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Investigate the Effects of Increased Yeast Addition and Proofing Time on the Quality Characteristic of Bread from Wheat and Cassava Flour

T. A. Dendegh[1*], D. I. Gernah[1] and M. O. Eke[1]

[1]Department of Food Science and Technology, University of Agriculture, P.M.B 2373 Makurdi, Benue State, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author TAD designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author DIG managed the analyses of the study. Author MOE managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To investigate the effect of yeast addition and proofing time on the quality characteristic of bread from wheat and cassava flour.
Study Design: Composite flour of wheat and cassava was prepared in a ratio 70:30% from which sample B, C, D, E, F, F, G, H, I and J were obtained. Each of the samples was treated with 3, 6 and 9 g yeast concentration at different proofing time of 60, 90 and 120 minutes respectively. The samples were further subjected to analyses of proximate composition, vitamins and sensory properties to ascertain the quality to wheat-Cassava flour.
Results: The result revealed a significant (P< 0.05) increase in proximate composition as Protein content range from 13.13-15.57, Ash content 1.76-3.47, Fat content 2.39-3.14, Moisture conten34.65-35.87, Fibre content 0.78-2.17, Carbohydrate content 53.11-60.94% and Energy 289-304 Kcal. Vitamins content also showed significant (P< 0.05) increase as β-carotene ranged from 2.51-5.21, B_1 0.22-1.19, B_2 0.21-0.25, B_3 0.08-0.21 and Vitamin C 1.14-10.22 mg respectively. The

**Corresponding author: E-mail: dendeghterwaseabraham@gmail.com;*

sensory attributes showed significance ($p< 0.05$) changes in crumb colour, crust colour, aroma and texture.

Conclusion: Acceptable and nutritious bread was produced from the composite flour of wheat and cassava. Though the 100% wheat bread was organoleptically proved more acceptable, the composite flour bread samples were more nutritious. However, with the present cost of wheat flour, it is advantageous to explore the possibility of using cassava (30%) flours for the commercial production of bread in Nigeria.

Keywords: Yeast; proofing time; wheat; cassava and bread.

1. INTRODUCTION

Bread is a staple food prepared from the dough of flour and water, usually by baking. Throughout recorded history, it has been popular around the world and is one of the oldest artificial foods, having been of importance since the dawn of Agriculture [1]. In Nigeria, Bread has been one of the most widely consumed food products after rice. Till date, most Nigerians have not been introduced to other types of bread apart from that made from 100% wheat flour. To cut the nation's expense on wheat importation and find wider utilization for the increasingly produced cassava roots, the Federal Government mandated the use of composite cassava-wheat flour for baking by adding a minimum of 10% cassava flour to wheat for a start [2]. To ensure the commercial success of this composite cassava wheat flour technology, systematic studies need to be conducted to fully understand the best way to formulate product and to determine the optimal processing conditions required to realize high quality baked products [2]. Most of the previous studies conducted on the use of composite flour for bread making purposes were devoted to determining the effect of the biological origin of flour and level of wheat flour substitution on their bread making quality [3]. The composite flours used were either binary or ternary mixtures of flours from some other crops with or without wheat flour. They generally observed a reduction in loaf volume and impairment of sensory qualities (e.g., appearance, texture, and flavor) as the level of substitution of wheat with nonwheat flour increased. Some varietal differences within the same crop in terms of bread making potential were also reported. In the work of [3] it was specifically reported that inclusion of Cassava Flour into wheat flour up to about 30% could still give an acceptable fresh loaf depending on the source of flour. Bread is the loaf that results from the baking of dough which is obtained from a mixture of flour, salt, sugar, yeast, and water. This other ingredients like fat, milk solids, sugar, egg, and anti-oxidant may be added. Nowadays, the emphasis is on healthy bread with low glycemic index, more protein and increase dietary fibre. Cassava is a major source of dietary energy for low income consumers in many parts of tropical Africa [4]. Cassava flour can be substituted into many products (such as wheat flour) that provide the same function as it. Cassava flour seems to be golden products that have surpassed the imagination of stakeholders in the industry. Wheat flour which is used produce many finished products is now gradually being dumped for cassava flour in Nigeria. The fact is not far from the reason that it improves the economic value of bakers [2]. This research study tends to consider the possibility of increased yeast addition and proofing time to improve the quality characteristic of Bread from Wheat and Cassava flour.

