Production and Evaluation of the Physicochemical, Functional and Sensory Properties of *alkubus* (steam bread) Produced from the Blends of Two Local Wheat Varieties (*Atilla gan Atilla* and *Seri-M82*) and Cowpea Flour Supplements

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Abstract

The quality of the two local wheat varieties (atilla gan atilla, seri-m82) and cowpea composite based alkubus (steam bread) were evaluated. Formulations of 100%, 95%, 90% and 85% were substituted with 5%, 10% and 15% levels of cowpea that yielded 8 experimental groups with 100% control sample of alkubus. Commercial wheat flour sample were employed for alkubus production. The proximate composition, bulk density, water absorption capacity, swelling power, solubility, gluten index, microbial count and acceptability of the alkubus were determined using standard methods of analysis. Bulk density ranged from 0.50 to 0.78 g/cm³ and 0.69 to 0.76 g/cm³, Water absorption from 56.80 to 59.20% and 50.78 to 69.56% increased with addition of cowpea flour. Swelling power decreased with increase in the solubility of the flour. Alkubus supplemented with cowpea had an increased in protein (10.77 to 13.22%, 9.05 to 10.45%), crude fats (4.21 to 4.61%, 4.09 to 4.51%), ash (2.03 to 2.11%, 1.79 to 2.33%), crude fibre (1.01 to 1.51%, 0.92 to 1.24%) and energy (232 to 256kcal, 236 to 258kcal) which increased with the level of substitution. While moisture decreased with the level of substitutions respectively. Level of acceptability showed that all the alkubus products were acceptable in terms of colour, aroma, taste, flavor and texture when compared with the control at 100%. Alkubus produced from the blends of two local wheat cultivars and cowpea increased the protein content that can satisfy the dietary requirement of human.

Introduction

Alkubus (Steamed Bread) is a traditional food product usually consumed by the *Hausa* people found in the northern part of Nigeria. It is made by mixing hard wheat flour, salt, yeast and water, into dough and mould, which is then steam at boiling water temperature to form *alkubus*. It is served with *agushi* soup, vegetable soup, or tomato sauce. One of the major applications of wheat in Nigeria is the production bread and biscuits, in China steamed bread represents about 40% of the wheat consumption (He *et al*., 2003). According to He *et al*. (2003), the quality of *Alkubus* (Steamed bread) is positively correlated with the protein content and gluten strength.

The fermented dough is rolled into shape, with smooth white skin and no crust. The texture varies from dense to open, and the flavour is dependent on the region of production. They are eaten fresh as their sensory attributes deteriorate rapidly once manufactured. The resulting protein quantity and quality of the flour is important for the production of acceptable *Alkubus*

(Steamed bread), with low protein soft wheat's best suited for *Alkubus*. *Alkubus* required longer fermentation and less yeast. Quality characteristics of *Alkubus* (Steamed bread) are affected by dough water absorption, sugar-yeast combinations and fermenting and proof times (Bernard, 2006). Production of *Alkubus* using the two local wheat varieties (*Atilla gan Atilla* and *Seri-M82*) and Cowpea is to Improve the protein quality of the product and utilization of locally grown wheat and minimize the huge fund spend in importing foreign wheat for the production of wheat base foods in industries. Therefore, Low level of utilization of local wheat to produce different food products is commonly observed by food scientists, which increased the food insecurity imposed in community and enhanced devastating security challenges consequently lack of protein based food products.

Materials and Methods
Samples Collection
The Wheat and Cowpea were purchased from Kano Agricultural & Rural Development Authority (KNARDA) Nigeria. Samples were processed and analyzed in food analysis laboratory, Kano University of Science and Technology, Wudil, Kano Nigeria.
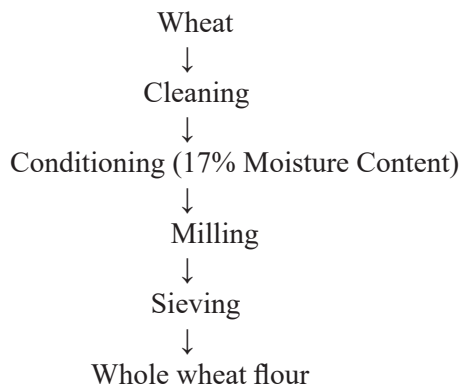
Methods of Production

Wheat
↓
Cleaning
↓
Conditioning (17% Moisture Content)
↓
Milling
↓
Sieving
↓
Whole wheat flour

Figure 1: Flowchart of whole wheat flour production

Cowpea
↓
Cleaning
↓
Soaking in water (30mins)
↓
Drying (at ambient temperature)
↓
Grinding
↓
Sieving
↓
Beans flour
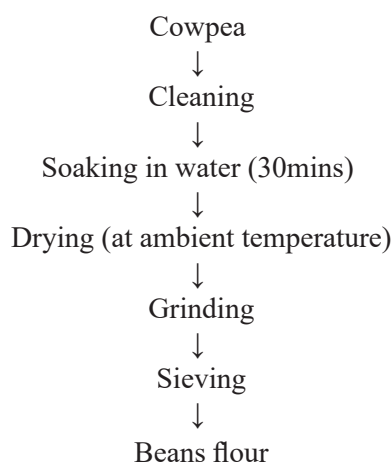
Figure 2: Flowchart for the production of cowpea flour (Source: Okwunodulu *et al.*, 2019)

