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Proximate, Functional and Sensory Evaluation of Cake Produced from Composite Mixture of African Locust Bean Fruit Pulp *(Parkia Biglobosa)* Flour and Wheat Flour.

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Abstract

Cake was produced using blends of wheat flour and African locust bean fruit (Parkia biglobosa) pulp flour to assess the suitability of the locust bean fruit pulp flour in baking cake of higher nutritional value. The proximate, functional and sensory qualities of the cake samples produced were investigated. The flour used was made from composite blends of wheat flour and African locust bean fruit pulp flour in varying proportions (100:0, 80:20, 60:40, 40:60 and 20:80). The cake produced from 100% wheat flour served as control, and the flour blends were also analyzed for their functional properties. The results showed that there was a significant increase in moisture, ash and crude fibre as the amount of African locust bean fruit pulp flour increased, while the protein, crude fats and carbohydrate content decreased. The moisture content ranged from 4.40 - 6.92 %, ash (1.51 - 2.18 %), and fibre (1.11 - 2.32 %). The functional properties of the flour varied as the substitution level increased. An increase was observed in the oil absorption capacity (1.19 to 2.42 g/mL), bulk density (0.25 – 0.65 g/mL), water absorption capacity (1.18 – 1.60 g/mL) and the loose density (0.08 – 0.37 g/mL). On the other hand, a decrease was observed in the gelation temperature (72.10 – 68.10 ^{o}C) and the swelling index (1.55 – 1.40 g/mL). The result of sensory attributes were evaluated using 9 point hedonic scale with a mean value of appearance ranging from 6.68 - 8.50, taste (6.82 - 8.28), texture (6.69 - 8.05), and the flavour (6.33 - 7.67). The overall acceptability value ranged from 7.38 to 8.52. The results showed that there was a significant difference at $P<0.05$ between the control and samples with increase in level of substitution in all the parameters investigated. Hence, acceptable cake can be produced from a composite substitute of 80:20 for wheat flour and African locust bean fruit pulp flour.

Keywords: *Wheat flour, Locust bean flour, Cake, Quality assessments.*

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INTRODUCTION

Cake can be described as a highly sweetened, desirable, delicate, tender, non-yeasted baked product, (Okaka, 2005). Cake can also be defined as a baked batter made from sugar, egg, shortenings, and milk as well as leavening agent mixed to produce a fluffy, fine grained baked product, which is often considered as a desert of choice used at ceremonial occasions, particularly wedding anniversaries and birthday and parties (Eke, *et al*., 2008; Zakari, *et al*., 2014).

African locust bean (*Parkia biglobosa*) tree grows widely throughout the savannah region. The locust bean tree can produce between 25-52 kg of pods per annum (Akoma *et al*., 2001). A mature fruit contains a yellow pulp with dark brown seeds embedded inside. The pulp is usually consumed for it sweet taste, and it can also is be washed away to obtain the seeds which are usually processed into a condiment called *dawadawa in Hausa* or *iru in Yoruba. Dawadawa* is a good source of protein among the low income families in West Africa. Although the locust bean seed had been extensively studied, (Afolayan *et al*., 2014) little studies have been carried out on the utilization of the pulp. Sometimes the pulp is prepared into flour and used in soups as a thickener, or eaten with cereals as porridge (Omauvbe *et al*., 2004). A traditional drink can also be prepared valued for its health benefits (Akoma *et al*., 2001). Products processed from locust bean pulp by infusing the fruit pulp in hot water. The drink is usually consumed locally as health tonic and on experimental basis include jam and syrup (Akubor, 2007).

The locust bean fruit pulp is good source of nutrient and phytochemicals which includes flavonoids, phenols, carotenoids among others (Gernah, 2007). Phytochemicals provide health benefits in chronic disease control such as cardiovascular arrest. Thus, more food contains phytochemical compound are required from a conventionally new source. There is need to identify local source of phytochemicals and enhance their consumption. The objectives of this research are to exploit the potential of African locust bean fruit pulp flour (*Parkia biglobosa*) in composite mixture with wheat flour for its proximate composition, functional properties and organoleptic evaluation, and also those of the cake produced from blends of varying proportions.