2. MATERIALS AND METHODS

High-yielding, low-cyanide cassava roots of improved cultivar TMS 30572 were obtained from the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, and processed into high-quality starch (HQCS) within 24 h according to standard procedures developed and adopted by FIIRO at the pilot plant of the Federal Institute of Industrial Research, Oshodi (FIIRO), Lagos, Nigeria.

2.1 Proximate Composition

2.1.1 Moisture content determination

The moisture content of the flour samples was determined according to [5]. Two grams each of the flour samples were weighed into different moisture cans. It was then placed in an oven at 150ºC for three hours. Drying was stopped after obtaining two consecutive values differing by 0.001. The samples were cooled in a desiccator and weighed.

$$\% \, Moisture \, Content = \frac{W_2 - W_3}{W_2 - W_1} \, X \, 100$$

Where:

W_1 = initial weight of empty can,
W_2 = weight of empty can + sample before drying,
W_3 = final weight of empty can + sample after drying.

2.1.2 Ash content determination

Porcelain crucible was dried and cooled in desiccators before weighing. Two (2) grams of the sample flours were weighed into the crucible and the weight taken. The crucible containing the samples were placed in the muffle furnace and ignited at 550ºC. This temperature was maintained for three hours. The muffle furnace was then allowed to cool; the crucibles were then brought out, cooled and weighed. The ash content was calculated as follows:

$$\% \, Ash \, Content = \frac{W_2 - W_3}{Weight \, of \, sample} \, X \, 100$$

Where:

W_2 = weight of crucible + ash,
W_1 = weight of empty crucible.

2.1.3 Crude fat content determination

The fat content of the flour samples was determined using two (2) grams each of the flour samples in a filter paper and placed in a soxhlet reflux flask which is connected to a condenser on the upper side and a weighed oil extraction flask full with two hundred ml petroleum ether. The ether was brought to its boiling point, the vapor condensed into the reflux flask immersing the samples completely for extraction to take place on filling up the reflux flask siphons over carrying the oil extract back to the boiling solvent in the flask. The process of boiling, condensation, and reflux was allowed to go on for four hours before the defatted samples were removed. The oil extract in the flux was dried in the oven at 60˚C for thirty minutes and then weighed.

$$\% \, Fat \, Content = \frac{W_4 - W_3}{W_2 - W_1}$$

Where:
W_1 = weight of oven dried thimble,
W_2 = weight of sample used,
W_3 = weight of round bottom flask,
W_4 = weight of round bottom flask with fat residue.

2.1.4 Crude fibre determination

The crude fibre of the flour and bread samples was determined according to the method. Two grams each of the samples were boiled under reflux for thirty minutes with 200 mL of the solution containing 1.25 g of H_2SO_4 per 100 mL of solution. The solution was filtered through linen on a flaunted funnel and washed with water until the washing is no longer acidic. The residue was then transferred to a beaker and boiled for thirty minutes with 100 mL of solution. The final residue was filtered through a thin—but—closer pad of washed and ignited asbestos in a Gosh crucible. The residue was then dried in an electric oven and weighed; the residue was incinerated, cooled, and weighed.

$$\% \, Crude \, Fibre = \frac{W_2 - W_3}{W_1} \, X \, 100$$

W_1 = weight of sample used,
W_2 = weight of crucible plus sample,
W_3 = weight of sample crucible + ash.