Weighing
↓
Mixing
↓
1st Proofing (1hr)
↓
Moulding
↓
2nd Proofing (30 mins)
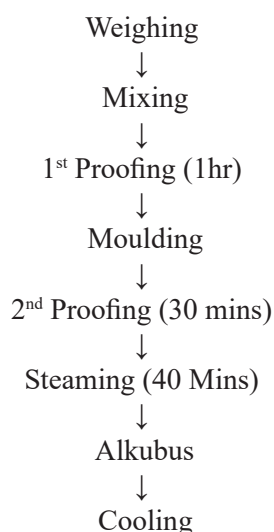↓
Steaming (40 Mins)
↓
Alkubus
↓
Cooling

Figure 3: Flowchart for the production of *Alkubus* (Steamed bread) Source: (Rubenthaler *et al.*, 1990).

Steam Bread Production
A known weigh of 100g wheat flour and varying proportions of cowpea flour, together with salt, yeast and water were measured. The so called ingredients were mixing with warm water to form dough, that undergoes Proving or proofing refers to the dough resting period during fermentation. During the period of resting, fermentation of the dough continues. The dough finally proofed or fermented in on a wire gauge inside a bowl covered before placing into a steamer for desired dough height. It is generally carried out at 30-35ºC and at 85% relative humidity. Proofing takes about 1hr or 30 minutes. During proofing the dough increases remarkably in volume. The dough expands by a factor of 3-4 during proofing. During proofing care has to be taken that the skin of dough remains wet and flexible so that it does not tear as it expands. A high humid condition is also required to minimize weight loss during proving. Temperature, humidity and time influence proofing. Proofing temperature depends on the variety of factors such as flour strength, dough formulation with respect to oxidants, dough conditioners, type of shortening, degree of fermentation and type of product desired.

Sample Codes	Wheat Flour (%)	Cowpea (%)	Dry Yeast (g)	Salt (g)
Ctrl A (100%)	100	00.00	2.00	1.00
ACp (95:5%)	95	05.00	2.00	1.00
ACp (90:10%)	90	10.00	2.00	1.00
ACp (85:15%)	85	15.00	2.00	1.00
Ctrl S (100%)	100	00.00	2.00	1.00
SCp (95:5%)	95	05.00	2.00	1.00
SCp (90:10%)	90	10.00	2.00	1.00
SCp (85:15%)	85	15.00	2.00	1.00

Key: A = *Atilla-gan-atilla*
S= *Seri M82*
CTRL A = Control sample of *Atilla-gan-atilla*
CTRL S = Control sample of *Seri M82*

Table 1.0: Formulations of *Alkubus* (Steamed bread)

Proximate Analysis
The proximate analyses was carried out experimentally on the *Alkubus* (Steamed bread) are;
Determination of Moisture Content (AOAC, 2010)
About 2g of sample was weight, Place in the dish and oven dried for 1h 30mins at 105°C. After drying, transfer the dish with partially covered lid to the desiccator to cool. Reweigh the dish and its dried sample.
Calculation

$$\%Moisture = \frac{(Wt1\ of\ wet\ sample\ +\ Pan) - (Wt2\ of\ Dried\ Sample\ +\ Pan)}{(Wt1\ of\ Wet\ Sample + pan) - (Wt\ of\ Pan)} X100$$

Where:
Wt1 = weight (g) of sample before drying, Wt2 = weight (g) of sample after drying, Wt = weight (g) of pan

Determination of Protein Content (AOAC, 2010)
2g sample was placed in the digestion flask. And 5g Kjedahl catalyst together with 15ml of conc. H_2SO_4, were added,

Placed the flasks in inclined position and heat gently unit frothing ceases. Boil briskly until solution clears. Cooled and add 60ml of distilled water cautiously. Immediately connect flask to digestion bulb on condenser and with tip of condenser immersed in standard acid and 5-7 drops of mix indicator in receiver. Rotate flask to mix content thoroughly; then heat until all NH_3 is distill. Remove receiver, wash tip of condenser and titrate excess standard acid distilled with standard NaOH solution.

Calculation

$$\%\text{Total nitrogen} = \text{Normality HCl} \times \frac{\text{Acid vol}}{W} \times 14 \, \text{gN} \times 100\%$$

Where

A = volume (ml) of 0.2 N HCl used sample titration, B = volume (ml) of 0.2 N HCl used in blank titration, N = Normality of HCl, W = weight (g) of sample and 14 = atomic weight of nitrogen

Determination of Ash Content (AOAC, 2010)

Place the crucible and lid in the furnace at 550°C overnight to ensure that impurities on the surface of crucible are burned off. Cool the crucible in the desiccator (30min). Weigh the crucible and lid to 3 decimal places. Weigh about 5g sample into the crucible. Heat over low Bunsen flame with lid half covered. When fumes are no longer produced, place crucible and lid in furnace. Heat at 550°C overnight. During heating, do not cover the lid. Place the lid after complete heating to prevent loss of fluffy ash. Cool down in the desiccator. Weigh the ash with crucible and lid when the sample turns to gray. If not, return the crucible and lid to the furnace for the further ashing.

