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Production of infant weaning food from plant-based milk substituted into children diet for weight gain, brain development and hemoglobin.

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Abstract

In developing countries, researchers have focused their attention on the possibility of formulation of infant weaning food from locally available, vegetable proteins and cereal to reduce frequent maternal morbidity and mortality. The present was set to produce infant weaning food from plant- based milk substituted for children for weight gain, brain development and hemoglobin formation. The milks were produced from locally accessible plant –based vegetable. The energy was supplied from cereals and tubers. A Proximate composition, mineral composition, microbial and sensory evaluation of each product was determined. The sensory assessment took place in pediatric ward of women and children primary health care, these children ages ranged between 6-36 months old. The results of the proximate, mineral, microbial and sensory evaluation were reported for preparing and commercial weaning foods have followed: 12.62-18.34%, 3.00-9.50%, 2.04-3.54%, 1.10-3.42%, 1.80-3.01%, 64.20-78.02%, 398.17-460.23%, 398.26-480.20mg/100g, 246.05-280.01 µg/100 kcal, 188.40-225.20 µg/100 kcal and the results of microbial quality in prepared weaning foods revealed mold and yeast were not detected and low counts for total bacterial count, coliform and salmonella. The scores of aroma and mouth feel for diet (I) was significant ($p < 0.05$) lower than diets (II and III). Meanwhile, commercial weaning and the formulated foods were generally accepted. The weaning foods composite plant- based milk can be a cost-effective and possible tool to overcome malnutrition among children in developing countries.

Key words: weight- gain, hemoglobin, formulation, weaning, plant-based milk.

1.0 Introduction

World's population increase by over 9 billion and almost ten million people are determined to be protein or energy malnourished (Alexandratos and Bruinsma, 2012). By 2050, it would be needed two times more food production as compared to recent food production worldwide to meet the demand of the times. Nutritionists and other scientists follow similar observations that animal and plant sources will play a more important role in fulfilling the increased future food and energy requirements worldwide (Alexandratos and Bruinsma, 2012; Sass et al., 2020). Sufficient nutrition requirements through infancy and early childhood are necessary for the growth of a beach child's full human potential. It is fully noticed that the first 2 years of children's age is a "critical window" for the development of health, optimal growth, and behavioral improvement. When a child attains 2 years of age, it is quite challenging to change the stunting that has happened earlier (Bernard et al., 2016). The instant results of inadequate nutrition throughout these developmental years include significant delays in motor and mental growth and significant morbidity and mortality. So, this early stage of nutritional deficiency is associated with impairments in mind (Bernard *et al*., 2016; Martorell et al., 1994). Complementary feeding starts when mother milk individually no longer adequate to satisfy the nutritional demands of infants. So, that's why the other liquids and foods are required, accompanied by mother milk. Complementary feeding commonly starts at 6 months up to 24 months of age (United Nations Children's Fund, 1998). More than one-third of child mortality occurs due to nutrition deficiency and from extended severity of disease (Addis et al., 2013). In Africa, the most common forms of malnutrition are protein-energy malnutrition (PEM), vitamin A, iodine, and Iron deficiencies as recommended by UNICEF, (2014) also responsible for about one-half of deaths among children under five years (World Health Organization, 2014).

Fruits and vegetables possibly beneficial origins of micronutrients and can be used for the formulation of complementary foods.

The quality of protein can be enhanced by the incorporation of foods from both plant and animal source (Bernard *et al*., 2016; Roobab et al., 2020). Several types of weaning foods are marketed in market but due to high cost, only available for 30% of the infant community. Rural mothers, that's why to rely on accessible low-cost complementary foods to wean their children, these household foods may not provide the needed nutrients for the infant; hence the demand for substitute sources that will be increased which is affordable for everyone. Because of this nutritional issue, various approaches have been applied to form weaning food, by using the combination of locally accessible foods. This study aims to formulate complimentary instant food from locally accessible, underutilized components (coconut milk, almond milk, soy milk, carrot, banana, date fruit, beetroot, immature green beans and local white rice) which will provide the needed nutritional demand for infants and will be available and affordable to all mothers.

Coconut milk is rich nutrients. It mostly contains fat that are good for the body. Babies need essential fats for brain development, insulation and for benefits of their skin (Victor, E.E. 2014). It contains several vitamin and minerals like iron, magnesium, zinc, vitamin C and E. All these nutrients can help in maintaining baby's good health, development and boosting immunity (Elvira, V.*et al.,* 2012). Other protein supplements include soy milk and almond milk. They are great substitute for babies who have dairy allergies.

