and Water Department using amino acid analysis according to the method provided by (Scriver CR, 2001). The carrier phase consisting of (methanol: acetonitrile: 5% formic acid) (C2-NH2) with a length of (25 cm * 4.6 mm * 10um) to separate the amino acids while the fluorocarbon detector was used to detect amino acids at wavelengths (Ex = 445 nm), (Em = 465 nm).

Preparation of standard material

(0.01 g) of a mixture of high purity amino acids (99.9%) was dissolved in non-ionic water and was transferred to a 100 ml conical flask and completed the size of the mark until it became 100 ppm. Standard in the device.

Amino acid analysis conditions :

Mobile phase = acetonitrile : buffer (30 : 70)

Injection: injection plan, containing derivatization ladders with OPA .

inserted volume = 100 uL

Column type = ZORBAX Eclipse-AAA, L x i.d.=150 x 4.6 mm,3.5µm;

Detector : florescence (Ex = 360 nm , Em = 450 nm)

Sensory Evaluation of the Bread:

The sensory evaluation of the bread samples was carried out by replacing different percentages of wheat flour by cowpea dust by faculty and students of the Department of Food Science at the University of Kufa according to the form described by Jaber (1981), The bread were prepared and presented on ten Arbitrators who were interested by breads the treatments were examined constructed on (diameter (cm), thicken (Mm), top layer colour, bottom layer colour, pulp colour, uniformity of pulp texture, pulp softness, odor, chewing, bread leavininig)

Statistical analysis:

All results are presented as means of three replicates and the data are conveyed as means ± standard deviations. In addition, the results were imperiled to one way ANOVA and individual sample T Test using SPSS (version17). The treatments means were separated by comparing the means at $p \leq 0.05$. (Steel *et al*., 1997).

Results and Discussions

Proximate characterization of flour blends from wheat and cowpea

The proximate structure of the flour mixtures is presented in Table (2), against 100% wheat flour (C); 95% wheat flour with 5% cowpea flour (B1), 90% wheat flour with 10% cowpea flour (B2), 85%wheat flour with 15% cowpea flour (B3), 80% wheat flour with 20% cowpea flour (B4), 70%wheat flour with 30% cowpea flour (B5), and 100% cowpea flour (B), the moisture, fat, protein, ash and carbohydrates extended from 9.43% to 10.80%, 11.93% to 16.6%, 1.15% to 2.0%, 1.11% to 1.52% and 76.37% to 69.09% correspondingly for the diverse flour samples. The moisture import for (100%) cowpea flour remained the maximum (12.64%) and was significantly changed from all the flour mixtures. In addition, moisture results indicated that as the wheat replacement increased the moisture increased significantly except B3 and B4 treatments. The moisture substances for all the samples are around the recommended ranges for reliable saving of testes by the criteria organization of FDA and displays that it will has advance keeping value as moisture substance more than 14% in flour was more hazard of bacterial act and mould growing which generate unpleasant modifications in the flours (ASAE,

2003). For the fat content in the flour samples the results showed that cowpea flour has the highest fat content (2.40%) which was significantly differences compared with all other flour samples. Also, the Table (2) showed that the highest protein content was in cowpea flour (24.19%) and as the wheat flour replacement increased the protein content increased significantly. For the ash content, the scores showed that as the wheat flour replacement using flour of cowpea increased the ash content increased significantly except for B4 and B5 which showed no significant . Increase ash ratio denoted that the treatments with high proportion of ash will exist suitable suppliers of metals. However, the carbohydrate content results showed that as the wheat flour replacement increased the carbohydrate content decreased significantly. Reduce in carbohydrate matter might be owing to the little carbohydrate contented of cowpea flour as decayed in comparable employments utilizing legumes (Kent,1984). Oladunmoye, *et al*. (2010) reported that moisture, protein, fat, content for cowpea flour was 14.9 %, 19.39% and 1.95% respectively.