Calculation

$$\text{Ash}(\%) = \frac{\textit{Weight of ash}}{\textit{Weight of sample}} \times 100$$

Determination of Fat Content (AOAC, 2000)

Place the bottle and lid in the incubator at 105oC overnight to ensure that weight of bottle is stable. Weigh about 2g of sample to paper filter and wrap. Take the sample into extraction thimble and transfer into soxhlet. Fill petroleum ether about 250ml into the bottle and take it on the heating mantle. Connect the soxhlet apparatus and turn on the water to cool them and then switch on the heating mantle. Heat the sample about 14h (heat rate of 150 drop/min). Evaporate the solvent by using the vacuum condenser. Incubate the bottle at 80-90oC until solvent is completely evaporate and bottle is completely dry. After drying, transfer the bottle with partially covered lid to the desiccator to cool. Reweigh the bottle and its dried content.

Calculation

$$\text{Fat}(\%) = \frac{\textit{Weight of fat}}{\textit{Wet of sample}} \times 100$$

Determination of Crude Fibre (AOAC, 2000)

Five grams (5 g) of the sample was extracted with diethyl ether for about 8 hours. The extract was air dried for about

5-10 minutes and boiled with sulphuric acid for exactly 30 minutes; the solution was filtered with a funnel covered with a cotton cloth or filter paper. The insoluble matter was washed with boiled water until the washing was free of acid. It was transferred into the original flask and boiled for another 30 minutes after it was filtered. The insoluble matter was washed, first with boiling water then with hydrochloric acid, and finally with boiled water until free from acid. The insoluble matter was further washed with alcohol and ether, transferred to a dried ash less paper and dried at 100°C to a constant weight. The filter paper and the insoluble matter is then incinerated in the muffle furnace for about two to three hours, cooled and weighed. Percent crude firer was calculated as follows:

% Crude Fibre = (weight of insoluble matter + filter paper – weight of ash)

Carbohydrate content determination

Total carbohydrate content was obtained by difference. The sum total of crude fibre, moisture, ash, protein and fat in percentage, subtracted from one hundred, gives carbohydrate content in a sample.

% carbohydrate = 100 – percent (moisture + ash + protein + fat + crude fibre)

Calculation of energy values

Energy was evaluated using an Atwater formula as follows;

E = P x 4 + C x 4 + F x 9 (kcal/100g)

Where, E energy value, P protein content, C carbohydrate content and F fat content.

Functional Properties Determination
Bulk Density Determination

The method described by (Onwuka, 2005) was adopted. Ten (10ml) capacity graduated measuring cylinder was pre-weighted. The cylinder was filled gently with the sample. The cylinder was tapped gently several times on the laboratory bench until no further reduction of the sample level after filling to the 10ml mark. It was weighed, calculated as follows:

$$\text{Bulk Density (g/ml)} = \frac{\textit{Weight of sample (g)}}{\textit{Volume of sample}}$$

Determination of Water Absorption Capacity

Water absorption capacity was determined using the method described by (Onwuka, 2005). One gram (1g) of the sample was weighed in a graduated centrifuge tube. It was mixed thoroughly with 10ml distilled water using a continuous whirl mixer for 30seconds. The sample was allowed to stand for 30minutes at room temperature and then centrifuge at 5000×g for 30minutes. The volume of free water (supernatant) was read directly from the graduated centrifuged tube.

Swelling power and solubility index determination

The method described by (Hirsch & Kokini, 2002) was used for

swelling power and solubility index determination. One gram of the flours of ingredients and gurasa blends were poured into pre-weighed graduated centrifuge tube appropriately labeled. Then, 10 ml of distilled water was added to the weighed sample in the centrifuge tube and the solution was stirred and placed in a water bath heated at different temperature of 85°C for one hour while shaking the sample gently to ensure that the starch granules remained in suspension until gelatinization occurred. The samples were cooled to room temperature under running water and centrifuged for 15 min at 3000 rpm. After centrifuging, the supernatant was decanted from the sediment into a pre-weighed petri-dish; the supernatant in the petri-dish was weighed and dried at 105°C for 1 h. The sediment in the tube was weighed and the reading recorded. The starch swelling power and solubility was determined according to the equations below;

$$\text{Swelling power} = \frac{\text{weight of swollen sediment}}{\text{weight of starch sample}}$$

$$\text{Solubility} = \frac{\text{weight of dry supernatant}}{\text{weight of starch sample}} \times 100$$

Gluten Content Determination
Wet Gluten
Weigh 10g of wheat flour into a petri-dish and add 2ml of 2% salt solution to make a dough ball. Put 250ml at 2% solution into a separate conical flask and washout the starch of the dough ball, living the elastic material (Gluten). Rinse the elastic material using distills water. Dry the gluten by rubbing it between the palms, to remove every single drop of water. Weigh the gluten using a weighing balance, 9m scale. (Onwuka, 2005).