The use of soy milk was first reported about 2000 years ago in China. Soy milk was the first plant-based milk which served the purpose of providing nutrients to a population where the milk supply was inadequate Singhal, Baker and Baker (2017). Soy beverage contains much lower carbohydrates and fats compared to CM. Therefore, it has a lesser energy value, while the protein supply is also lower. Regarding the lipidic profile, it contains low levels of saturates, while it represents a good source of trans fats, MUFA, and PUFA (ALA and LA).Regarding micronutrients, it contains isoflavones probably responsible for the beneficial effects of soy against cancer, cardiovascular disease, and osteoporosis; phytosterols widely recognized for their cholesterol-lowering properties . Soy drink shows calcium and vitamin B-12 deficit; for this reason, those micronutrients are often supplemented. The claimed benefits of consuming soy milk include the absence of lactose and cholesterol, high nutritive value, higher protein quality compared to other beverages, and high digestibility Singhal, Baker and Baker (2017). However, these drinks should not be given to younger children (early years of life). In this regard, it is judged necessary to resort to a 3 or 7 days food diary to define the micronutrient intake according to age needs. Unfortunately, a well-known disadvantage of soy milk preparation is a characteristic beany flavor Sethi, Tyagi and Anurag (2016). Furthermore, soy beverage cannot be used in individuals allergic to soy proteins as it may result in possible flatulence.

Almond milk, compared to bovine milk, has less protein content while the amount of carbohydrates and fats almost compares to those in CM. Regarding the lipidic profile, it presents fewer levels of saturates and higher levels of trans-fats, MUFA (oleic acid) and PUFA (ALA and LA). Regarding almond milk micronutrients, it has good levels of vitamin E, an important antioxidant, and manganese. Almonds are also a rich source of other nutrients such as calcium, potassium, magnesium, iron, selenium, copper, and zinc Giovannini et al., (2014). This nutritional profile makes it unsuitable as the only food in a baby's diet. If given as a milk substitute, it would be essential for fortification by adding critical micronutrients like calcium and B12, based on the growing need. The stated benefits of almond milk are the cholesterol-lowering power and potential prebiotic features, which may determine the bifidobacteria growth Singhal, Baker and Baker, (2017). Generally, this drink is nutritionally better than other plant-based beverages, and it represents a good trans-fat and vitamin E source but has downsides too: the prevalence of nut allergies and high price limit the consumption Singhal, Baker and Baker, (2017). Despite their characteristics, they cannot be considered as a milk substitute but as a beverage to be given to children during snack time.

2.0 Materials and methods

2.1 Procurement of raw material and preparation of weaned products

All the ingredients need for the preparation of weaning foods was purchased from the food chemical store in Jos, Plateu State, Nigeria. The imported commercial weaning food (Friso gold rice-based milk cereal) was selected on the basis of its popularity and market availability. The friso gold are produced and marketed by Friesland Campina Limited. This commercial weaning food is recommended for children aged 6 months and above. This weaning food was purchased from the super markets in Central Market, Bauchi State, Nigeria.

2.2 Preparation of soy milk: Soybean was prepared using the method described by Nyagaya, (2008). Soybeans were cleaned and soaked in100ml of water for 12hr at room temperature (25℃). After draining the soaking and rinsing with cold water, the beans were ground with 200ml of water of water using a warring laboratory electric blender (HGBTWTG4, USA) and squeezed with muslin cloth and boiled (100℃) for 10mins, package and cooled at temperature 4℃.

2.3 Preparation of almond milk: Almond seed was prepared using the method described by Preeti et al., (2018). Almond seeds were cleaned and soaked in 100ml of distilled water for 12h followed by draining and dehulling to reduce the level of oxalic. The dehulled almonds were ground with water in a blender. The obtained slurry was strained through a two layer muslin cloth to obtain filtrate (almond milk). The almond milk was boiled (100℃) for 10mins, package and cooled at temperature 4℃.

2.4 Preparation of coconut milk: Coconut milk was prepared using the method described Victor and Aniekpeno, (2016). The coconut was dehusked, cracked to separate the meat from the shell while the coconut water was poured into a container and stored for further use. The brown skin of the coconut meat was removed and the meat thoroughly washed and grated using manual grater. The grated coconut meat was mixed in a ratio of 1:1 with a solution containing 75% distilled water and 25% coconut water and allowed to stand in a water bath. The slurry was then pressed and filtered through cheese cloth to remove the solid residue and recover the milk. The milk was pasteurized at 90°C for 30 min and allowed to cool at temperature 4℃.

