Effect of Plantain and Cray Fish Flour Addition on the Chemical and Sensory Properties of Millet-Based *OGI*

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***Abstract:*-In this study, the quality of complementary food from millet, plantain and crayfish flour blends, with respect to their functional properties, proximate composition, pH, minerals, vitamins and sensory properties, was evaluated. Four Products (311, 324, 337, and 363) were formulated from blends of millet, plantain and crayfish flours in the ratios of 100:0:0, 90:8:2, 80:16:4 and 70:24:6 respectively. The blended flour samples differed significantly ($p<0.05$) from the control (311) in terms of protein, crude fibre, ash and carbohydrate contents. However, the fat content of the control was higher (2.75% dry matter), while lower moisture content (8.69%) and pH value (6.40) were recorded. The control was lower in terms of bulk density (0.79 g/ml), swelling capacity (7.83%) and gelation capacity (6.40%), but higher in terms of water absorption capacity (80.46%) than the blended samples. The mineral contents of the blended samples were higher than the control and ranged from 21.65-24.32 mg/100g (Iron), 2.38-6.06 mg/100g (Zinc), 1.43-1.93 mg/100g (Iodine), 105.35-162.43 mg/100g (Phosphorous) and 412.37-504.67 mg/100g (Calcium). The beta-carotene contents of the blended samples were higher (4.17, 6.34 and 7.13 mg/100g respectively) than the control (2.41 mg/100g). The vitamins B2, B3, C and D contents of some of the blended samples were higher, but did not differ significantly ($p>0.05$) from the control. The sensory scores for the control were higher in terms of aroma, colour, taste, mouthfeel and overall acceptability compared to the blended samples. Consequently, supplementation of millet flour with plantain and crayfish could be employed in the formulation of complementary foods with improved protein and micronutrients content.**

***Keywords: Ogi*, complementary food, millet flour, crayfish flour, plantain flour**

I. INTRODUCTION

The foundations for optimal health, growth and development of children are built during the period of complementary feeding [1]. The effects of poor nutrition on growth and development are very pronounced at this stage, as breast milk alone becomes inadequate to meet the nutritional requirements of infants as from six months [1]. Complementary foods are generally introduced between the ages of six months to two years old as breast feeding is discontinued [2]. Most infants suffer from malnutrition not mainly because of theeconomic status, but also due to inability to utilize the locally available raw materials to formulate infant foods that will meet their daily requirements [3]*;* [4]. Most complementary foods used are starchy porridges traditionally prepared from locally available cereals [5], which are often characterized by low nutrient densities, poor protein quality, and high bulk [1]. This contributes to the highprevalence of under nutrition among children, especially in developing countries [5]. Foods intended for complementary feeding must therefore be nutrient dense in order to cover the needs of the growing child while maintaining breastfeeding. *Ogi* is a fermented semi-solid complementary food product from cereals (commonly maize, sorghum, or millet) which is a staple in most African countries and has a unique fermented taste for which the product is known and loved for. It is commonly used as weaning food for babies from four months and above where breast milk is insufficient to fully cover protein and micronutrient requirement in infants. Millet contains 7-12% protein, 2-5% fat, 65-75% carbohydrate and 15-20% dietary fibre. It is a good source of essential amino acids but it is deficient in lysine and methionine [6] and micronutrients including pro-vitamin A required for good vision and its antioxidant property. In general, cereal proteins including millet are limited in lysine and tryptophan content, required for proper growth and development. The absence of these nutrients often results to protein energy malnutrition and micronutrient deficiencies.

The World Health Organization (WHO) and United Nations Children's Emergency Funds (UNICEF) are concerned about Protein-Energy Malnutrition (PEM) and micronutrient deficiencies. Hence, the development and use of nutritious products from diverse food sources as well as modified processing methods have been advocated, to alleviate problems of short food supply and malnutrition. Some of the strategies employed in improving the quality of complementary foods include the use of complementary flours from cereals, legumes, animal sources and household preparation methods such as fermentation [7].

Crayfish is one of the cheapest sources of animal protein. Generally, fish flesh contains mainly water, protein and fat with traces of carbohydrates, amino acids and other non-protein nitrogenous extractives, various minerals and vitamins [8]. Plantain is rich in fibre content, and thus it is capable of lowering cholesterol, prevent constipation and hence prevent the occurrence of colon cancer. Besides this, its high potassium content is found to be useful in the prevention of high blood pressure and muscle cramp [9]. The aim of this research was to determine the effects of crayfish and plantain flours addition on the proximate composition, functional properties, mineral contents, vitamin contents and sensory properties of millet-based complementary foods.

