PROXIMATE COMPOSITION AND SENSORY EVALUATION OF A CEREAL-LEGUME-CRAYFISH BASED COMPLEMENTARY PORRIDGE

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ABSTRACT

The study produced under-five porridge made from soya bean, white maize, groundnut and crayfish flour. The different flours were combined in three concentrations of 30:30:20:20, 35:35:15:15 and 40:40:10:10 of soyabean, white maize, groundnut and crayfish respectively. Porridge was prepared from the different samples of flour. The population of the study was 26 students. A 9-point hedonic scale was the instrument used for data collection. Mean, standard deviation and analysis of variance (ANOVA) were used for data analysis. Nutrient composition analysis showed that the different samples of porridge had appreciable values of protein, fats, and carbohydrate. The sensory evaluation result indicated that there was no significant difference in the mean responses of the students on the sensory evaluation of the porridge samples. However, Sample A had the highest value for colour, taste, flavour, mouth-feel and general acceptability. Among recommendations made is that mothers should be encouraged to produce porridge from soyabeans, white maize, groundnut and crayfish since it has high nutritional content.

Keywords: Complimentary Porridge, Sensory Evaluation, Nutrient Composition.

INTRODUCTION

Malnutrition is one of the major public health challenges in developing countries like Nigeria. Childhood malnutrition either in form of inadequate intake of nutrients due to lack of food, ignorance, socio-cultural factors and diseases, poor dietary intake, among other causes, resulting in underweight, overweight (obesity) and other nutrient deficiencies. Malnutrition can impair physical and brain development of young children most especially the under - fives. World Health Organization (WHO) (2020) reported that Nigeria had 11.8% severely wasted, 16.8% wasting, 2.1% overweight, 36.8% stunted and 21.6% underweight under-fives. WHO (2020) noted that in

many parts of the world, under five children diets contain insufficient micronutrients and deficiencies are widespread. Millions of children particularly from developing countries suffer from stunted growth, cognitive delays, weakened immunity and disease as a result of micronutrient deficiencies.

Presently, there is a growing food insecurity in developing countries including Nigeria. Children are the most vulnerable group affected by food insecurity. The micro and macronutrient deficiencies of under-five meal could be responsible for certain growth and development disorders. The researchers of this study believe that adequate processing and development of under-five meals from locally available food sources would lead to intake of improved meals among under-fives which would enhance nutrients and prevent nutritional diseases among under-fives.

Therefore, there is need to formulate and evaluate the nutrient constituents and acceptability of improved under-five meals from locally available staple foods. Most locally available foods such as soya beans, groundnut and crayfish are highly nutritious. FAO (2017) reported that the crude protein content of most legumes varies between 16.0% in bambara groundnut to 35.1% in soybeans. FAO (2017) further reported that soy protein is limiting in essential sulphur containing amino acids (methionine and cysteine), but rich in lysine and tryptophan. FAO/WHO/UNU, (2002) reported that crayfish is classified as an animal polypeptide source which accounts for 36% to 45% of crude protein. Crayfish is a freshwater crustacean resembling small lobster. FAO/WHO/UNU, (2002) reported that crayfish have high nutritive value with a superior biological value, true digestibility, net protein utilization, high content of essential amino acid, and protein efficiency which is favourable compared to casein. Nahid, Zaglol and Fayza (2009) highlighted the nutritional information of crayfish to contain total fat of 1g, saturated fat 0 g, cholesterol 0 g, protein 126 mg, compared to one egg of 200 mg, sodium 170mg, dietary fiber 0 mg, sugar 0 mg, calories of 80mg compared to beef 242 mg calories.

Groundnut on the other hand being an oil seed crop, contains **40 to 49% oil. In addition to protein, groundnuts are a good source of calcium, phosphorus, iron, zinc and boron**. Groundnut also contains vitamin E and small amounts of vitamin B complex (FAO, 2017). Maize will also be utilized in this study. Maize is a stable food crop for most sub-Saharan Africans of which Nigeria is inclusive (FAO, 2014). In Nigeria maize is the third most important cereal crop after sorghum and millet (Ojo, 2010). Major varieties of maize are white and yellow coloured. The study utilized white maize. Maize is an inexpensive type of starch and a source of carbohydrate. Ekpa (2020) noted that 100g of a freshly cultivated maize consists of 74 g of carbohydrates, 7.3 g of fibre and 0.64 g of sugar. Matured corn has more starch while un-matured corn contains more sugar.