METHODOLOGY

Sample Collection

The locust bean fruits were purchased from Gaya, which is the headquarters of Gaya Local Government Area (LGA) of Kano State. , They were pre-treated by sorting, grading, cleaning to remove all extraneous matter. They were then packaged separately in labeled polythene bags, ready for processing. Refined wheat flour, baking powder, sugar, butter, egg and salt were obtained from a commercial store in Wudil central market, Wudil LGA, Kano state, Nigeria.

Production of African Locust Bean Flour

This was achieved using the methods of Gernah, *et al.,* (2007). The pre-treated fruits were peeled and de-pulped after which their seeds were removed. The pulp were then dried at 60 C for 9 hours, after which they were milled. The resulting flour was sieved using a sieve with pore size of 0.5mm to obtain the fruit pulp flour. This was packaged using suitable packaging materials, ready for use (Fig 1.0).

Formulation of Flour Blends

Wheat flour- locust bean fruit pulp flour blend was produced in different proportions, while the control sample was 100% wheat flour. Five (5) recipe formulations were produced. The locust bean fruit pulp flour replaced wheat flour at ratio of 0.0, 20, 40, and 80% respectively. The formulations were used for the cake production following the method of Zakari, *et al*., (2014).

Table 1.0: Percentage Ratio of Wheat and African Locust Bean Fruit Pulp Flour

Sample code	Wheat flour (%)	Locust bean flour (%)
WFS (Control sample)	100	00
WLB	80	20
WLF	60	40
LBW	40	60
LBF	20	80

Production of Wheat-Locust Bean Fruit Pulp Cake

Five cake samples were prepared using the different flour compositions in Table 1. The creaming method was employed in the preparation of cake reported by Eke *et al*., (2008) and Anon (2004), using wheat-locust bean fruit pulp flour blends, sugar, margarine, baking powder, eggs and salt as shown in table 2.0 to obtain a creamy cake (Figure 2.0).

Table 2.0: Recipe Formation

Ingredient	**Quantity (%)**
Flour (different ratio's)	100
Fat	60
Granulated sugar	50
Milk powder	10
Baking powder	1.25
Whole liquid egg	7.50
Flouring agent	1.25
Salt	1.50

Source: (Zakari, *et al*., 2014).

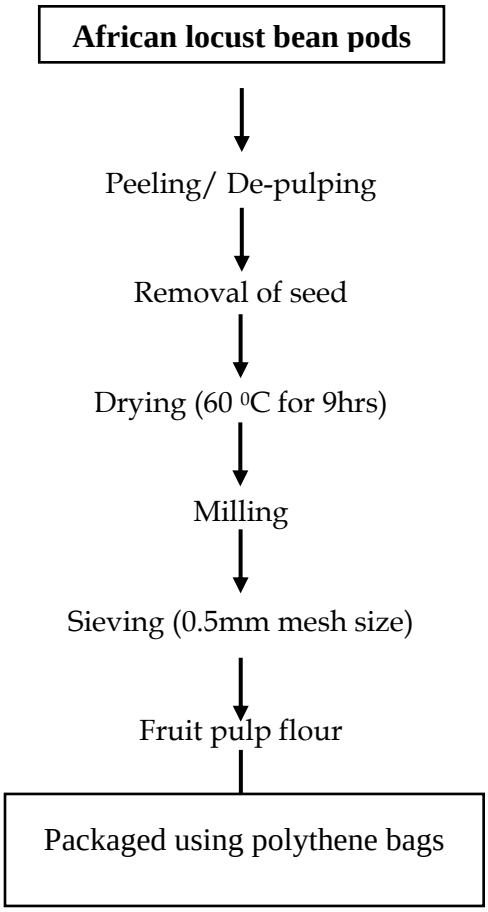

Figure 1.0: Flow Chart for the Production of Locust Bean Fruit Pulp Flour.
Source: (Adopted method of Gernah*, et al.,* 2007).

