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Research article

Formulation of nutrient enriched germinated wheat and mung-bean based weaning food compare to locally available similar products in Bangladesh

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ABSTRACT

Poor weaning practice and malnutrition among under 5 (yrs) children are still major public health issues in Bangladesh. This study aimed to develop a cheap and nutritious weaning food for the children of Bangladesh. For this purpose, three weaning formulations of Q1, Q2, and Q3 with different ratios of germinated wheat, germinated mung-bean, and soya-bean, and a constant amount of sweet potato, sugar, salt, and milk flavor were processed and evaluated. The prepared formulations were investigated for proximate composition and sensory evaluation and compared with six commercial weaning food products. The proximate composition values indicated that the fat content of formulated foods ranged between 09.29% and 11.40%. The carbohydrate content was ranged between 52.80% and 61.20%, which was low compared with commercial ones. The protein content of the formulated foods was 20.33%–27.70%, and that was approximately two times more than available commercial foods. The energy content was also more than locally available commercial weaning foods, which were 411.40 ± 1.51 kcal to 419.30 ± 1.12 kcal. Sample Q2 had an 8.4 acceptance score in sensory analysis of a 9-point hedonic scale scorecard, which made it more acceptable than the other two samples. The values of mineral elements (Na, K, Fe) were similar to all analyzed varieties of commercial weaning foods. This nutrient-enriched weaning food will easily be affordable for the people of developing countries like Bangladesh. The results showed that the formulated weaning food had the desired characteristics of a weaning food; hence, it could decrease malnutrition in children.

1. Introduction

Breast milk is the best food for infants and supports them with all necessary nutrients for babies' normal mental and physical growth. It provides polyunsaturated fatty acids, proteins, immunological and bioactive compositions, and all essential minerals in a readily absorbable form (Ballard and Morrow, 2013). But human milk alone is no longer sufficient to meet the nutritional needs of the growing babies after 6 months of their age (Hampson et al., 2019). Many mothers, especially in developing countries, breastfeed for 12 months while others breastfeed for up to 24 months (WHO, 2007). So, they need additional foods to support their growing nutritional demands besides mother's milk, which is known as weaning or complementary feeding, and begins from 6 months and continues to 24 months of age or beyond (World Health Organisation, 2019). It is the transitional period from exclusive breastfeeding to the regular family foods of the children. Weaning is the introduction of mashed or semi-solid adult meals to the babies, and it needs to be balanced and nutritionally well-adjusted for the babies (Cichero, 2016; Koletzko et al., 2019). Weaning foods should be rich in calories and good-quality protein, vitamins, and minerals. These foods should be precooked or well processed and low in indigestible fiber content so that babies can easily swallow and digest it (Abeshu et al., 2016). Generally, weaning foods are two types: homemade complementary foods that are broadly the same as those consumed by the rest of the adult family members and commercial foods, which are designed to meet the specific nutritional needs of the infants. Complementary foods should be free from anti-nutritional factors (García et al., 2013). Weaning is the crucial period of life when malnutrition starts in many children, which significantly contributes to the high prevalence of malnutrition in children under 5 years of age. According to WHO, 40% of the children are

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malnourished in low-income countries (World Health Organization, 2018). Malnutrition in infancy has a significant impact on the world's population; more than 800 million children suffer from malnutrition complexity, and every year almost 3.1 million children die from malnutrition (UNICEF, 2018; Fongar et al., 2019). Numerous studies have reported that in developing countries, weaning foods are low in essential macronutrients and micronutrients for babies, which leads to malnutrition, and Protein-energy malnutrition (PEM) is still a tenacious problem for children in developing countries (Ijarotimi, 2013; Wu and Xu, 2018). Generally, PEM occurred at the transitional phase when children are introduced to liquid or semi-solid family regular foods. In this case, weaning is the best opportunity to prevent malnutrition and promote optimal health and behavioral development, mainly in developing countries (Reiher and Mohammadnezhad, 2019). On the other hand, the too late or too early introduction of weaning foods to children can significantly lead to the prevalence of malnutrition (Nagahori et al., 2017). Complementary foods should be designed to meet the nutritional requirement of growing children. Poor and inadequate amounts of weaning foods can negatively affect children's usual mental and physical development; hence, increase infant morbidity and mortality.