2.1.5 Crude protein determination

Crude protein of the sample flours was determined using the Kjeldahl method. One gram of the sample was introduced into the digestion flask. Kjedahl catalyst (Selenium Tablets) was added to the sample. Twenty ml of concentrated sulphuric acid was added to the sample and fixed to the digester for eight hours until a clear solution was obtained. The cooled digest was transferred into one hundred ml volumetric flask and made up to the mark with distilled water. The distillation apparatus was set and rinsed for ten minutes after boiling. Twenty ml of 4% boric acid was pipetted into a conical flask. Five drops of methyl red were added to the flask as an indicator and the sample was diluted with seventy-five ml distilled water. Ten ml of the digest was made alkaline with twenty ml of NaOH (20%) and distilled. The steam exit of the distillatory was closed and the change of color of the boric acid solution to green was timed. The mixture was distilled for fifteen minutes. The filtrate was then titrated against 0.1 N HCl. The percentage total was calculated:

% protein = % nitrogen ×conversion factor (6.25).

2.1.6 Carbohydrate content determination

Carbohydrate content of the flour samples was determined by using the formula described by Ihekoronye and Ngoddy, (1985).

% carbohydrate =100 −% (protein + fat + fibre + ash +moisture content.)

2.1.7 Energy value

This was done using the Atwater Factor (4, 9, and 4) for carbohydrate, fat and protein respectively as described by Suzanne [6].

2.2 Vitamin Analysis

2.2.1 Determination of β carotene

xylene (a/a); 1 M solution of potassium hydroxide in 90% ethanol. 1 mL of the analyzed liquid was measured into the test-tube I (centrifugal) and tightened. 1 mL of the KOH solution was added. The tube was plugged and placed on a shaker for 1 minute. It was then heated in a water bath (60°C, 20 minutes), then cool in cold water. 1 mL of xylene was added, then shake vigorously again for 1 minutes in a centrifuge the tube (1500×g, 10 minutes). The separated extract (upper layer) was transferred into a test tube II made of "soft" (sodium) glass to measure the absorbance A1 of the obtained extract at 335 nm against xylene irradiate extract in the test tube II to the UV light for 30 minutes, then take the absorbance A2. The concentration cx of vitamin A (μM) was calculated in the analyzed liquid, using the formula:

$cx = (A1 – A2) \cdot 22.23$

Where:

22.23 – multiplier received on basis of the absorption coefficient of 1% solution of vitamin A (as the retinol form) in xylene at 335 nm in a measuring cuvette about thickness = 1 cm.

Preparation of Diluent for B-group vitamins

Double distilled water was used as the diluent while 3% dipotassium phosphate solution was used for folic acid because it is insoluble in water.

2.2.2 Determination of Vitamin B1, B2, B3 and C stock solutions

Accurately weighed amounts, 50 mg of thiamine hydrochloride (vitamin B1), 60 mg of riboflavin (vitamin B2), 50 mg of nicotinamide (vitamin B3) and 50 mg of ascorbic acid (vitamin C), were taken into 100 mL volumetric flask separately and 50 ml of diluent was added and sonicated to dissolve. The volume was made up to the mark with diluent. The working standard solutions of vitamins contained 500 μg/mL of thiamine hydrochloride (vitamin B1), 600 μg/mL of riboflavin (vitamin B2), 500 μg/mL of nicotinamide (vitamin B3), and 500 μg/mL of ascorbic acid (vitamin C). The solutions were then filtered through Whatman filter paper 1.

Standard preparation

The stock solution, 2 ml of thiamine hydrochloride (vitamin B1), 2 ml of riboflavin (vitamin B2), 2 ml of nicotinamide (vitamin B3) and 10 of ascorbic acid (vitamin C) were transferred to a 100 volumetric flask and the volume was made up with diluent and mixed well. This final solution contains 10, 12, 10 and 50 μg/mL of vitamin B1, vitamin B2, vitamin B3 and vitamin C respectively.

