PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 12 (2): 205-208, 2013
ISSN 1680-5194

Evaluation of Complementary Food Prepared from Sorghum, African Yam Bean (*Sphenostylis stenocarpa*) and Mango Mesocarp Flour Blends

P.A. Yusufu, F.A. Egbunu, S.I.D. Egwujeh, G.L. Opega and M.O. Adikwu
Department of Food, Nutrition and Home Sciences, Faculty of Agriculture,
Kogi State University, P.M.B 1008, Anyigba, Nigeria

Abstract: The use of Sorghum, African yam bean (*Sphenostylis Stenocarpa*) and Mango mesocarp (Mangifera indica) flour blends in the formulation of complementary food was studied. Traditional Weaning Food (TWF) obtained from 100% sorghum was used as the control sample. The sorghum, African yam bean and mango mesocarp flour were blended in the ratio of 5:3:2 respectively and used to formulate complementary food (SAM). The sample of complementary foods produced were subjected to chemical, functional and sensory properties analyses. The result of the chemical composition showed a significant ($p<0.05$) increase in the protein and fat level of the formulated complementary food (8.9±1.09 to 17.4±1.19% and 1.5±0.11 to 3.50±0.31%, respectively. However, a significant $p<0.65$) decrease in the carbohydrate level (78±1.00 to 67.59±1.35) was observed vitamins A composition of formulated food was 3.54µg/mg. Functional properties evaluated showed no significant ($p<0.05$) difference in the bulk density but a high water absorption (70.6±3.3%), Emulsion (6.00±0.30%) capacities and reconstitution index (85±1.0%) were noticed. The sensory panelists rated the formulated complimentary food highly for taste, colour, flavour, texture and the overall acceptability. The formulated complementary food is a protein-rich product with good functional and sensory properties. Use of plant protein sources in local food formulations appeared to be vital in upgrading their nutritional, functional and sensory properties.

Key words: Complementary food, chemical properties, sensory, functional

INTRODUCTION

In the sub-Saharan region of the tropics, protein deficiency in diets is common and it is usually associated with deficiencies in calories leading to endemic protein malnutrition with its attendant health consequences particularly in children. Complementary foods are foods other than breast milk introduced to an infant to provide nutrients. In developing countries like Nigeria, complementary foods are mainly based on starch tubers like cocoyam, sweet potato or on cereals like maize, millet and sorghum. Children are normally given these staples in the form of gruels that is either mixed with boiled water or boiled with water (Igyor *et al*., 2011).

Sorghum is an important food crop grown on a subsistence level by farmers in the semi arid tropics of Africa and Asia. It is the principal food crop grown in Northern Nigeria (Zakari and Inyang, 2008). Sorghum like other cereals is predominantly starchy. The average starch content of the grain ranges from 56 to 73%. It is relatively rich in iron and phosphorus but do not contain pro-vitaminA FAO (1999).

African yam bean (*sphenostylis stenocarpa*) is an under utilized legume crop that is predominantly cultivated in Western Africa. It produces nutritious pods, highly protenous seeds and capable of growth in marginal areas where other pulses fail to thrive (Enwere, 1998). It has the potential to meet the ever increasing protein demands of the people in this region. Mango fruit (*Mangifera Indica*) is the only mango tree commonly cultivated in many tropical regions. Mango mesocarp flour has been reported to be rich in beta carotene, a pro-vitamin A (Badifu and Iloch, 2004).

Since many African mothers use gruels made from sorghum as complementary foods, for their infants, due to their inability to afford the cost of nutritional superior commercial weaning foods, this work was conducted to evaluate the chemical composition, functional properties and the sensory characteristics of locally formulated complementary food from sorghum, African yam beans and mango mesocarp flour blends.

MATERIALS AND METHODS

Procurement of raw materials: African yam bean (*sphenostylis stenocarpa*) and the red variety sorghum (*Sorghum bicolor*. L) were obtained from a local market in Anyigba town, Kogi State, Nigeria. The mangoes (*Mangifera indica*) were picked from Kogi State

Corresponding Author: P.A. Yusufu, Department of Food, Nutrition and Home Sciences, Faculty of Agriculture, Kogi State University, P.M.B 1008, Anyigba- Nigeria

