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

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Assessment of Chemical Compositions of Soybean Supplemented Weaning Foods and Nutritional Knowledge of Nursing Mothers on Their Utilizations

O.S. Ijarotimi and J.A.V. Famurewa
Department of Food Science and Technology (Human Nutrition Division),
Federal University of Technology, PMB 704, Akure, Ondo State, Nigeria

Abstract: A semi-structured questionnaire was used to collect information on the nutritional knowledge of the mothers on the various utilizations of soybeans as weaning diets. The results of Chemical composition analyses of ogi and soy-ogi showed that the energy values ranges between 310-337kcal, moisture content 9.7-8.8g, protein 1.8-12.5g and fat 0.8-5.6g, while others fiber, ash and carbohydrate range between 1.2-2.4g, 12.5-11.5g and 74-59g respectively. The values for mineral composition were calcium 4.0-107.5mg, phosphorus 86.0-129.0mg, iron 0.6-2.22mg, riboflavin 0.07-0.1mg and vitamin A 3.9-5.6mg; and the ascorbic acid (Vitamin C) content of both ogi and soy-ogi were 0.0 respectively. For moinmoin and soy-moinmoin: energy 356-388Kcal., moisture content 7.3-8.7g, protein 23.1-34.0g, fat 2.1-13.2g, fiber 1.6-4.4g, ash content 3.5-7.7g and carbohydrate 33.3-61.0g. The mineral composition showed that calcium 101-289mg, phosphorus 383-420mg, iron 6.5-7.6mg, riboflavin 0.05-0.18mg, ascorbic acid 0.03-0.9mg and vitamin A 9.73-38.9mg. The overall acceptability sensory evaluation results showed that CSF 1 (80% of maize corn and 20% of soybean) and CPSF 1 (75% of cowpea and 25% of soybean) were rated next to the ogi and moinmoin without soybean supplementation respectively. The study established that high percentage of the mothers agreed that soybean was a good source of protein; and that Soybean could be used as protein substitute in weaning food.

Key words: Weaning foods, nutritional knowledge, nursing mothers

Introduction

Every child has the inalienable right to be free from hunger and malnutrition in order to develop fully and maintain their physical growth and mental faculties. Poor growth is attributable to a range of factors closely linked to overall standards of living and the ability of population to meet their basic needs, such as access to food, housing and health care. Recent findings have shown that malnutrition is increasing in some part of the world, particularly in developing countries, and that infections and unsatisfactory feeding practices, or more often a combination of the two, are the major causative factors (WHO, 1985; UNICEF, 1989; WHO, 2000).

In developing countries, one of the greatest problems affecting millions of people, particularly children are lack of adequate protein intake in term of quality and quantity. Evidences have shown that protein deficiency is a major nutritional problem among the children and has hindered their health, mental capability, school performance and productivity, thus affecting the country's economic growth (Spur *et al*., 1977; Martorell, 1992; NHCD, 1998; Chapin, 1999; Berkman and Kawachi, 2000; Ivanovic *et al*., 2002; Braveman and Gruskin, 2003; Ishara, 2005). Some of the major factors attributed to this low protein intake; particularly among those in low-income class are poverty and lack of nutritional knowledge. Also, finding has shown that in traditional communities special foods for the weaning-age-child are seldom prepared (UNICEF, 1989). The child slowly gets accustomed to the adult food, which is low in protein, through the softer, carbohydrate parts of that food (Cohen *et al*.,1994). In recent years some countries have introduced homemade complementary foods, which are not readily accessible to majority of rural nursing mothers, as a result of some difficulties in the production process (Akapo *et al*., 1993). However, a cheaper source of protein that could help in alleviating the problem of undernourishment and malnutrition among the children is the consumption of soybean-supplemented products.