Dry Gluten
The gluten from the wet gluten test explained earlier was rolled into a ball shaped and evaporated in an oven at 180°C for 1hr. It is then cooled in a desiccator and then weighs in a weighing balance.

Calculation
Dry gluten=dry gluten

Microbiological Analysis
Determination of Total Plate Count
Enumeration of aerobic micro-organism was carried out using nutrient agar. For the enumeration of mesophilic bacteria, the serial dilution method as described by (Kawo *et al*.,2006) was employed. 11g of the sample was mixed with 0.2% peptone water. The sample was shaken and thoroughly comminuted to make a homogenate solution; this gave the dilution of 101. One millilitre of the prepared solution was transferred in to one milliliter of the diluents (0.1% peptone water), this gave the dilution of 101. This procedure was repeated up to the third dilution which gave the dilution of 10^3.

The dilution bottles were agitated. 1ml of each dilution was pipetted into a separate corresponding petri-dish in duplicates. About 15ml of the nutrient agar (NA) cooled to 45°C was poured into each plate. The sample and the agar medium were mixed by rotating the plate on a flat surface and allowed to solidify. The petri-dishes were then inverted and incubated at 35°C for 48 hours. Plates containing between 30-300 colonies were selected and counted. The number obtained was multiplied by the dilution factor this gave the number of colony forming units per gramme of the sample (cfu/g).

Determination of Fungal Count
Enumeration of aerobic mesophilic fungi/mould was carried out using Potato dextrose agar. For the enumeration of mesophilic fungal/mould, the serial dilution method as described by (Kawo *et al*., 2006) was employed. 11g of the sample was mixed with 99ml of 0.1% peptone water. The sample was shaken and thoroughly comminuted to make a homogenate solution; this gave the dilution of 101. 1ml of this prepared solution was transferred in to 9ml of the diluents (0.1% peptone water); this gave the dilution factor of 102. This procedure was repeated up to the third dilution which gave the dilution of 103.

The dilution bottles were agitated. 1ml of each dilution was pipetted into separate corresponding petri-dishes in duplicates. About 15ml antibiotic supplemented agar (cooled to 45°C) was poured into each plate. The sample and the agar medium were mixed by rotating the plate on a flat surface and allowed to solidify. The petri-dishes were then inverted and incubated at 25°C for 3-5days (APHA, 1992). Plates containing less than 50 colonies were selected and counted at 3-5days incubation periods. The count was reported as fungi/mould colony forming unit per gramme of the sample (cfu/g). A set of control plate for each sample containing agar and diluents was incubated to ascertain the sterility of the media.

This formula was used to calculate the number of bacteria/fungi colony forming units per gram of the sample.

$$N = n/vd$$

Where,
N= the number of bacterial colony per gramme of sample
n= Number of colonies counted
v= volume of sample used
d= dilution factor

Sensory Evaluation
Samples *Alkubus* (Steamed Bread) was subjected to Sensory evaluation, consisting of (12) twelve panelists made of male and female among students of the Department of Food Science and Technology, Kano University of Science and Technology, KUST Wudil. The panelist rated the sample for overall acceptability and sensory attributes of color, aroma, taste and mouthful using Hedonic scale ranging from (7) which means like very much to one (1) meaning dislike very much was used. The sample was rated for shape, aroma, taste, appearance, texture and general acceptability, scores obtained were statistically analyzed. As described by (Onwuka, 2005).

Statistical Analysis
Data generated from the study were subjected to Duncan multiple range test, f-test (analysis of variance ANOVA) was used to verify significant difference while the means were

separated using turkeys LSD tests which were analyzed using a statistical package of window version 8.0.

Results and Discussions

Results
Proximate Analysis of *Alkubus* (Steamed Bread)
The results of proximate composition of *Alkubus* (Steamed bread) produced from blends of two local wheat varieties (*Atilla-gan atilla* and *Seri M82*) was shown in Table 4.1, moisture content ranged from 44.14 to 37.21%, and protein from 13.22 to 9.05%, fat ranged from 4.61 to 4.09%, ash 2.53 to 1.79%, carbohydrate from 44.06 to 37.02% and energy 258.63 to 232.33% respectively. Moisture content ranged from 44.14 to 37.21% respectively. As the rate of substitution with cowpea increased, the amount of moisture of the *alkubus* produced from *Atilla* and *Seri-M82* decreased. Zobel and Kulp (1996) reported that water is an effective plasticizer in bread. However, the results indicated that the content of protein increased with cowpea addition. Cowpea is a high source of protein. There was an increased in protein content in sample treated with cowpea. Significant different (p>0.05) exits between the control sample CTRL A and CTRL S with the substituted samples. Significant difference (p>0.05) was observed in protein content, with an increased in the ranged of protein when substituted with cowpea, this is in lined with, (Mc-Kevith, 2004) reported that wheat protein is relatively low amounts and therefore, essential amino acids must be supplied /from another source of the diet. Higher amount of protein was observed in the samples treated with cowpea flour replacement. Fat ranged from 4.61 to 4.09% this was attributed to the rate of substitution with cowpea. Samples were significantly different (p<0.05). It showed that there was a Significant difference (p>0.05) in Crude fibre, which ranged from 1.51 to 0.92%. According to Schneeman (2002), crude fibre contributes to the health of the gastrointestinal system and metabolic system in man. Ash ranged from 2.53 to 1.79% which was significantly different (p>0.05), The results indicated that there was an increased in ash content in sample ACp (95,5)% and SCp (85,15%) which is 2.36% and 2.53% as it compared to control sample CTRL A 100% and CTRL S 100% which is 2.03% and 1.79% respectively. The carbohydrate ranged from 44.06 to 37.02%. This showed a significance difference (p>0.05) that exited within the column. The carbohydrate content of *Alkubus* (Steamed bread) as shown in table 4.1 indicated that the results was lower than the results reported by (Noor *et al.*, 2012) which was found 55.71%, and lower than that reported by (Elsayed, 1999) who reported 78.967%. The low carbohydrate content of the *Alkubus* (Steamed bread) was due to the addition of cowpea flour when compared with control sample. The low carbohydrate content after addition of cowpea to wheat flour was in lined with those reported by (Salama *et al.*, 1992).

