American Journal of Food Technology 2 (5): 421-427, 2007
ISSN 1557-4571


# Production and Characterization of a Weaning Food from Dissi-oule Rice and Philippine Peanut Locally Grown in Guinea

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**Abstract:** The aim of present study is to make a low cost weaning formulation using traditional method. Appropriate process characteristics and blend formulations were developed for the preparation of a high protein-energy weaning food, using Dissi-oule rice and Philippine peanut. Since rice and peanut are deficient in lysine and methionine the ingredients were supplemented with skim milk powder. The product was based on a blend of dissi-oule rice flour (70%), Philippine peanut flour (20%), skim milk powder (10%), maltodextrin (1.97%), lecithin (0.17%) and hydrogenated peanut oil (0.5%). These ingredients were mixed, blended and fortified by dry mixing with vitamins and minerals. Weaning food made from dissi-oule rice and Philippine peanut had physical and sensory characteristics similar to those of traditional Guinean cereal-based weaning food but was of superior nutritional quality. The protein content was 18%, with 10% fat and 67% carbohydrate. Calcium, iron and phosphorus levels were also high. The blend can therefore be used as an ideal weaning food hence can improve the nutritional status of Guinean infants and can help solve problems associated with protein-energy malnutrition.

**Key words:** Malnutrition, Dissi-oule rice, Philippine peanut, flour, weaning food formula

## INTRODUCTION

In Guinea, the rates of protein-energy malnutrition is high with 26% of children stunted, 9% experiencing wasting and 33% are underweight. These proportions are 13, 3 and 16 times, respectively, higher than those expected for a relatively healthy and well-nourished population according to international standards (Sidibe *et al*., 2004).

Weaning denotes the process when an infant shifts from breast milk to a split diet progressively (Dvadas, 1998). At first, along with breast milk, small quantities of complementary foods are given mostly in liquid form. Slowly but regularly these complementary foods are added in increased quantities and also in the semi-solid and later solid form as the child grows and continues until full replacement of milk by a normal adult diet (Dvadas, 1998).

Weaning thus becomes an essential feature for balancing nutrients such as energy, protein, vitamins and minerals that the growing child needs. Up to 6 months of age, breast milk is adequate for meeting the calorie and nutrient requirements of an infant.

The economy of Guinea is predominantly agricultural with roughly 85% of the population depending on subsistence agriculture. The staple foods grown are rice, maize, peanut, bean, cassava

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and plantains (GMA, 2002-2004). The rice grown in Guinea is categorized into two major varieties, that is, Dissi-oule and Bintiana rice. Dissi-oule rice has a vegetative cycle of 120 days. It is a very productive variety when grown under favorable conditions. It tillers relatively well. According to the investigations carried out by the National service of the Agricultural Statistics of Guinea, its production capacity was estimated at 870.570 tons and 929.333 tons in the year 2002-2003 and 2003-2004. Peanut varieties grown in Guinea are categorized into two major varieties, that is, Philippine peanut and Hurried peanut. Philippine peanuts are crawling nuts whose stems spread out over the ground and bear fruits over the entire length. The tegument is pink sharp. The vegetative cycle of Philippine peanut lasts about four and a half months.

According to the investigations carried out by the National service of the Agricultural Statistics of Guinea, production capacity was estimated at 209.583 and 230.227 tons in the year 2002-2004, respectively. Among cereals and legumes cultivated in Guinea, Dissi-oule rice and Philippine peanut are considered first due to their importance in the diet of the population. A combination of Dissi rice and Philippine peanut in appropriate proportions enables the complementation of amino-acids that are limited in Dissi-oule rice.

The purpose of present study is to make a low-cost weaning formulation using the traditional methods which can be later adopted in modern technology to ensure wholesome foods that are not contaminated.