Sensory Properties of breads

Sensory evaluation is a important assess for quality evaluation in a freshly improved diet creation to interest punters and to assemble them necessities. Te select of a diet result be contingent on numerous features like individual, humor, trial and features for example sensual assets, nutrition, health and usefulness. Results in Table (3) showed the sensual feathers of combined bread of the diverse levels with cowpea four supplementation added to the wheat flour. A significant decreased in top layer color attribute was shown in bread samples compared to the control treatment (wheat flour 100%). For the bottom layer color, the grades indicated a significant variations among the control treatment and the other bread treatments. Highest score was in B1 and B2 treatments (8.06). A notable difference is assembled through the estimation of the scrap colour among the combined bread treatments and the wheat bread 100% except B5, the marks noticeably showed that bread made from wheat flour 100% had maximum mark (9.90) enjoyed by sample made from 90% of wheat four with 10% cowpea flour (9.06). Here is an raise in strength of scrap texture with grater grad of fortification. The scores for crumb smoothness exposed that the product prepared including 90% and 80% wheat flour with 10 and 20% of cowpea flour given the maximum counting rate (8.06, 8.03). The addition of cowpea flour initiated more moisture and fat of the product crumb, then the bread was normally not harmfully assessed by the texture just for B5 samples significantly minor records for crumb texture were valued in assessment to control bread (5.03). With the estimation for the odor and chewing of bread, the quality mark extended from 7.03 to 9.80 and 7.06 to7.93. The control bread samples has significantly the highest odor score followed by B1 and B2 treatments. However, B1 treatments has significantly the highest chewing and bread leavening score compared to other bread samples. These differences in bread samples scores can be initiated by the certain fundamental cowpea flour complex, mainly at extreme temperatures, as registered by Serrem *et al*. (2011). Here elements may be influence to the final creation of bread containing amounts of water immersed during dough adding; baking ailments; the situation of the bread constituents, for example starch, fibre, and protein (Majeed *et al*., 2017). Our findings verified that fortification of bread blends with cowpea flour at 10% with wheat flour 90% is suggested for enhancing the dietary and sensorial characters of bread. For physical characteristic of bread, Table (4) showed the physical characteristics of bread blended with different levels of cowpea flour. For the bread weight, the results indicated that B5 has significantly the highest weight (234g) compared to other bread samples. While for the volume the results showed no significant differences between the bread samples.

Amino acid Analysis

As the performance of protein is basically influenced by its amino acid constitution thus the amino acid profile of blends was determined. The results of Table (5) noticed that the all hydrophobic and hydrophilic amino acids content values of the wheat flour supplemented with5, 10, 15 ,20 and 30% of cowpea flour were increased compared to the control (100% wheat flour). As the replacement of wheat flour with cowpea flour increased all the amino acid tested increased. This increase was due to their higher contents in cowpea flour than wheat flour (Mcwatters *et al*., 2004). Asumugha (2002) mentioned that amino acids imitative from cowpea are an actual supplement to those gotten from cereals flour .

Table 2 : Chemical Composition of the wheat flour with different level of Cowpea flour and blends

Means ± standard					Four Treatment
Carbohydrate (%)	**Ash (%)**	**Protein (%)**	**Fat (%)**	**Moisture (%)**	
$76.37^{a} \pm 0.04$	$1.11^{f} \pm 0.003$	$11.93^{g} \pm 0.04$	$1.15^{f} \pm 0.03$	$9.43^{f} \pm 0.03$	Wheat Flour Control
$58.31^{g} \pm 0.09$	$2.90^{a} \pm 0.008$	$24.19^{a} \pm 0.06$	$2.40^{a} \pm 0.02$	$12.19^{a} \pm 0.04$	Cowpea Flour Control
$75.05^{b} \pm 0.07$	$1.22^{e} \pm 0.01$	$12.60^{f} \pm 0.05$	$1.23^{ef} \pm 0.02$	$9.90^{e} \pm 0.005$	B1 (5%)
$73.96^{c} \pm 0.06$	$1.30^{d} \pm 0.02$	$13.05^{e} \pm 0.08$	$1.34^{de} \pm 0.03$	$10.33^{d} \pm 0.03$	B2 (10%)
$71.88^{d} \pm 0.03$	$1.39^{c} \pm 0.01$	$14.79^{d} \pm 0.03$	$1.40^{d} \pm 0.03$	$10.53^{c} \pm 0.01$	B3 (15%)
$70.52^{e} \pm 0.02$	$1.47^{b} \pm 0.01$	$15.70^{c} \pm 0.04$	$1.68^{c} \pm 0.04$	$10.62^{c} \pm 0.01$	B4 (20%)
$69.09^{f} \pm 0.01$	$1.51^{b} \pm 0.03$	$16.59^{b} \pm 0.02$	$2.00^{b} \pm 0.06$	$10.80^{b} \pm 0.05$	B5 (30%)
0.1687	0.0563	0.1635	0.1256	0.103	L.S.D
0.0001	0.0001	0.0001	0.0001	0.0001	P(value)

Means with same letter are not significantly differences

Table 3 : Sensory Evaluation of Bread Supplemented blends with Different Level of Cowpea flour

