International Journal of Applied Chemical and Biological Sciences (2021), 2(5), 16-22.
ISSN 2582-788X

RESEARCH ARTICLE

Sensory properties of complementary food formulated from blends of Sweet Potato, Soybean and Carrot flour

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ABSTRACT

The sensory properties of complementary food formulated from sweet potatoes, carrots and soya bean were determined in this study. Three (3) blends of composite flours which are made up of sweet potato, carrot and soybean were formulated at different proportions, and the flours blends were produced into complementary foods with different formulation as follows: 40% sweet potato, 30% carrot and 30% soybean (PS1), 50% sweet potato, 30% carrot and 20% soybean (PS2), 60% sweet potato, 20% carrot and 20% soybean (PS3), 70% sweet potato, 20% carrot and 10% soybean (PS4) and 80% sweet potato, 10% carrot and 10% soybean (PS3). The most preferred formulated sample (PS3) which was obtained through sensory evaluation had the mean scores of 7.80 for colour, 8.10 for taste, 7.60 for texture, 8.30 for flavour and 7.95 for overall acceptability while sample (PS1) had the least mean score from all the samples. However, all the samples could be said to be generally accepted by the panellist because there were no significant difference ($p<0.5$) between the scores obtained from all the samples. The findings of this study has shown that acceptable complementary food of good sensory and nutritional properties can be obtained from blends of potato, soybeans and carrot and the formulated complementary food can support in reducing poor growth and malnutrition among infants and children.

Keywords: composite flour, sweet potatoes, carrot, soya beans, sensory evaluation

1. INTRODUCTION

Complementary foods are foods other than breast milk or infant formula (liquids, semisolids, and solids) introduced to an infant mostly above 6 months of age. To complement breast milk and to provide additional nutrients to the infants, the complimentary food helps in transition from breast milk to family food [1].

Complementary foods are mostly produced from cereals, such as wheat, maize and rice; legumes (soybeans, cowpeas, roots and tubers), etc. Formulation of complementary foods can be made from only one cereal or can be combination of more than one food product like maize, millet and sorghum combined with legume such as cowpea, groundnut or soybeans

etc. [2]. According to Cooperate Affair Commision, CAC (2008), an ideal complementary food should be of appropriate nutritional quality, high in energy density, containing all essential nutrients, amino acids, vitamins and minerals and should contain safe level of anti-nutritional components while maintaining the qualities and good sensory properties [3]. Animal-source foods such as milk are important for complementary feeding as they provide high quality protein, bio available micronutrients, and have low levels of anti-nutrients and fibre. However, these are not readily available or not affordable for majority of the average individuals in some African countries like Nigeria. Most nursing mothers use local alternatives to milk which include cereals such as maize or millet in combination with legumes such as soybean and groundnut. The young infant has a little stomach size and can only consume small amounts of food at a time. Therefore, it is very important to feed the baby with nutrient and energy dense meals at any feeding time [4].

The high prevalent rate of malnutrition and high cost of infant formulae has led to researches into ways of processing locally available foods to improve their nutritive value and introduce variety in the diet. This study was done with the aim to meet the need of the growing children especially infants who are more prone to malnutrition. WHO (2002) reported that breast milk is the best for the infants, (0-6months) but as they continue to grow, in the second part of their first year of life [5]. They are gradually introduced to semi- solid and solid foods known as complementary foods which help in the transition from breast milk to family food for nutritional and developmental reasons.

An ideal homemade West African infant formula must contain four different types of ingredients. At first, there must be a main constituent of cereals like millet, rice or sorghum. The second portion is a complementary ingredient rich in protein, such as milk powder or dry beans. Thirdly, an energy dense food, such as nuts or oil can be added to increase the overall caloric value. Finally a supplement of minerals and vitamins such as fruits or vegetables must be included [6]. However, traditional weaning diets often just contain staple starchy food. These are heated with water and form a thick porridge due to the gelatinisation of starch [6]. Traditional West African weaning foods often comprise four main staples (maize, sorghum, millet and cassava) as the main ingredient. Nonetheless, cereals often have limited amino acids such as lysine and have a low protein digestibility compared to animal proteins, partly due to the presence of fibre [6]. The most acknowledged porridge is a fermented gruel called Ogi made from maize, sorghum or millet flour and cooked for approximately 10 to 15 minutes in water [7]. To combat the problems of under-nutrition, this work has introduced the use of sweet potatoes flour as the main ingredient, supplemented with soya bean and carrot to formulate a nutrient dense complementary formula.

