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PROXIMATE COMPOSITION, FUNCTIONAL PROPERTIES AND ACCEPTABILITY OF WHEAT BASED FUNKASO AS AFFECTED BY ADDITION OF PEARL MILLET AND SOYBEAN FLOURS

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Flours of wheat cultivars, pearl millet and soybean were used to formulate funkaso blends. The experimental design was a 3 x 4 x 2 factorial experiment. Factor one was wheat cultivar (Norman, Cettia, Atilla gan Atilla), factor two the substitution level (0, 20, 30, 40%) of wheat cultivars for pearl millet flour and factor three substitution level (0, 30%) of cereal (combined wheat and pearl millet flours) for soybean flour giving rise to 24 samples plus one commercial sample making a total of 25 samples all together. Funkaso was produced from the 25 blends and their proximate composition, functional properties and acceptability determined. Data generated were subjected to statistical analysis. There were wide variations among the 25 funkaso formulations with regard to proximate composition, functional properties and sensory score by panelists. Addition of soybean increased the protein and fat contents of complementary food significantly (P<0.05). Sensory scores tasted by panelists were generally high and therefore wheat can be supplemented with soybean and pearl millet at 30% and 28% levels, respectively in funkaso processing which can increase protein and fat contents as well as increase the profit margin and save foreign exchange earnings by reducing importation of wheat.

Keywords: Funkaso, Soybean, Pearl millet, Wheat

INTRODUCTION

Funkaso is a prestigious well liked and consumed traditional fermented foods in northern Nigeria. It is of great importance in the diet of kanuris and shuwa Arab. It is prepared mostly on special occasions and festive periods because of its rich value. Method for preparation of *Funkaso* varies from one processing to other due to lack of standardized ingredient formulation that would ensure product consistency.

It is prepared by mixing of whole wheat flour (fine or grits) together with water, yeast, baking powder and pint of salt to form a batter (thin flour mixtures that are beaten or stirred), which is allowed to stand depending on weather condition and then deep fat fried in oil. Wheat is the principal ingredient used for *funkaso* production but it remains costly despite the intensity in local production in Nigeria. Most of the wheat used in Nigeria is imported and the negative effect of this on foreign exchange cannot be over emphasized. This prompts investigation into supplementation of wheat with any readily available cereal grains.

Pearl millet is abundant in semi-arid region of northern Nigeria where *funkaso* is usually produced and consumed, and incidentally it has higher protein content compared to most cereal grains (Badau *et al*., 2008; and Badau *et al*., 2009). Therefore, there is need to supplement wheat with

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pearl millet in *funkaso* production, if the industry is to thrive. Supplementing of wheat with pearl millet in *funkaso* production can only reduce the cost of production and probably increase its profit margin thereby saving our foreign exchange but there is the problem of incomplete essential amino acid profile, since both wheat and peal millet are cereal grains.

The nutritional quality of most cereal protein is poor (Wang *et al.,* 2008) because they contain less of the essential amino acid particularly lysine needed for growth and maintenance. On the other hand legumes contain lysine but lack methionine and cystine essential amino acid abundant in cereals. Therefore, blending both cereal and legumes in *funkaso* production can make available the required essential amino acid needed by the body comparable to protein of meat, fish and eggs.

Soyabean (*Glycine max)* is a legume that is considered as an excellent source of protein (35-40%) and is not expensive. The seed is the richest in food value of all plant foods consumed in the world (Kure *et al.*, 1998). Soybean protein have been used widely in foods for their distinctive physico-chemical and functional properties as well as nutritional value (Wang *et al.*, 2008). Therefore, its utilization as a supplement in production of *funkaso* may not only address its nutrient status but also functional properties (reducing oil absorption) thereby making it more economical and affordable to the low income earners.

In a similar studies, Badau and Magaji (2011) and Badau *et al.* (2013) supplemented pearl millet with cowpea in alkaki and garabia (traditional wheat and rice based snack). Kalmajit *et al.* (2013)-incorporate cowpea flour as functional ingredients in wheat baked foods. Hence, incorporation of legume in *funkaso* (wheat based product) will go a long way in addressing its deficit. It has been reported that mutual compensation is closest to ideal when the ratio by mass of cereal to legume is roughly 70:30 (Marero *et al.*, 1988; and FAO, 2005).

The problems associated with the local production include: Non-standardization of equipment, process and raw materials, inadequate hygiene during and after production, and little or no packaging. These problems can result in poor preservation techniques and high levels of contaminant in food resulting in food borne illness (Ingbian and Akpapunam, 2005). These problems could be tackled by, among others, standardizing ingredients and processes in *funkaso* production.

The objectives of the study were to produce *funkaso* from the blend of wheat, pearl millet and soybean flours at various proportions; evaluate the flour blends and *funkaso* produced from various formulations by determining their functional properties (bulk density, water and oil absorption, swelling capacity), proximate composition and acceptability.

MATERIALS AND METHODS

Three wheat cultivars (*Norman*, Cettia (CTA) and Atilla gan Atilla), one Pearl millet cultivar (SOSAT C-88) and Soybean were obtained from Lake Chad Research Institute Maiduguri, while other ingredients (baking powder, yeast and oil) were obtained from Maiduguri Monday market, Nigeria.

Whole Wheat Flour Production

The wheat grain was cleaned to remove unwanted chaff and dirt; it was then milled into fine flour without conditioning so as to prevent separation of the bran from the endosperm which is not desired in production of whole wheat flour for *funkaso* production.

Pearl Millet Flour Production

The grain was cleaned to remove foreign matters, conditioned to soften the bran, mellow the endosperm hence facilitating its separation during dehulling. The dehulled grain is then washed with water and allowed to dry in the sun, milled in a hammer mill and finally sieved to obtain fine flour.

Soybean Flour Production

Soybean was sorted, washed and soaked for 5 hours in a clean water of three times its weight and volume until the coat becomes soaked and wet to enhance the removal of some soluble anti-nutrient factor and facilitate dehulling. The soybean was further washed, drained and partially sundried. The soybean was then toasted at surface temperature of 180±5 °C for 30 minutes in an open thick aluminum pot (Iwe, 2003; and Badau *et al*., 2006). It was milled into fine flour with a hammer mill and let to pass through a 0.8 µm mesh size screen.