2.5 Preparation of the weaning food: The date fruits and local white rice were sorted to remove defective portion. They were soaked for 6hr. Carrot and green beans were cleaned and cut into small size. These entire ingredients were blended in food processing blender (Kenwood, USA) for 3-4min. The blended slurry was mixed with soy milk and boiled (100℃) for 3-4mins in sauce pan and transfer into serving bowl for further analysis (first formulation diet). The oat, date fruits and green beans were cleaned, cut and soaked with warm water (for 10mins). It was further autoclave at 121℃ for 15mins. Then, the beetroot was cleaned, peeled and cut into small size. The same procedure was followed for almond milk (second formulation diet). The yellow sweet potatoes, date fruits and green beans were cleaned and cut into small size. It was steamed in pressure cooker until after 2-3 whistling. The ripped banana was sliced and blended with steamed potato and green beans. The same procedure was followed for coconut milk (third formulation diets)

Rice, date, carrot and green beans	Oat, date, beet and beans	Potatoes, date, beans and banana.
↓	↓	↓
Sorting	Cleaning (cold water)	Cleaning
↓	↓	↓
Cleaning (cold water)	Cutting	Peeling and cutting
↓	↓	↓

Soaking (for 6hr)	Soaking	Steaming (2-3 whistling)
↓	↓	↓
Blending	Blending	Slicing (approx. 2cm)
↓	↓	↓
Mixing (soy milk)	Mixing (almond milk)	Blending
↓	↓	↓
Boiling (100 for 3-4mins)	Boiling	Mixing (coconut milk)
↓	↓	↓
Serving	Serving	Boiling

Figure 1: Flow chart for weaning food from age 6-36months

Formulation chats for infant weaning food from 6-36 months old

Formulation Table

Materials	Diet I	Diet II	Diet III
Soy milk	25	-	-
Almond milk	-	25	-
Coconut milk	-	-	25
White rice	50	-	-
Oat	-	50	-
Yellow sweet potatoes	-	-	50
Immature green beans	10	10	10
Date fruits	10	10	10
Carrot	5	-	-
Beet root	-	5	-
Ripe banana	-	-	5

2.6 Proximate composition of formulated diets

The formulated diet products were evaluated for proximate composition i.e. moisture content, crude protein, crude fat, crude fiber, and ash content according to the method described AOAC (2006). The carbohydrate was determined by different.

2.7 Determination of minerals.

The mineral contents were determined after the ash content determination. The ash residue of each formulation was digested with per chloric acid and nitric acid (1:4) solution. The samples were left to cool and contents were filtered through Whatman filter paper 42. Each sample solution was made up to a final volume of 25 ml with distilled water. The aliquot was used separately to determine the mineral contents of Fe and Ca by using an Atomic Absorption Spectrometer (Spectra AA 220, USA Varian).

2.8 Determination of microorganism: Microbiological examination of the weaning foods was performed to assess bacterial, fungal and yeast load under laboratory condition. Standard Plate Count (SPC), fungal and yeast count and enumeration of total coliform and *Salmonella* of the weaning foods were examined according to BAM (1998). Plate count method was employed for the examination of total number of viable microbes present in the sample. Standard plate count (SPC) was estimated by decimal dilution technique followed by pour plate method and spread method for fungus and yeast. Streak plate method was used to isolate the specific micro-organism. Isolation and enumeration of total coliform were per-formed by most probable number (MPN) method using MacConkey broth (Harrigen and MacCance, 1976).

2.9 Sensory Quality Evaluation and Acceptability Test.

The quality of different weaned food products was ranked according to the 9-point Hedonic scale (Meilgaard et al., 2007; Shahzad et al., 2020). The sensory evaluation was carried out at pediatric ward in woman and children primary health center Bauchi metropolis, Bauchi State, Nigeria. The children age group range from 6months -36months old were used to investigate the acceptability of three (3) different formulated diets and commercial baby food (Friso gold rice-based milk cereal) was used as control. Briefing regarding the evaluation was given at the beginning of the session. Each panelist (mothers) was assigned a number for identification purposes and she was responsible to evaluate different samples. Samples were coded using a 3-digit random number and served successively. Panelists were asked to fill out a score sheet for each sample been evaluated in term of taste, mouth feel, aroma and overall acceptability. Each sample attribute was rated using a nine-point Hedonic Scale. The nine points on the Hedonic Scale were: dislike extremely = 1, dislike very much = 2, dislike moderately = 3, dislike slightly = 4, neither like nor dislike = 5, like slightly = 6, like moderately = 7, like very much = 8 and like extremely = 9. The average and mean values of scores for each of attributes was computed and analyzed statistically.