Nutritionist, researchers and other stake holders are concerned about the development of nutritious foods for under-fives from staple foods available in the community. Samuel and Otegbayo (2006) determined chemical analysis and sensory evaluation of *Ogi* enriched with soybeans and crayfish. Akinola, Bashkayeva and Hammed (2014) determined the formulation of local ingredient-based

complementary food in South-west Nigeria. Akinola, *et. al.* (2014) formulated complementary foods using maize, soya bean, groundnut, guinea corn, millet and sorghum. None of the related empirical studies reviewed by the researchers utilized white maize, soyabean, ground nut and crayfish in the development of under-five porridge which is the focus of this study.

Objectives of the Study

The main objective of the study was to determine nutrient composition and sensory evaluation of under-five porridge produced from white maize, soyabean, ground nut and crayfish. Specifically, the study was carried out to:

1. Produce porridge from white maize, soyabean, groundnut and crayfish in different concentrations.
2. Assess the nutrient composition of the different concentrations of the under-five porridge.
3. Evaluate the sensory evaluation of the different concentrations of the under-five porridge.

Hypotheses

1. There is no significant difference on the nutrient composition (protein, carbohydrate, fats and oils, crude fiber, moisture and ash content) of the different ratios of the under-five porridge.
2. There is no significant difference on the sensory evaluation (colour, taste, flavour, mouth feel and general acceptability) of the different proportions of the under-five meal.

MATERIALS AND METHODOLOGY

The population of the study consisted of twenty-six (26) Home Economics students of Vocational Education Department, School of Technical Education, Yaba College of Technology, Yaba, Lagos State. No sampling was done since the population was a manageable size.

A 9-point hedonic scale was the instrument used for data collection in this study. The 9-point hedonic scale used for the study is a standard scale adopted from Peryam and Girardot (2013). The sensory attributes (texture or consistency, colour, flavor, aroma and general acceptability) of the under-five meal of white maize, soya bean, ground nut and crayfish were collected using the 9 - point hedonic scale. The 9-point hedonic scale was rated as like extremely 9 points while dislike extremely as rated 1 point. Sensory attributes of the processed forms of the under-five meal from white maize, soya bean, ground nut and crayfish were evaluated by the 26 members of panel.

For the food product preparation, the production method by Kuku, Etti and Ibironke (2014) was used. White maize was picked to remove impurities, and thereafter blended to fine consistency. Soyabean seeds were cleaned by picking to remove sand and other impurities. The seeds were washed and dried using a hydro extractor. Thereafter, the seeds were roasted using an electric roasting machine, then, milled into fine powder. The groundnut seeds were picked to remove impurities. Thereafter, they were washed and dried in a hydro extractor, then roasted in an electric roaster and then, milled into smooth powder. The crayfish was picked to remove impurities.

Thereafter, it was dried and milled to fine consistency. Each sample was packed separately.
Three samples were formulated in different concentrations from the packed flour of white maize, soyabean, groundnut and crayfish. The formulation ratio was Sample A: 30:30:20:20, Sample B: 35:35:15:15 and Sample C: 40:40:10:10 of white maize, soyabean, groundnut and crayfish respectively.

For the analytic procedure, after the sample processing and formulation, each sample was packed in an airtight polythene bag and taken to the laboratory for analysis. Each of the sample formulations were analyzed for moisture content, crude protein, ash, crude fibre, fats and oil using AOAC (2012) methods. Carbohydrate content was determined by difference. The laboratory analysis was conducted at the College Central Research Laboratory in Yaba College of Technology, Yaba, Lagos State.

In carrying out the sensory evaluation, each packed formulated sample powder was prepared into thin porridge (gruel). Adesanya, Eduzor, Samuel, Onuoha and Alao, (2020) method was utilized to make the gruel. The sample was dissolved in little water to form a slurry solution. Then, boiling water was added to it and stirred until a thick consistency was achieved. The gruel was presented for evaluation at a temperature of 40^0C. According to FSAS (2012) ideal food serving temperature is between 40C to 63C. The evaluation was conducted in Home Economics Laboratory in Vocational Department, in Yaba College of Technology, Epe Campus, Lagos State. The gruel was presented to the judges in clean, odourless and tasteless containers. The 9-point hedonic scale was placed near the products such that each judge collected and used each for evaluation.

For the statistical analysis, mean, standard deviation and analysis of variance (ANOVA) were used for data analysis. All data analyses were done using the statistical package for social sciences (SPSS) version 25. Hypotheses were tested at 0.05 level of significance.

RESULTS AND DISCUSSION OF FINDINGS

Table I: Nutrient composition of the complimentary porridge at different concentrations.