Functional Properties of (*Atilla-gan-atilla* and *Seri M82*)
The functional properties of flour produced from two local wheat varieties (*Atilla-gan atilla* and *Seri M82*) are illustrated in Table 4.2, the results of Bulk density range from 0.78-0.60 and 0.76-0.69 g/cm³, The results showed that the addition of cowpea flour at different proportions of (*Atilla-gan-atilla, Seri M82* and *cowpea flour*) decreased in bulk density as compared to the control samples CTTR A and CTRL S were 0.78 and 0.76 g/cm³ which was showed as samples with high bulk density. As the rate of substitution increased the water absorption capacity (WAC) decreased with addition of cowpea therefore, significant difference (p>0.05) exited and it ranged from 69.56 and 59.20% respectively, While the result however indicated that control sample of *Atilla-gan-atilla* (CTRL A) and SCp (85,15%) possessed high water absorption capacity (W.A.C) which was 59.20% and 69.56%. Significant difference existed in the swelling capacity of the *alkubus* blends. Value ranged from 9.28 to 7.17%. Sample CTRL A had the highest values while others decreased with replacement of wheat with cowpea flour. The swelling capacity of flours depends on the variety and particle size of the flour (Suresh & Shamser 2013). Significant difference (p<0.05) existed in the mean solubility of the blends. Sample CTRL A 100% had the least values. The range of solubility increased with decrease in swelling capacity. Samples were significantly different (p<0.05) when compared with the control (CTRL).

Gluten Content of (*Atilla-gan-atilla* and Seri M82) Flour
The results of Gluten content of (*Atilla-gan atilla* and *Seri M82*) was shown in Table 4.3, The results of dry gluten as shown in table 4.3 and was similar with the results reported by (Rao *et al.*, (2000), who found that dry gluten from different cultivars of local wheat ranged between 11.11 to 8.05%. This showed that a significance different (p>0.05) was observed both in wet gluten and dry gluten percentage. And the result of wet gluten was lower than that of (Siddeg, 2019) who reported 32%. Gluten was appreciated for its viscoelastic properties. It gives elasticity to dough, helping it to raise and keep its shape and often gives the final product a chewy texture as stated by (Shewry *et al.,* 2002). The gluten content of control samples CTRL A 27.20% .and CTRL S 11.11% were higher compared to samples that are supplemented with cowpea flour. Samples of atilla substituted with cowpea (ACP 95, 5%), had a close range in value of wet and dry gluten percentage.

Microbial Analysis of *Alkubus* (Steamed Bread)
The total bacterial counts of the *Alkubus* (Steamed bread) from (*Atilla-gan-atilla* and *Seri M82*) ranged from 1.0×10^4 cfu/g to 3.0×10^4 cfu/g. The fungal counts ranged from 1.0×10^4 cfu/g to 3.2×10^4 cfu/g as indicated in table 4.4. The results of bacterial count show that sample ACp (85,15%) was recorded with high count of 3.0×10^4 cfu/g), while the lowest counts $(1.0 \times 10^4$ cfu/g) were obtained in sample ACp (95,5%). No detection of E. coli in all samples. While the fungal count indicated that sample ACp (85,15%) was 3.2×10^4 were found to be with higher count, while the lowest counts $(1.0 \times 10^4$ cfu/g) were observed in sample SCp (90,10%). The presence of heavy load on the sample ACP (85, 15%) could attributed to either poor handling during processing. Fungal growth had also been seen on all the samples of *Alkubus* produced. This could be as a result of the high Moisture content present on the *Alkubus* product. Contamination of streets vended foods has been attributed to exposure to polluted environment, poor sanitation, poor

hygienic practices and recontamination after production. High level of contamination as a result of staphylococcus aureus may be linked to human source during production.

