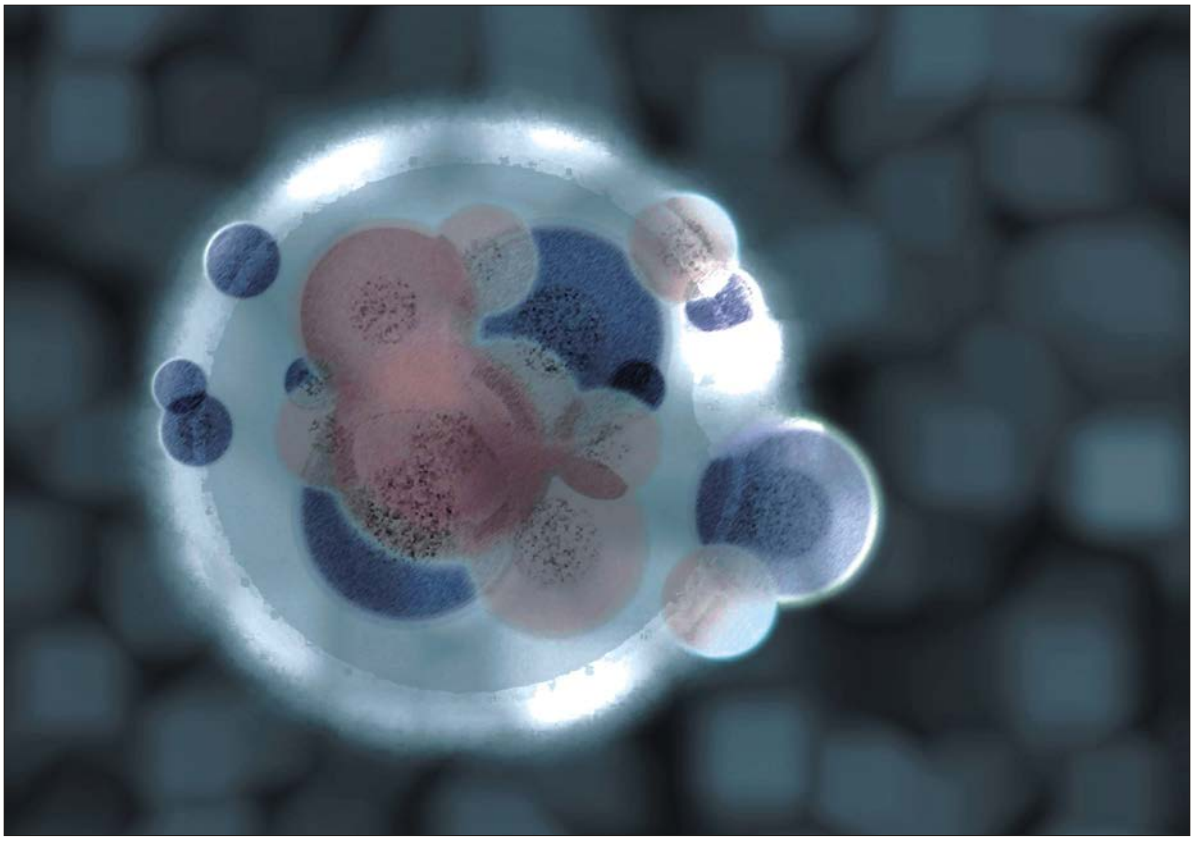

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Effect of Supplementation of Ogi a Pearl Millet Based Nigerian Weaning Food, With Cowpea, on Chemical Composition, Sensory and *in vitro* Protein Digestibility

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Abstract: Studies on the supplementation of ogi a weaning food produced from different pearl millet varieties with cowpea was carried out. The proximate composition of the ogi/cowpea blends shows that, the moisture content within the ogis blends ranged from 8.48±0.58 for GB 8735 to 9.31±0.35 for Zango, respectively. The crude protein of the ogi/cowpea blends ranged from 8.60±0.36 for GB 8735 to 9.27±0.10 for Gwagwa. GB 8735 ogi blend, an improved variety had the higher carbohydrate content compared to the two local varieties, Gwagwa and Zango, respectively. The digestibility at 2 h ranged from 52.6±1.1 for Gwagwa to 59.4±7.8 for Zango both being local cultivars, with the improved variety GB-8735 recording 53.7±1.5. The same pattern was observed at the 4th h for the three varieties. But at 6th h of incubation, GB-8735 recorded the highest digestibility of 89.0±9.1 followed by Zango 69.8±8.1 and Gwagwa recording 60.0±0.8. The result for the sensory evaluation test for the ogi/cowpea blends revealed that, all the parameters evaluated gave a statistically significant ($p<0.05$) differences, except for overall acceptability. GB 8735, an improved variety recorded the highest score in colour, taste and overall acceptability, while Gwagwa a local variety recorded highest in texture and is next to GB 8735 in terms of taste. The viscosity characteristics of the cowpea flour and their ogi blends shows that, the pure ogi product recorded higher viscosity values compared to their respective blends. The cowpea blend alone had the least viscosity compared to the pure ogi and their blends. This shows that, ogi from any one of the cereals blends is acceptable and can be use as a weaning complementary food.