Sample preparation

The average weight of 20 capsule and tablets were determined and crushed to a fine powder. An amount equivalent to the average weight of the sample, i.e., 1.0 mg of vitamin B1, 1.5 mg of vitamin B2, 10 mg of vitamin B3 and 50 mg vitamin C, were taken into 100 mL volumetric flask and 50 ml of diluents was added and sonicated to dissolve. The volume was made up to the mark with diluents. The solutions were then filtered through Whatman filter paper 1. Above sample solution, 5 ml of vitamin B3, and 5 ml of vitamin C were taken into 50 mL volumetric flask separately and 20 ml of diluents was added to dissolve. The volume was made up to the mark with diluents. (3% dipotassium phosphate solution) was added and sonicated to dissolve. The volume was made up to the mark with diluents. This final solution contains 10, 12, 10 and 50 μg/mL of vitamins B1, vitamin B2, vitamin B3 and vitamin C respectively.

Vitamin B1 (Thiamine hydrochloride)

5 ml of the standard and sample was taken in marked test tubes. In each test tube, 5 ml NH_4OH (0.1 M) and 0.5 ml 4-Amino phenol solution added and mixed well, then kept for 5 minutes added 10 ml chloroform and separate of chloroform layer. The absorbance

recorded chloroform layer at 430 nm against blank. The amount of vitamins B1 (mg or mcg) was calculated by the following:

$$Amount\ of\ Vitamins = \frac{sample\ Absorbance}{standard\ \ Absorbance} X \frac{Standard\ weight}{Standard\ Dilution} X \frac{Si}{S}$$

Vitamin B2 (Riboflavin)

5 ml of the standard and sample solution was taken in marked test tubes. In each test tube, 2 ml hydrochloric acid (1 M), 2 ml glacial acetic acid, 2 ml hydrogen peroxide, 2 ml potassium permanganate (15% w/v) and 2 ml phosphate buffer (pH 6.8) added and mixed well and absorbance recorded at 444 nm against blank. The amount of vitamins B2 (mg or mcg) was calculated by the following:

$$Amount\ of\ Vitamins = \frac{sample\ Absorbance}{standard\ \ Absorbance} X \frac{Standard\ weight}{Standard\ Dilution} X \frac{Si}{S}$$

Vitamin B3 (Nicotinamide)

2 ml of the standard, sample and blank solution was taken in marked test tubes. In each test tube, 5 ml sulphanilic buffer (pH 4.5), 5 ml water and 2 ml cyanogen bromide solution (10% w/v) added and mixed well and absorbance recorded at 450 nm against blank and recorded an interval of 2 minutes. The amount of vitamins B3 (mg or mcg) was calculated by the following:

$$Amount\ of\ Vitamins = \frac{sample\ Absorbance}{standard\ \ Absorbance} X \frac{Standard\ weight}{Standard\ Dilution} X \frac{Si}{S}$$

2.2.3 Determination of vitamin C

1g of bread samples was weighed into a conical flask. 2.5mL of 1M H_2SO_4 and 40mL of distilled water were added to the samples in the conical flask. The flask was then shaken properly and titrated against 0.05M iodine solution with starch mucilage solution added as an indicator. A standard solution of 100mg of Vitamin C was prepared and titrated as above and Vitamin C was then calculated as shown below:

$$Vitamin\ C \frac{mg}{100g} = \frac{Vt}{Vs}\ X\ Ws\ x\ 20\ x \frac{5}{vol}.\ of\ acid\ used$$

2.3 Sensory Evaluation

Sensory evaluation based on the sensory attributes were conducted by using a standard 9-points hedonic scales method (where 1 = dislike very much and 9 = like very much) as described by Ihekoronye and Ngoddy, (1985). A total of 30 semi-trained panelists aged 18 and above years old were involved in the evaluation of crust and crumb color, aroma, taste, texture and overall acceptability. The bread samples were sliced into pieces of uniform thickness (2 cm), coded with a 3-digit random number using statistical random Tables and served to the panelists with bottled water for rinsing the mouth after every sample taste in a randomized order. The panelists were instructed to rate the attributes indicating their degree of liking or disliking by putting a number as provided on the hedonic scale according to their preference.