Sample Codes	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Fibre (%)	Carbohydrate (%)	Energy (kcal)
Ctrl A (100%)	44.14±0.21[a]	10.77±1.30[d]	4.21±0.10[c]	2.03±0.04[g]	1.01±0.19[g]	37.84±0.89[g]	232.33
ACp (95:5%)	43.69±2.02[b]	11.27±0.46[c]	4.38±0.77[d]	2.36±0.00[d]	1.28±0.18[c]	37.02±1.66[h]	232.58
ACp (90:10%)	40.00±0.07[e]	11.67±0.46[b]	4.52±1.12[b]	2.40±1.14[c]	1.33±0.09[b]	40.08±0.36[e]	247.68
ACp (85:15%)	38.02±3.15[g]	13.22±1.37[a]	4.61±0.12[a]	2.11±0.17[f]	1.51±0.17[a]	40.53±3.23[d]	256.49
Ctrl S (100%)	43.33±2.12[c]	9.05±3.89[h]	4.09±0.52[f]	1.79±0.04[h]	0.92±0.29[h]	40.82±6.53[c]	236.29
SCp (95:5%)	42.34±1.30[d]	10.15±0.28[g]	4.23±0.26[e]	2.23±0.17[e]	1.13±0.26[f]	39.92±1.08[f]	238.35
SCp (90:10%)	39.26±1.30[f]	10.28±2.16[f]	4.38±0.56[d]	2.42±0.02[b]	1.21±0.15[e]	42.45±7.47[b]	249.34
SCp (85:15%)	37.21±1.56[h]	10.45±1.16[e]	4.51±0.41[c]	2.53±0.14[a]	1.24±0.45[d]	44.06±2.04[a]	258.63

Values are mean of three replicates ± Standard Deviation, number in the same column followed by the same letter are not significantly different at p>0.05. Key; A = Atilla, S = Seri-m82, Cp = Cowpea

Table 2: Proximate Analysis of *Alkubus* (Steamed Bread) Produced from Different Blends

Sample Codes	Bulk Density(g/cm³)	Water Absorption Capacity (%).	Swelling power (%)	Solubility (%)
Ctrl A (100%)	0.78±0.03[a]	59.20±0.018[a]	9.28±0.00[a]	4.00±0.11[h]
ACp (95:5%)	0.70±0.03[d]	57.44±0.14[b]	8.76±0.11[c]	4.13±0.05[g]
ACp (90:10%)	0.69±0.06[e]	56.44±0.13[d]	8.70±0.00[b]	5.55±0.05[f]
ACp (85:15%)	0.60±0.02[f]	56.80±0.06[c]	7.98±0.00[d]	6.18±0.00[e]
Ctrl S (100%)	0.76±0.00[B]	69.56±0.05[a]	7.79±5.31[e]	6.18±0.05[d]
SCp (95:5%)	0.73±0.01[C]	65.55±0.14[b]	7.64±0.07[f]	6.23±0.05[c]
SCp (90:10%)	0.70±0.02[d]	53.43±0.01[c]	7.57±0.28[g]	6.34±0.05[b]
SCp (85:15%)	0.69±0.02[e]	50.78±0.60[d]	7.17±0.05[h]	6.56±0.32[a]

Values are mean of three replicates ± Standard Deviation, number in the same column followed by the same letter are not significantly different at p>0.05. Key; A = Atilla, S = Seri-m82, Cp = Cowpea

Table 3: Functional Properties of (*Atilla-gan-atilla* and *Seri M82*) Flour Produced from Different Blends

Sample Codes	Wet Gluten (%)	Dry Gluten (%)
Ctrl A (100%)	27.20±0.70[a]	11.11±0.29[a]
ACp (95:5%)	23.85±0.37[b]	9.34±0.14[b]
ACp (90:10%)	22.64±0.55[e]	8.94±0.03[c]
ACp (85:15%)	22.53±0.19[f]	8.78±0.09[d]
Ctrl S (100%)	22.80±0.43[d]	8.58±0.47[e]
SCp (95:5%)	20.86±0.33[c]	8.06±0.07[g]
SCp (90:10%)	21.18±0.11[h]	8.09±0.04[f]
SCp (85:15%)	20.22±0.17[g]	8.005±0.00[h]

Values are mean of three replicates ± Standard Deviation, number in the same column followed by the same letter are not significantly different at p>0.05. Key; A = Atilla, S = Seri-m82, Cp = Cowpea

Table 4: Gluten Content of (*Atilla-gan-atilla* and *Seri M82*) Flour Produced from Different Blends

Sample Codes	Bacterial Count (cfu/g)	Fungal Count (cfu/g)	E.Coli (cfu/g)
Ctrl A (100%)	2.0×10^4	1.3×10^4	ND
ACp (95:5%)	1.0×10^4	2.0×10^4	ND
ACp (90:10%)	2.8×10^4	1.2×10^4	ND
ACp (85:15%)	3.0×10^4	3.2×10^4	ND
Ctrl S (100%)	1.6×10^4	2.5×10^4	ND
SCp (95:5%)	2.0×10^4	2.0×10^4	ND
SCp (90:10%)	2.2×10^4	1.0×10^4	ND
SCp (85:15%)	1.8×10^4	1.8×10^4	ND

Values are mean of three replicates ± Standard Deviation, number in the same column followed by the same letter are not significantly different at p>0.05. Key; A = Atilla, S = Seri-m82, Cp = Cowpea