Standardization Procedure

Funkaso mix flour was standardized by paying several visits to traditional *funkaso* processors in Maiduguri following the procedure of Badau *et al.* (1997). A weighing balance was used to measure out all the ingredients added by the traditional processors during the preparation. The average weights of the various ingredients used in the traditional

Table 1: *Funkaso* Formulations

Formulations (Codes)	Whole Wheat Flour (g)	Pearl Millet Flour (g)	Soybean Flour (g)	Water (ml)	Baking Powder (g)	Yeast (g)	Salt (g)
CC	200	-	-	210	3	2.4	3.6
A1	200	-	-	210	3	2.4	3.6
A2	140	-	60	210	3	2.4	3.6
A3	160	40	-	210	3	2.4	3.6
A4	112	28	60	210	3	2.4	3.6
A5	140	60	-	210	3	2.4	3.6
A6	103	42	60	210	3	2.4	3.6
A7	120	80	-	210	3	2.4	3.6
A8	84	28	60	210	3	2.4	3.6
C1	200	-	-	210	3	2.4	3.6
C2	140	-	60	210	3	2.4	3.6
C3	160	40	-	210	3	2.4	3.6
C4	112	28	60	210	3	2.4	3.6
C5	140	60	-	210	3	2.4	3.6
C6	103	42	60	210	3	2.4	3.6
C7	120	80	-	210	3	2.4	3.6
C8	84	28	60	210	3	2.4	3.6
N1	200	-	-	210	3	2.4	3.6
N2	140	-	60	210	3	2.4	3.6
N3	160	40	-	210	3	2.4	3.6
N4	112	28	60	210	3	2.4	3.6
N5	140	60	-	210	3	2.4	3.6
N6	103	42	60	210	3	2.4	3.6
N7	120	80	-	210	3	2.4	3.6
N8	84	28	60	210	3	2.4	3.6

recipe was used to produce the as a basis for arriving at the formulations presented in Table 1.

Experimental Design

A 3 × 4 × 2 factorial experimental design as reported by Gomez and Gomez (1983) was used for the production of *funkaso* flour blends, where three (3) wheat cultivars {*Norman*, Cettia (CTA), Atilla gan Atilla} were substituted with pearl millet (SOSAT C-88) at four (4) levels (0, 20, 30, 40%) and soybean (ER-biu) at two (2) levels (0, 30%) giving rise to a total of 24 samples plus commercial one as control.

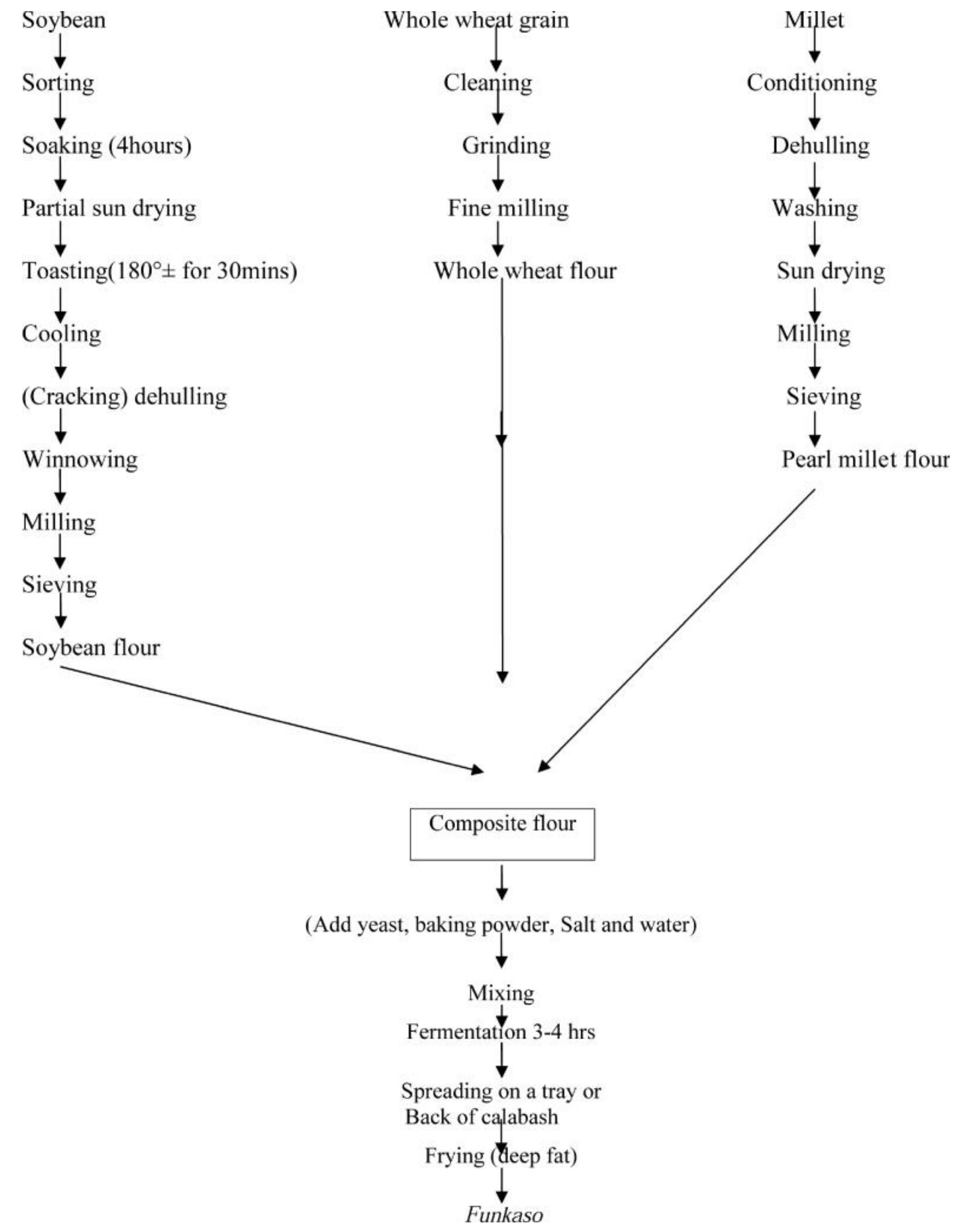
Formulation of Funkaso Flour Blends

The flour blend ratios used were 100%; 70%:00:30%; 80%:20%:0%; 56%:14%:30%; 70%:00%:30%; 49%:21%:30%; 60%; 40%:00%; and 42%:28%:30%. Other quantity of ingredients salt, yeast, baking powder and water remained the same for all formulations (Table 1).

Funkaso Production

Funkaso was prepared by mixing of whole wheat flour with together water, yeast, baking powder and pint of salt to form a batter. The batter was allowed to stand depending on weather condition (2-4 hrs) and then deep fried in oil (Figure 1).

Figure 1: Flow Diagram of Modified *Funkaso* Preparation



Functional Properties

Water absorption and Oil absorption capacities of the samples were determined using the method described by Ojinnaka *et al*. (2013). One gramme (1 g) of the flour was mixed with 10 ml of the water in a centrifuge tube and allowed to stand at room temperature for 1 hr. This was centrifuged at 3500 rpm for 30 min. The volume of water in the sediment was measured. The water absorption was calculated as water absorbed per gramme of flour (Adejuyitan *et al*., 2009). Bulk density of the samples was determined using the method described by Omidiran *et al*. (2015) and calculated as weight of flour (g) divided by flour volume (cm^3) (Okaka and Potter, 1979; and Adejuyitan *et al*., 2009). Water swelling capacity of the sample was determined by the method described by Okaka and Potter (1977) and Adejuyitan *et al*. (2009).

Proximate Composition

Moisture, protein, fat, ash and crude fibre were determined by methods of AOAC (2003). Carbohydrate was calculated as described by Asma *et al.* (2006) and Energy was calculated using Atwater factor (FAO, 2002).