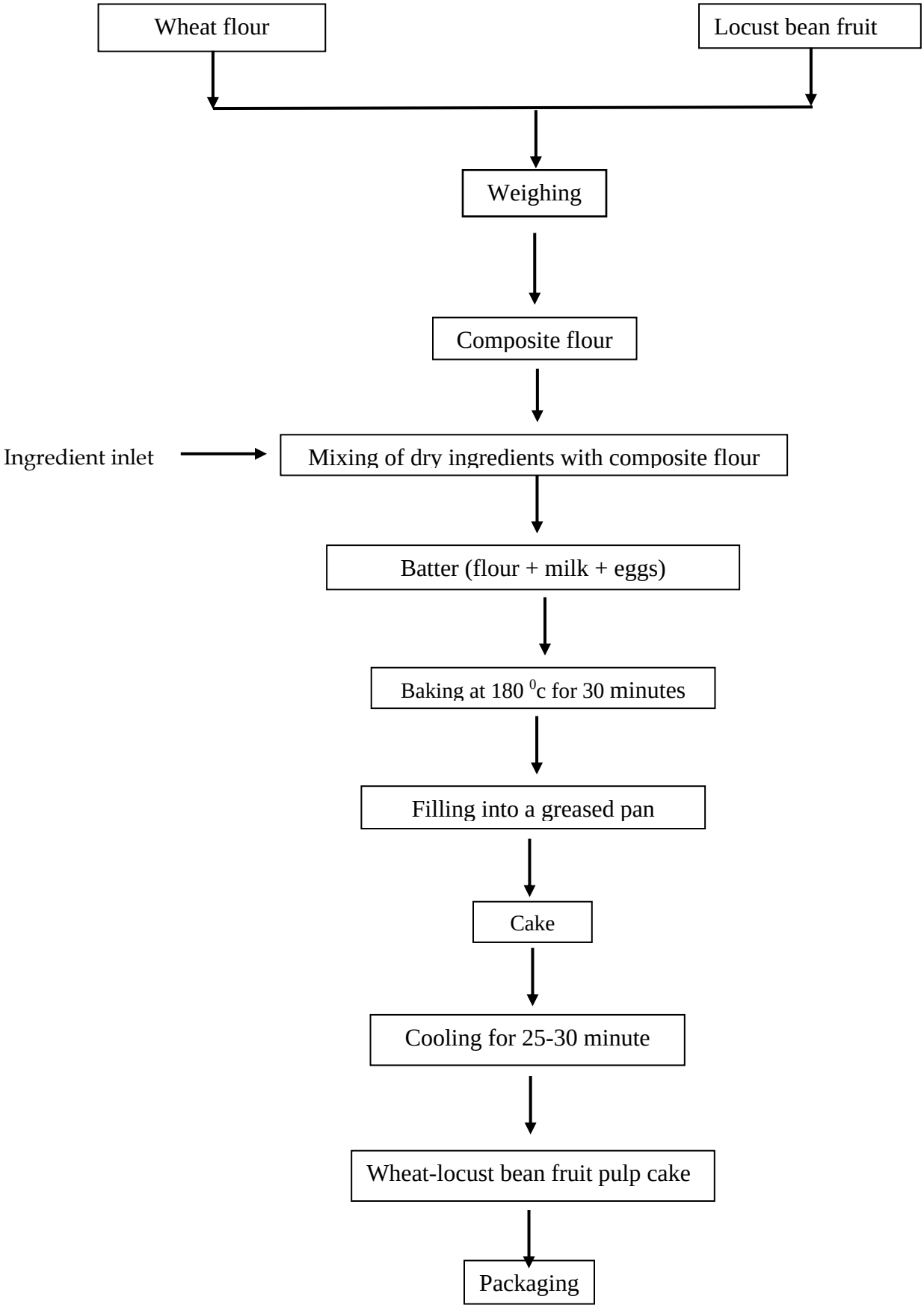
Wheat flour
Locust bean fruit
Weighing
Composite flour
Ingredient inlet
Mixing of dry ingredients with composite flour
Batter (flour + milk + eggs)
Baking at 180 ^{0}c for 30 minutes
Filling into a greased pan
Cake
Cooling for 25-30 minute
Wheat-locust bean fruit pulp cake
Packaging

Figure 2: Flow diagram for the Production of wheat – locust bean Cake.