Table 5 : Microbial Count of *Alkubus* (Steamed Bread) Produced from Different Blends

Sample Codes	Color	Aroma	Taste	Flavor	Texture	Overall Acceptance
Ctrl A (100%)	8.53 ± 0.64^a	7.33 ± 0.64^b	8.13 ± 0.64^a	8.06 ± 0.79^a	8.00 ± 1.00^a	8.53 ± 0.51^a
ACp (95:5)%	7.20 ± 1.01^c	8.50 ± 1.01^a	7.26 ± 0.88^b	7.33 ± 1.29^b	7.93 ± 1.33^b	8.46 ± 0.51^b
ACp (90:10%)	6.73 ± 1.53^d	5.43 ± 1.53^d	6.46 ± 1.30^d	6.66 ± 1.49^d	7.06 ± 1.38^c	6.46 ± 0.99^c
ACp (85:15%)	7.40 ± 0.82^b	6.76 ± 0.82^c	7.06 ± 1.83^c	6.86 ± 1.50^c	5.61 ± 1.34^d	5.60 ± 2.29^d
Ctrl S (100%)	7.86 ± 0.83^a	8.60 ± 0.83^a	7.33 ± 1.04^a	7.20 ± 0.94^a	7.73 ± 1.28^a	8.66 ± 0.48^a
SCp (95:5%)	7.26 ± 0.96^d	5.36 ± 0.96^d	6.80 ± 1.20^c	6.46 ± 1.30^c	7.13 ± 1.45^b	8.26 ± 0.59^b
SCp (90:10%)	7.60 ± 1.12^b	7.71 ± 1.12^b	7.46 ± 1.35^b	6.40 ± 1.54^d	6.60 ± 1.29^c	6.60 ± 0.91^c
SCp (85:15%)	7.33 ± 0.97^c	7.13 ± 0.97^c	6.66 ± 1.39^d	6.66 ± 1.67^b	6.53 ± 1.30^d	5.00 ± 1.89^d

Values are mean of three replicates ± Standard Deviation, number in the same column followed by the same letter are not significantly different at p>0.05. Key; A = Atilla, S = Seri-m82, Cp = Cowpea

Table 6: Sensory Analysis of *Alkubus* (Steamed Bread) Produced from Different Blends

Sensory Evaluation of *Alkubus* (Steamed Bread)

The sensory attributes of *Alkubus* (Steamed bread) samples produced from (*Atilla-gan-atilla* and *Seri M82*) are illustrated in Table 4.5, the results of color range from 6.73-8.53 and 7.26-7.86, aroma value range from 6.76-8.50 and 5.36-8.60, taste 6.46-8.13 and 6.66-7.46, flavor 6.66-8.06 and 6.40-7.20, texture range from 5.61-8.00 and 6.53-7.73 respectively. The results from sensory evaluation as shown in table 4.5 Variation with high level of acceptance were observed from the table of results. From the table 4.5, *Alkubus* (Steamed bread) was showed all the samples treated at different level with the control samples were all accepted. With 5% cowpea level of substitution showed excellent results attributed to the samples when compared to the other samples of *Alkubus* (Steamed bread) with different cowpea substitution level. The mean comparison of scores of different attributes like colour, flavor, texture, aroma, taste and overall acceptability were recorded and found to be significantly different(p<0.05). It was found that as the rate of substitution increases, acceptability rate decreased. And also variations exits within the columns of the sensory attributes such as colour, flavor, texture, aroma, taste and overall acceptability.

Conclusion

It was observed that the two local wheat varieties (*Atilla gan Atilla* and *Seri-M82*) can performed effectively when compared with the foreign wheat variety in the production of *alkubus* using both the traditional and modern processing methods. It also enhanced the protein quality as it affects addition of cowpea into the products, whereas it reduced wheat importation.

References

1. 1. He, Z. H., Liu, A. H., Pena, R. J. & Raja ram S. (2003). Suitability of Chinese wheat cultivars for production of northern style Chinese steamed bread. *Euphytica*, 131, 155-163. Retrieved from He, Z. H., Liu, A. H., Pea, R. J. & Raja ram, S. (2003) Suitability of Chinese wheat cultivars for production of northern style Chinese steamed bread, *Euphytica*. 131 155–163 - References - Scientific Research Publishing (scirp.org)

2. Bernard, C. (2006). Bernard Clayton's New Complete Book of Breads. Simon & Schuster. Columbus, *Ohio*, USA. Retrieved from Bernard Clayton's New Complete Book of Breads (October 3, 2006 edition) | Open Library

3. Okwunodulu, I. N., Peter, G. C. & Okwunodulu, F.U. (2019). Proximate quantification and sensory assessment of moi-moi prepared from Bambara nut and Cowpea flour blends. *Asian Food Science Journal, 9*(2), 1-11. DOI: 10.9734/afsj/2019/v9i230008

4. Rubenthaler, G. L., Huang, M. L., & Pomeranz, Y. (1990). Steamed bread. I, Chinese steamed bread formulations and interactions. *Cereal Chemistry, 67*(5): 471-475. Retrieved From [PDF] Steamed bread. I, Chinese steamed bread formulation and interactions | Semantic Scholar

5. AOAC. (2010). International Approved Methods of

Analysis 11th (Eds.) Methods 44 15.02A Association of Official Analytical Chemists. *Arlington*, VA, USA.