P (value)	LSD	B5	B4	B3	B2	B1	Control Wheat 100%	Characteristics
0.0001	0.7629	$12.96^{e} \pm 0.08$	$27.03^{d} \pm 0.03$	$33.10^{b} \pm 0.05$	$35.06^{a} \pm 0.03$	$33.26^{b} \pm 0.14$	$29^{c} \pm 0.57$	(cm) Diameter
0.0001	0.2685	$2.03^{c} \pm 0.03$	$5.10^{b} \pm 0.05$	$5.13^{b} \pm 0.06$	$4.96^{b} \pm 0.08$	$4.96^{b} \pm 0.08$	$6.76^{a} \pm 0.14$	Thickness (Mm)
0.0001	0.1512	$8.06^{b} \pm 0.03$	$8.06^{b} \pm 0.06$	$7.03^{d} \pm 0.03$	$8.03^{b} \pm 0.03$	$7.90^{c} \pm 0.05$	$9.10^{a} \pm 0.05$	Top layer colour
0.0001	0.2481	$7.06^{c} \pm 0.03$	$7.03^{c} \pm 0.03$	$6.96^{c} \pm 0.08$	$8.06^{a} \pm 0.06$	$8.06^{a} \pm 0.03$	$7.80^{b} \pm 0.15$	Bottom layer colour
0.0001	0.1569	$8.03^{c} \pm 0.03$	$9.03^{a} \pm 0.03$	$9.03^{a} \pm 0.03$	$9.06^{a} \pm 0.03$	$8.83^{b} \pm 0.08$	$9.90^{c} \pm 0.05$	crumb colour
0.0001	0.1624	$5.03^{c} \pm 0.03$	$7.03^{b} \pm 0.03$	$8.03^{a} \pm 0.03$	$8.06^{a} \pm 0.03$	$7.96^{a} \pm 0.08$	$6.93^{b} \pm 0.06$	Uniformity of Pulp Texture
0.0001	0.2138	$6.03^{d} \pm 0.03$	$7.06^{c} \pm 0.06$	$8.06^{b} \pm 0.03$	$7.90^{b} \pm 0.05$	$8.86^{a} \pm 0.06$	$6.93^{c} \pm 0.12$	Pulp Softness
0.0001	0.1569	$7.03^{d} \pm 0.03$	$7.06^{d} \pm 0.03$	$8.03^{c} \pm 0.03$	$9.03^{b} \pm 0.03$	$9.06^{b} \pm 0.03$	$9.80^{a} \pm 0.10$	Odor
0.0001	0.1512	$7.06^{c} \pm 0.03$	$8.03^{b} \pm 0.03$	$8.00^{b} \pm 0.05$	$8.03^{b} \pm 0.03$	$9.00^{a} \pm 0.05$	$7.93^{b} \pm 0.06$	Chewing
0.0001	0.1453	$4.06^{e} \pm 0.03$	$6.06^{d} \pm 0.03$	$7.03^{b} \pm 0.03$	$7.06^{b} \pm 0.03$	$8.03^{a} \pm 0.03$	$6.83^{c} \pm 0.08$	Bread Leavening

Means with same letter are not significantly differences

Table 4 : Physical feathers of bread samples.

B5	B4	B3	B2	B1	Control	Feathers
$234^{e} \pm 0.2$	$229^{d} \pm 0.2$	$222^{c} \pm 0.1$	$219^{c} \pm 0.1$	$199^{d} \pm 0.3$	$193^{c} \pm 0.5$	Weight (g)
$135^{d} \pm 0.3$	$105^{d} \pm 0.1$	$133^{d} \pm 0.2$	$123^{d} \pm 0.2$	$120^{d} \pm 0.2$	$105^{d} \pm 0.1$	Volume (cm3)
$2.9^{d} \pm 0.3$	$2.20^{c} \pm 0.1$	$2.25^{d} \pm 0.2$	$2.55^{e} \pm 0.1$	$2.86^{d} \pm 0.2$	$3.19^{d} \pm 0.1$	Specific volume (cm3 /g)

Means with same letter are not significantly differences

Table 5 : Amino Acid Profile(mg/g) of Wheat Flour with Different Level of Cowpea Flour

B5 (30%)	B4 (20%)	B3 (15%)	B2 (10%)	B1 (5%)	Control Cowpea	Control Wheat	Treatment amino acid
33.4	23.3	19.2	13.6	9.4	5.2	5.6	Aspartic Acid (hydrophilic)
34.6	27.6	22.1	16.7	11.4	7.4	7.6	Phenylalanine
32.1	29.4	25.3	18.6	14.6	10.2	8.7	Lysine (hydrophilic)
36.7	24.9	19.1	16.0	12.6	8.2	11.6	Valine (hydrophilic)
36.1	23.7	18.7	14.3	10.7	6.3	6.7	GlutamicAcid (hydrophilic)
42.6	32.7	27.8	23.7	19.8	15.7	4.4	Arginine (hydrophilic)
46.2	40.1	36.0	31.6	26.3	22.6	6.3	Glycine (hydrophilic)
36.0	28.6	21.1	17.2	11.8	9.8	10.5	Alanine (hydrophobic)
42.7	33.7	26.7	19.4	15.2	11.9	6.2	Methionine (hydrophilic)
50.3	30.0	24.3	16.9	11.9	9.9	5.2	Lucien (hydrophilic)

Conclusion

This study showed a innovative fortification diet made by complement of complete wheat flour with five variance flours levels of cowpea are appropriate by human. Bread of suitable eminence were created from merged of wheat and cowpea flours, its made have improve nutrient ingredients which are completely appropriate for safe health then safety. In addition, the paper showed that fortification of wheat flour beside 10% cowpea flour made well accepted breads. The use of cowpea in bread will exit a lengthy style in enriching health nutrition then safety of the users and lessen the addition on wheat flour, thus keeping the enormous external conversation utilized in trade in wheat, on behalf of other schemes. It will moreover decrease food diffidence and vary the usage of cowpea flour.

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