Sensory Evaluation

The sensory evaluation test was conducted by a team of semi-trained 15 panelists drawn from staff and students of University of Maiduguri. The sample were rated for taste, color, texture and overall acceptability based on nine point hedonic scale with representing 9 like extremely and 1 representing dislike extremely as described by Ihekoronye and Ngoddy (1985). Although, the panelists were selected based on basic requirements of a panelist, such as availability for the entire period of evaluation, interest, willing to serve, good health (not suffering from colds), not allergic or sensitive to the products evaluated (Penfield and Campbell, 1990).

Statistical Analysis

The data generated from the study were subjected to analysis of variance (ANOVA) as described by Gomez and Gomez (1983) and means separated using Duncan Multiple Range Test as described by Duncan (1955).

RESULTS AND DISCUSSION

Proximate Composition of Flours of Wheat Cultivars, Pearl Millet Cultivar, Soybean

The proximate composition of three wheat cultivars, one pearl millet cultivar and soybean are shown in Table 2. There were wide significant (P<0.05) variations of moisture, protein, fat, ash, crude fibre, soluble carbohydrate and energy

Table 2: Proximate Composition of Wheat, Pearl Millet and Soybean

S. No.	Commodity	Proximate Composition (%)						Energy (Kcal/100 g)
		Moisture	Protein	Fat	Ash	Crude Fibre	Carbohydrate	
1	Wheat cultivars							
	Atillagan Atilla	11.10 ± 0.00^{d} (88.90)	9.59 ± 0.00^{a}	3.16 ± 0.10^{a}	3.37 ± 0.20^{d}	1.58 ± 0.10^{b}	$71.19\pm0.98b^{c}$	351.58 ± 0.47^{a}
	Cettia (CTA)	10.56 ± 0.48^{d} (89.44)	11.65 ± 0.00^{b}	3.09 ± 0.18^{a}	3.24 ± 0.00^{c}	1.57 ± 0.00^{b}	69.88 ± 0.49^{b}	353.97 ± 1.82^{ab}
	Norman	9.42 ± 0.33^{c} (90.58)	9.38 ± 0.04^{a}	3.69 ± 0.00^{b}	2.99 ± 0.00^{b}	1.64 ± 0.01^{b}	72.86 ± 0.02^{cd}	362.23 ± 0.15^{b}
2	Pearl millet cultivar							
	SOSAT C-88	7.49 ± 0.11^{b} (92.58)	11.63 ± 0.19^{b}	4.58 ± 0.14^{c}	1.97 ± 0.03^{a}	1.32 ± 0.01^{a}	73.83 ± 1.40^{d}	375.62 ± 6.27^{c}
3	Soybean	4.16 ± 0.00^{a} (95.84)	44.15 ± 0.15^{c}	18.92 ± 0.14^{d}	3.24 ± 0.00^{c}	4.89 ± 0.00^{c}	24.63 ± 0.01^{a}	448.87 ± 2.81^{d}

Note: Means (±SE) within each column not followed by the same superscripts are significantly different (P<0.05). Values in brackets are percent dry matter beneath the moisture content of each commodity.

contents among the ingredients used for *funkaso* formulations. Highest moisture content was recorded by wheat cultivars (Cettia, Atilla gan Atilla and Norman) while soybean had the lowest (P<0.05). On the other hand, soybean had the highest (P<0.05) protein and fat contents. Norman had the highest (P<0.05) ash content. Atilla gan atilla had the highest crude fibre followed by Cettia and soybean with insignificant variation (P<0.05). The carbohydrate content of Norman and SOSAT C-88 were higher (P<0.05) that the rest of the ingredients. Soybean had the lowest (P<0.05) carbohydrate but had the highest (P<0.05) energy values.

Proximate Composition of Funkaso Flour Blends

The proximate composition of *funkaso* flour blends is presented in Table 3. It revealed that moisture being important criteria of food shelf stability and was found to range from 8.93-11.25%. The results showed that protein level increased significantly (p<0.05), ranging from 6.97-18.67%. Sample C2 had the highest value and C3 was observed to have the least value. Similar results were reported by Okoye *et al.* (2010) and Yusufu *et al.* (2013).

The fat content ranged from 1.88-8.81. Least value was observed in sample N7 (60% whole wheat flour, 40% pearl millet), which was significantly (P<0.05) different from N2 (70% whole wheat flour, 30% soybean) and C2 (70% whole wheat flour, 30% soybean). *Funkaso* flour blends (Fproduced from A variety were having higher amount of crude fat but significantly different from the control having a value of 14.17±0.10. An increase in the level of fat was observed with soybean incorporation, similar trend was observed by Ghangale and Jadhao (2016) in puri (Indian snack similar but produced from white flour) which was also supplemented with soybean up to 15%. These implies that *funkaso* from composite flour can be referred to as healthy and energy dense food because of high amount of protein, crude fibre and fat, hence will be recommended for those that are on strenuous work especially athletes and growing children as the case may be. Sample C1 (100% Whole wheat flour) and C3 (80% whole wheat flour, 20% pearl millet) remained insignificant (P>0.05) from control (CC).

Dietary fiber is one of the important nutraceutical components with wide range of health benefits. Pearl millet is one of the richest sources of iron and dietary fiber (Singh and Sehgal, 2008; and Gangale and Jadhao, 2016). The control varied significantly from all the sample with the exception of sample N2 (70% whole wheat flour, 30% soybean) and N4 (56 % whole wheat flour, 14% pearl millet, 30% soybean). The crude fibre content of *funkaso* produced ranged between 2.18-3.78. *Funkaso* being a whole wheat product is expected to have high amount of fibre. Sample supplemented with pearl millet and soybean had its level increased significantly at p<0.05 these could be as a result of relatively high amount of fibre in the bran of the whole-wheat flour and/or residual hulls from the supplements that have been inevitably included during processing, representing variable fraction of dietary fibre including mostly the lignin, cellulose and hemicelluloses components (Mannay and Shadaksharaswany, 2005). The increased fibre and the lower carbohydrate content of *funkaso* have several health benefits, as it will aid digestion, reduce constipation and reduce the risk of colon cancer often associated with products from refined grain flours (Slavin, 2005; and Elleuch *et al.*, 2011).

There was significant increase (P<0.05) in ash content of the flour blends with a range of 1.33-3.87% with incorporation of soybean flour substitution especially in the A variety formulation. Sample N3 had the least and C6 the highest value. All the samples are significantly different p>0.05. Ash content is indicative of the amount of minerals in any food sample. The increase in ash is indicative of high mineral content of pearl millet and soybean flour.

A significant decrease in carbohydrate was observed with the incorporation of pearl millet and soybean ranging from 46.53-58.43%. The concomitant decrease in carbohydrate and increase in protein content is due to supplementation with pearl millet and soybean since soybean flour is rich in proteins and fats (Igbabul *et al.*, 2012). All the samples were significantly different from the CC with exception of C5 (70% whole wheat flour, 30% pearl millet, 00% soybean). The highest value was observed in sample C5 and the least in C6 (49% whole wheat flour, 21% pearl millet 30% soybean). No significant difference were observed in these samples A3 (80% whole 20% Pearl millet), A4 (56% whole wheat flour, 14% pearl millet, 30% soybean), A6 (42% whole wheat flour, 28% pearl millet, 30% soybean), A8 (42% whole wheat flour, 28% pearl millet, 30% soybean) and N2 among others.