II. MATERIALS AND METHODS

2.1 Sample procurement

Millet (*Pennisetumglaucum,* L), crayfish (*Procambarusclarkii*) and plantain (*Musa paradisica*) were purchased from a local market in Makurdi, Benue State.

2.2 Preparation of flours, blends and complementary foods

Millet grains (*Pennisetumglaucum*, L) were washed, steeped in cold sterile distilled water for 48 h at room temperature, wet milled, sieved and allowed to sediment, decanted to form *Ogi* slurry, drained, dried, milled into flour, sieved and packaged in plastic bowl with a lid.

The procedure described by [10] was used for the preparation of plantain flour. In brief, unripe plantains were sorted, graded, washed, peeled, sliced, dried, milled and sieved using 250µm aperture sieve. The flours were packaged and sealed in polyethylene bags.

Crayfish flour was prepared as described by [11]. Crayfish were sorted, cleaned, sun-dried and milled into flour using 30 mm particle size sieve. Four products were formulated comprising of millet, plantain and crayfish flours in the ratios of 100:0:0 (sample 311), 90:8:2 (sample 324), 80:16:4 (sample) and 70:24:6 (363). The complementary food was prepared by mixing the different flours in their respective blends. After mixing the flour with distilled water, boiled water was added into the mix to form *Ogi*.

2.3Determination of proximate composition

The samples were separately analysed using the standard methods of the Association of Official Analytical Chemists [12]. Protein contents (N × 6.25) were estimated from the crude nitrogen contents of the samples, as determined using Micro Kjeldahl method. Moisture content was calculated from the loss in weight of the *ogi* samples after drying to constant weight in a hot oven. Ash and crude fibre contents were determined as described by [12]. Fat content was determined by soxhlet method and carbohydrate was determined by difference.

2.4 Determination of functional properties

The swelling index was determined using the method by [13]. 10.0g of the sample was weighed into a 100mlgraduated cylinder with the dry bulk volume noted. 100ml of hot water at 70^0C was mixed. The volume after 10 minutes was recorded and the swelling index calculated. The bulk density of the freshly prepared flour was determined as described by[13].A10ml cylinder was weighed and filled to the 10ml mark and then reweighed. The bulk density was determined on the graduated cylinder by gently tapping the bottom of the cylinder on the laboratory bench several times until there was no further diminution of the sample level. Then the level of the flour was read directly. The method described by [13] was used to determine the least gelation capacity. Sample suspensions of 2 - 20% (w/v) were dissolved respectively in a boiling test tube containing 5mL of distilled water and heated for 1 h in a boiling water bath. The heated dispersion was cooled rapidly under running cooled water and then cooled further at 4^oC for 2h. Gelation was determined either by its ability to flow or not in test tube when slanted. The gelation capacity is the least gelation concentration determined as the concentration when the sample from the inverted test tube will not fall or slip.

2.5 Determination of minerals

The mineral contents of the products were determined as described by [12]. 2g of each oven-dried sample were ashed at 600°C in a muffle furnace. The resultant ash was transferred into 250ml glass beaker and 120ml conc. HNO_3 and 10mlH_2O_2 added. The mixture was heated at 90°C for 1 hr, cooled and filtered using glass wool. The filtrate was transferred into 250ml volumetric flask and made up to the mark with deionised water. After gentle shaking to mix, 2ml was transferred into 250ml using a pipette and diluted to the mark with deionised water. Stock solution of 1000mg/kg of iron, zinc, iodine, phosphorous and calcium were prepared using deionised water. Dilution comprising 0.4, 1.0, 1.5 and 2.0 mg/kg of each element were made with deionised water and together with the test sample were analysed using an atomic absorption spectrophotometer.

2.6 Determination of vitamins

Beta-carotene, VitaminsB2, B3, C and D wereevaluated using HPLC techniques using Spectrophotometer as described by [12]. For each sample, 3g was mixed with 5ml of nHexane and 20ml of HPLC of grade water. The mixture was homogenised (1200 r.p.m), centrifuged (3500 × g) for 30mins followed by sequential filtration through whatman filter paper and 0.45 micrometre membrane. Then 15 µl of supernatant was injected into the HPLC equipped with a uv detected set at 254nm. The peaks of the vitamins in the samples were calculated in relation to peaks of standard vitamins.