Key words: Cowpea, pearl millet, blend, weaning food

INTRODUCTION

Most infants are first fed with breast milk, a food supply that produces adequate nutritional and some resistance to disease, Rowland *et al.*[1]. At four to six months of age, it becomes necessary to introduce other foods into the diet, because human breast milk alone is insufficient to meet the ever-increasing needs of the infants, Lutter *et al.*[2]. Among the weaning foods prepared in Nigeria and some parts of west African countries is ogi (akamu) which usually consist of bulky mono cereal foods either from Maize, sorghum and or Millet. These weaning foods have been reported by many workers to be inadequate in energy and nutrient content[3-5]. Even though, pearl millet varieties have been reported as the cereal of choice for the preparation of porridges for children as weaning food, for the sick and the old in India and Africa. It is considered to be more palatable and its mineral composition, especially calcium content, is greater than that of sorghum or maize[6]. Although the 8-11% total protein content of pearl millet is comparable to that of other cereals, it is limiting in lysine but has sulfur-containing amino acid at levels to that of milk protein[7].

Cowpea and soybean are important source of dietary protein, especially in the regions where animal proteins may be unavailable or expensive[8]. These legumes are easy to prepare and can be soften easily by simple processing methods, such as cooking.

Technologies such as germination, cooking and lactic acid fermentation are simple and inexpensive and have been practiced for many years by communities in developing countries to process cereals and legumes blends. Germination is mainly used to lower dietary bulk in cereals, because it converts significant amounts of starch, which is principally responsible for viscosity in cereal gruels, to sugars and short chain oligosaccharides[9]. Lactic acid fermentation gives fermented foods a sour taste and lowers the pH of the food, rendering it stable against the growth of

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gram-negative bacteria, the main pathogen in foods for children in developing countries[10,11]. It also degrades phytic acid, resulting to increase in digestibility[12]. A lot of emphases have been laid on developing cereal-legume complementary foods to address mainly protein energy malnutrition and such formulations should target vitamin A and micronutrient deficiency, especially Ca, Fe and Zn, which are deficient in many diets for children[13].

Objective of the present study was to formulate cereal legume blend, with improved nutritional quality and acceptable sensory qualities as a weaning food.

MATERIALS AND METHODS

The three pearl millet varieties used in this study are Gwagwa, Zango both (local cultivars) and SOSAT-C88 (improved variety) were collected from Lake Chad Research Institutes Maiduguri at end of the 2002 harvest. The cowpea was purchased in the Maiduguri Monday market. Both grain and legume samples were clean and stored at 0°C until used.

Preparation of ogi: Ogi was produced by the laboratory method as described by Akingbala *et al.*[3] as follows, grain was steeped for 72 h to soften the endosperm and ferment, it was followed by wet milling and sieving to remove the bran. The top water was decanted and the ogi sun dried to constant weight.

Formulation of the cowpea and millet ogi blend: About 2 kg of the cleaned cowpea was soaked in distilled water for 5 min, this was then followed by dehulling using pestle and mortar gently. The dehulled cowpea was then washed and sieved. It was then roasted and ground into a powdered form. The blending was in a ratio of 7:3 ogi/cowpea as described by Akpapunam[14]. The proximate composition of the cowpea flour and their ogi blends standard AOAC[15] methods. The protein apparent *in vitro* digestibility was determined as described by Neils[12]. The sensory evaluation test was carried out using the hedonic scale (1-9) scores in an ascending order as described by Williams[16]. The viscosity was measured as described by Sopode and Filibus[17].

Statistical analysis, analysis of varieties (ANOVA) was used to determine the differences within the groups and Duncan Multiple Test Range was use to determined the differences within the varieties at 95% confidence level ($p<0.05$).

RESULTS AND DISCUSSION

The moisture content within the ogis blends ranged from 8.48±0.58 for GB 8735 to 9.31±0.35 for Zango, respectively. The crude protein of the ogi/cowpea blends ranged from 8.60±0.36 for GB 8735 to 9.27±0.10 for Gwagwa. GB 8735 ogi blend, an improved variety had a higher carbohydrate content compared to the two local varieties, Gwagwa and Zango, respectively (Table 1).

The differences recorded within the ogi produced from the pearl millet, might be due to varietal differences existing at genetic level in the grains. The significant increase recorded in protein level is consistent with earlier reports by Eka[18] and Akpapunam[14].

The digestibility at 2 h ranged from 52.6±1.1 for Gwagwa to 59.4±7.8 for Zango both being local cultivars, with the improved variety GB-8735 recording 53.7±1.5. The same pattern was observed at the 4th h for the three varieties. But at 6th h of incubation, GB-8735 recorded the highest digestibility of 89.0±9.1 followed by Zango 69.8±8.1 and Gwagwa recording 60.0±0.8 (Table 2). It was observed that increased in digestibility is dependent on time of incubation. The significant increase in the *in vitro* protein digestibility recorded in this study can be attributed to the varietal differences existing within the pearl millet varieties. This also consistent with earlier report by Usha[11].