Energy value range for all the samples is between 380.96-411.92 kcal, the CC (393.78) varied from all the samples except A5 (394.25) at p<0.05 level of significance. The high energy value in sample A3 (411.92) could be attributed to the high fat contents of which has been absorbed by the sample during frying which is directly proportional to the intrinsic and extrinsic factors which determines the end product. This is highly desired especially in famine and war-torn locations were the next meal is not easy to come by. High-energy foods tend to have a protective effect in the optimal utilization of other nutrients (Wardlaw, 2004).

Proximate Composition of Funkaso Produced from Several Formulations

Proximate composition of *funkaso* produced from several formulations is presented in Table 4. The results showed that the dry matter content which is sum of the total solid in the flour ranged between 88.91-91.06%. The moisture content accounts for 8.93-11.25%; with N4 (56% whole wheat flour, 14% pearl millet,30 soybean) having the least value and C1 (100% Whole wheat flour) has the highest percentage. The moisture content decreased with pearl millet and soybean flour supplementation, samples formulation (C4, C5 and C8), (C6, C7) and (N1, N2) from variety A and C are insignificant different (p<0.05). All other samples varied

Table 3: Proximate Composition *Funkaso* Flour Blends

Formulations				Proximate Composition (%)							Energy (Kcal/100 g)
WT	ST	SB		Dry Matter	Moisture	Crude Protein	Crude Fat	Crude Fibre	Ash	CHO	
100AA	0	0	(A1)	88.89±0.33^{def}	11.11±0.00^{ij}	9.59±0.00^{h}	3.16 ±0.01^{cd}	3.37±0.02^{i}	1.58±0.10^{a}	71.19±0.09^{i}	351.58±0.47^{a}
70AA	0	30	(A2)	89.86±0.00^{efgh}	10.14±0.00^{def}	18.30±0.00^{n}	7.74±0.06^{e}	3.22±0.07^{p}	1.21±0.07^{f}	59.39±0.04^{bc}	372.49±0.47^{d}
80AA	20	0	(A3)	89.98±0.02^{abc}	11.01±0.02^{hij}	7.82±0.03^{c}	2.88±0.06^{bc}	2.83±0.00^{e}	1.72±0.00^{bc}	73.71±0.08^{klm}	352.12±0.37^{a}
56AA	14	30	(A4)	90.04±0.01^{fghi}	9.95±0.01^{def}	15.66±0.02^{km}	6.62±0.06^{fg}	4.11±0.00^{o}	2.15±0.02^{def}	61.48±0.07^{e}	378.26±0.38^{def}
70AA	30	0	(A5)	89.13±0.00^{abcd}	10.86±0.00^{ghij}	10.52±0.00^{j}	2.70±0.01^{bc}	2.70±0.00^{c}	1.72±0.01^{bc}	71.55±0.03^{i}	352.73±0.14^{a}
49AA	21	30	(A6)	89.44±0.01^{bcde}	10.56±0.01^{fghi}	16.18±0.01^{km}	7.30±0.00^{efg}	3.88±0.00^{l}	2.19±0.00^{ef}	59.88±0.02^{c}	374.97±0.02^{de}
60AA	40	0	(A7)	89.43±0.38^{bcde}	10.56±0.38^{fghi}	9.61±0.01^{h}	2.33±0.00^{ab}	2.42±0.00^{a}	1.76±0.00^{c}	73.29±0.36^{jk}	352.65±1.59^{a}
42AA	28	30	(A8)	89.83±0.00^{efg}	10.16±0.00^{ef}	17.87±0.00^{mn}	6.98±0.00^{ef}	3.72±0.00^{k}	2.22±0.00^{f}	61.02±0.01^{ab}	375.46±0.07^{de}
100C	0	0	(C1)	89.44±0.48^{bcde}	10.56±0.48^{fghi}	11.65±0.00^{k}	3.09±0.01^{c}	3.24±0.00^{h}	1.57±0.00^{a}	69.88±0.49^{h}	353.97±1.82^{ab}
70C	0	30	(C2)	89.70±0.16^{def}	10.29±0.16^{fg}	18.67±0.01^{n}	8.48±0.19^{fg}	4.02±0.00^{n}	2.08±0.00^{d}	67.44±0.33^{g}	376.78±0.35^{def}
80C	20	0	(C3)	88.91±0.04^{ab}	11.25±0.20^{j}	6.97±0.01^{a}	3.08±0.04^{c}	3.11±0.00^{g}	1.63±0.00^{ab}	73.94±0.16^{lm}	351.41±1.06^{a}
56C	14	30	(C4)	89.57±0.21^{def}	10.42±0.21^{fgh}	17.66±0.00^{e}	8.67±0.01^{g}	3.97±0.00^{m}	2.13±0.00 ^{def}	66.13±0.19^{f}	377.39±0.86^{def}
70C	30	0	(C5)	89.58±0.23^{def}	10.41±0.23^{fgh}	7.77±0.00^{c}	2.89±0.01^{bc}	2.95±0.01^{f}	1.70±0.00^{bc}	74.26±0.22^{m}	361.27±8.07^{c}
49C	21	30	(C6)	89.48±0.11^{bcdef}	10.51±0.11^{fghi}	17.13±0.08^{m}	8.56±0.00^{fg}	3.85±0.03^{l}	2.16±0.00^{def}	61.78±0.17^{c}	376.69±0.57^{def}
60C	40	0	(C7)	89.85±0.07^{a}	10.81±0.40^{ghij}	8.81±0.00^{f}	8.81±0.00^{bc}	2.55±0.00^{b}	1.74±0.00^{abc}	73.38±0.40^{jkl}	353.14±1.61^{ab}
42C	28	30	(C8)	89.52±0.04^{cdef}	10.48±0.04^{fgh}	17.64±0.00^{mn}	14.64±0.00^{efg}	3.66±0.05^{j}	2.17±0.00^{def}	60.70±0.04^{a}	376.41±0.13^{def}
100N	0	0	(N1)	90.57±0.03^{ijkl}	9.42±0.03^{abcd}	9.38±0.04^{g}	3.69±0.00^{d}	2.99±0.00^{f}	1.64±0.01^{ab}	72.86±0.02^{j}	362.23±0.15^{c}
70N	0	30	(N2)	90.49±0.28^{hijk}	9.51±0.28^{abcd}	18.37±0.01^{n}	8.26±0.02^{efg}	4.10±0.00^{o}	2.10±0.00^{de}	67.64±0.33^{g}	378.43±1.06^{def}
80N	20	0	(N3)	90.66±0.0^{jkl}	9.33±0.00^{abc}	12.13±0.00^{l}	3.01±0.00^{c}	2.73±0.00^{d}	1.70±0.00^{bc}	71.08±0.01^{i}	359.95±0.09^{bc}
56N	14	30	(N4)	91.06±0.0l8	8.93±0.08^{a}	16.68±0.01^{r}	8.68±0.00^{g}	3.88±0.00^{l}	2.23±0.04^{f}	60.59±0.05^{a}	383.26±0.16^{f}
70N	30	0	(N5)	90.97±0.01^{kl}	9.02±0.01^{ab}	10.40±0.00^{i}	2.98±0.00^{c}	2.54±0.00^{b}	2.12±0.07 ^{def}	73.00±0.07^{j}	354.53±8.86^{ab}
49N	21	30	(N6)	90.40±0.00^{hij}	9.59±0.00^{bcde}	16.11±0.00^{m}	8.64±0.01^{fg}	3.71±0.00^{k}	2.16±0.00 ^{def}	62.77±0.00^{d}	381.28±0.10^{ef}
60N	40	0	(N7)	90.31±0.02^{ghi}	9.69±0.02^{cde}	7.69±0.00^{b}	1.88±0.94^{a}	2.51±0.00^{b}	1.72±0.02^{bc}	75.55±0.02^{n}	358.45±0.18^{abc}
42N	28	30	(N8)	90.44±0.00^{hijk}	9.55±0.00^{bcd}	17.17±0.00^{mn}	8.28±0.00^{efg}	3.64±0.00^{j}	2.32±0.00^{g}	61.02±0.00^{ab}	379.36±0.04^{def}