2.7 Sensory evaluation

A semi-trained panel, consisting of 20 panellists selected from the College of Food Technology and Human Ecology, University of Agriculture, Makurdi, was used. A 9-point hedonic scale (1- dislike extremely, 5- neither like nor dislike, 9- like extremely) as described by [14] was used to assess the sensory attributes of colour, aroma, taste, mouth feel and overall acceptability. The samples were labelled using three-digit random codes as 311, 324, 337 and 363. Each panellist was provided with clean water which served as a palate cleanser in between evaluations.

2.8 Statistical analysis

The data obtained in this study were subjected to analysis of variance (ANOVA) using SPSS 20 statistical software and the Duncan Multiple range test with significance level at $p<0.05$

III. RESULTS AND DISCUSSION

3.1 Effects of plantain and crayfish addition on the proximate composition and pH of millet-based ogi

The proximate composition of complementary food samples ispresented in Table 1. The moisture content of the samples ranged from 8.68 to 8.90%. There was no significant difference ($p<0.05$) in the moisture content between the control and the samples supplemented with plantain and crayfish flours. The low moisture content obtained in this study is in agreement with the report of [15] for maize-based complementary food supplemented with crayfish and black bean. [4] also reported low moisture content for complementary food formulated from sorghum, African yam bean and mango mesocarp flour blends. The low residual moisture content of the blends is advantageous in that microbial proliferation is reduced and storage life is enhanced and prolonged. The protein content of the control differed significantly ($p<0.05$) from the blended samples.

The protein content was observed to increase with supplementation of the flours. The increased levels of protein recorded by the formulated samples could be due to supplementation with crayfish and plantain flours. The result of this study is similar to the report of [16] for sorghum-based

Table 1: Effect of Plantain and Crayfish Addition on the Proximate Composition and pHof Millet-Based *Ogi*

Sample	Crude Protein (%)	Crude Fat (%)	Crude fibre (%)	Ash (%)	Moisture (%)	CHO (%)	pH
311	$13.42^c\pm0.01$	$2.75^b\pm0.72$	$0.69^c\pm0.02$	$5.13^c\pm0.01$	$8.68^a\pm0.02$	$69.53^a\pm0.72$	$6.40^a\pm0.00$
324	$14.77^b\pm0.01$	$2.72^b\pm0.01$	$0.84^b\pm0.02$	$5.68^b\pm0.01$	$8.70^a\pm0.00$	$67.30^b\pm0.06$	$6.43^a\pm0.01$
337	$15.74^a\pm0.01$	$3.23^a\pm0.01$	$0.92^b\pm0.01$	$6.00^b\pm0.00$	$8.76^a\pm0.01$	$65.36^b\pm0.04$	$6.45^a\pm0.01$
363	$16.54^a\pm0.02$	$3.87^a\pm0.01$	$1.12^a\pm0.01$	$6.37^a\pm0.01$	$8.90^a\pm0.21$	$63.21^c\pm0.08$	$6.30^b\pm0.00$
LSD	0.79	0.03	0.08	0.32	0.03	1.94	0.03

Values are means ± standard deviation of duplicate determinations. Means within the same column with different superscripts are significantly ($P<0.05$) different

Table 2: Effect of Plantain and Crayfish Flours Addition on the Functional Properties of Millet Flour

SAMPLE	Bulk Density(g/ml)	WAC (%)	Swelling Index (%)	Gelation Capacity (%)
311	$0.79^c\pm0.07$	$80.46^a\pm0.01$	$7.43^c\pm0.07$	$6.16^c\pm0.01$
324	$0.84^c\pm0.07$	$78.43^a\pm0.07$	$8.45^b\pm0.07$	$7.23^b\pm0.01$
337	$0.96^b\pm0.01$	$75.01^b\pm0.02$	$9.38^b\pm0.01$	$9.86^a\pm0.02$
363	$1.04^a\pm0.01$	$71.43^c\pm0.01$	$10.49^a\pm0.02$	$10.12^a\pm0.02$
LSD	0.05	2.04	0.93	0.36

Values are means ± standard deviation of duplicate determinations. Means within the same column with different superscripts are significantly (P<0.05) different

Table 3: Effect of Plantain and Crayfish Addition on the Mineral Contents of Millet-Based *Ogi*