6. Hirsch, J.B. & Kokini, J.E. (2002). Understanding the mechanism of cross-linking agents (POC13, STMP and EPI) through swelling behavior and pasting properties of cross-linked waxy maize starches, *Cereal Chemistry, 79*(1), 102-107. DOI: 10.1094/CCHEM.2002.79.1.102

7. AOAC, (1990). AOAC Official Methods of Analysis, 15th (Edition). Association of official analytical chemists. Arlington. Retrieved from AOAC (1990) AOAC Official Methods of Analysis. 15th Edition, Association of Official Analytical Chemists, Arlington. - References - *Scientific Research Publishing* (scirp.org)

8. Onwuka, G. (2005). Food analysis and instrumentation,theory and practice (2nd edition). Napthali printing press, Nigeria, 179-348. Retrieved from Onwuka, G.I. (2018). *Food Analysis and Instrumentation*(Theory and Practice)-Second edition. Naphtali Printers, Nigeria, pp. 299-314. (sciepub.com)

9. Kawo, A. H., Omole, E., M., & Na'aliya, J. (2006). Quality assessment of some processed yoghurt products sold in Kano Metropolis, Kano, Nigeria, *BEST Journal 3*(1): 96-99. Retrieved From Kawo A. H., Omole E. M. and Na'aliya, J. (2006). Quality assessment of some processed yoghurt products sold in Kano Metropolis, Kano, Nigeria *BEST Journal 3*(1): 96-99. (sciepub.com)

10. Zobel, H.F. & Kulp, K. (1996). The Staling Mechanism. In: Hebeda, R.E. and Zobel, H.F., Eds., Baked Goods Freshness, Marcel Dekker, New York, 1-64. Retrieved From Zobel, H.F. and Kulp, K. (1996) The Staling Mechanism. In Hebeda, R.E. and Zobel, H.F., Eds., Baked Goods Freshness, Marcel Dekker, New York, 1-64. - References - *Scientific Research Publishing* (scirp.org)

11. Mc-Kevith, B. (2004). Nutritional Aspects of Cereals. *British Nutrition Foundation, 29*(2), 111-142. https://doi.org/10.1111/j.1467-3010.2004.00418.x

12. Scheeman, B.O (2002). Gastrointestinal physiology and functions. *British Journal of Nutrition, 88*(Suppl 2), 159-163. DOI: 10.1079/BJN2002681

13. Noor, A. A. A., Ho, L. H., Noor Shazliana, A. A., & Bhat, R. (2012). Quality evaluation of steamed wheat bread substituted with green banana flour, *International Food Research Journal 19*(3), 869-876. Retrieved from Noor Aziah, A.A., Ho, L.H., Noor Shazliana, A.A. and Rajeev, B. (2012) Quality evaluation of steamed wheat bread substituted with green banana flour, International. *Food Research Journal*, 19, 869-876. - References - Scientific Research Publishing (scirp.org)

14. Elsayed, A. A. (1999). The use of sorghum malt to enhance conventional fermentation of sorghum flour used for Kisra preparation. Koha. Retrieved from Koha online catalog › Details for: The Use of Sorghum Malt to Enhance Conventional Fermentation of Sorghum Flour Used for Kisra Preparation / (uofk.edu)

15. Salama, N. A, Abd El-Latef A. R, Shouk, A. A, & Alian, A. M. (1992). Effect of some improvers on the nutritional components and in vitro digestibility of Egyptian Balady bread. *Egyptian Journal of Food Science*, 20, 135-146.

16. Suresh, S. &Shamser, S. (2013). Assessment of functional properties of different flours. *African Journal of Agricultural Research, 8*(38), 4849-4852. DOI: 10.5897/AJAR2013.6905

17. Rao, V. K., Mulvaney, S. J., & Dexter, J.E. (2000). Rheological characterization of long and short mixing flours based on stress-relaxation. *Journal of Cereal Science, 31*(2):159-171. Retrieved from Rao V.K., Mulvaney S.J. and Dexter J.E. (2000). Rheological characterisation of long and short mixing flours based on stress-relaxation. *Journal of Cereal Science, 31*(2):159-171. (sciepub.com)

18. Siddeeg, A., Salih, Z. A., Al-Farga, A., Altayeb, F. T., & Ali, A. O. (2019). Production, Quality and Acceptability Characteristics of Steamed Bread Enhanced with Cowpea Powder in Comparison to the Classical Bread. *Food Science & Nutrition Technology, 4*(3), 1-10. Retrieved from Published Date the Production, Quality and Acceptability Characteristics of Steamed Bread Enhanced with Cowpea Powder in Comparison to the Classical Bread (researchbib.com)

19. Shewry, P. R, Halford, N. G., Belton, P. S., & Tatham, A. S. (2002). The structure and properties of gluten: An elastic protein from wheat grain. Philosophical Transactions of the Royal Society B: *Biological Sciences, 357*(1418), 133-142. DOI: 10.1098/rstb.2001.1024