Note: Means (±SE) in the same column having different superscripts are significantly (p<0.05) different. WT = Wheat; ST = SOSAT C – 88; SB = Soybean; CC = Commercial Control; N = Norman; C = Cettia CTA; AA = Atillagan Atilla.

significant at $p>0.05$. The low values of moisture content in this study would enhance the storability and keeping quality of the products.

A proportionate increase in protein content occurred ranging between 6.97-1.56. The protein increase is due to supplementation with soybean which is known for its excellent source of protein because it contains all the essential amino acids, is very rich in minerals and is a good source of fat soluble vitamins (Alabi *et al.*, 2007; and Serrem *et al.*, 2011). Other studies have also reported a similar increase of protein content in soy-composite flours according to Singh *et al.* (2000) and Mashayekh *et al.* (2008). Sample C3 (80% whole wheat flour, 20% pearl millet, 0%) having the least which might be as a result of high percentage of pearl millet supplemented even though many researchers have proved its protein level to be comparable to other cereal grain. The highest value was observed in sample N4. All the samples were significantly different at

Table 4: Proximate Composition *Funkaso* Produced from Several Formulations

Formulations				Proximate Composition (%)							Energy (Kcal/100 g)
WT	ST	SB		Dry Matter	Moisture	Crude Protein	Crude Fat	Crude Fibre	Ash	CHO	
100CC	0	0	(CC)	86.30±0.00^{bcd}	13.69±0.00^{fgh}	13.58±0.25^{abcdefg}	14.17±0.15^{hi}	2.86±0.02^{fg}	2.71±0.05^{j}	52.97±0.41^{defg}	393.78±0.62^{efg}
100AA	0	0	(A1)	86.45±0.23^{cdefg}	13.54±0.23^{defg}	10.86±3.21^{bcdefg}	14.43±0.50^{i}	2.88±0.01^{g}	2.79±0.01^{k}	51.47±3.48^{bcde}	395.29±3.46^{fg}
70AA	0	30	(A2)	87.09±0.21^{i}	12.90±0.02^{b}	18.32±1.21^{efg}	14.56±0.23^{i}	3.78±0.01^{q}	2.99±0.00l^{m}	48.42±1.12^{abcd}	394.05±1.22^{efg}
80AA	20	0	(A3)	87.67±0.00^{j}	12.32±0.00^{a}	8.43±3.39^{defg}	15.02±0.00^{j}	2.51±0.01^{d}	2.96±0.00^{l}	50.74±3.40^{abcde}	403.92±0.06^{i}
56AA	14	30	(A4)	86.53±0.23^{cdefg}	13.40±0.20^{cdefg}	16.04±2.73^{defg}	12.49±0.00^{d}	3.60±0.01^{op}	3.87±0.00^{q}	50.59±2.89^{abcde}	378.97±0.83^{a}
70AA	30	0	(A5)	86.63±0.17^{cdefgh}	13.33±0.14^{bcdef}	12.92±1.67^{abcde}	11.99±0.00^{c}	2.31±0.01^{b}	3.04±0.01^{m}	56.40±1.52^{fghi}	385.26±0.68^{cd}
49AA	21	30	(A6)	85.78±0.01^{a}	14.21±0.01^{i}	16.32±1.12^{abcdefg}	15.29±0.03^{j}	3.32±0.00^{k}	2.45±0.01^{g}	50.39±1.14^{abcde}	396.52±0.09^{g}
60AA	40	0	(A7)	86.89±0.00^{ghi}	13.10±0.00^{bcd}	10.83±2.11^{abcdefg}	16.31±0.01^{kl}	2.18±0.00^{a}	2.50±0.01^{h}	52.06±2.12^{cdef}	410.42±0.14^{j}
42AA	28	30	(A8)	86.40±0.00^{cde}	13.59±0.00^{efgh}	17.80±1.47^{defg}	13.00±0.00^{e}	3.21±0.00^{j}	3.46±0.01^{o}	50.92±1.49^{abcde}	383.92±0.12^{cd}
100C	0	0	(C1)	86.79±0.43^{efghi}	13.20±0.04^{bcde}	10.39±0.50^{ab}	14.18±0.15^{hi}	3.11±0.00^{i}	2.33±0.00^{f}	56.78±0.43^{ghi}	396.30±0.70^{g}
70C	0	30	(C2)	86.86±0.06^{fghi}	13.13±0.06^{bcd}	18.10±0.60^{defg}	16.99±0.00^{l}	3.54±0.02^{no}	2.59±0.01^{i}	47.63±0.55^{abc}	407.88±0.32^{j}
80C	20	0	(C3)	86.44±0.00^{cdefg}	13.55±0.00^{defg}	9.58±0.36^{a}	14.33±0.00^{hi}	3.02±0.00^{h}	2.22±0.00^{e}	57.28±0.35^{ghi}	396.45±0.04^{g}
56C	14	30	(C4)	86.69±0.00^{defghi}	13.20±0.10^{bcde}	17.64±0.78^{efg}	16.33±0.00^{k}	3.48±0.01^{m}	3.33±0.00^{n}	47.00±0.72^{ab}	401.58±0.37^{hi}
70C	30	0	(C5)	86.55±0.01^{cdefg}	13.44±0.01^{cdefg}	10.06±0.51^{a}	13.36±0.03^{ef}	2.67±0.00^{e}	2.01±0.01^{c}	58.43±0.45^{hi}	394.25±0.04^{efg}
49C	21	30	(C6)	86.43±0.00^{cdef}	13.63±0.02^{efgh}	17.50±0.35^{cdefg}	16.90±0.01^{l}	3.54±0.00^{no}	3.87±0.00^{q}	46.53±0.40^{a}	400.30±0.06^{h}
60C	40	0	(C7)	86.74±0.15^{defghi}	13.28±0.18^{bcdef}	11.05±0.44^{abc}	10.96±0.04^{b}	2.41±0.00^{c}	2.12±0.00^{d}	60.16±0.62^{i}	383.50±0.67^{bc}
42C	28	30	(C8)	86.51±0.28^{cdefg}	13.52±0.29^{defg}	17.74±0.70^{efg}	16.49±0.16^{k}	3.40±0.03^{l}	3.04±0.02^{m}	46.79±0.40^{ab}	402.61±1.46^{hi}
100N	0	0	(N1)	86.42±0.12^{cdef}	13.64±0.02^{efgh}	13.59±0.59^{abcdef}	10.69±0.03^{ab}	2.80±0.01^{f}	1.67±0.00^{b}	57.58±0.62^{hi}	380.96±0.15^{ab}
70N	0	30	(N2)	86.54±0.24^{cdefg}	13.46±0.24^{defg}	18.35±0.70^{fg}	12.37±0.01^{d}	3.61±0.01^{p}	2.68±0.00^{j}	49.52±0.63^{abcde}	382.82±0.94^{bc}
80N	20	0	(N3)	86.53±0.05^{cdefg}	13.46±0.05^{defg}	11.76±0.69^{abcd}	12.62±0.03^{d}	2.67±0.00^{e}	1.33±0.00^{a}	58.13±0.77^{hi}	393.22±0.16^{ef}
56N	14	30	(N4)	86.61±0.34^{cdefgh}	13.38±0.34^{cdefg}	18.31±0.07^{fg}	13.01±0.01^{e}	3.53±0.01^{mn}	3.34±0.01^{n}	48.41±0.37^{abcd}	384.01±1.33^{cd}
70N	30	0	(N5)	86.42±0.02^{cdef}	13.64±0.01^{efgh}	14.17±1.71^{abcdefg}	13.62±0.03^{fg}	2.49±0.05^{d}	2.01±0.01^{c}	54.04±1.73^{ef}	395.50±0.39^{fg}
49N	21	30	(N6)	86.99±0.01^{hi}	13.00±0.01^{bc}	18.48±0.01^{abcdefg}	13.68±0.00^{fg}	3.54±0.03^{no}	2.68±0.01^{j}	48.60±0.04^{abcd}	391.49±0.27^{e}
60N	40	0	(N7)	85.98±0.01^{ab}	14.01±0.01^{hi}	13.31±0.90^{abcde}	10.36±0.03^{a}	2.39±0.03^{c}	1.66±0.00^{b}	58.25±0.90^{hi}	379.56±0.35^{a}
42N	28	30	(N8)	86.20±0.01^{bc}	13.80±0.01^{gh}	17.04±0.01^{defg}	13.96±0.04^{gh}	3.39±0.03^{l}	3.62±0.04^{p}	49.18±0.12^{abcd}	386.53±0.05^{d}