Cowpea (Vigna unguiculata) and soybeans (Glycine max) belong to the class of foods known as legumes. They are important sources of proteins, particularly for those nursing mothers who cannot afford to purchase commercial complementary foods for their children. The nutritional value of cowpea lies in their high protein content, which is higher than that of cereals. The utilization of cowpeas as weaning diet is widespread in Nigeria and other developing countries either alone or in combination with cereals or other food materials (FAO, 1970; Dovlo *et al*., 1976)

Soy-ogi (porridge of sorghum or corn and soybean) is another form of local weaning food. Sorghum and corn are very low in protein. The nutritional quality of ogi can be improved by soybean supplementation. Soybean is very rich in almost all the essential amino acids needed by human body and the only vegetable that provides

Table 1: Demographic and socio-economic status

Parameters		Sample size	Percentage (%)
Age:	20- 25 years	88	22.0
	26-30	175	43.7
	31-35	99	24.8
	36-40	23	5.7
	41-45	15	3.8
Socio-economic Status			
High Socio-economic		39	9.7
Medium Socio-economic		77	19.3
Low Socio-economic		284	71.0

Table 2: Soy-ogi (Corn and soy flour (CSF) blends) and Soy-moinmoin (Cowpea and soy flour (CPSF) blends)

Samples	Corn (%)	Soybeans (%)
Soy-ogi		
SF 0	0	100
CF 0	100	0
CSF 1	80	20
CSF 2	75	25
CSF 3	70	30
Soy-moinmoin		
SF 0	0	100
CPF 0	100	0
CPSF 1	75	25
CPSF 2	50	50
CPSF 3	25	75

complete protein when compared with animal protein (Newell and Lymowits, 1981). The aim of the study was to evaluate the nutritional composition of local homemade weaning foods fortified with soybeans and the perception of the nursing mothers towards their utilization.

Materials and Methods

Data collections: A cross-sectional descriptive study was conducted between March and May 2005 among 400 nursing mothers, who attended government owned hospitals during postnatal clinic. Data on the socio-economic status and utilizations of soybeans for complementary foods were collected by means of structured and semi-structured questionnaires and the questionnaire was divided into three sections, i.e., demographic characteristics (sex & age), socio-economic status, nutritional knowledge and utilization of soybean.

Socio-economic status: The subject and their husbands' occupation, total monthly income and educational level were used as the criterion for SES. The subjects were grouped into three socio-economic statuses, that is, those who have a good occupation, with monthly income above =N= 25000 (US $156) and higher educational background were classified as high socio-economic status (HSES) group, those with tertiary education, good occupation and with monthly income between the range of =N= 15000 and =N= 25000 (US$94-$156) were grouped as medium socio-economic status and those with income less than =N= 15000 (US $94) in a month, poor occupations and low or no educational background were classified as low socio-economic status (LSES).

Nutritional knowledge of nursing mothers: The nutritional knowledge and utilization of soybean as component of weaning diet by the nursing mother was assessed through questionnaire. The questionnaire was designed in accordance with the modified Likert-scale technique to enable the respondents to indicate the extent of agreement and disagreement of the supplied statements. Thus the response was supplied with three points modified rating scale of: Not sure, Agree and Disagree.

Nutritional composition of weaning foods

Materials: The raw materials used in this work are mature healthy cowpea (Vigna unguiculata), maize corn (*Zea mays*) and soybean (*Glycine max* L. Merri). Maize corn, cowpea and soybean were obtained from the local market in Akure. The raw materials were washed three times with tap water and later with distilled water, air-dried and collected into separate sterile plastic containers.

Processing Methods

Soybean flour: The soybean seeds were washed and soaked in 0.5% sodium hydrogen carbonate solution at a temperature of 30°C for 2 hours. The seeds were cooked for 30 minutes at a temperature of 100°C. The seeds were dehulled, oven dried at a temperature of 60°C 24 hours in an air drought oven. The dried seeds were milled and sieved through a 0.4mm mesh screen.

Maize corn Flour (Ogi): The corn seeds were washed and soaked in warm water (30°C) for four days. The corns were oven dried at a temperature of 60°C 24 hours in an air drought oven. The dried corns were milled and sieved through a 0.4mm mesh screen.

Cowpea flour: The cowpea seeds were clean, washed and soaked in ordinary water for twenty minutes. The seeds were dehulled, oven dried at a temperature of 60°C 24 hours in an air drought oven. The dried seeds were milled and sieved through a 0.4mm mesh screen. The blends were prepared (homogeneously) and labeled as shown in Table 2.