Due to the high moisture content and high perishability of sweet potatoes and carrots, the resulting complementary food cannot be preserved and has a short shelf life resulting in spoilage and wastage, hence, the need to process these foods into dry composite flour in other to

increase the shelf life as well as encourage bulk production.

This work was aimed at using different formulated blends of composite flour from sweet potatoes, soybean and carrot in the production of complementary foods, to prepare gruel from these blends of flour for sensory evaluation and proximate composition of the resulting food.

2. METHOD AND MATERIAL

2.1. Sample collection

The sweet potatoes, soyabean and carrots used for this study was purchased from a local market in Anambra state, Nigeria.

2.2. Preparation of composite flour

The flour composite blends containing sweet potatoes flour, soya bean flour and carrots flour were prepared in different ratios to obtain five (5) samples. The flour were blended uniformly to homogenize and then packed in air tight clean plastic container. The mixture was kept at room temperature until further use.

2.3. Sensory Analysis

Porridges were prepared from the composite flour blend of formulated complementary food. 100g of each sample was mixed into boiling water with continuous stirring to obtain homogenous porridges. The porridges obtained were evaluated in sensory evaluation boots for attributes of colour, taste, mouthfeel, texture and overall acceptability by a panel of semi-trained judges consisting of nursing mothers. The judges were instructed to assess and score the samples based on the degree of likeness and acceptance of the porridges using a nine-point Hedonic scale. The scores were assembled and statistically analyzed.

3. RESULTS AND DISCUSSION

Table.1 showed the result of sensory qualities of weaning food produced from blends of soybean, sweet potato and carrot. From the result above, it would be observed that sample PS3 had the highest mean score in taste, color, flavor and overall acceptability with the total mean score of 7.95 while sample (PS1) had the least total mean score of 6.85. However, it was observed that the colour, taste, flavor and texture of the whole samples were generally accepted by the panellist. The high preference of the sample PS3 could probably be due to equal blending proportion of carrot and soybean flour as well generous blend of sweet potatoes which gave the sample a sweet taste, smooth and creamy colour which was similar to the result was reported by Ijoratimi and Ashipa (2006) [8]. There were no significance difference ($p<0.5$) in the color, flavor, texture, mouth feel and overall acceptability of all the samples evaluated for sensory, however sample PS3 had the highest mean score for all the parameters, hence the best accepted sample by the panellist while sample PS1 had the least mean score, hence the least accepted sample. However this study result has shown that an acceptable complementary food can be formulated from blends of potatoes, carrot and soybean which is an agreement with the previous research [9].

Table 1. Mean Sensory Score for Complementary Food Produced from Soybean, Sweet Potato and Carrot flour

Sample	Color	Taste	Texture	Flavor	Acceptability
PS1	7.30±0.483	6.60±0.843	6.80±0.786	6.70±0.483	6.85±0.293
PS2	7.70±0.674	7.80±1.032S	7.60±0.843	8.00±0.816	7.77±0.617
PS3	7.80±0.918	8.10±1.197	7.60±0.699	8.30±0.674	7.95±0.510
PS4	6.80±1.032	7.00±1.154	7.20±0.918	7.20±0.788	7.05±0.814
PS5	7.00±1.054	6.70±1.159	7.00±0.942	7.50±1.080	7.05±0.797

*Means with same superscript in the same column are not significantly different ($p<0.05$)