Source: Adopted from Zakari, *et al.,* (2014) and modified.

Experimental Site

The experiment was conducted in Food Analysis Laboratory, Department of Food Science and Technology, Kano University of Science and Technology, Wudil, Nigeria.

Method of Analysis

Proximate Composition

The proximate analysis was carried out on the various four blends and also on the cake samples produced. Moisture, crude fats, ash, and fibre were determined following the methods described by Onwuka, (2018). The carbohydrate content was determined by percentage difference, while, the crude protein was determined using the micro-kjeldahl method (AOAC, 2000).

Functional properties of wheat – locust bean flour

The functional properties of the various blends of wheat - locust bean flour were determined to ascertain their constraint in cake baking. The properties determined included the bulk density (BD), loose density (LD), water absorption capacity (WAC), swelling index (SI), gelation temperature (GT) and oil absorption capacity (OAC).

Sensory evaluation of wheat – locust bean cake

Sensory evaluation was carried out on the cake samples with 100% wheat flour cake as control. The samples were baked using the different blends with formulation ratio (Table 1). A panel consisting of fifteen (15) semi-trained panelists from the Department of Food Science and Technology, Kano University of Science and Technology Wudil assessed the cake samples. The 9 – point Hedonic scale ranging from nine (9) which means like extremely to one (1) which means dislike extremely was used. The samples were rated for aroma, taste, appearance, texture and general acceptability (Onwuka, 2018).

Statistical Analysis

The results obtained for all parameters were analyzed using INSTAT Package for analysis of variance (ANOVA), except for the results of sensory evaluation, which were analyzed using one way analysis of variance and least significant difference (LSD) were obtained using Turkey's test. (Iwe, 2010).

RESULTS AND DISCUSSION

Proximate composition of wheat-African locust bean fruit pulp flour

Table 3.0 shows the proximate composition of the various blends of wheat - African locust bean fruit pulp *(Parkia biglobosa*) flour. There was a significant increase in moisture, ash and crude fibre as the amount of- African locust bean fruit pulp flour increased, while the protein, crude fats and carbohydrate content decreased. The moisture content ranged from 4.40 - 6.92 %, ash (1.51 – 1.99 %), and fibre (1.11 - 2.10 %).

Table 3.0: Proximate Analysis of Wheat - African Locust Bean Fruit Pulp Mixed Flour.

Code	Moisture (%)	Ash (%)	Crude Fats (%)	Crude fibre (%)	Protein (%)	CHO (%)
WFS	4 .40 ± 0.00[a]	1.51±0.28[a]	2.54±0.00[d]	1.11±00.09[a]	6.98±0.09[c]	83.46±0.02[a]
WLB	5.41±0.04[b]	1.70±0.28[a]	2.31±0.03[c]	1.49±0.01[b]	5.85±0.08[b]	83.24±0.05[b]
WLF	5.78±0.04[b]	1.92±1.56[b]	1.89±0.05[b]	1.86±0.05[b]	5.50±0.08[b]	83.05±0.05[b]
LBW	6.25±2.08[a]	1.99±0.56[b]	1.44±0.00[a]	2.10±0.00[c]	5.23±0.09[b]	82.99±0.01[c]
LBF	6.92±0.01[c]	2.18±0.98[c]	1.12±0.01[a]	2.32±0.11[c]	4.59±0.12[a]	82.87±0.02[c]

*All values are Mean ± Standard deviation of duplicate measurement. *Different letters in same column indicate significant difference between samples at 5% ($P<0.05$).

KEY: WFS-Whole wheat flour sample, 100% wheat as a control sample, WLB - 80% Wheat flour and 20% locust bean fruit pulp flour, WLF- 60% wheat flour and 40% locust bean fruit pulp flour.LBW-40% wheat flour and 60% locust bean fruit pulp flour, LBF-20% wheat flour and 80% locust bean fruit pulp flour.