Note: Means (±SE) in the same column having different superscripts are significantly ($p<0.05$) different. WT = Wheat; ST = SOSAT C – 88; SB = Soybean; CC = Commercial Control; N = Norman; C = Cettia CTA; AA = Atillagan Atilla p>0.05 with the exception (C6, N6); (C2, N7); (A3, C5); (A4, C1) and (A1 and A7) respectively.

A value range of 1.88-8.67 fat content was obtained from these studies with the least recorded in sample N7 and the highest in sample C4. No significant difference in fat content were observed at p<0.05 for these sample formulation A3, A5, A7; C1, C3, N3, N5; C8, A8; and C8, N2 respectively.

A high amount of crude fibre was observed in this study when compared to the amount in conventional wheat grains (local), these could be as a result of wholeness of the grain (wheat), varietal difference as the samples used in these studies were improved and might have affected the overall grain composition. The crude fibre content ranged between 2.42-4.22, significant variation was observed among the samples. The high crude fibre is most likely from the bran of the whole-wheat flour and the hull of soy beans, which represents variable fraction of dietary fibre and includes mostly the lignin, cellulose and hemicelluloses components (Mannay and Shadaksharaswany, 2005). The least value was observed in sample A7 and highest in sample A2. Sample having the same formulation in variety C and N are not different at 5% level of significance.

An increasing trend was observed in the ash content level with pearl millet and soybean incorporation. The value ranged between 1.64-2.32%, least being observed in sample N1 (100% whole wheat) and the highest in N8 (42% whole wheat, 28% pearl millet, 30% soybean).

Value range of carbohydrate (60.59 to 75.55) was observed among all the flour samples. N7 had the highest value of 75.55 and the least sample was observed in sample N4 which was also found to be insignicantly different to C8 (60.70) at p<0.05. Sample A (100%), A5 (70% whole wheat flour, 30% pearl millet, 0% soybean) and A3 (80% whole wheat flour, 20% pearl millet, 0%) an were also insignificantly different. A concomitant decrease in carbohydrate and increase in protein occurred, these could be as result of soybean flour inclusion as they are rich sources of protein. These trends have been reported by many researchers. The resulting total carbohydrate content in this study indicates that these types of flour are classified as food of the group one or food energy supplier of nutritive and economical value which could represent good sources for industrial flour and starch (FAO, 1998).

Functional Properties of Tunkaso Produced from Several Formulations

The result of the functional properties of *Funkaso* produced from different formulation is presented in Table 5, where water absorption ranged from 2.00-3.03 ml/g. The highest and lowest values were observed in C1 (100% Whole wheat flour) and N6 (49% whole wheat flour, 21% pearl millet, 30% soybean).Most samples that were not supplemented with soybean were insignificantly different (p<0.05) except few. Considering the water absorption in terms of varietal difference, the CC (Control Commercial) was insignificantly different to formulation in variety A and C not containing soybean (A1, A3, A5, C1, C2 and N1). Sample C1 having higher water absorption when compared to the flour from which it was processed, and this might be as result of protein concentration, loss of conformal structure and leaching of amylose during processing (Butt and Batool, 2010). Sample N3, N4 and N5 were indifferent (P<0.05).

A value range of 0.50-1.00 was observed in oil absorption of *funkaso*. Insignicant difference (p<0.05) was observed in the control and most samples that are not supplemented with soybean in variety A and C, but variety N appeared to be different. Increased oil absorption was observed with incorporation of soybean in all the samples, similar result were reported by Gangale and Jadhao (2016). These could possibly be due to protein concentration and their conformational properties in foods which also influence oil absorption (Ige *et al.*, 1984; and Ahmad and Prakash, 2006).

The bulk density of *funkaso* flour increased concomitantly with supplementation at varying levels. The resulting value ranged between 0.71-1 ml/g. Bulk density give reflection/indication of relative volume of packaging material, mixing quality of particulate matter and load the flour sample accommodates if allowed to rest directly on the matter. The density of processed products dictate the characteristics of its container or package product, density influences the amount and strength of packaging material, texture or mouth feel (Apotiola *et al.*, 2016). According to Basman *et al.* (2003) higher bulk density is desirable for greater ease of dispensability of flours. In contrast, however, low bulk density would be an advantage in the formulation of complementary foods (Ugwu and Ukpabi, 2002).

Water swelling capacity of the *funkaso* ranged from 16-28 ml/10 g at 30 °C and 18-29.33 ml/10 g at 70 °C. Water swelling capacity decreased significantly at p<0.05 for both temperatures but lower in samples with soybean, and significantly different (p<0.05) when compared to CC with other samples. High swelling capacity has been reported as part of the criteria for a good quality product (Apotiola *et al.,* 2016) . Among all the samples at varying temperature sample A1 had the highest at 60 °C which is as result of increased temperature that enabled the starch to immobile water and swells (Ikegwu *et al.*, 2009).