## MATERIALS AND METHODS

Dissi-oule rice and Philippine peanut grains were purchased from the local market in Conakry, Guinea in July 2003. They were put into a plastic bag and transported to laboratory of the Institute of Nutrition and Child health of Donka hospital, Conakry. Skim Milk Powder, maltodextrin, Lecithin and Calcium chloride dehydrate were obtained from the chemical store of G.A.N .C.U and SYTU.

### Preparation of Flours

The Dissi-oule rice and Philippine peanut flours were prepared according to the flow diagrams shown in Fig. 1 and 2.

### Soaking

Dissi-oule rice was washed and soaked in distilled water for 8 h at room temperature. A kernels-to-water ratio of 1:2 (w/v) was used. The soaked rice were then taken from the water and milled whole to fine (1.0 mm mesh) flour using a commercial hammer mill (Ndume Mills Co., UK).

### Roasting

Peanuts were roasted using oven. The temperature was held constant at 145°C for 15 min to obtain medium roast peanuts. Peanut was milled into fine flour (1.0 mm mesh) using a commercial hammer mile.

### Preparation of Infant-weaning Food Formulation

The flow diagram for the preparation process is outlined in Fig. 3 and the process is briefly described as below:

The weaning food was made by mixing dissi-oule rice flour (70%), Philippine peanut flour (20%) and skim milk (10%). Maltodextrin and hydrogenated peanut oil/lecithin were added, to give fat and protein contents of the final product of about 18 and 20%, respectively. Maximum complementation of amino acids and protein content of about 20% were targeted to satisfy the minimum protein content of 15% required under the Food and Agriculture Organization (FAO)/World Health Organization (WHO)/Codex Alimentarius Standards (FAO/WHO, 1982). A commercial cereal-based weaning food, cerelac, was purchased and used for comparison.

**Dissi-oule rice grains**

↓

**Washing**

↓

**Soaking (4 h, at room temperature)**

**In water at 1:2 (rice/water) ratio.**

↓

**Discard liquid ← Draining (for 30 min)**

↓

**Sun drying (4 h)**

↓

**Milling**

↓

**Sifting**

↓

**Flour**

Fig. 1: Flow diagram for preparation of Dissi-rice flour

### Chemical Composition

The chemical composition of the foods was determined by the AOAC (1995) methods. Samples of the weaning foods and raw ingredients were analyzed for moisture, protein, fat and ash by AOAC standard procedures (AOAC, 1995). Carbohydrate was determined by the difference and energy by calculation. Iron, phosphorus and calcium were measured using AACC (1995) methods.

### Sensory Evaluation

A 10 member trained panel drawn from students conducted sensory test. Acceptability parameters of weaning food formula and traditional weaning food were scored a using a 9-point hedonic scale (Price and Morris, 1991).

### Quantitative Determination of Solubility

The reconstituted sample (5 g powder in 35 mL water at 25~30°C) was centrifuged in a weighed tube at about 2000 x g rpm for 10 min. The sediment was washed once. After the second or the third