In developing countries like Bangladesh, infants suffer from malnutrition, including PEM, stunting, wasting, vitamin A and Iodine deficiency due to faulty weaning practices or nutritionally low weaning foods (Tette et al., 2016). Many previous studies have found the proportional relation between growth failure and faulty weaning practices (Vyas et al., 2014; Arthur et al., 2015). According to the WHO database, the mean weight of the children starts to fall rapidly at age 3 months and continues until at the age of 19 months in Bangladesh (World Health Organization, 2010). These nutrition-related issues can be solved by giving them nutritious weaning foods. Most of the traditional weaning foods in Bangladesh are deprived of protein or calorie content (Satter, 2013). Besides, locally available commercial complementary foods are specific for the nutritional needs of the babies, and prices are generally 10 to 15 times higher than the staple foods (Bahlol et al., 2007). As about one third of the population of Bangladesh are living under the poverty line, they cannot afford commercial weaning foods. Therefore, the formulation of weaning foods based on locally available cereals and legumes has been suggested by several studies to prevent malnutrition (Muhimbula et al., 2011; Onoja et al., 2014). Cereals are the primary energy sources in Bangladesh, which are excellent sources of methionine, cysteine, sulfur-based amino acids, and vitamin-B complex; besides, legumes are adequate in lysine and protein content (Tien Lea et al., 2016; De Jager et al., 2019). Moreover, germination of the cereals and legumes improves its lysine contents and amino acids composition and increases the digestibility of the infants (Nkhata et al., 2018). Germination can also increase the availability of minerals. Weaning foods can be formulated by mixing local cereals, legumes, and sweet potatoes at low cost, which can support the children with all necessary macro and micronutrients (Dary and Hurrell, 2006).

Considering these entire problems, this current study is therefore designed to formulate a low-cost nutritious weaning food from the combination of locally available and cheap sources like wheat, mung bean, soya bean, and sweet potatoes. This food is sufficient to meet the nutritional requirement of the growing children at their weaning period.

2. Materials and methods

The study was carried out in the laboratory of the Quality control research section, Institute of Food Science & Technology, Bangladesh Council of Scientific & Industrial Research (BCSIR), Dr Kudrat-E-Khuda Road, Dhanmondi, Dhaka-1205. The entire procedure of the formulation of weaning food is illustrated in Figure 1 as a flow sheet that commenced with collecting necessary ingredients and six commercial weaning foods and ended up with the statistical analysis of obtaining data.

2.1. Samples and raw materials collection

Six comparative weaning food samples were collected from the local departmental store of Gulshan, and Dhanmondi, Dhaka, Bangladesh. Besides, all other weaning food ingredients like wheat, mung-bean, soya bean, sweet potato, sugar, milk powder, salt, and milk flavors were collected from local food markets of Newmarket, Dhaka, Bangladesh.

2.2. Preparation of flour

The collected wheat and mung-beans were cleaned by removing impurities and washed in running water for three times, separately. After that, the washed seeds were soaked in water for a minimum of 12 h in separate containers, and the water-seeds ratio was 3:1 for both wheat and mung-beans. Then the drenching water was drained off and washed again by using sterile water to inhibit the chance of growth of microorganisms during germination. The soaked seeds were covered with a moist cloth to germinate for 48 h, and the whole system was kept at ambient temperature. The wheat and mung-bean sprouts were dried for 15 h at 60 °C. The germinated seeds were milled separately by using an electric grinder to make delicate powder and then sieved. The two types of flour were kept in airtight containers, distinctly and stored at room temperature.

Soya beans were cleaned by excluding unnecessary particles and then washed in water for three times. The clean and washed soya beans were soaked in water for 12 h. Soaked soybeans were de-hulled and then washed again. These soybeans were boiled in an adequate volume of water to make them more digestible. Then boiled soya beans were dried for 12 h at 60 °C temperature and ground by using a grinder for making soya flour. The soya flour was sieved and kept in an airtight plastic bottle until further use.

The collected sweet potatoes were hand shorted to exclude infected or damaged ones and cleaned in running water. The cleaned potatoes were then cooked until they got soft-flesh. The soft potatoes were hand-peeled and sliced into small cubes. After that, the sliced sweet potatoes were dried at 60 °C for 12 h in the oven. The dried potato cubes were milled for delicate powder and sieved by using a sieve. Then the sweet potato flour was stored in an airtight bag at room temperature.