Table 5: Functional Properties of *Funkaso* from Different Formulation

Formulations (%)				Water Abs	Oil Abs	WSC 30 °C	WSC 70 °C	BD
WT	ST	SB		(ml/g)	(ml/g)	(g/ml)	(g/ml)	(g/ml)
100CC	0	0	(CC)	2.93±0.03^{e}	0.50±0.00^{a}	27.00±0.00^{k}	28.66±0.33^{lm}	0.89±0.00^{k}
100AA	0	0	(A1)	2.96±0.03^{e}	0.50±0.00^{a}	28.00±0.00^{l}	29.33±0.33^{n}	0.76±0.00^{h}
70AA	0	30	(A2)	2.53±0.03^{cd}	1.00±0.00^{d}	20.33±0.33^{d}	26.00±0.00^{j}	0.83±0.00^{j}
80AA	20	0	(A3)	3.00±0.00^{e}	0.50±0.00^{a}	22.33±0.33^{h}	20.33±0.33^{c}	0.83±0.00^{j}
56AA	14	30	(A4)	2.50±0.11^{cd}	1.00±0.00^{d}	21.33±0.33^{ef}	22.33±0.33^{fg}	0.76±0.00^{h}
70AA	30	0	(A5)	3.00±0.00^{e}	0.50±0.00^{a}	21.66±0.33^{fg}	24.00±0.00^{h}	0.71±0.00^{d}
49AA	21	30	(A6)	2.53±0.03^{cd}	0.50±0.00^{a}	19.33±0.33^{c}	21.00±0.00^{cd}	0.71±0.00^{d}
60AA	40	0	(A7)	2.33±0.33^{bc}	1.00±0.00^{d}	21.00±0.00^{e}	21.33±0.33^{de}	0.66±0.00^{b}
42AA	28	30	(A8)	2.50±0.00^{cd}	0.50±0.05^{a}	20.33±0.33^{d}	22.66±0.33^{fg}	1.00±0.00^{n}
100C	0	0	(C1)	3.03±0.03^{e}	0.73±0.03^{b}	24.33±0.33^{j}	28.33±0.33^{l}	0.76±0.00^{h}
70C	0	30	(C2)	2.96±0.03^{e}	0.96±0.03^{d}	16.00±0.00^{a}	21.00±0.00^{cd}	0.76±0.00^{h}
80C	20	0	(C3)	2.20±0.00^{ab}	0.50±0.00^{a}	20.00±0.00^{d}	19.00±0.00^{b}	0.82±0.00^{i}
56C	14	30	(C4)	2.23±0.03^{ab}	1.00±0.00^{d}	19.33±0.33^{c}	18.33±0.33^{ab}	0.71±0.00^{e}
70C	30	0	(C5)	2.50±0.00^{cd}	0.50±0.00^{a}	23.00±0.00^{i}	22.33±0.33^{fg}	0.71±0.00^{d}
49C	21	30	(C6)	2.23±0.03^{ab}	0.93±0.03^{cd}	16.33±0.33^{a}	18.00±0.00^{a}	0.76±0.00^{g}
60C	40	0	(C7)	2.70±0.11^{d}	0.50±0.00^{a}	22.00±0.00^{gh}	24.33±0.33^{hi}	0.71±0.00^{c}
42C	28	30	(C8)	2.53±0.03^{cd}	1.00±0.00^{d}	20.00±0.00^{d}	22.00±0.00^{ef}	0.99±0.00^{m}
100N	0	0	(N1)	3.00±0.00^{e}	1.00±0.00^{d}	23.00±0.00^{i}	27.00±0.00^{k}	0.92±0.00^{l}
70N	0	30	(N2)	2.50±0.00^{cd}	0.73±0.03^{b}	23.00±0.00^{i}	24.66±0.33^{hi}	0.76±0.00^{h}
80N	20	0	(N3)	2.30±0.00^{bc}	0.50±0.00^{a}	22.00±0.00^{gh}	26.00±0.00^{j}	0.71±0.00^{c}
56N	14	30	(N4)	2.43±0.03^{bc}	1.00±0.00^{d}	21.00±0.00^{e}	24.00±0.00^{h}	0.71±0.00^{d}
70N	30	0	(N5)	2.30±0.00^{bc}	0.90±0.00^{c}	19.00±0.00^{c}	25.00±0.00^{i}	0.62±0.00^{a}
49N	21	30	(N6)	2.00±0.00^{a}	1.00±0.00^{d}	18.00±0.00^{b}	22.33±0.33^{fg}	0.76±0.00^{h}
60N	40	0	(N7)	2.53±0.03^{cd}	1.00±0.00^{d}	18.00±0.00^{b}	22.66±0.33^{fg}	0.71±0.00^{d}
42N	28	30	(N8)	2.20±0.00^{ab}	0.76±0.06^{b}	19.00±0.00^{c}	23.00±0.00^{g}	0.72±0.00^{f}

Note: Means (±SE) in the same column having different superscripts are significantly (p<0.05) different. WT = Wheat; ST = SOSAT C – 88; SB = Soybean; CC = Commercial Control; N = Norman; C = Cettia CTA; AA = Atillagan Atilla.

Sensory Scores of Funkaso Produced from Various Formulations

The Sensory characteristics of the *funkaso* presented in Table 6 shows the overall acceptability of prepared *funkaso* was defined by sensory evaluation which was performed by 15 number of semi- trained panelist. The result from these study shows that, there is significant difference (p>0.05%) in overall acceptability, appearance, taste,

Table 6: Sensory Scores of *Funkaso* Produced from Various Formulations[1]