SAMPLE	Iron (mg/100g)	Zinc (mg/100g)	Iodine (mg/100g)	Phosphorus (mg/100g)	Calcium (mg/100g)
311	$21.65^c\pm0.01$	$2.38^c\pm0.02$	$1.43^c\pm0.01$	$105.35^d\pm0.01$	$412.37^d\pm0.02$
324	$22.22^c\pm0.01$	$3.18^c\pm0.01$	$1.62^b\pm0.01$	$124.59^c\pm0.01$	$456.34^c\pm0.28$
337	$23.46^b\pm0.01$	$4.70^b\pm0.04$	$1.87^a\pm0.21$	$141.12^b\pm0.01$	$487.13^b\pm0.02$
363	$24.32^a\pm0.02$	$6.06^a\pm0.01$	$1.93^a\pm0.01$	$162.43^a\pm0.01$	$504.67^a\pm0.01$
LSD	0.57	0.80	0.06	16.52	17.54

Values are means ± standard deviation of duplicate determinations. Means within the same column with different superscripts are significantly (P<0.05) different

Table 4: Effect of Plantain and Crayfish Addition of the Vitamin Contents of Millet-Based *Ogi*

SAMPLE	Beta-carotene (mg/100g)	Vitamin B2 (mg/100g)	Vitamin B3 (mg/100g)	Vitamin C (mg/100g)	Vitamin D (mg/100g)
311	$2.42^d\pm0.01$	$0.06^c\pm0.00$	$0.07^b\pm0.00$	$12.35^c\pm0.01$	$0.17^b\pm0.01$
324	$4.17^c\pm0.01$	$0.07^c\pm0.01$	$0.08^b\pm0.00$	$14.16^b\pm0.03$	$0.23^a\pm0.01$
337	$6.34^b\pm0.04$	$0.19^b\pm0.01$	$0.95^b\pm0.01$	$16.83^a\pm0.02$	$0.27^a\pm0.01$
363	$7.13^a\pm0.02$	$0.13^a\pm0.01$	$0.12^a\pm0.01$	$17.43^a\pm0.01$	$0.31^a\pm0.01$
LSD	0.78	0.01	0.01	0.60	0.02

Values are means ± standard deviation of duplicate determinations. Means within the same column with different superscripts are significantly (P<0.05) different

Table 5: Effect of Plantain and Crayfish Addition on the Sensory Properties of Millet-Based *Ogi*

SAMPLE	Aroma	Color	Taste	Mouth feel	General Acceptability
311	7.80^a	7.50^a	8.05^a	7.90^a	8.30^a
324	6.70^a	6.15^b	6.70^b	6.75^b	7.30^b
337	6.45^a	5.30^b	6.70^b	5.80^b	6.50^b
363	5.20^b	5.55^b	4.90^c	4.65^c	1.63^c
LSD	1.10	1.20	1.00	0.95	0.80

Values are means ± standard deviation of duplicate determinations. Means within the same column with different superscripts are significantly (P<0.05) different

complementary foodsupplemented with groundnut and crayfish flours. [17] also reported increased protein content (10.64 to 15.86%) of maize-based complementary food supplemented with plantain and soybean flours. This could be useful in the elimination of the challenges of protein-energy malnutrition.

The fat content of the complementary food samples which ranged from 2.75 to 3.87% increased significantly ($p<0.05$) with increase in the proportion of crayfish flour and plantain flours in the products. The result of this study is in agreement with studies by [15] who reported increased fat content (2.36 to 5.17%) for maize-based complementary food supplemented with black bean and crayfish. [17] reported increased fat content (4.82 to 5.25%) of maize-based complementary food supplemented with plantain and soybean flours. The fat content obtained in this study was lower than the recommended 10% for complementary foods [18]. Fat is important in the diets of infants and young children as it provides high energy density and facilitates the absorption of fat-soluble vitamins. It also provides essential fatty acids such as omega-3 and omega-6 polyunsaturated fatty acids (PUFA'S) needed for proper neural development in infants and young children [19].