Preparations: Soy-ogi (Maize corn and soybean flours blends): Each of the blends was mixed with 40ml of

Table 3a: Chemical composition of corn pap (ogi) and soy-ogi: Corn and soy flour (CSF) blends (g/100g)

Nutrients	CF 0	CSF 1	CSF 2	CSF 3
Energy (Kcal)	310.0	329.0	333.0	337.0
Moisture (g)	9.7	9.12	8.9	8.8
Protein (g)	1.8	8.94	10.8	12.5
Fat (g)	0.8	4.02	4.8	5.6
Fiber (g)	1.2	2.02	2.2	2.4
Ash (g)	12.5	11.7	11.6	11.5
CHO (g)	74	64.2	61.5	59.0
Calcium (mg)	4.0	73.0	90.3	107.5
Phosphorous (mg)	-	86.0	107.5	129.0
Iron (mg)	0.6	1.68	1.95	2.22
Riboflavin (mg)	0.1	0.08	0.075	0.07
Ascorbic acid (mg)	0	0	0	0
Vitamin A (IU)	5.6	4.5	4.2	3.9

Table 3b: Chemical composition of Soy-moinmoin: Cowpea and soy flour (CPSF) blends (g/100g)

Nutrients	CPF 0	CPSF 1	CPSF 2	CPSF 3
Energy (Kcal)	356	367	377.3	388.3
Moisture (g)	8.7	8.2	7.8	7.3
Protein (g)	23.1	26.7	30.4	34
Fat (g)	2.1	5.8	9.6	13.2
Fiber (g)	1.6	2.5	3.5	4.4
Ash (g)	3.5	4.9	6.3	7.7
CHO (g)	61.0	51.8	42.5	33.3
Calcium (mg)	101	165	227	289
Phosphorous (mg)	383	398.2	410	420
Iron (mg)	7.6	7.3	6.9	6.5
Riboflavin (mg)	0.18	0.14	0.09	0.05
Ascorbic acid (mg)	0.9	0.08	0.05	0.03
Vitamin A (IU)	38.9	29.2	19.5	9. 7 3

water into smoother paste (Table 1). The boiling water (100°C) was slowly mixed with the sample and stirred continuously until homogenous gel was formed.

Soy-moinmoin (Cowpea and soybean flours): Each of the blends was mixed with water, salt, grounded dry pepper, onion and vegetable oil (1.5g). The mixture was placed in an aluminum pot and placed on the electric heater (hot plate) and steamed for about 45 minutes.

Chemical analyses: Triplicate samples of each blend were analyzed for moisture, fat, protein (N x 6.25), crude fiber and ash in accordance with the procedures of AOAC (1995). Total lipids were estimated by petroleum ether extraction. Carbohydrate content was estimated by difference. Gross energy was determined using a Gallenkamp Autobomb automatic adiabatic bomb calorimeter (London, UK). The total ash was estimated after ashing for 12 hours at 550°C. Calcium, and iron contents were determined on ash sample using a Buck Model 200A flame atomic absorption spectrophotometer, while phosphorous content was determined using the vanadomolybdate method (AOAC, 1995).

Sensory evaluation: The sensory evaluation was carried out on the following parameters: taste, appearance, aroma, mouth (texture), colour and overall acceptability by a panel of ten members using a 9-point Hedonic scale. The rating of the samples ranged from 1 (Dislike extremely) to 9 (Like extremely)

Table 4: Sensory evaluation scores for reconstituted soy-ogi and soy- moinmoin

Sample	Taste	Aroma	Mouth	feel	Overall
Appearance					acceptability
Soy-ogi					
CF 0	5.0^{a}	5.0^{a}	5.0^{a}	5.0^{a}	5.0^{a}
CSF 1	4.8^{a}	5.3^{a}	5.8^{a}	4.3^{a}	5.5^{a}
CSF 2	5.3^{a}	4.8^{a}	6.3^{b}	3.9^{a}	4.6^{a}
CSF 3	6.0^{a}	5.9^{a}	6.0^{ab}	5.1^{a}	5.0^{a}
Soy-moinmoin					
CPF 0	5.0^{a}	5.0^{a}	5.0^{a}	5.0^{a}	5.0^{a}
CPSF 1	5.0^{a}	5.0^{a}	5.0^{a}	5.0^{a}	5.0^{a}
CPSF 2	5.4^{a}	5.4^{a}	5.3^{a}	5.3^{a}	4.6^{a}
CPSF 3	5.7^{a}	5.6^{a}	4.9^{a}	4.8^{a}	4.8^{a}

*Means with similar alphabets are not significantly different from each other at the 5% statistical level.