S/N	Nutrient Composition	Sample A	Sample B	Sample C
1	Crude Protein %	28.48	31.22	35.04
2	Moisture Content %	6.16	5.18	4.71
3	Crude fibre %	0.01	0.03	0.04
4	Ash %	3.87	2.86	1.66
5	Fat %	34.81	36.08	38.32
6	Carbohydrate %	26.7	24.63	20.22

Note: Sample A: 30:30:20:20, Sample B: 35:35:15:15 and Sample C: 40:40:10:10 of Soyabeans, White maize, Groundnut and Crayfish

Table I showed the result of the nutrient composition of the three different samples of the complimentary porridge produced from soyabeans, white maize, groundnut and crayfish. The

results revealed that sample C ($P<0.05$) had the highest crude fibre when compared with the other samples. The higher fat content of sample C can be attributed to the high proportion of groundnut in the sample when compared to other samples. According to FNB (2015) the recommended macro nutrient range for fats and oils for under five children of both genders is 25-35g. Hence, the developed porridge can serve as a rich source of fats and oil for the under five children. High crude protein results were found in the three samples. The high crude protein content of 28.48, 31.22 and 35.04 is above the recommended dietary intake of protein for under-five children as reported by WHO (2002). WHO (2002) recommended the nutrient intake of 14.5 - 19.7 for protein in gms/day for children between 1 to 5 years. FAO (2005) cited in FAO (2017) recommended 10-35% of protein for adults. The high protein content can be attributed to the legume (soyabeans) and groundnut used in the food sample. In line with the high protein content, researchers like Afolabi, Okache, Eke and Alakali (2018) had earlier established that crayfish contains 58.14% protein and is highly nutritious. The crude fibre and ash content of the porridge showed an insignificant increase in all the samples. This is due to the low cellulose content of soyabeans, groundnuts and crayfish.
Thus, there was a significant difference in the nutrient composition (protein, carbohydrate, fats and oils, crude fiber, moisture and ash content) of the different ratios of the under-five porridge.

Table II: Sensory Evaluation of the different Samples of Porridge Produced from Soyabeans, White Maize, Groundnut and Crayfish.

S/N	Sensory Evaluation	Sample A	Sample B	Sample C	F	Decision
1	Colour	8.7 ± 2.03	7.9 ± 0.03	8.2 ± 1.31	0.07	NS
2	Taste	8.2 ± 1.17	8.1 ± 0.88	8.0 ± 0.78	1.01	NS
3	Flavour	7.7 ± 0.33	7.2 ± 1.19	7.5 ± 0.60	0.32	NS
4	Mouth Feel	8.4 ± 1.01	8.1 ± 0.01	8.0 ± 0.32	0.11	NS
5	General Acceptability	8.8 ± 5.6	8.1 ± 4.09	8.5 ± 7.8	0.62	NS

Note: Sample A: 30:30:20:20, Sample B: 35:35:15:15 and Sample C: 40:40:10:10 of Soyabeans, White maize, Groundnut and Soyabeans. N = 20, values are means ± standard deviation. Scores are based on results from 9-point hedonic scale, F = calculated value of ANOVA using SPSS.

Results of the sensory evaluation were presented in Table II. The results indicated that there was no significant difference in the mean responses of the students on the sensory evaluation of the porridge samples. Their F values (ANOVA) ranged from 0.07 to 1.01 which is more than the 0.05 level of significance ($P>0.05$). Therefore, the null hypothesis of no significant difference was retained for the sensory evaluation. Although, sample A, had the highest value for colour, taste, flavour, mouth-feel and general acceptability.

CONCLUSION

The study produced porridge for under-five children using different ratios of white maize, soyabeans, groundnut and crayfish. Nutrient composition analysis showed that the different samples of porridge had appreciable values of protein, fats, and carbohydrate. The formulated three samples had high crude protein content of 28.48, 31.22 and 35.04 which is above the recommended dietary intake of protein for under-five children as reported by WHO (2002). The sensory evaluation result indicated that there was no significant difference in the mean responses of the respondents on the sensory evaluation of the three porridge samples.

RECOMMENDATION

Based on the findings of the study, the following were recommended:

Mothers should be encouraged to produce porridge from soyabeans, white maize, groundnut and crayfish since it has high nutritional content. Nutritional status of under-five children can be enhanced through the provision of porridge made from soyabeans, white maize, groundnut and crayfish. Different proportion of soyabeans, white maize, groundnut and crayfish can be combined in producing flour for under-five children porridge. Unemployed graduates can venture into mass production of flour from soyabeans, white maize, groundnut and crayfish which will be commercialized.

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