2.3. Formulation of weaning foods

Three different weaning foods were formulated as Q1, Q2, and Q3. The percentage of germinated wheat flour, mung-bean, and soya flour were different in the different formulated products. The germinated wheat flour and mung-bean cover 57% of each formulated weaning food, where the amount of wheat flour was increased by 25%. On the other hand, milk powder, sugar, salt, and milk flavor were added to the food sample at the same percentage. Then the ingredients were blended to obtain desirable texture, consistency, flavor, and overall acceptability. The milk flavor was added during the mixing process as a flavor enhancer. The compositions of the three different germinated wheat–mung bean (GWM) based formulated weaning foods are shown in Table 1.

2.4. Determination of proximate and mineral compositions

Proximate and mineral compositions of the formulated and local weaning foods were determined by AOAC (2005) method. The total carbohydrate content of the sample was calculated by difference of total carbohydrate, protein fat, crude fiber, ash and moisture from original weight as shown in Eq. (1) rather than direct analysis. At first, the weight of moisture, ash, protein, fat, and crude fiber was determined individually in the sample, then summed those weights and subtracted from the total weight of the sample (Mahmud et al., 2019).

$$\% \text{ of carbohydrate} = [100 - (\text{Moisture\%} + \text{Ash\%} + \text{Protein\%} + \text{Fat\%} + \text{Crude fiber\%})] \quad [1]$$

The energy content of both local and formulated samples was calculated by Atwater's conversion factor from their carbohydrate, protein, and fat content in gram as shown in Eq. (2) rather than direct analysis AOAC (2005).

$$\text{Energy content (Kcal/100 g)} = [(\text{carbohydrate\%} \times 4) + (\text{Fat\%} \times 9) + (\text{protein\%} \times 4)] \quad [2]$$

2.5. Sensory analysis

The trained taste panelists examined the sensory attributes of the formulated samples. Before the sensory test began, written consent was