2.4 Statistical Analyses

All analyses were carried out in triplicate unless otherwise stated. Statistical significance was

Table 2. Requirements for white bread

S/NO	Characteristic	Requirements
A	Specific vol.	4.0
B	Moisture (%) (Max)	40.0
C	Total solids content (%)	60.0
D	Protein (%)	10.0
E	pH of aqueous extract	5.3 – 6.0
F	Ash content (%) Max	0.6
G	Acid soluble ash (Max)	0.5
H	Fat content (%) Max	2.0
	Saturated	0.5
I	Crude fibre (%) Max	0.5
J	Carbohydrate (%) Max	48.0
K	Energy (kj/100g)	900 – 1000

SON, 2014

established using one-way analysis of variance (ANOVA), and data were reported as the mean standard deviation. Mean comparison and separation was done using Fisher's Least Significant Difference test (LSD) at p≤ 0.05. (P< 0.05). Statistical analysis was carried out using the SPSS 20 statistical package.

3. RESULTS AND DISCUSSION

3.1 Discussion

3.1.1 Effect of yeast addition and proofing time on the proximate composition of wheat–cassava composite bread samples

Table 2 shows the effect of yeast addition and proofing time on the proximate composition of wheat/cassava composite bread. The high crude protein content in this work was due to yeast activity and the quantity of yeast added. The crude protein was also found to be higher than that of the control (100% wheat) bread and SON. This result agrees with those presented by [7] but is less than those presented by [8].

The Ash content of the composite bread is higher than those presented by [9]. The increase in ash content could be due to increase in cassava flour inclusion as reported by [10].

The crude fat content also was found to higher than the control (100% wheat) and SON. This could possibly be as a result of the amount of margarine added during ingredient mixing. However, [10] suggested more butter, sugar etc. to aid production of carbon dioxide in composite bread.

The moisture content of the bread was below that reported [11]. The moisture content presented in Table 2 agree with the study reported by [7] and [11]. Moisture 30 – 35% for bread is good compared to the maximum value of 40% specified by SON [9,7]. The moisture content of food is usually used as an indicator of food quality. Hence, the moisture content presented above was satisfactory. Too high moisture content in bread could have a potential impact on the sensory physical and even microbial characteristic of the bread [12].

The crude fibre content of the composite bread was more than that of the control (100% wheat) and SON. Increase in the crude fibre content of the composite bread arising from cassava flour inclusion may have pronounced effects on dough properties yielding higher water absorption, mixing tolerance and tenacity, small extensibility in comparison with those obtained without fibre addition [13]. This adverse effect as suggested by [8] could be seen in the dough structure and volume. This is because of the reduction in the gluten network of wheat flour which in turn impairs the retention of carbon dioxide produced. It had also been reported that crude fibre had an adverse effect on the mineral element in the body [14].

The carbohydrate content of the composite bread sample was higher than those presented by SON. The increased carbohydrate content could be due to the high amount of cassava flour inclusion.

The same could not be said for Energy value because they were less than the SON standard. This result, however, agrees with those which were reported by [8].

3.1.2 Effect of yeast addition and proofing time on the vitamin content of wheat – cassava composite bread samples

The effect of yeast addition and proofing time on the vitamin content of the composite bread samples are presented in Table 3. The β-carotene content of the composite bread sample tends to increase with increase yeast addition and proofing time. This could be because of the yeast activities during fermentation. Though, the β-carotene content of the composite bread is less than that of the control (100% wheat) sample. β-carotene is required in the body for clearer vision and sight. Deficiency could lead to blindness, the wettability of the eyes, xerosis (dryness) of the eye surface, bones, reproduction, cell division and differentiation [15]. It also aids in immune response and reduces the risk of degenerative diseases such as cancer and cardiovascular disease.