2.10 Statistical Analysis

The proximate composition and sensory analysis of the formulated diets samples were statistically evaluated using t-test.

3.0 Results and Discussion

3.1 Proximate composition of the weaning products

The proximate composition of all weaning products are presented in Table 1.The moisture contents of the formulated diets were ranged; 3.00%-9.50%. The results reveal that the moisture contents of all prepared weaning products were range of moisture contents (5-10%) as described by FAO/WHO guidelines. Moisture contents were shown variation among all treatments from FI- FIII due to the different percentages moisture content in each material used for the treatment. The low moisture content was recorded for the control; this showed that there is a positive effect on its shelf life. The higher the moisture content, the shorter the lifespan. Ash content is an important nutritional indicator of mineral content and an important quality parameter for contamination, particularly with foreign matter (for example, pebbles) (Fennema, 1996). The ash content of the prepared weaning food ranged from1.80- 3.01% respectively. There was significant different in result obtained from prepared formulated –I in compare with commercial weaning food. The obtained results are comparable with the results published by Aderonke *et al*. (2014) for complementary diets prepared from soybean, maize, and pigeon pea. The results of the present study are in the recommended range, according to the Protein Advisory Group of the United Nations System (1972), the ash content of weaning foods should not exceed 5%.

The fat contents of the formulated foods significantly ($p < 0.05$) varies from 2.04% to 3.54%. The prescribed level of fat for formulated foods should not be higher than 10% (Protein Advisory Group of the United Nations System, 1972) because if it's higher than it can influence the stability of the weaning foods. A food sample with higher fat contents more porn to spoilage because fat can undergo oxidative decay, which directs to spoilage and rancidification.

The obtained results indicate that the protein content significantly ($p < 0.05$) varied from 12.62% to 18.34% for formulated weaning foods. The highest protein content was observed in FI. According to WHO/FAO (Reddy et al., 1984), a minimum of 15% protein and a maximum of 25% are needed for the best complementation of amino acids in growth and foods (Sanni et al., 1999). So, this formulation, satisfy the necessary demand for protein for infants. Fiber is an important dietary component in preventing overweight, constipation, cardiovascular disease, and diabetes and colon cancer (Mosha *et al*., 2000). High dietary fiber content has been reported to impair protein and mineral digestion and absorption in human subjects (Whitney et al., 1990). Some fiber related fractions such as polyphenols and non-starch polysaccharides, bind minerals such as Ca, Zn and Fe, making them unavailable for human nutrition (Fairweather-Tait and Hurrell, 1996).

Maximum dietary fiber content of 3.42% were found formulation diet (I) compared to all other formulation. This work is in line with the study of Oche et al. (2017) explained that crude fiber content in the formulated food of soybean and cereals (2.64%) is higher than the mean crude fiber in both proprietary formulae (1.74%) and complies with Protein Advisory Group (PAG) recommendation (P<5%). This implies that the formulated food will better promote lactation, bacterial colonization, and maturation of the gastrointestinal tract, but may interfere with mineral absorption more by adsorption (Temesgen, 2013).The energy content of the prepared weaning food ranged from 398.17 -460.23kcal/100 g respectively. For the commercial weaning foods, the energy content was 420.67 kcal/100 g which was significantly lower than the prepared formulated-I. For all the weaning foods both prepared and commercial, the energy density per 100 g of the food was lower than the minimum energy (483.9 kcal/100 g) recommended in the Codex Alimentarius Standards for weaning/follow up foods (FAO/WHO, 1994).