Proximate Composition of Wheat-Locust Ban Cake Samples

Table 4.0 shows the proximate composition of the five (5) cake samples produced from composite mixture of African locust bean fruit pulp -wheat flour. As with the flour, there was an increase in the moisture, ash and crude fibre values as the substitution increased. Also, the fat, protein and carbohydrate contents decreased. The control cake sample had the lowest moisture content (7.90 %) followed by the WLB sample which was produced from flour with 20% substitution. The LBF sample which had the highest substitution (80 %) with locust bean flour had a significantly higher crude fibre content (1.99 %) as compared to the control sample.

Table 4.0: Proximate Analysis of Wheat - African Locust Bean Fruit Pulp Cake.

Code	Moisture (%)	Ash (%)	Crude Fats (%)	Crude fibre (%)	Protein (%)	CHO (%)
WFS	7.90±0.14[d]	1.04±0.06[d]	17.28±0.11[a]	1.09±0.03[d]	10.75±0.10[a]	61.94±0.00[c]
WLB	8.32±3.11[c]	1.45±0.04[c]	16.97±0.01[b]	1.41±0.00[c]	9.44±0.012[b]	62.41±0.01[b]
WLF	8.56±5.65[c]	1.97±0.08[b]	16.39.±0.05[c]	1.76±0.01[b]	9.05±0.012[c]	62.27±0.04[b]
LBW	8.98±3.81[b]	2.21±0.02[a]	15.20±0.00[c]	1.99±0.01[a]	8.60±0.011[d]	63.02±0.00[a]
LBF	9.26±2.40[a]	2.30±0.00[a]	15.01±0.03[d]	2.05±0.00[a]	8.23 ±0.12[d]	63.15±0.05a

*All values are Mean ± Standard deviation of duplicate measurement. *Different letters in same column indicate significant difference between samples at 5% ($P<0.05$).

KEY: WFS-Whole wheat flour sample, 100% wheat as a control sample, WLB - 80% Wheat flour and 20% locust bean fruit pulp flour, WLF- 60% wheat flour and 40% locust bean fruit pulp flour.LBW-40% wheat flour and 60% locust bean fruit pulp flour, LBF-20% wheat flour and 80% locust bean fruit pulp flour.

Functional Properties of Wheat - African Locust Bean Fruit Pulp Flour

The functional properties of the wheat – locust bean fruit pulp flour produced from composite mixture of African locust bean fruit pulp flour and wheat flour blends are shown in table 5.0. An increase in the values of the bulk density, loose density, water absorption index, oil absorption capacity was observed. The LBF sample which was produced from the blend with the highest substitution of locust bean flour (80 %) had the highest bulk density (0.65 g/mL), loose density (0.37 g/mL), water absorption capacity (1.60 g/mL) and oil absorption capacity (2.42 g/mL).

Table 5.0: Functional properties of Wheat and African locust bean fruit pulp flour

Code	B.D (g/mL)	LD (g/mL)	WAC(g/mL)	OAC (g/mL)	S.I (g/mL)	G.T (%)
WFS	0.25±0.09^{d}	0.08±0.02^{c}	1.18±0.04^{d}	1.19±0.00^{c}	1.55±0.02^{a}	72.10±0.03^{a}
WLB	0.29±0.13^{d}	0.15±0.04^{b}	1.39±0.01^{c}	1.25±0.01^{c}	1.52±0.06^{a}	70.98±0.02^{b}
WLF	0.36±0.09^{c}	0.29±0.02^{a}	1.41±0.02^{b}	1.31±0.00^{b}	1.50±0.03^{a}	69.00±0.01^{b}
LBW	0.41±0.15^{b}	0.32±0.00^{a}	1.44±0.02^{b}	1.38±0.05^{b}	1.45±0.01^{b}	69.50±0.01^{c}
LBF	0.65±0.16^{a}	0.37±0.01^{a}	1.60±0.00^{a}	2.42±0.04^{a}	1.40±0.06^{b}	68.10±0.12^{d}

*All values are Mean ± Standard deviation of duplicate measurement of duplicates independent values. *Different letters in same column indicate significant difference between samples at 5% (P<0.05).