The millet ogi/cowpea blend showed variations in the *in vitro* digestibility recorded at various stages of incubations. At 2 h of incubation the digestibility recorded ranged from 45.8 for Gwagwa to 79.9 for Zango blends, respectively. While at the 4th h a significant increase was recorded, while the difference within the varieties is not significant. At the 6th h the digestibility ranged from 81.2±1.6 for GB 8735 to 81.8±1.4 for Zango, while Gwagwa recorded 92.2±0.2 (Table 3). An increase of about 40% was recorded in the ogi blends compared to their unblended ogi. This may be attributed the reduction in anti nutritional factors in the cereal and legume, as a result of fermentation and the heat treatment they were subjected to, respectively. This is in addition to the high levels of protein reported in legumes by Akpapunam[14], Akinrele and Edward[19].

The result for the sensory evaluation gave a statistically significant ($p<0.05$) differences, except for overall acceptability (Table 4). GB 8735, an improved variety recorded the score in colour, taste and overall acceptability, while Gwagwa a local variety recorded highest in texture and is next to GB 8735 in terms of taste. This shows that, ogi from any one of the cereals blends is acceptable and can be use as a weaning complementary food.

The viscosity characteristics of the cowpea flour and their ogi blends shows that, the pure ogi product recorded higher viscosity values compared to their respective blends (Table 5). The cowpea blend alone had the least viscosity compared to the pure ogi and their blends. This might be due to the fact that it contains the least amount of starch content, resulting to less gelatinization. The

Table 1: Proximate composition of the cowpea flour and their ogi (Akamu) blends

Varieties	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Carbohydrate (%)
Cowpea	4.00±0.02	29.10±0.66	2.70±0.04	3.20±0.95	61.10±1.50
Gwagwa-ogi	8.97±0.59	9.27±0.86	4.24±0.25	1.39±0.18	76.93±1.12
Gwagwa/cowpea	6.12±0.85	18.75±1.55	3.95±0.46	1.95±0.06	70.20±1.45
GB8735-ogi	8.48±o.57	8.60±0.36	4.18±0.16	1.61±0.25	77.17±0.93
GB8735/cowpea	5.31±0.45	19.96±0.61	3.64±0.15	2.60±0.02	68.50±1.29
Zango-ogi	9.31±0.35	9.10±0.40	3.90±1.62	1.62±0.14	76.10±0.98
Zango/cowpea	6.21±0.37	16.84±0.33	3.15±0.61	2.30±0.11	71.54±1.55

Table 2: *In vitro* (%) protein digestibility (%) of ogi produced from six pearl millet cultivars

Varieties	Digestibility at 2 h	Digestibility at 4 h	Digestibility at 6 h
Zango	59.4±7.8	71.1±1.1	69.8±8.1
Gwagwa	52.6±1.1	58.1±9.9	60.0±0.8
GB-8735	53.7±1.5	61.5±1.4	89.0±9.1

Table 3: Protein digestibility (%) of cowpea/millet ogi blends in ratio of 3:7, respectively

Cowpea/Millet	Digestibility at 2 h	Digestibility at 4 h	Digestibility at 6 h
Zango	79.9±6.2	85.3±5.5	81.8±1.4
Gwagwa	45.8±1.5	84.2±2.5	92.2±0.2
GB 8735	74.9±3.9	83.2±4.1	81.2±1.6

Table 4: Sensory evaluation test for the cowpea/ogi blended

Millet/cowpea ogi blends	Colour	Odour	Taste	Texture	Overall acceptability
Gwagwa	7.29±0.50	5.33±1.74	6.71±2.03	7.43±1.72	7.76±0.89
GB-8735	7.76±0.70	6.81±0.81	7.05±1.56	7.10±1.48	7.81±1.12
Zango	6.75±1.26	7.05±1.60	6.38±1.77	6.81±1.47	7.62±0.97

Values are means±standard deviation

Table 5: Viscosity of the cowpea and ogi/cowpea blends

Pearl millet varieties/Blends	Viscosity (centipoises) at shear rate "50" (rpm)
Gwagwa	1395
Gwagwa/Cowpea	967
GB 8735	1443
GB 8735/Cowpea	711
Zango	2056
Zango/Cowpea	1430
Cowpea flour	163

GB8735 and Zango cowpea blends recorded a viscosity values within recommended ideal values for weaning foods 1000-3000 centipoises[10].

In conclusion, the two local varieties (Zanogo and Gwagwa) and their blends compared favorably with the improved variety (GB 8735) and its blend based on the parameters evaluated. Although based on the sensory evaluation test, an acceptable complementary weaning food can be produced from any of the pearl millets and their blends.

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