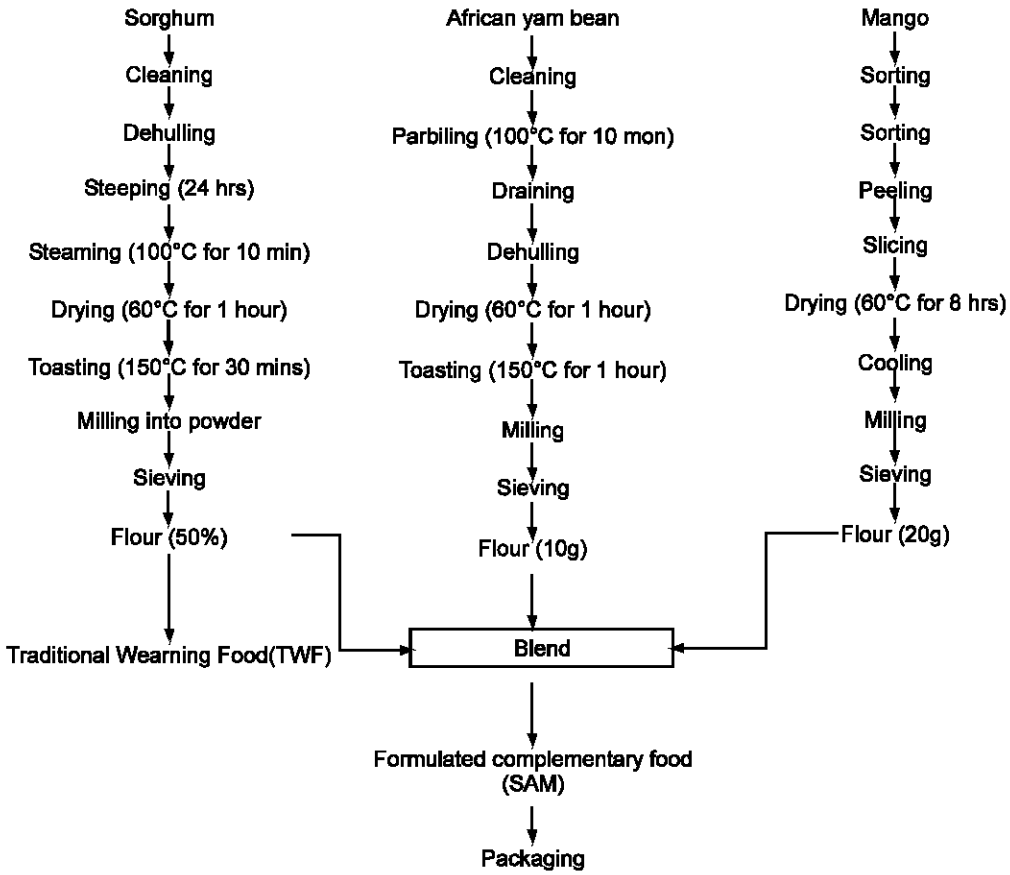

Fig 1: Flow diagram for the production of Traditional Weaning Food (TWF) and formulated complementary food (SAM)

University campus Anyigba, Nigeria. The department of food Nutrition and Home Sciences, Kogi State University, Anyigba provided the facilities for this work.

Preparation of Traditional Weaning Food (TWF): The sorghum grains were cleaned of dirts, dehulled using mortar and pestle, winnowed and steeped in clean water for 24 hours. The steeped grains were washed, drained and steam for 10 minutes. The grains were dried in hot oven (Quincy 51-550 Laboratory oven) at 60°C for an hour and toasted. The toasted grains were milled in a hammer mill and sieved through a 500 µm mesh sieve and packaged in a polyethylene bag (Fig. 1).

Preparation of formulated complementary food (SAM): African yam bean seeds were cleaned of dirts, parboiled (100°C for 30 minutes) in an aluminum port with lid. The parboiled seeds were drained for 5 minutes, dehulled manually and washed with clean water. The seeds were oven dried and toasted at 150°C for an hour. The toasted seeds were milled in a hammer mill and sieved through a 500µm mesh and the flour was packaged in an air tight container Fig. (1) The mango fruits were plucked, sorted and washed. The fruits were peeled manually and the mesocarps were sliced. The thinly sliced mesocarps were oven dried at 60°C for 8 hours in a hot air oven. The dried slices were milled in a hammer mill and sieved through a 500µm mesh. The flour obtained wash packaged in a polyethylene bag. The flours obtained from 100% sorghum (TWF) was blended with flours from African yam bean and mango mesocarp in the ratio of 5:3:2 respectively to produce the complementary food as shown in Fig. 1.

Analysis of sample: Chemical composition was analyzed by the method of AOAC (2006). Bulk density was determined by the method described by Owuka (2005). Emulsion, water Absorption capacity and reconstitution index were determine by the method of Beuchat (1977). The products were assessed for sensory properties with the help of 15 nursing mothers from Anyigba community in Kogi State who were trained on sensory attributes for the evaluation. The scores were based on the intensity of organoleptic quality attributes of taste, colour, flavour, texture and overall acceptability using a 9-point hedonic scale 9 for like extremely and 1 for dislike extremely. Samples were reconstituted 1:3 (meal: water) and coded for the participating judges' rating.