Vitamin B_1 (thiamin) also increases in the same trend but less than the control sample for most of the sample as shown in Table 3. Vitamin B_1 aids to promote neurotransmission involved in memory and learning. Its role also includes carbohydrate metabolism, maintenance of normal digestion and appetite. It is also essential for normal functioning of the nervous system, muscular and cardiovascular system, a certain amount of Energy and also aid in fertility and lactation. It's deficiency cause beri-beri and Wernicke-Korsakoff syndrome [16].

Table 2. Effect of yeast concentration and proofing time on the proximate composition of wheat –cassava composite bread samples

Samples	Crude protein	Ash	Crude fat	Moisture	Crude fibre	CHO	Energy
Wheat flour	12.3± 0.04	0.80±0.00	4.40±0.02	11.6 ±0.01	0.98±0.00	70.9 ±0.01	372.40±0.09
Cassava flour	0.80±0.13	0.1± 0.00	1.0 ±0.00	10.4± 0.08	1.25±0.04	87.8 ±0.13	362.8 ±0.01
SON							
A	13.14^{a} ± 0.02	1. 76^{a} ±0.04	2.39^{a} ± 0.02	34.64^{a} ± 0.04	0.78^{a} ± 0.02	60.94^{a} ± 0.09	320.23^{a}±0.02
B	12.14^{b} ± 0.00	3.86^{b}± 0.01	3.14^{a}±0.01	35.85^{b}± 0.03	2.17^{b}±0.01	53.11^{b}± 0.07	289.26^{b}±0.04
C	14.23^{c} ± 0.00	3.72^{bc} ± 0.29	3.12^{a}± 0.04	35.86^{b}±0.02	2.18^{b}± 0.00	53.60^{c}± 1.25	299.40^{d}±0.02
D	15.54^{d} ± 0.03	3.59^{bc} ± 0.24	3.08^{a}± 0.04	35.85^{b}± 0.02	2.13^{b} ± 0.02	53.62^{c}± 1.03	304.36^{e}±0.01
E	12.15^{b}± 0.00	3.84^{b} ±0.24	3.13^{a}±0.00	35.91^{b}±0.04	2.15^{b}± 0.04	53.11^{b}± 0.26	289.21^{b}±0.01
F	14.21^{e}± 0.00	3.71^{bc} ± 0.28	3.10^{a}±0.06	35.96^{b}± 0.02	2.12^{b}± 0.00	53.60^{c}± 0.70	299.14^{d}±0.07
G	15.58^{d} ± 0.00	3.47^{c} ± 0.21	3.12^{c}± 0.00	35.92^{b}± 0.02	2.13^{b} ± 0.00	53.62^{c}± 1.03	304.80^{e}±0.03
H	12.14^{b} ± 0.00	3.72^{bc} ± 0.29	3.12^{a}± 0.04	35.94^{b} ±0.01	2.17^{b}± 0.01	53.67^{c} ± 0.28	298.70^{c}±0.00
I	14.19^{c}±0.01	3.62^{bc} ± 0.24	3.10^{a}±0.11	35.86^{b}±0.02	2.14^{b}±0.01	53.61^{c}± 0.85	299.10^{d}±0.01
J	15.57^{d}± 0.00	3.47^{c} ± 0.21	3.08^{a}± 0.04	35.87^{b}±0.02	2.17^{b}±0.01	53.61^{c}± 0.85	304.40^{e}±0.03
LSD	0.41	0.32	0.89	0.64	0.52	0.34	0.56
SON	10.0	0.60	2.0	40.0	0.50	48.0	900 - 1000

Means in the same column with different superscript are significantly ($p<0.05$) different

Key:

A (Control) = 100 % Wheat flour 1.3 g yeast at Proofing Time 60min
F = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 90 Min
B= Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 60 Min
G = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 120 Min
C = Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 90 Min
H = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 60 Min
D = Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 120 Min
I = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 90 Min
E = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 60 Min
J = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 120 Min

Table 3. Effect of yeast concentration and proofing time on the vitamin content of wheat–cassava composite bread samples

Samples	β-Carotene	Vitamin B_1	Vitamin B_2	Vitamin B_3	Vitamin C
A	5.21^{a}±0.00	0.22^{a}±0.00	0.210^{a}±0.01	0.08^{a}±0.00	1.14^{a}±0.02
B	2.51^{b}±0.01	0.18^{a}±0.01	0.12^{a}±0.01	0.17^{a}±0.01	9.62^{b}±0.12
C	2.74^{bc}±0.02	0.19^{a}±0.01	0.17^{a}±0.01	0.19^{a}±0.00	10.06^{b}±0.021
D	3.42^{d}±0.01	1.14^{b}±0.01	0.24^{a}±0.03	0.21^{a}±0.01	10.21^{b}±0.014
E	2.51^{b}±0.01	0.18^{a}±0.002	0.12^{a}±0.01	0.17^{b}±0.01	9.630^{b}±0.261
F	2.78^{bc}±0.03	0.19^{a}±0.03	0.17^{a}±0.01	0.185^{a}±0.01	10.05^{b}±0.000
G	3.43^{d}±0.02	1.15^{b}±0.02	0.24^{a}±0.03	0.205^{a}±0.01	10.20^{b}±0.000
H	2.51^{b}±0.03	0.18^{a}±0.02`	0.13^{a}±0.00	0.19^{a}±0.01	9.76^{b}±0.049
I	2.89^{c}±0.01	0.19^{a}±0.01	0.17^{a}±0.01	0.21^{a}±0.01	10.05^{b}±0.000
J	3.49^{d}±0.02	1.16^{b}±0.01	0.25^{a}±0.03	0.210^{a}±0.01	10.22^{b}±0.010
LSD	0.33	0.19	0.24	0.31	0.87

Means in the same column with different superscript are significantly (p<0.05) different

KEY:

A (Control) = 100% Wheat flour 1.3 g yeast at Proofing Time 60min
F = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 90 Min
B= Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 60 Min
G = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 120 Min
C = Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 90 Min
H = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 60 Min
D = Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 120 Min
I = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 90 Min
E = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 60 Min
J = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 120 Min

Table 4. Effect of yeast concentration and proofing time on the sensory attributes of wheat – cassava composite bread

Samples	Crust colour	Crumb colour	Aroma	Texture	Overall acceptability
A	8.42^{a}±0.54	8.47^{a}±0.32	8.00^{a}±0.44	6.0^{a}±0.56	8.02^{a}±0.62
B	5.75^{b}±0.79	5.75^{bcd}±0.78	5.85^{b}±0.59	5.90^{ab}±0.55	5.87^{bc}±0.87
C	5.65^{b}±0.81	5.95^{ed}±0.82	5.75^{bc}±0.72	5.65^{bc}±0.75	6.00^{b}±1.03
D	5.65^{b}±0.81	5.85^{ed}±0.81	5.85^{b}±0.93	5.55^{cd}±0.88	5.85^{bcd}±0.87
E	5.55^{b}±1.05	5.60^{bc}±0.88	5.50^{e}±0.82	5.55^{cd}±0.60	5.55^{de}±0.94
F	5.70^{b}±0.92	5.65^{bc}±0.98	5.70^{bc}±0.86	5.25^{def}±1.16	5.50^{ef}±0.94
G	5.80^{b}±0.62	5.90^{ed}±0.79	5.35^{cd}±0.93	5.25^{def}±0.97	5.60^{cde}±0.59
H	5.50^{b}±1.05	5.55^{b}±0.94	5.20^{cd}±1.01	5.40^{cde}±0.88	5.35^{ef}±1.14
I	5.70^{b}±1.08	5.65^{bc}±0.98	5.40^{cd}±1.09	5.20^{ef}±1.10	5.20^{fg}±0.95
J	5.55^{b}±1.23	5.55^{b}±1.10	4.80^{e}±1.01	5.05^{f}±1.43	4.95^{g}±1.15
LSD	0.295	0.290	0.296	0.302	0.304