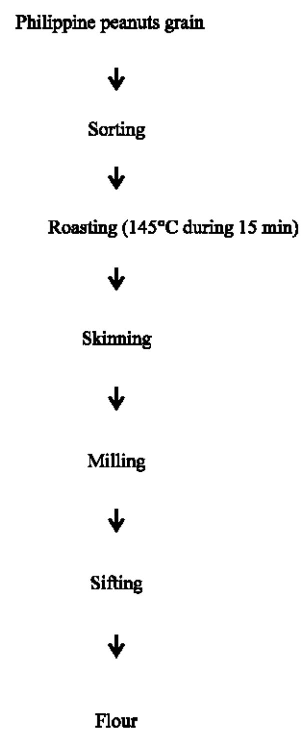


Fig. 2: Flow diagram for preparation of Philippine peanut flour

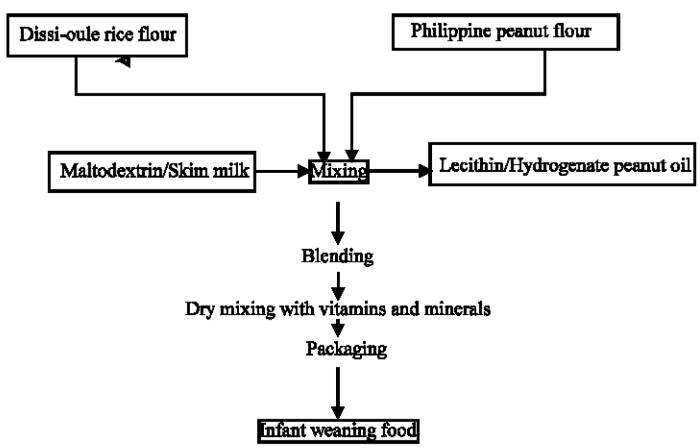


Fig. 3: Flow diagram of the process for the preparation of infant weaning food formulation based on Dissi-oule rice and Philippine peanut

centrifuging the wash water was decanted and the tube with the sediment was dried. The solubility index was calculated according Eq. 1:

$$\text{Solubility}(\%) = 100 - \frac{G}{W \times (1 - H\%)} \times 100 \tag{1}$$

Where:

G : The insoluble matter
W : The Sample weight and
H : The moisture content of the sample

## RESULTS AND DISCUSSION

This study was performed as a result of the high price of commercial weaning foods which cannot be afforded by many of low-income families. It is the believed that if mothers fortify local weaning diets with peanut would ensure that infants and children consuming the peanut supplemented diets would be able to meet their requirements for protein and other nutrients such as Lysine, tryptophan and the sulphur-containing amino acids (S-aa). Due consideration is given to the right proportions of the blend components for maximum protein quality through the mutual complementation of the limiting amino acids. According to the report by Oyenuga (1968), the high lysine content of legumes improves the nutritional quality of cereals by complementing the limiting amino acids. For insistence, sulphur containing amino acids such as methionine are limiting in legumes and relatively high in cereals, lysine is limiting in cereals and high in legumes. These two amino acids are indispensable to the growth of infants.

The chemical composition of the raw ingredients used is given in Table 1. Protein and fat contributions to the blend were mainly provided by Philippine peanuts and skim milk powder and the main source of carbohydrate was Dissi-oule rice. The protein content of the formulated blend was almost twice that of the traditional weaning food and fat content increased from 4 to 10% (Table 2).

Table 1: Chemical composition of raw ingredients weaning food[a]

| | Ingredients | | |
|---|---|---|---|
| Components | Dissi-oule rice | Philippine peanut | Skim milk |
| Moisture (%) | 12.3±0.05 | 5.1±0.04 | 4±0.00 |
| Protein (%) | 13.4±0.05 | 26±0.005 | 32±0.01 |
| Fat (%) | 0.7±0.005 | 55.54±0.005 | 1.5±0.001 |
| Ash (%) | 1.71±0.001 | 2.21±0.001 | 8.5±0.002 |
| Carbohydrate (%) | 68.38±0.0015 | 21±0.25 | 54±0.025 |
| Energy (kcal) | 333±0.005 | 688±0.01 | 358±0.0025 |

a, Values are means±standard deviation of triplicate determination expressed on as is basis.