Table 5: Amount of soy-ogi (CSF 1) and soy-moinmoin (CPSF 1) needed to meet RDA of children (0.5-3 years)

Nutrients	RDA	Amount of soy-ogi (80:20) needed to meet RDA (g)	Amount of soy-moinmoin (75:25) needed to meet RDA (g)
Energy (Kcal)	1250	380.0	341.0
Protein (g)	14.5	162.2	54.3
Calcium (mg)	550	753.4	333.0
Phosphorous (mg)	0.8	0.93	0.2
Iron (mg)	14	833.3	191.8
Riboflavin (mg)	0.8	1000.0	571.4
Ascorbic acid (mg)	20	0.0	25000
Vitamin A (IU)	1333	29622.0	4565.0

Statistical analysis: The statistical significance of the observed differences among the means of triplicate readings of experimental results were evaluated by analysis of variance (ANOVA), while means were separated using Duncan's Range. The results of response of the nursing mothers were expressed as percentages. These analyses were carried out using SPSS 12 computer program.

Results

The results of demographic and socio-economic status of the nursing mothers were shown in Table 1. These results show that 22% of the subjects were between the age range of 20 and 25 years; 43.7% between the age of 26 and 30 years and 24.8% were within the ages of 31 and 35 years, while others 5.7% and 3.8% were within the ages of 36 and 40, and 41 and 45 years respectively. The socio-economic status distribution showed that 9.7% of the subjects were falling within the high socio-economic status (HSES), 19.3% were within medium

Table 6: Nutritional knowledge of nursing mothers towards soybeans utilization as weaning food supplementation

Parameters	Not sure (%)	Agree (%)	Disagree (%)
Soybean is a good source of plant protein	08.8	88.5	02.7
The protein quality of soybean is as good as animal protein	22.0	44.7	33.3
Soybean can be used as protein substitute in weaning food	22.0	67.5	10.5
Maize corn or sorghum can be supplemented with soybean to form weaning food	27.7	61.0	11.3
Cowpea can be supplemented with soybean in order to improve its nutritional quality	18.5	76.7	04.8
Does your child accept weaning food supplemented with soybean	13.3	78.0	08.7
Does your child nutritional status improves whenever you feed him/her with soy-ogi /soy-moinmoin.	26.7	71.8	01.5
Does your child develops problem whenever he/she takes food supplemented with soybean	68.0	24.0	08.0

socio-economic status (MSES) and 71.0% were within low socio-economic status (LSES).

Table 3a and b show the chemical compositions of two major ways of utilizing soybean as weaning diets among the local nursing mothers. The chemical analyses of ogi and soy-ogi showed that the energy values ranges between 310-337kcal, moisture content 9.7-8.8g, protein 1.8-12.5g and fat 0.8-5.6g, while others fiber, ash and carbohydrate range between 1.2-2.4g, 12.5-11.5g and 74-59g respectively. The analyses for mineral composition of ogi and soy-ogi showed that calcium range between 4.0-107.5mg, phosphorus 86.0-129.0mg and iron 0.6-2.22mg, while others ranges between 0.07-0.1mg and 3.9-5.6mg for riboflavin and vitamin A respectively.; and the ascorbic acid (Vitamin C) content of both ogi and soy-ogi were 0.0 respectively.

The result of moinmoin and soy-moinmoin chemical composition showed the following ranges; energy 356-388Kcal., moisture content 7.3-8.7g, protein 23.1-34.0g, fat 2.1-13.2g and fiber 1.6-4.4g, ash content 3.5-7.7g and carbohydrate 33.3-61.0g respectively. The mineral composition showed that calcium ranges between 101-289mg, phosphorus 383-420mg, iron 6.5-7.6mg and riboflavin 0.05-0.18mg; while others ranges between 0.03-0.9mg and 9.73-38.9mg for ascorbic acid and vitamin A respectively.