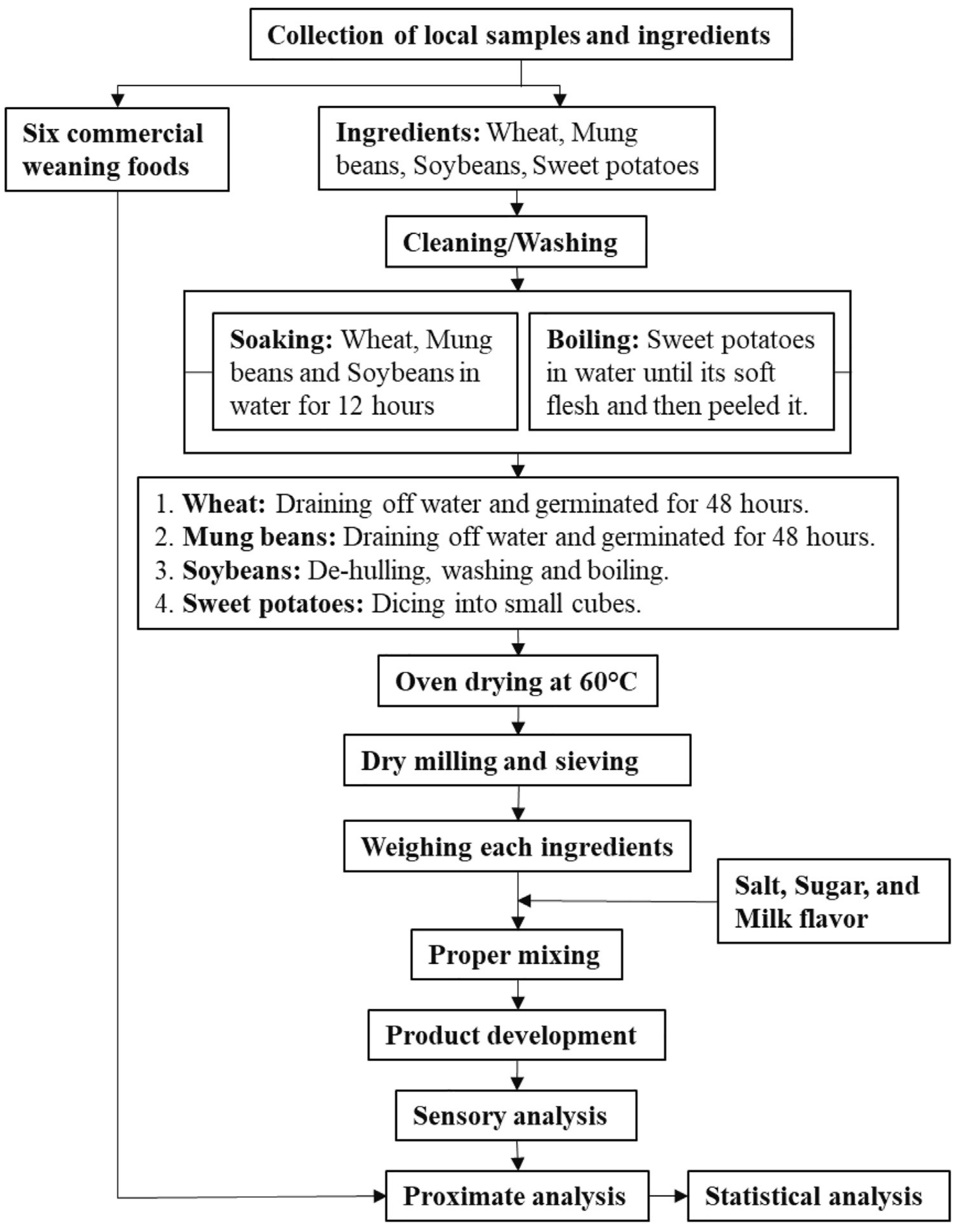

Figure 1. Flow chart for the weaning foods formulation.

Table 1. Compositions of three GWM based formulated weaning food samples.

Ingredients	Sample Q1	Sample Q2	Sample Q3
Germinated Wheat Flour (%)	32	25	41
Mung-bean Flour (%)	25	32	16
Soya Flour (%)	16	16	16
Sweet potato Flour (%)	8	8	8
Milk powder (%)	8	8	8
Sugar (%)	9.65	9.65	9.65
Salt (%)	1	1	1
Milk flavor (%)	0.35	0.35	0.35

taken from each panelist to confirm that they were willingly attended to the sensory analysis. At first, 25 g of weaning foods of each sample were poured in 75 ml lukewarm water into a transparent glass bowl. The samples were presented to 10 trained panelists selected from the institute's staff members of food science and technology (IFST), BCSIR. Then they were asked to rate the three samples (Q1, Q2, and Q3) based on their flavor, taste, texture, color, mouthfeel, and overall acceptancy by using a 9-point hedonic scale (1 = disliked extremely, 2 = dislike very much, 3 = disliked moderately, 4 = dislike slightly, 5 = neither disliked nor liked, 6 = liked slightly, 7 = like moderately, 8 = liked very much, 9 = liked very extremely).

2.6. Statistical analysis

The obtained data were presented as Mean ± Standard Deviation of triplicate analysis. A comparison of formulated Q2 products was compared with commercial products using Duncan's Multiple Range Test (DMRT). The statistical analysis was done by using the software IBM Statistical Package for Social Sciences (SPSS) v 26 and GraphPad Prism v 8.

3. Results

The proximate and mineral compositions of three formulated weaning foods (Q1, Q2, and Q3) have been illustrated in Table 2. Among these three weaning foods, the protein content was the highest in the sample Q2, which was 27.70 %. The highest amount of fat (11.40%) and fiber (3.50%) content were found in the Q1sample. On the other hand, the lowest level of fiber content was found in the Q3 sample. Even though sample Q3 had the maximum amount of 61.20% carbohydrate content (61.20%), which was the maximum than the other two samples, but its energy content was the lowest, 411.40 Kcal. Whereas the energy content in 100 g of sample Q1 and Q2 were 419.30 Kcal and 416.65 Kcal, respectively. However, both sodium and iron were high in sample Q1, which were 322 mg and 6.80 mg in 100 g of the sample, correspondingly. In the Q2 sample, 542.45 mg potassium was found, which was the highest amount than the Q1 and Q3 samples. Moreover, the amount of iron was detected 6.80 mg, 6.78 mg, and 6.70 mg in the sample Q1, Q2, and Q3, respectively.