Table 1: Chemical composition of the complementary food

Sample	Moisture	Protein %	Ash	Fibre(%)	Fat %	CHO%	Vit. A (µg/mg)
SAM	760±0.10[a]	17.4±1.1[a]	2.50±0.10[a]	1.40±0.30[a]	3.50±0.31[a]	67.59±1.39[a]	3.5±0.90[a]
TWF	7.00±1.00[a]	8.88±1.09[b]	1.50±1.00[a]	1.60±0.40[a]	1.50±0.11[b]	78±1.00[b]	0.00±00[b]

Means followed by the same letter on the vertical column are not significantly ($p<0.05$) different from each other, SAM: Sorghum African Yam bean and mango blend, TWF: Traditional Weaning Food from100% sorghum

Table 2: Functional properties of the complementary food

Sample	Bulk density g/cm^3	Water absorption capacity (%)	Emulsion capacity (%)	Reconstitution Index (%)
SAM	0.42±0.02[a]	70.67±3.35[a]	6.00±0.30[a]	85±1.00[a]
TWF	0.43±0.02[a]	50.00±2.50[a]	3.00±0.21[b]	80±1.00[a]

Means followed by the same letter on the vertical column are not significantly ($p<0.05$) different from each other, SAM: Sorghum African Yam bean and mango blend, TWF: Traditional Weaning Food from100% sorghum

Table 3: Results of sensory evaluation of the complementary food

Sample	Taste	Colour	Flavour	Texture	Overall acceptability
SAM	7.58±0.66[a]	7.66±0.77[a]	8.00±0.73[a]	7.53±0.03[a]	8.00±1.03[a]
TWF	5.00±1.65[b]	5.41±1.16[b]	6.33±1.55[b]	5.33±1.1.49[b]	6.00±0.10[b]

Means followed by the same letter on the vertical column are not significantly ($p<0.05$) different from each other, SAM: Sorghum African Yam bean and mango blend, TWF: Traditional Weaning Food from100% sorghum

Statistical analysis: All values obtained were subjected to analysis of variance (ANOVA) and the differences in mean separated using LSD which was defined at $p<0.05$.

RESULTS AND DISCUSSION

Table 1 shows the results of the chemical composition of the samples. The protein content of the formulated complementary food increased significantly ($p<0.05$) from 8.88±1.9 in the control sample to 17.41±1.19 in the formulated sample. This was higher than the one reported by Okoye *et al*. (2010). The protein content of African yam bean and mango mesocarp flours complemented the sorghum protein and improved the nutritional quality of the formulated food. The vitamin A level of the formulated food increased significantly from 0.00 to 3.54±0.90. This result agrees with Badifu (2004), who reported that dried mango mesocarp flour can be incorporated into traditional foods in order to improve their Vitamin A level. The fact content of the complementary food was higher than the control. This implies that it will deliver, more energy when consumed but may have less storage life. There was no significant ($p>0.05$) difference in the moisture levels of the samples. The moisture content was below 10%. The low moisture levels obtained here is in agreement with those obtained for dried fura powder (Igyor *et al*., 2011). The product had low bulk density (0.42±0.02). This has nutritional and economic significance as more of the products can be eaten resulting in high energy and nutritional density (Nnam, 2000). The water absorption capacity of the formulated food was higher than that of the control. This was due to higher absorption capacity of the African yam bean flour. This result is in agreement with the earlier report by Igyor *et al*. (2011) that protein functions in binding water and fat while retaining them. Thus, the availability of African yam bean protein has increased its ability to absorb water. The high emulsion capacity reported (Table 2) was the result of high concentration of protein in the food. Oyarekua and Adeyeye (2009) reported that high value of emulsion capacity acts as flavour retainer and enhances the mouth feel and taste of food. The constitution index shows how easily a powdered product can be reconstituted in water before consumption. This property is depended on temperature and particle size as reported by Igyor *et al*. (2011). All the products were passed through the same sieve 500 µm after milling, this could have accounted for the lack of significant difference between the samples.

The results of the sensory evaluation (Table 3) showed that the formulated complementary food was highly rated for all the parameters investigated.

Conclusion: The work has demonstrated that formulation of complementary food from sorghum, African yam bean and mango mesocarp flour is a protein-rich product with good functional and sensory properties. Use of plant protein sources in local food formulation has the potential of meeting the protein and vitamins need of children in the regions where protein-energy malnutrition is prevalent.

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