KEY: WFS-Whole wheat flour sample, 100% wheat as a control sample, WLB - 80% Wheat flour and 20% locust bean fruit pulp flour, WLF- 60% wheat flour and 40% locust bean fruit pulp flour.LBW-40% wheat flour and 60% locust bean fruit pulp flour, LBF-20% wheat flour and 80% locust bean fruit pulp flour.

Sensory Evaluation of Cake Samples

Table 6.0 shows the result of sensory evaluation of the five (5) cake samples produced from the various blends of wheat – locust bean fruit pulp flour. The control sample (WFS) was the most acceptable in terms of appearance (8.50), flavor (7.67), and taste (8.28), while the sample with the least substitution of locust beans flour (20 %) had the best score for texture (8.05) and overall acceptability (8.52). The flavour score and overall acceptability of the control sample and the WLB sample with 10 % substitution of locust bean flour had no statistically significant difference (P< 0.05). The texture of sample WLB was significantly different from that of the control.

Table 6.0: Sensory evaluation of Cake Samples

Sample Code	Appearance	Flavour	Taste	Texture	Acceptability
WFS	8.50±0.76^{a}	7.67±1.31^{a}	8.28±0.78^{a}	7.55±1.42^{b}	8.50±0.51^{a}
WLB	7.71±0.73^{b}	7.46±0.94^{a}	8.18±0.88^{a}	8.05±0.94^{a}	8.52±0.94^{a}
WLF	7.52±1.39^{b}	7.23±1.67^{a}	7.00±1.52^{b}	7.51±1.56^{b}	7.59±0.88^{b}
LBW	6.41±1.70^{c}	6.33±1.56^{b}	7.01±1.48^{b}	7.64±1.81^{b}	7.44±0.99^{b}
LBF	6.68±2.18^{c}	6.40±1.90^{b}	6.82±1.82^{c}	6.69±2.2^{c}	7.38±1.49^{b}

*All values are Mean ± Standard deviation of fifteen (15) independent measurement. *Different letters in same column indicate significant difference between samples at 5% (P<0.05) level.

KEY: WFS-Whole wheat flour sample, 100% wheat as a control sample, WLB - 80% Wheat flour and 20% locust bean fruit pulp flour, WLF- 60% wheat flour and 40% locust bean fruit pulp flour.LBW-40% wheat flour and 60% locust bean fruit pulp flour, LBF-20% wheat flour and 80% locust bean fruit pulp flour.

Discussion

The proximate composition of composite mixed wheat - locust bean fruit pulp flour and cake samples showed an increase in moisture, ash, and crude fibre due to hydroscopic nature of the African locust bean. The flour therefore tends to absorb moisture easily. An increase in moisture may be as a result of high moisture content in the locust bean flour, storage condition or as a result of the other ingredients added. The high percentage increase in ash content is an indication of high mineral content in locust bean flour. This finding agrees with that of Zakari, *et al*., (2004) where it was reported that the ash content of cake produced from a blend of wheat flour and locust bean fruit pulp flour also increased as the substitution increased. An increase in crude fibre is desirable because fibre adds bulk to the cake and thereby helps in increased bowel movements, which is important in the prevention of diseases in human beings (Gernah, *et al*., 2007). There was a decrease observed in the fat content, protein content and carbohydrate content of the samples as the substitution increased. There was a significant decrease in protein content of the

samples with an increase in African locust bean fruit pulp flour due to low protein content in the locust bean fruit pulp flour.

The increase noticed in the moisture, ash and fibre contents of the cake samples as the substitution increased was as a result of the high content of these parameters in the locust bean flour (Onuegbu, *et al.*, 2013). However, the protein and fat content of the cake decreased as the substitution increased due to an increased locust bean fruit pulp flour which agrees with the findings of Zakari, *et al.,* (2014).