The result of sensory analysis of the three formulated weaning foods has been demonstrated in Figure 2. Among all three formulated foods, the color, texture, flavor, taste, and mouthfeel of the sample Q2 had the highest score, and the overall acceptance of the sample Q2 was 8.4 on a 9-point hedonic scale. The overall acceptance of the other two samples was the same, and that was 7.2 out of 9. So, the superiority of the sample Q2 made it the most preferred one.

Table 3 compares the proximate compositions of the formulated sample Q2 with the locally available six weaning foods. In commercial weaning foods, the highest amount of protein was found in sample P6 that was 15.54 g in 100 g of the sample, whereas the formulate sample Q2 had 27.70% protein. A high percentage of protein was found due to the more legumes in sample Q2 than the commercial weaning foods. Moreover, local sample P1 had the highest fat content than the other five locally available commercial weaning foods. On the other hand, formulated sample Q2 had 10.6% fat content. Another fact worth noticing that the fiber content of sample Q2 was 3.15%, while the fiber proportion was lower than 1% in all local complementary foods except sample P5 (1.44%). In formulated and local weaning foods, the highest amount of carbohydrate was found in sample P3 (76.92%), while the formulated sample Q2 had 52.80% carbohydrate. Considering the local samples' energy content, P2 had 405.94 Kcal in 100 g while sample Q2 had 416.65 Kcal energy. Though the carbohydrate percentage was low in formulated sample Q2, the increased concentration of protein and fat are the primary sources of more energy than the commercial one.

The comparison of the mineral compositions of formulated sample Q2 with local weaning foods has been shown in Table 4. The Sodium content was high in local sample P6 that was 360 mg, whereas 312 mg was found in the formulated sample Q2. Potassium (K) was highly presented in sample Q2 than the other six commercial samples, which was 542.45 mg. Moreover, local sample P3 had the highest potassium among them,

Table 2. Proximate and minerals composition data of GWM based formulated weaning foods.

Samples	Q1	Q2	Q3
Proximate compositions (%)			
Moisture	03.70 ± 0.03	03.50 ± 0.07	03.30 ± 0.02
Ash	02.08 ± 0.08	02.33 ± 0.05	02.36 ± 0.10
Protein	23.80 ± 1.02	27.70 ± 0.16	20.33 ± 0.07
Fat	11.40 ± 0.21	10.60 ± 0.23	09.29 ± 0.10
Fibre	03.50 ± 0.00	03.15 ± 0.00	03.10 ± 0.01
Carbohydrate	55.60 ± 0.10	52.80 ± 0.09	61.20 ± 0.21
Energy (Kcal)	419.30 ± 1.12	416.65 ± 1.08	411.40 ± 1.51
Mineral compositions (mg/100g)			
Sodium (Na)	322 ± 1.93	312 ± 1.10	317 ± 1.30
Potassium (K)	515.21 ± 0.19	542.45 ± 0.07	523.46 ± 0.02
Iron (Fe)	6.80 ± 0.02	6.78 ± 0.01	6.70 ± 0.02

Table 3. Comparison of proximate compositions (mean ± SD) of locally available weaning foods with the formulated best one (Q2).

Sample	Moisture (g/100g)	Ash (g/100g)	Protein (g/100g)	Fat (g/100g)	Fibre (g/100g)	Carbohydrate (g/100g)	Energy (Kcal/100g)
Q2	3.50 ± 0.07	2.33 ± 0.05	27.70 ± 0.16*	10.6 ± 0.23*	3.15 ± 0.01*	52.80 ± 0.09	416.65 ± 1.08
P1	3.40 ± 0.03	3.24 ± 0.02	15.25 ± 0.10	6.14 ± 0.19	0.72 ± 0.03	71.24 ± 0 .16	401.22 ± 1.30
P2	2.87 ± 0.07	1.88 ± 0.03	15.14 ± 0.12	5.33 ± 0 .10	0.43 ± 0.02	74.35 ± 0.11	405.94 ± 1.70
P3	2.49 ± 0.04	1.98 ± 0.01	13.87 ± 0.01	4.19 ± 0.16	0.55 ± 0.07	76.92 ± 0.15	400.87 ± 1.20
P4	3.30 ± 0.08	3.00 ± 0.04	14.02 ± 0.03	3.58 ± 0 .18	0.05 ± 0.00	75.84 ± 0 .20	392.47 ± 0.78
P5	2.85 ± 0.06	2.87 ± 0.05	15.52 ± 0.17	6.02 ± 0.12	1.44 ± 0.08	71.30 ± 0.10	401.46 ± 1.50
P6	3.85 ± 0.02	2.20 ± 0.01	15.54 ± 0.26	5.95 ± 0.21	0.31 ± 0.01	72.14 ± 0.15	404.27 ± 1.60

*$p < 0.05$ when compared Q2 products with locally available six commercial products (P1–P6).