Means in the same column with different superscript are significantly (p<0.05) different

Key:

A (Control) = 100% Wheat flour 1.3 g yeast at Proofing Time 60 min
F = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 90 Min
B= Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 60 Min
G = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 120 Min
C = Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 90 Min
H = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 60 Min
D = Wheat/ Cassava (70:30) Flour with 3.0 g Yeast at proofing Time of 120 Min
I = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 90 Min
E = Wheat/ Cassava (70:30) Flour with 6.0 g Yeast at proofing Time of 60 Min
J = Wheat/ Cassava (70:30) Flour with 9.0 g Yeast at proofing Time of 120 Min

Vitamin B_2 and B_3 showed the same trend from the Table 3. They all increase as yeast addition and proofing time increases. Vitamin B_3 was found to be higher than that of the control sample. Vitamin C, on the other hand, was found to be higher in the composite bread sample. Vitamin C aids in the prevention of scurvy. Vitamins generally are very important in the body for the formation of certain enzymes, natural growth and reproduction. They are involved in our adaptation to light, respiration etc. they promote energy production and healthy red blood cells formation. They aid in the maintenance of healthy skin, nails, hair, growth, promote blood clotting and in a stress situation. Deficiency can cause gastrointestinal and mental disturbances. However, a study by [17] reported that yeast is a good source of vitamin B and protein.

3.1.3 Effect of yeast addition and proofing time on the sensory attributes of wheat –cassava composite bread

The sensory scores of the composite bread sample and control are presented in Table 4. There was significance ($P<0.05$) difference between the composite bread and control samples in terms of crust color, crumb color, aroma and Overall acceptability. In texture characteristics, there was no significance ($P<0.05$) difference between composite bread sample A and the control sample. The Overall acceptability was determined on the basis of quality scores obtained from the evaluation of taste, texture, aroma, crust and crumb color. However, a result from Table 20 tends to agree with those reported by [18] who reported the same for wheat/maize ans rice bran. The significance ($P<0.05$) difference in color could be as a result of Millard browning reaction caused by the reaction between the wheat protein and added sugars and caramelization which are influenced by the distribution of water and reaction of added sugar Amino acids [19]. Colour is very important criterions for initial acceptance and also used to judge completion of the baking process [8]. Though, it is evident from Table 4 that the control (100% wheat) had the highest score in color. Generally, the baking properties of composite flour are often impaired as well as the organoleptic attributes of the product because of the dilution of the gluten content [20]. Nevertheless, it is evident from the result that the control (100% wheat) bread sample was more acceptable by the panelists. This was because people are used to the quality attributes of the control (100% wheat) than the composite bread samples. However, the composite bread samples were more nutritious in content. This trend also was reported by [21].

4. CONCLUSION

Yeast addition and proofing time significantly improved the crude fibre, vitamin, ash and crude protein content of the bread respectively. The vitamin content of the composite bread product increased as yeast addition and proofing time increase. The sensory attributes, on the other hand, showed that sample C was preferred amongst the composite bread sample. Therefore, acceptable and nutritious bread could be produced from the composite flour of wheat and cassava. Though the 100% wheat bread was organoleptically proved more acceptable, the composite flour bread samples were more nutritious. Cassava flour, yeast addition and proofing time significantly improved the dietary fibre, vitamins and protein contents of the composite bread produce. However, with the present cost of wheat flour, it is advantageous to explore the possibility of using cassava (30%) flours for the commercial production of bread.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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