Table 2: Composition and acceptability of traditional and improved weaning foods

| | Weaning food | | |
|---|---|---|---|
| Component | Traditional weaning food | Weaning food formula | Commercial cerelac |
| Moisture (%) | 2.32±0.001[a] | 3±0.00[b] | 5.30±0.003[c] |
| Protein (%) | 9.60±0.001[b] | 18±0.25[a] | 15.50±0.025[c] |
| Fat (%) | 4.30±0.03[b] | 10±0.075[c] | 9±0.005[a] |
| Ash (%) | 1.39±0.003[b] | 2±0.011[a] | 3.30±0.01[c] |
| Carbohydrates (%) | 82.40±0.025[a] | 67±0.5[b] | 66.90±0.05[c] |
| Energy (kcal) | 406.62±0.005[a] | 430±0.125[a] | 411±0.4[b] |
| Iron (mg100 $g^{-1}$) | 3.60±0.00055[b] | 4.50±0.025[c] | 7.50±0.01[a] |
| Phosphorus (mg 100 $g^{-1}$) | 369.70±0.023[b] | 374.40±0.027[a] | 430±0.005[c] |
| Calcium (mg 100 $g^{-1}$) | 139.1 5±0.003[b] | 253.50±0.06[c] | 530±0.02[a] |
| **Selected amino acids** (g 100 $g^{-1}$ $N^{-1}$) | | | |
| Lysine | 2.7±0.005[a] | 5.3±0.038[b] | - |
| Tryptophan | 0.7±0.006[a] | 1.2±0.001[b] | - |
| S-aa | 3.5±0.03[b] | 3.8±0.0011[a] | - |
| Solubility | - | 98.29±0.0049 | - |
| Acceptability[3] | 7.5±0.001[a] | 8.2±0.0056[b] | - |

[1]Means ±standard deviations based on three replications, all values expressed in dry weight basis, [2]Means within a column with different letter are not significant using Duncan's Multiple Range Test at ($p \leq 0.05$), [3]Based on a nine-point hedonic scale, S-aa : Sulphur amino acids

Protein contribution to the total energy was 18% in weaning food and was significantly ($p<0.05$) higher than the amount in traditional weaning food (9.60%). In commercial cerelac, protein contributed 15.5% of the total energy and was significantly ($p<0.05$) lower than the level in the weaning food (18%). The result was higher than that reported by Mahgoub (1999) who found protein content (16.7%) to be low using sorghum, chickpeas and sesame as weaning formula. Similar findings of protein content (18.37%) in weaning food using millet and soybean flour have been reported by Anjou and Sarita (2002).

Fat contribution to the total energy in the commercial cerelac and traditional weaning food were significantly ($p<0.05$) lower than the level in weaning food (10%) with fat contribution to the total energy ranging between 9 and 4.3%, respectively. Carbohydrate contributed the biggest proportion of the total energy for both traditional weaning food and weaning formula. The carbohydrate contribution to the total energy was 82.4% in traditional weaning food and was significantly ($p<0.05$) higher than the levels in weaning formula (67%) and commercial cerelac (66.9%). Similar results were reported by Plahar *et al*. (2003) in extruded weaning foods and had higher content of protein than the commercial Tom Brown product that had peanut as one of the ingredients. Total energy, iron, calcium and phosphorus levels were also significantly higher ($p<0.05$) in weaning food and commercial cerelac. The total ash content of 2% is an improvement in traditional weaning food but is still less than 5%.

## CONCLUSION

The present study has shown the advantage this weaning food formulation has in foods for infants in addition to breast milk. The weaning formulation in the present study was based on commonly consumed, low-cost food materials locally-available in Guinea. The weaning food based on Dissi-oule rice and Philippine peanut showed compositional and nutritional properties, that were comparable to commercial cerelac. It can therefore, be a potential substitute for use as weaning food at home and commercial level.

A suitable mixture thus allows us to obtain a food of more or less balanced diet which contains all the essential amino acids with the harmonious development of the infant during the period of weaning. It can also help poor mothers especially, in the rural areas to prepare nutritious weaning food based on inexpensive locally available foods for feeding their children.

Food for children in general and that of the infant in particular are an alarming problem for the major part of the households in Guinea especially the urban who are entirely dependent on imported products. The development of the local product which contains the same food values contributes to save important financial resources which could be reoriented towards other priorities of the households. It is for these reasons that the following is suggested:

- To widen and study all the products used in the weaning of children.
- To widen the food recipes for each case and to make sure that these recipes are appropriate indeed to cover both the qualitative and quantitative requirements.

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