Table 4. Comparison of Mineral compositions (mean ± SD) of locally available Weaning foods with the formulated one.

Samples	Sodium (Na) mg/100g	Potassium (K) mg/100g	Iron (Fe) mg/100g
Q2	312 ± 1.10	542.45 ± 0.07	6.8 ± 0.01
P1	310 ± 0.11	494.43 ± 0.08	6.6 ± 0.03
P2	130 ± 0.07	516.80 ± 1.92	6.8 ± 0.09
P3	140 ± 0.08	520.72 ± 1.98	6.9 ± 0.20
P4	320 ± 0.12	510.50 ± 1.80	6.2 ± 0.01
P5	325 ± 0.15	511.88 ± 1.89	3.7 ± 0.84
P6	360 ± 0.13	512.04 ± 1.90	3.2 ± 0.15

which was 520.72 mg. Further, both in formulated and local samples, iron was highly found in sample P3 (6.9 mg), while sample Q2 and P2 had 6.8 mg iron. Besides the mother's milk, the iron recommendation can be fulfilled with this formulated weaning food.

4. Discussion

The perspective of this current research was to formulate a cheap and nutritious weaning food from the locally available cereals and legumes. Germinated wheat flour and Mung-bean flour were the two main ingredients among the others, and we formulated three samples (Q1, Q2, and Q3) with different proportions of them. A trained panelist with ten members then examined the sensory attributes of three samples according to the 9-point hedonic scale. The sample Q2 received the highest overall acceptance score among them. The proportion of wheat and mung-bean flour in sample Q2 were 25% and 32%. On the contrary, a weaning food formulated in Ghana, rice was used as a staple cereal, and the proportion was 22.5% (Amankwah et al., 2009), which was slightly closed to the percentage of cereal in sample Q2. Some parallel studies on the weaning foods, formulated from locally available staple cereals and legumes in Nepal (Adhikari and Twayanbasu, 2014), Ghana (Amankwah et al., 2009), Cameroon (Achidi et al., 2016), and Nigeria (Adenuga, 2010) also showed a good level of public acceptance. A good-quality weaning food has balanced protein and calorie contents, adequate vitamins and minerals, and low fiber with a soft texture. A previous study on complementary feeding in London reported that high protein intake at age 6–24 months is positively associated with the proper growth of the children (Jabri et al., 2020). However, in formulated sample Q2, the protein was 27.70 g in 100 g, which was the highest protein content than the other six market available weaning foods. A weaning food formulated from the cowpea and local cereals in Nigeria had 25.31% protein, less than our formulated Q2 sample (Bassey et al., 2013). On the other hand, a low-level intake of fat has a negative impact on cognitive development and the immune functions of the children, and adequate fat intake is good for mental development and the immune system (Michaelsen et al., 2017). Table 3 shows that fat content was found in the highest amount in sample Q2 compared to the locally available commercial weaning foods, which was 10.60 g per 100 g of sample, where the ideal amount of fat in weaning food should be up to 10% (Sajilata et al., 2002). Nevertheless, legumes are good sources of unsaturated fatty acids; for that reason, this formulated sample (Q2) is the richest in unsaturated fatty acids than the other formulated and local weaning foods (Polak et al., 2015).