The ash content of the blended samples increased with increase in substitution with crayfish and plantain flours compared to the control. The ash content of thesamples ranged from 5.13 to 6.37%. The ash content of a food material could be used as an index of mineral constituents of the food [20]. [15] reported increased ash content (2.08 to 4.13%) for maize-based complementary food supplemented with black bean and crayfish, while [17] reported increased ash content (1.00 to 3.05%) of maize-based complementary food supplemented with plantain and soybean flours. The ash content obtained in this study was higher than the ash content (0.56-2.00%) of complementary food formulated from fermented maize, soybean and carrot flours reported by [21]. The crude fibre content of the complementary food samples varied between 0.69 to 1.12%. The significant ($p<0.05$) difference between the fibre content of the control and those of the substituted samples could be due to the low fibre content of millet which formed the major ingredient of the formulated complementary foods.

The carbohydrate content of the complementary blends ranged from 69.53 to 63.21%. The carbohydrate contents of all the substituted samples were significantly ($p<0.05$) higher than the control (sample 311). [17] reported similar decrease in carbohydrate content (78.08 to 65.34%) of maize-based complementary food supplemented with plantain and soybean flours. The carbohydrate contents of the samples observed in this study could be nutritionally desirable as children require energy to carry out physical and physiological activities as growth continues [22]. The pH values of the blended samples were not significantly different from the control except sample 363.

3.2 Effects of plantain and crayfish addition on functional properties of millet flour

The functional properties of the flour blends of millet, plantain and crayfish are presented in Table 2. The result showed that the addition of plantain and crayfish flours to millet flour significantly ($P<0.05$) increased the bulk density of the millet flour. Values ranged from 0.79 g/ml for the control to 0.84, 0.96 and 1.04 for the blended samples. [23]reported increased bulk density of complementary foods from millet, soybean and African locust bean pulp blend. The decrease in WAC could be attributed to the presence of more hydrophobic constituents in the flour blends. When the lipid content is high in flour, the water absorption decreases because lipids block the polar sites of the proteins thereby mitigating the absorption of water [24].

There was progressive increase in the swelling index as the level of supplementation increased. Values ranged from 7.43% for the control to 8.45, 9.38 and 10.49% for the blended samples. The increase in swelling index of the flours due to the addition of plantain and crayfish flours could be attributed to the partial breakdown of starch [24]. Although lower swelling index is advantageous as it increases the nutrient density of the food and allows the child to consume more in order to meet the nutrient requirements.

The gelation capacity of the blended samples increased (7.23, 9.86 and 10.12%) significantly compared to the control (6.16%). The results of this study are comparable with that by [23] who reported increased gelation capacity of complementary foods from millet, soybean and African locust bean pulp blend.

3.3 Effects of plantain and crayfish addition on the mineral contents of millet-based ogi

The mineral composition of the complementary food samples is shown in Table 3. The iron, zinc, iodine, phosphorous and calcium contents of the formulated complementary food samples increased with increased substitution with plantain and crayfish flours. The iron content of the samples increased (21.65 to 24.32 mg/100g) significantly ($p<0.05$) as the level of substitution with plantain and crayfish flour increased in the blends. The observed increase in the iron content of the substituted samples is an indication that crayfish is a good source of iron [20]. Iron is essential for the formation of blood cells and prevention of anaemia in infants and children.

The zinc content of the formulations varied significantly ($p<0.05$) among the samples. The zinc content of the complementary foods ranged from 2.38 to 6.06 mg/100g with the control and the blended samples. The substitution of the products with crayfish and plantain flours resulted in increase in the zinc content of the formulated samples and this is in agreement with the report that crayfish is a good source of zinc [8]. Zinc plays a central role in cell division, protein synthesis and growth. The values obtained in this study compares favourably with that by [17] for maize, plantain and soybean complementary foods. The iodine contents of the blended samples increased with the addition of plantain and crayfish flours and ranged from 1.43 to 1.93 mg/100g.

The phosphorus content of the samples increased significantly ($p<0.05$) from 105.35 mg/100g in the control (311) to 124.59, 141.12 and 162.43 mg/100g for the blended samples (324, 337 and 363 respectively). The increase in the phosphorus content observed in the blends could be attributed to the supplementation effect of crayfish and plantain flours added to the formulations and this is in agreement with the report that crayfish [8] and plantain [17] are rich sources of phosphorus. Phosphorus is an important constituent of every living cell. It is also essential for the formation of bone.

The calcium content of the complementary foods increased significantly ($p<0.05$) with increased substitution with plantain and crayfish flours. The calcium contents of all the blends formulated in this present study were generally higher than that of the control (sample 311). The values (412.37 to 504.67 mg/100g) obtained in this study were higher than the calcium content (15.01-25.10mg/100g) of complementary food formulated from malted millet, plantain and soybean flour blends reported by [25]. Calcium is necessary for optimal growth and development of infants and young children.