The result of functional properties of the composite flour samples showed that water and oil absorption capacity increased with increased addition of locust bean fruit pulp flour. The water absorption capacity showed that locust bean fruit pulp flour can be incorporated into food formulations, especially those involving dough or batter handling as well as beverage. This findings agreed with the findings of Ubbor and Nwagogu (2010). Good water absorption suggests better performance in texture of baked products as reported in similar findings by Okezie and Bello, (1998). The gelation temperature of the flour samples depend on the carbohydrate content of the food product. The gelation temperature affects the digestibility and textural properties of starch - containing foods (Zakari, *et al*., 2014).

The sensory evaluation conducted on the cake samples showed that there was a significant difference in the mean value of the samples in terms of appearance, taste, flavour, texture and the overall acceptability. The control sample (WFS) was the most acceptable in terms of appearance, flavor, and taste, while the sample with the least substitution of locust beans flour (20 %) had a statistically significant better texture and overall acceptability. The flavour score and overall acceptability of the control sample and the WLB sample with 20 % substitution of locust bean flour had no statistically significant difference ($P< 0.05$). This suggests that the mixed flour sample were well suitable for baking except that with 80% substitution of locust bean flour which was least preferred by the panelists.

CONCLUSION

The result of this study showed that wheat flour can be substituted with up to 20% of African locust bean fruit pulp flour in the production of cake without altering the sensory characteristics and acceptability of the product, though there will be significant changes in the nutritional composition of the samples. This research therefore showed that locust bean fruit pulp flour can be utilized in production of snacks and confectionaries considering its functional properties. The utilization turn would help reduce the cost of wheat and also exploit our locally available raw material to harness it full potential. Further research should also be carried out in the area of vitamin and mineral content of the cake sample as well as the shelf stability of the cake sample to document information on period of storage time.

REFERENCES

Afolayan, M., Bawa, G.S., Sekoni, A.A., Abeke, F.O., Inekwe, V.O, and Odegbile, E.O., (2014): Phytochemical and Nutritional Evaluation of Locust Bean Fruit Pulp *Journal of Emerging Trends in Engineering and Applied Sciences* (JETEAS) Vol. 5(7): Pp. 44-47

Akoma, O.O., Onuoha, J.A., Akoma, A.O., and Zigis, A.A., (2001): Physicochemical attributes of wine produced from the yellow pulp of *Parkia biglobosa* using traditional juice extraction techniques. *Nigerian Food Journal., vol.* 19: page: 76 79.

Akoma, O., Olawepo, O. and Ogunrinde, B.A., (2002): The Production of *T*samiya‟ Wine from *Tamarindus Indica*. *Journal of. Chemical. Society of. Nigeria*. Vol. 27 (1): 17 19.

Akubor, P.I., and Badifu, G.I.O., (2004): Chemical composition, functional properties and baking properties of African breadfruit kernel and wheat flour blends. *Int. J. Food Science and Technology,* Vol. 39: pp.: 223 229

Akubor, P.I., (2007): Processing, utilization and storage properties of locust bean (*Parkia biglobosa*) fruit pulp. Ph.D. Dissertation, Department of Food Science and Technology, University of Nigeria, Nsukka.

Anoop, K.S., Selvam, P.R. and Sivakuma, T. (2010): Isolation, characterization and formulation properties of a new plant gum obtained from *magnifera indica*. *International Journal of Pharmaceutical and Biomedical Research.* Vol. 1(2), page: 35 – 41.

AOAC (2010): *Official Methods of Analysis*.19th edition. Association of Official Analytical Chemists, Washington, DC.

Association of Analytical Chemists (AOAC). (1990). Official Methods of Analysis, Washington D.C. Association of Official Analytical Chemists. Page. 205-228.

Codex Alimentarius; Joint FAO/WHO Expert Committee on Food Additives (JECFA) General standard for food additives, (192-1995): Revision 2011. Viale delle Terme di Caracalla, 00153 Rome, Italy.