Table 1: Proximate composition of weaning products

Parameters	Formulation I	Formulation II	Formulation III	Control
Proteins content (%)	18.34±0.20	12.62 ± 0.44	14.10 ± 0.21	16.70 ± 0.34
Moisture content(%)	7.20 ± 0.10	8.20 ±0.25	9.50 ± 0.17	3.00 ± 0.22
Fat content (%)	2.04 ± 0.61	2.31± 0.42	3.54± 0.30	2.70 ± 0.16
Dietary Fiber (%)	3.42 ± 0.24	2.80 ± 0.20	3.20 ± 0.33	1.10 ± 0.14
Ash content (%)	3.01 ± 0.14	2.85± 0.34	1.80 ± 0.57	2.05 ± 0.20
Carbohydrate (%)	66.45 ±0.21	68.04 ± 0.23	78.02 ± 0.21	64.20 ± 0.12
Energy (Kcal)	460.23 ± 0.19	435.20 ± 0.22	398.17 ± 0.45	420.67± 0.18

3.2 Mineral composition of weaning food

The mineral composition of prepare weaning foods are presented in table 2. Calcium is an essential element in infants and young children for building bones and teeth, functioning of muscles and nerves, blood clotting and for immune defense (Whitney et al., 1990). The concentration of Ca of the commercial weaning was significant different (p< 0.05) than prepared weaning foods. Formulated diet (III) has lowest value of 398.24 mg/100 g which was significantly different from the result obtained from weaning formulated I and Formulated diet II by 456.16 and 469.24 mg/100 g, respectively (Table 2). According to the Codex Alimentarius standards, Ca concentrations in weaning foods should not be less than 435.51 mg/100 g of the dry food. On the basis of this standard, the prepared weaning food and the commercial product, except F-III had the Ca concentrations below the minimum amount (435.51 mg/100 g) specified in the Codex Alimentarius Standards (FAO/WHO, 1994). Iron is an essential micronutrient for the synthesis of hemoglobin (an oxygen carrier in the red blood cells), myoglobin (used for muscle contraction) and enzymes/coenzymes (used in various metabolic path-ways). Iron also enhances the body's immune system thus, reducing infections and fostering proper functioning of other organs of the body (Whitney et al., 1990).

Iron concentrations in the prepared weaning foods were ranged from 5.20- 8.44 mg/100 g has presented in (Table2).There was significant different ($p>0.05$) in value recorded for commercial weaning, which has highest of 9.10mg/100g in compare with prepared weaning foods. All the prepared weaning foods had the iron concentrations above the minimum amount (4.8 mg/100 g) specified in the Codex Alimentarius Standards (FAO/WHO, 1994). The result of magnesium (Mg), potassium (K) and phosphorus (P) are shown in table 2, ranged from; 130.20-162.54, 462.88-670.23 and 280.23-420.13mg/100g respectively. Vitamins are substances which are indispensible for the growth and maintenance of good health. According to Codex Alimentarius Standards (FAO/WHO, 1994), the recommended levels (µg/100 kcal) of vitamin A for processed cereal based foods for infants and young children ranged from 60 to 180 µg/100 kcal. On comparing with this standard, the prepared weaning food had vitamin A content ranged; 246.05-261.13 µg/100 kcal and the commercial weaning foods had vitamin A content of 280.01 µg/100 kcal, which were above the minimum limit (60 µg/100 kcal) specified in the Codex Alimentarius standards. The vitamin A content of the commercial weaning food was significantly higher ($p<0.05$) than the prepared weaning foods (Table 2). There was no significant different in the result obtained for vitamin B1 for both prepared weaning foods and commercial weaning food.

The prepared weaning food had vitamin B1 content varied from; 188.40-212.16 µg/100 kcal (Table 2). For the commercial weaning food, had vitamin B1 content of 225.20 µg/100 kcal. The vitamin B1 contents of the locally prepared weaning food and the commercial weaning foods were higher than the minimum amount (60 µg/100 kcal) specified in the Codex Alimentarius Standards (FAO/WHO, 1994). According to Food and Nutrition, Institute of Medicine (IOM, 2005), the recommended daily allowances (RDA) for energy, carbohydrate, protein, fat, vitamin A, vitamin B1, Ca and Fe for 7 to 12 months old infant are 743 kcal, 95 g, 11 g, 30 g, 500 µg, 0.3 mg, 270 mg and 11 mg, respectively. A 100 g portion of prepared weaning food assayed in this study could meet the daily requirements (% of RDA) of energy (398.17-46.23kcal), carbohydrate (66.45-78.02%), protein (12.62-18.34%), fat (2.04-3.54%), vitamin A (246.05-261.13%), vitamin B1 (188.40-212.16%), Ca (462.88-502.47%) and Fe (5.02-8.44%). For the commercial weaning foods, a 100 g portion of the food could meet the daily requirements (% of RDA) of energy (420.67%), carbohydrate (64.20%), protein (16.70%), fat (2.70%), vitamin A (280.01%), vitamin B1 (225.20%), Ca (670.25%) and Fe (9.10%).