The soy-ogi and soy-moinmoin were subjected to sensory evaluation the results showed that CSF 1 (80% of maize corn and 20% of soybean) and CPSF 1 (75% of cowpea and 25% of soybean) were rated next to the ogi and moinmoin without soybean supplementation respectively. It was observed that there were no significant differences between CF0 and other food samples in term of appearance, taste, mouth feel and overall acceptability while there were significant difference between CF0 and CSF2 and CSF 3 and there was no significant difference between CF 0 and CSF 1 in term of aroma. Also, the result showed that there were no significant differences between CPF 0 and other food samples in term of appearance, taste, aroma, mouth feel and over all acceptability (Table 4).

Table 5 shows the amount of soy-ogi and soy-moinmoin needed to meet the RDA of the children. The amount required to provide these nutrient requirements were as follows: Energy 380g of soy-ogi and 341g of soy-moinmoin; protein 753.4g of soy-ogi and 333.0g of soy-moinmoin; calcium 753.4g of soy-ogi and 333.0g of soy-moinmoin; phosphorus 096g of soy-ogi and 0.2g of soy-moinmoin; iron 833.3g of soy-ogi and 191.8g of soy-moinmoin; and others riboflavin 1000g of soy-ogi and 571.4g of soy-moinmoin,; ascorbic acid 2500g of soy-moinmoin and vitamin A 29622g of soy-ogi and 4565g of soy-moinmoin

Table 6 shows the nutritional knowledge of the nursing mother on the utilization of soybean as component of weaning diets. It was observed that high percentage of the mothers agreed that soybean was a good source of protein and that Soybean could be used as protein substitute in weaning food. Also, it was agreed by many of the mothers that their children grow normally and the children did not develop any nutritional problem whenever they were fed with soybean-supplemented diets

Discussion

It was evidenced from this study that large proportion of the nursing mother utilized soybean as source of protein to feed their children. This idea was as a result of high price of commercial weaning and animal foods which can not be afforded by many of the low-income families, and it was the believed of these mothers that fortifying the local weaning diets with soybean would ensure that infants and children consuming these soybeans supplemented diets would be able to meet their requirements for protein and some other nutrients. This finding has been previously reported by other investigators that legume, such as soybean, utilization was common among the low income group, and that it was mainly being utilized as a substitute for animal protein, which are very expensive to many of this low-income group (Akinrele and Edwards, 1971; Nnanyelugo, 1985; Uwaegbute and Nnanyelugo, 1987;

Plahar and Hoyle, 1991).

The study also indicates that the utilization of soybeans by many mothers was as result of their nutritional knowledge, which they acquired during the postnatal clinic. During the postnatal clinic the nursing mothers were educated on the importance of exclusive breast feeding practices and how to improve upon the nutritive values of local weaning foods and this action has drastically reduced the prevalence of protein-energy malnutrition among children from low-income families. The study established that large proportion of the mothers agreed that soybean protein was a good substitute for animal protein, and those infants and children consuming the right quantities of soy supplemented diet would grow normally without nutrition problems. Many studies have reported that cereal-based diets have lower nutritional value than animal-based ones, and that to improve the nutritional status of cereal based complementary diet various forms of economical protein-rich plant mixtures are used for different areas in African countries, for instance, vegetable proteins, particularly soybean have been used to improve the nutrient content of sorghum and maize in the preparation of local weaning food in many parts of West African countries (Armar-Klemesu and Wheeler, 1991; Jonsyn, 1985; Ijarotimi and Aroge, 2005; Ikujenlola and Fashakin, 2005). The high lysine content of legumes improves the nutritional quality of cereals by complementing their limiting amino acids, for instance, sulphur containing amino acids are limiting in legumes and relatively high in cereals, whereas lysine is limiting in cereals and high in legumes. These two amino acids are indispensable to the growth of the young child (Oyenuga, 1968).

Conclusions: This work has shown that in the study population the utilization of soybean as component of weaning diets was popular among the low-income nursing mothers. However, it is not clear whether the findings are specific to the studied population alone or applicable to other parts of Nigeria. Further studies are needed to confirm these findings.

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