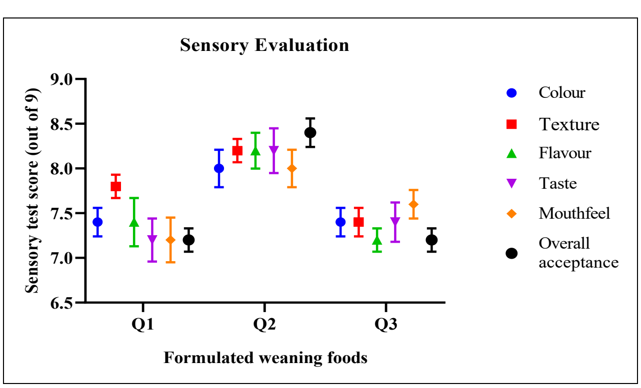

Figure 2. Sensory evaluation (Mean ± SE) of three formulated weaning foods.

Moreover, the first year of life is important for the growth of gut microflora, and low dietary fiber can inhibit their growth; and low fiber diet also has implications for child constipation and appendicitis (O'Keefe, 2019). The fiber content in our best sample was 3.15%, while the highest-fiber was found in the commercial sample at 1.44%. Some previous studies stated that children at complementary feeding age need more energy to cope up with their daily requirements (Abeshu et al., 2016). Further, the carbohydrate is needed as an energy source of the children, but the high consumption of the carbohydrates lead to child obesity (Sartorius et al., 2018). However, formulated sample Q2 showed a low carbohydrate percentage than the compared market available children's complementary foods. The number of carbohydrates in the commercial sample was over seventy percent; on the contrary, sample Q2 had only 52.80%. However, the lacking of energy supply makes them weak and retards their normal physiology (Miller et al., 2011). The highest energy level was estimated in local weaning foods 405.94 Kcal/100 g, while in our formulated sample, Q2 had 416.65 Kcal.

The recommended sodium for children at the complementary feeding period is 400 mg/day (Cribb et al., 2012; Strohm et al., 2018). Sodium is desired for the water balance in the body, for the proper nerve and muscle function; on the contrary, the lower or higher amount of sodium intake in children increases blood pressure and leads to hypertension in adult age (Roumelioti et al., 2018). The high amount of sodium was assessed in the local sample, 360 mg/100 g, where the sodium content in sample Q2 was 312 mg. Potassium is another crucial micronutrient for the baby's normal physiology, which helps to regulate the fluid balance in the body, maintain acid and water balance, and support the normal growth of the children (Pohl et al., 2013). The recommendation of potassium intake for children is 750 mg/day (Turck et al., 2016), and an inadequate amount of potassium intake causes hypokalemia, abnormal heartbeat, and feel weak muscle (Kjeldsen, 2010). In sample Q2, potassium was found 542.45 mg in 100 g of food, while in the commercial complementary foods, the highest amount was assessed 520.72 mg. However, According to the WHO, the daily iron recommendation for children age 6–23 months is 10–12.5 mg (WHO, 2016), where the amount of iron of sample Q2 had 6.8 mg/100 g. A previous study in Cameroon on formulated complementary food showed a higher iron content (24.12 mg/100 g) than the current study (Achidi et al., 2016). On the contrary, several studies have reported the adverse effects of a high amount of iron intake, including growth retardation, interactions with copper and zinc, transformed gut microflora to pathogenic bacteria, and poor cognitive development (Alexeev et al., 2017; Lönnerdal, 2017). Considering the sensory evaluation and the nutrients content, formulated sample Q2 is the best than the other prepared and locally available commercial weaning foods.

5. Conclusion

In Bangladesh, commercial weaning foods are relatively expensive, and the majority of people cannot afford them for their babies. Most children do not have proper nutrition supply at the weaning period and are vulnerable to malnutrition. That is why it is essential to prepare nutritionally well-adjusted weaning foods from locally available cheap raw materials. From this research work, it may be concluded that weaning food can be prepared using germinated wheat and mung-bean flour, sweet potato flour, and soya flour to meet the macro nutritional needs of babies. From the sensory evaluation and proximate analysis, the Q2 sample was found the best weaning food than the other two samples Q1 and Q3. It will be potentially suitable for use as weaning foods, both at the home and commercial levels. This inexpensive and nutritious formulated weaning food could effectively ameliorate the common symptoms associated with the incidence of protein-energy malnutrition.

Declarations

Author contribution statement

Sharmin Jahan: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data.

Fahiza Bisrat, Shompa Sharmin Khan: Performed the experiments; Analyzed and interpreted the data.

M. Omar Faruque: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Md. Jannatul Ferdaus: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Tasnim Farzana: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data included in article/supplementary material/referenced in article.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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