3.4 Effects of plantain and crayfish addition on the vitamin contents of millet-based ogi

The vitamin composition of complementary food samples is shown in Table 4. The beta-carotene, thiamine, niacin, ascorbic acid and vitamin D contents of the samples increased with increasedsubstitution of plantain and crayfish flours. The beta-carotene content of the samples which ranged from 2.42 to 7.13 mg/100g increased significantly ($p<0.05$) with increased substitution with plantain and crayfish flours. [8] reported that crayfish is a rich source of vitamin A. The values obtained in this study were higher than the vitamin A content (1.86-6.42mg/100g) of food gruels formulated from blends ofsoybean flour and ginger modified cocoyam starch reported by [3]. Vitamin A plays a vital role in the maintenance of good sight.

The thiamine content of the formulations increased significantly ($p<0.05$) from 0.06 mg/100g in the control sample to 0.07, 0.19 and 0.3 mg /100g for the sample substituted with plantain and crayfish flours. The observed increase in the thiamine content is an indication that plantain and crayfish are excellent sources of thiamine [16]; [26]. Thiamine helps in the treatment of beriberi and in the maintenance of healthy mental attitude.

The niacin (B3) contents in the blends varied significantly ($p<0.05$) among the samples. The control sample had the least niacin content (0.07mg/100g), while the samples substituted with plantain and crayfish flours had the highest values (0.08, 0.12 and 0.95mg/100g). The increase in niacin content observed in the samples could be due to the inclusion of plantain and crayfish flours in the blends. The niacin content of the complementary food formulated in this study was lower than the niacin content (3.17-8.72 mg/100g) of complementary food prepared from malted millet, plantain and soybean blends reported by [25]. Niacin helps in the reduction of the level of blood cholesterol in humans.

The ascorbic acid content of the complementary food samples ranged from 12.35 to 17.43 mg/100g for the control and the samples substituted with plantain and crayfish flours. The increase in ascorbic acid content observed in the samples could be attributed to the addition of plantain and crayfish flours in the blends. The values obtained in this study were higher than the ascorbic acid content (10.28-15.32 mg/100g) of complementary food prepared from sorghum, African yam bean and mango mesocarp flour blends reported by [4]. Ascorbic acid is necessary for the prevention of scurvy and development of healthy immune system in infants and young children. The vitamin D content of the samplewhich ranged from 0.17 to 0.31 mg/100g increased significantly ($p<0.05$) with increased substitution with plantain and crayfish flours.

3.5 Effects of plantain and crayfish addition on the sensory properties of millet-based ogi

The sensory properties of complementary food samples are presented in Table 5. The sensory scores of porridges prepared from both the control and developed complementary food samples showed significant ($p<0.05$) differences in terms of aroma, colour, taste, mouthfeel and overall acceptability. The control sample (311) had significantly ($p<0.05$) the highest scores in terms of aroma, colour, mouthfeel, taste and overall acceptability. The sensory scores decreased significantly with increased level of substitution with plantain and crayfish flours. The increase in substitution resulted in decrease in acceptability of the porridge as indicated by the significantly ($p<0.05$) low scores. The variation observed in the colour of the porridges could be due to increased substitution with plantain and crayfish flours. The development of dark colour in the porridges could be attributed to the mallard browning reaction which occurred as a result of interaction between the sugar and amino acids. The substitution of crayfish flours up to 6% produced the porridge that had the lowest scores in terms of taste (4.90) and mouthfeel (4.65) and was generally rejected. It therefore implies that there is need for further investigation on the methods of preparation that would be adopted to enhance the overall acceptability of the porridges at higher levels of substitution.

IV. CONCLUSION

The study revealed that the use of millet, plantain and crayfish flours in the preparation of complementary food formulations yielded products with enhanced nutritional value. Although, the products had high mineral and vitamin contents, there is need for further supplementation of the composite blends with better sources of minerals and vitamins to improve consumer acceptability. The aroma, colour, taste, mouthfeel and texture of all the porridges were acceptable by the panellists. Crayfish and plantain are cheap and readily available food ingredients that can be used by nursing mothers and care givers to supplement traditional complementary foods in Nigeria and other developing countries of the world in order to reduce the problem of protein-energy malnutritionamong infants and young children due to their high nutrient density.

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