Table 2: Mineral composition of weaning foods

Sample	Formulation I	Formulation II	Formulation III	Control
Calcium	456.16 ± 0.12	469.24 ± 2.11	398.26 ± 1.88	480.20 ± 2.02
Iron	8.44 ± 0.08	5.02 ± 0.03	7.68 ± 1.00	9.10 ± 0.40
Magnesium	130.20 ± 1.14	148.02 ± 1.11	162.54 ± 0.09	160.16 ± 1.68
Potassium	462.88 ± 1.08	502.47 ± 2.14	487.20 ± 3.12	670.23 ± 1.12
Phosphorus	280.23 ± 1.04	356.89 ± 1.16	342.08 ± 2.01	420.13 ± 3.00
Vitamin A	258.01 ± 0.88	261.13 ± 1.00	246.05 ± 0.44	280.01 ± 0.64
Vitamin B_1	212.16 ± 0.18	188.40 ± 0.12	194.45 ± 0.24	225.20 ±1.14

3.3 Microbiological quality of weaning foods

The overall bacteriological status of the prepared weaning foods was presented in (Table 3). The obtained results revealed that the total viable bacterial count, coliform count and presence of *Salmonella* in cfu/ml were ranged: $1.0 \times 10^1 – 1.4 \times 10^1$, $< 0.1 \times 10^1$ to $< 0.2 \times 10^1$ and 1.0×10^2 - 1.2×10^2 respectively. However, the total yeast and mold count were absolutely not detected in all the weaning foods. The low counts of the examined foods indicated adequate thermal process, good quality of raw materials and as a result of the good different processing conditions under which the production of foods was carried out. This result is line with the work of Satter *et al*., (2013).

Table 3: Microbial quality of weaning foods

Sample	Formulated I	Formulated II	Formulated III
Total bacteria count	$< 1.1 \times 10^4$	$< 1.4 \times 10^1$	1.0×10^1
Yeast	NIL	NIL	NIL
Mold	NIL	NIL	NIL
Coliform	$<0.1 \times 10^2$	$< 0.2 \times 10^1$	$<0.1 \times 10^1$

Salmonella	1.2×10^2	1.1×10^4	1.0×10^2

The sensory evaluation results for all the treatments are significantly ($p < 0.05$) varies and shown in Table 4. The obtained results confirm the average likeness of the formed weaning foods for mouth feel, appearance, color, taste, and aroma. The mean scores ranges of characteristics assessed were: taste (9.0. to 6.4), aroma (9.2 to 6.4), mouth feel (8.5 to 6.8), color (9.2-8.8), and appearance (8.4 to 8.0). The mean score for mouth feel and aroma in weaning formula mixed with soy milk were significantly difference ($p < 0.05$). This might be as a result of “beany” flavor. Similar findings were also been reported by Bernard et al. (2016) who reported that the taste values, flavor values, texture scores, and overall acceptability scores of all diets ranged between like slightly and like moderately.

Table 4: Sensory attribute of the weaning foods

Parameter	Formulated I	Formulated II	Formulated III	Control
Taste	6.40 $\pm$ 0.10	8.20 $\pm$ 0.10	8.90 $\pm$ 0.20	8.99 $\pm$ 0.08
Aroma	7.40 $\pm$ 0.30	8.00 $\pm$ 0.20	9.00 $\pm$ 0.22	8.75 $\pm$ 0.14
Mouth feel	6.80 $\pm$ 0.10	7.20 $\pm$ 0.10	8.50 $\pm$ 0.41	8.20 $\pm$ 0.20
Color	9.20 $\pm$0.20	9.00 $\pm$ 0.20	8.86 $\pm$ 0.12	8.56 $\pm$ 0.11
Appearance	8.10 $\pm$ 0.20	8.45 $\pm$ 0.10	8.20 $\pm$ 0.24	8.86 $\pm$ 0.18

4. Conclusions

The possibility of occurring PEM (Protein Energy Malnutrition) during this transitional phase when children are weaned from liquid to semi-solid or fully adult foods where the growing body of children needs nutritionally balanced and calorie-dense supplementary food such as weaning foods in addition to mother’s milk. The proximate compositions of all the formulated and commercial weaning products were varied significantly. The formulated diet (I) product was significantly different in term of taste and mouth feel. All other samples were generally accepted by sensory panelists. It is therefore recommended that, soy milk can be treated with $NaH(CO)_3$ salt during the production in other to lessen the “beany” flavor in soy milk. All these milks have several benefits but it can’t be substituted for breast milk.

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