Eka, O.U., (1980): Effect of Fermentation in the Nutrient Status of Locust Bean. Food Chemistry, pp. 303-308.

Eke-Ejiofor, J., and Kiin-Kabari D.B., (2004): Effects of substitution on the functional properties of flour, proximate and sensory properties of wheat/plantain composite bread. *International Journal of Agricultural Sciences*. Vol.2 (10): 281-284.

FAO (2017): Traditional *Food Plants*. FAO, Food and Nutrition Paper No. 42: pp.388-393.

Gernah, D.I., (2007): Nutritional and anti –nutritional composition of the African locust bean pulp. *Nigerian Journal of Nutritional. Science. Vol.* 25(2): 145 -148.

Gernah, D.I., Inyang, C.U and Ezeora, N.L., (2005): Effect of Incubation materials on fermentation of African locust beans *(Parkia biglobosa)* in the production of' Dawadawa'. *Nigerian. Food Journal.* Vol. 23: page. 166-173.

Gernmah, D.I., Atolagbe, M.O., and Echegwo, C.C., (2007): Nutritional Composition of the African Locust Bean (*Parkia biglobosa*) Fruit Pulp. *Nigerian Food Journal* Vol. 25: (1), pp. 190-196.

Gloria, N., Elemo, B.O., Elemo, Olufunmilola, O., Oladunmoye, and Ochuko, L. Erukainure., (2005): Comprehensive investigation into the nutritional composition of dehulled and defatted African locust bean seed (*Parkia biglobosa*) *African Journal of Plant Science* Vol. 5(5), pp. 291-295,

Okezie, O and Bello, U. (1988): Physio-chemical properties of winged bean. Journal of food science. Vol. 7 Pp: 14 – 15.

Omafuvbe, B.O., Falade, O.S., Osuntogun, B.A. and Adewusi, S.R.A. (2004): Chemical and Biochemical Changes in African Locust Bean (*Parkia Biglobosa*) and Melon (*Citrullus Vulgaris*) Seeds during Fermentation to Condiments. *Pakistan Journal of Nutrition* Vol. 10(3): page: 140-145.

Onuegbu, N.C., Ihediohanma, N.C., Odunze, O. F and Ojukwu, M. (2013): Efficiency of wheat: maize composite flour as affected by baking method in bread and cake production. *Sky Journal of Food Science* Vol. 2(8), page: 005–013.

Onwuka, G.I (2005): Food analysis and instrumentation, theory and practice. *1st edition,* Napthali printing press, a division of HG support Nig. Ltd. #Adeniyi Jones close, Surulere, Lagos, Nigeria. Pp: 122-128.

Onwuka, G.I (2018): Food analysis and instrumentation, theory and practice. 2rd edition, Napthali printing press, a division of HG support Nig. Ltd. #Adeniyi Jones close, Surulere, Lagos, Nieria. Pp: 179-348.

Osuji, C.M (2008): Importance and Use of additives in bread making. A paper presented at a training workshop on the use of cassava/wheat composite flour and non-bromate additives for making bread and other confectionaries. Held at Michael Okpara University of Agriculture, Umudike.

Ouoba, L.I.I., Rechinger, K.B., Barkholt, V., Piawara, B., Traore, A.S, *et al.,* (2003): Degradation of proteins during the fermentation of African locust bean (*Parkia biglobosa*) by strains of *Bacillus subtilis* and *Bacillus pumillus* for production of *soumbala*. *Journal of Applied Microbiology vol.* 94 page: 396 – 402.

Ubbor, S.C and Nwagogu, C.F. (2010): production and evaluation of noodles from flour blend of cocoyam, bread fruit and wheat. *Nigerian Food journal,* vol. 28(1). Page: 173-198.

WHO, (2003): Postharvest and processing technology of staple foods. Technical Compendium; *WHO*, *Agric. Sc. Bulletin*, no, 88: page: 171-172.

Zakari, U.M., Hassan, A. and Ndife, J. (2014): Quality characteristics of African locust bean fruit pulp cakes. *African Journal of Food Science*, Vol. 9 (1), pp. 17-22.