Formulations				Sensory Panel Scores[2]				
WT	ST	SB		Appearance	Taste	Texture	Colour	Overall
100CC	0	0	(CC)	7.83 ± 0.16^{g}	6.08 ± 0.67^{abcde}	6.08 ± 0.60^{abcdefg}	6.83 ± 0.69^{def}	7.33 ± 0.18^{hi}
100AA	0	0	(A1)	7.83 ± 0.20^{g}	8.33 ± 0.25^{f}	7.75 ± 0.32^{h}	8.16 ± 0.27^{f}	8.16 ± 0.16^{i}
70AA	0	30	(A2)	6.41 ± 0.54^{bcdefg}	6.41 ± 0.63^{bcde}	7.00 ± 0.40^{efgh}	7.25 ± 0.27^{ef}	6.75 ± 0.60^{defgh}
80AA	20	0	(A3)	6.25 ± 0.56^{abcdef}	5.58 ± 0.46^{abcde}	6.58 ± 0.37^{bcdefgh}	6.66 ± 0.33^{cde}	6.16 ± 0.54^{abcdefgh}
56AA	14	30	(A4)	6.58 ± 0.43^{bcdefg}	5.75 ± 0.49^{abcde}	6.91 ± 0.43^{defgh}	6.91 ± 0.37^{def}	5.75 ± 0.37^{abcdefg}
70AA	30	0	(A5)	6.75 ± 0.30^{cdefg}	5.50 ± 0.52^{abcde}	5.50 ± 0.50^{abcd}	6.33 ± 0.37^{abcde}	6.08 ± 0.45^{abcdefgh}
49AA	21	30	(A6)	6.83 ± 0.36^{cdefg}	5.58 ± 0.43^{abcde}	6.25 ± 0.44^{abcdefg}	6.91 ± 0.39^{def}	6.66 ± 0.41^{bcdefgh}
60AA	40	0	(A7)	6.58 ± 0.31^{bcdefg}	6.91 ± 0.37^{e}	7.25 ± 0.32^{gh}	6.66 ± 0.37^{cde}	6.91 ± 0.35^{efghi}
42AA	28	30	(A8)	7.41 ± 0.31^{fg}	6.50 ± 0.19^{cde}	6.75 ± 0.30^{cdefgh}	6.75 ± 0.30^{de}	7.08 ± 0.31^{fghi}
100C	0	0	(C1)	6.91 ± 0.52^{defg}	6.75 ± 0.59^{de}	7.16 ± 0.44^{fgh}	7.08 ± 0.28^{def}	7.16 ± 0.44^{ghi}
70C	0	30	(C2)	6.83 ± 0.40^{cdefg}	5.91 ± 0.33^{abcde}	6.33 ± 0.51^{abcdefgh}	6.66 ± 0.22^{cde}	6.58 ± 0.22^{bcdefgh}
80C	20	0	(C3)	6.66 ± 0.28^{bcdefg}	6.25 ± 0.49^{bcde}	6.08 ± 0.43^{abcdefg}	6.50 ± 0.35^{bcde}	6.50 ± 0.41^{bcdefgh}
56C	14	30	(C4)	6.50 ± 0.37^{bcdefg}	5.33 ± 0.39^{abcde}	6.00 ± 0.32^{abcdefg}	5.83 ± 0.34^{abcde}	5.66 ± 0.33^{abcdef}
70C	30	0	(C5)	6.58 ± 0.43^{bcdefg}	6.33 ± 0.35^{bcde}	5.08 ± 0.28^{ab}	6.00 ± 0.34^{abcde}	5.58 ± 0.14^{abcde}
49C	21	30	(C6)	6.33 ± 0.37^{abcdef}	5.66 ± 0.33^{abcde}	5.66 ± 0.51^{abcde}	6.83 ± 0.20^{def}	6.16 ± 0.40^{abcdefgh}
60C	40	0	(C7)	5.91 ± 0.48^{abcde}	5.83 ± 0.40^{abcde}	5.58 ± 0.51^{abcde}	6.00 ± 0.46^{abcde}	5.83 ± 0.40^{abcdefg}
42C	28	30	(C8)	5.41 ± 0.52^{abc}	5.33 ± 0.33^{abcde}	5.41 ± 0.43^{abc}	5.83 ± 0.51^{abcde}	5.66 ± 0.51^{abcdef}
100N	0	0	(N1)	5.41 ± 0.39^{abc}	4.50 ± 0.48^{a}	5.75 ± 0.46^{abcdef}	4.91 ± 0.41^{a}	5.41 ± 0.49^{abcde}
70N	0	30	(N2)	5.25 ± 0.44^{ab}	5.16 ± 0.61^{abcd}	5.00 ± 0.47^{a}	5.08 ± 0.49^{ab}	5.16 ± 0.53^{abc}
80N	20	0	(N3)	5.00 ± 0.50^{a}	5.00 ± 0.53^{abc}	5.08 ± 0.64^{ab}	5.16 ± 0.56^{ab}	5.00 ± 0.57^{ab}
56N	14	30	(N4)	5.66 ± 0.43^{abcd}	5.08 ± 0.60^{abcd}	5.33 ± 0.39^{abc}	5.91 ± 0.46^{abcde}	5.25 ± 0.55^{abcd}
70N	30	0	(N5)	5.83 ± 0.40^{abcde}	5.25 ± 0.50^{abcde}	5.33 ± 0.35^{abc}	5.25 ± 0.42^{abc}	4.83 ± 0.38^{a}
49N	21	30	(N6)	6.58 ± 0.43^{bcdefg}	4.75 ± 0.60^{ab}	5.50 ± 0.33^{abcd}	5.91 ± 0.51^{abcde}	5.33 ± 0.48^{abcd}
60N	40	0	(N7)	5.91 ± 0.66^{abcde}	5.66 ± 0.49^{abcde}	5.25 ± 0.42^{abc}	5.66 ± 0.41^{abcd}	5.50 ± 0.46^{abcde}
42N	28	30	(N8)	7.16 ± 0.29^{efg}	6.58 ± 0.64^{cde}	5.91 ± 0.35^{abcdefg}	6.16 ± 0.63^{abcde}	5.91 ± 0.67^{abcdefgh}

Note: [1] Means (±SE) in the same column with different superscripts are significantly (p< 0.05) different. [2] Scoring system using the 9-point hedonic scale in which 9-like extremely and 1-dislike extremely. WT = Wheat; ST = SOSAT C – 88; SB = Soybean; CC = Commercial Control; N = Norman; C = Cettia CTA; AA = Atillagan Atilla.

colour and texture evaluated. The highest score in terms of taste, texture, colour and overall acceptability were observed in sample A1 with 8.33, 7.75, 8.16 and 8.16 respectively. The score for overall acceptability ranged between 4.83 and 8.16, A1 is significantly different ($p>0.05$) to all the samples, and no significant difference were observed in sample A3, A5, C6 and N8; and A7, N1 and N5 among others but differ with the CC. Sample N5 had the least score. A score range of 4.75 to 8.33, 4.91 to 8.16, 5.00 and 7.75 was observed in terms of taste, colour and texture, A1 is significantly different from CC at $P<0.05$ while all other samples were not significantly different. No significant difference was observed in terms of Appearance with a range from 5.00 and 7.83, with the exception of A1 and CC. Sample A1 remains the most acceptable following the various parameters used in evaluating its acceptability. The score reduces with the supplementation of pearl millet and soybeans, and this is in line with the finding of Apotiola (2013) where cookies was supplemented with yam and soybean.

In terms taste and texture samples CC, A3, A4, A5, A6, C2, C4, C6, C7, C8, N5 and N7; and CC, A6, C3, C4 and N8 are insignificantly different at 5% level, also no significant difference was observed in colour CC, C1, A4 and A6; and A5, C4, C5, N4, N6 and N8 at $p<0.05$ respectively.

CONCLUSION

Funkaso flour blends were produced from mixtures of wheat cultivars, pearl millet, soybean along with other ingredients such as baking powder, yeast, salt and water. Funkaso produced from these blends were subjected to proximate composition, functional properties and sensory evaluation. Protein and fat contents increased significantly ($P<0.05$) with soybean supplementations. Addition of soybean increased the protein and fat contents of complementary food significantly ($P<0.05$). Sensory scores tasted by panelists were generally high and therefore wheat can be supplemented with soybean and pearl millet at 30% and 28% levels, respectively in *funkaso* processing which had increased the protein and fat contents which could also increase the profit margin and save foreign exchange earnings by reducing importation of wheat.

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