Cereals which are mostly used as major ingredient for traditional complementary foods in Nigeria are mainly prepared as gruels or porridges produced from cereals such as maize, sorghum or millets, provide some energy, minerals and vitamins, but are also deficient in some other nutrients [10]. Cereals are said to contain phytates which inhibit the absorption of iron and also are limiting in lysine and methionine. They also contain minimal amounts of vitamin A and vitamin C and are not protein dense [11], therefore the need to enrich cereals with legumes or animal food products such as milk, meat, fish and egg in order to improve its limitations in fat and protein content. Nuts or oil seeds can also be added to increase its energy density and provide some protective nutrients [12]. In some cases, the gruel may be too watery with low energy density or too bulky and low nutrients, thus protein deficiency in the diets is common and it is usually associated with deficiencies in calories and micronutrients leading to endemic protein-energy malnutrition with its attendant health consequences. Improper feeding as well as feeding with meals low with required nutritional component during the period of complementary feeding may results in infant morbidity and mortality as well as delayed mental health and development. In order to limit infant malnutrition due to improper feeding, cereals as a major ingredient can be replaced with other locally available nutrient dense food crops such as sweet potatoes, in the formulation of complementary foods. Sweet potatoes has been recognized as a viable food for formulating complementary food in developing countries which could supplement the nutritional needs for infants as well as enhance the utilization of the crop.

The sweet potato root is a sweet food with high energy content, macro nutrients such as vitamin A and C, potassium, iron, zinc and dietary fibre, but low in protein and fat contents; hence the need to complement with high protein food such legumes or animal products like fish or milk when making complementary food. It is characterized by high moisture content; hence, high perishability, therefore, the need to diversify it into forms that are acceptable especially for children. It can also add natural sweetness and flavour to food products processed with it [13].

Soybean (*Glycine max*) is a legume species native to East Asia, widely grown for its edible bean which has numerous uses [14]. Soybeans have relatively low carbohydrates content and a high content of proteins, and contain a great number of health improving compounds. Together, soybean oil and protein content account for about 60% of the dry beans by weight (protein

at 40% and oil at 20%). The remainder consists of 35% carbohydrate and about 5% ash. Soybean consists of approximately 8% seed coat or hull, 90% cotyledons and 2% hypocotyl axis or germ [14]. Akpapunam *et al.*, (2008) and Akpingbala *et al.,* (2005), reported an improvement of protein quality of cereal and tuber crops with the addition of soya bean, in their Soy-agidi and soya-ogi respectively [15-16].

Carrot (*Dacus carota*) is the most important crop of Apiaceae family. It is a root vegetable that has worldwide distribution. They were firstly used for medical purposes and later began to be used as food. They are a very good source of antioxidant compounds, and the known richest vegetable source of the pro-vitamin A, carotenes. Carrots contain antioxidant compounds which help to protect against cardiovascular disease and cancer and also promote good eyes sight, especially night vision. They have a unique combination of three flavonoids: kaempferol, quercetin and luteolin, they are also rich in phenols [17].

The major limitations in the research works on sweet potato-based complementary foods were the viscous nature of the resultant complementary foods [9, 18]. Amagloh *et al.,* (2012) employed three processing methods (extrusion, roller drying and oven toasting) to resolve this drawback. These processes also improved the nutrient composition of the complementary foods [19]. However, to further improve the nutrient composition of the sweet potato-based complementary food and to enhance the suitability of sweet potato in the baby food industry, studies into the use of the orange fleshed sweet potatoes (OFSP), which has higher β-carotene compared with the cream flesh used, should be explored. Moreover, soybean, which is the protein and fat source for the complementary food has been reported to lack methionine and cysteine. These amino acids are abundant in cereals such as millet or maize. Therefore, a blend of cereals and legumes in the formulation of a complementary food, which was lacking in this study, will improve on its protein quality.

4. CONCLUSION

The result of this study has shown that complementary food of good and acceptable sensory properties can be produced from blends of sweet potato, carrot and soybean. From the overall acceptability result obtained from its sensory evaluation, it could be said that this complementary food from blends of sweet potato, carrot and soybean had a very well acceptable sensory properties at 7.95 (Sample PS3) as well as a good nutritional composition, therefore, can be used as an alternative complementary food which will reduce malnutrition and poor growth in infants.

5. ACKNOWLEDGEMENT

NA

6. CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

7. SOURCE/S OF FUNDING

No source of funding

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