



A STUDY ON THE FABRICATION, NUTRITIONAL EVALUATION AND ACCEPTABILITY OF WEANING MIX

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ABSTRACT

Complementary feeding, also known as weaning, mixed feeding, or introduction of solid foods, should begin for infants by six months of age (26 weeks) but not before 17 weeks. The formulation and development of nutritional weaning foods from local and readily available raw materials has received a lot of attention in many developing countries. The study aimed to develop a weaning mix from locally available ingredients like red rice flakes, ragi milk powder, roasted bengal gram, sesame, groundnut, and jaggery, which is packed with loads of nutrients, making it a healthy and tasty food for babies, toddlers, and growing children. Red rice flakes are gluten and cholesterol free. It can be easily digested by people of all age groups. It is an ingredient with the highest composition of iron and when given to infants regularly, it can prevent or treat anaemia. The developed weaning mix contains ragi milk powder which is the best alternative to the infants with lactose intolerance. Three different variations of weaning mix was developed with different proportion of the same ingredients and organoleptically accepted variation of the weaning mix was analysed for its nutritional and phytochemical composition. The results showed significant presence of protein, fibre, iron, zinc, thiamine and niacin. The presence of phytochemicals such as flavonoid and phenolic compounds was also evident.

Keywords: Complementary foods, Ragi milk powder, Red rice flakes, Weaning mix

INTRODUCTION

Weaning is considered a prime process when the child is around six months of age, the period, when the nutritional support of breast milk alone is found to be insufficient for the baby to meet its demand for growth and development [1]. Nutrition through external foods (weaning foods) becomes essential and the characteristics of the ingredients present in those foods play a crucial role in determining the quality of weaning foods. Ready availability, highly nutritious, easily digestible, low cost and acceptability are the important parameters to be noted when formulating or choosing a weaning food. The ingredients utilized in this study possess all these attributes which are detailed below.

Red rice flakes (*Oryza sativa*) is a healthy food with high nutritious worth and quickly absorbable form of rice products widely produced in India. It is utilized to make light bites and rapid feasts types and knock off as a staple breakfast in north – eastern locales. Rice flakes are locally perceived by many names like aval, avalakki, poha, chivda and beaten rice. Red rice flake is unpolished so it is wealthy in unrefined starches (carbohydrates - 86.22 g) [2]. Ragi or finger millet (*Eleusine coracana* L.) has customarily been a significant millet staple

dinners in the parts of eastern and central Africa and India. Traditionally in India, finger millet was handled through techniques like crushing, malting, and aging for making products like drinks, porridges, idli (Indian matured steamed cake), dosa (Indian matured pan cake) and roti (unleavened flat bread). Finger millet has the most elevated amount of calcium (344 mg %) and potassium (408 mg %). It has higher dietary fiber, minerals, and sulfur containing amino acids contrasted with white rice [3]. Bengal gram (*Cicer arietinum*) is a vital source of protein in the food plan of the overall Indian populace. India delivers practically 66.9% of the entire yearly world Bengal gram assembling of around 8.9 metric million tons. Roasted Bengal gram (*Cicer arietinum*) flour is utilized in numerous product like in breakfast, nibble food sources and dietary supplement food as a result of its reasonable cost and availability of proteins, carbohydrates, minerals, vitamins, dietary fiber, folate, β -carotene and wellbeing advancing unsaturated fats. Bengal gram is an extraordinary protein source with appropriate scopes of the most essential amino acids [4]. Sesame seeds are fundamental source of oil, protein, carbohydrates, and minerals for human [5].

Groundnut or peanuts are the 2nd most reaping oil seed, offering an important supplement source to the total populace. They are phenomenal sources of nutrients from oil practically in all tropical and sub-tropical countries of the world [6]. Gur (Jaggery) is a standard sugar made by the congeration of sugarcane squeeze and has all minerals and nourishing vitamins existing in sugarcane juice, and it is perceived as best form of sweetness. India is the best maker and benefactor of jaggery, more than 70% is produced in India [7]. Thus, this study is

framed with the objective of formulating a weaning mix at low cost from locally available foods and to assess its acceptability, nutritive value and phytochemical parameters.

MATERIAL AND METHODS

Procurement and processing of raw materials

Different ingredients for the development of weaning mix like red rice flakes, ragi, roasted bengal gram, groundnut, sesame and jaggery were procured from the local market in Salem, Tamil Nadu.

Table 1: Proportion of ingredients to develop weaning mix

Ingredients (g)	Control	Variation 1	Variation 2	Variation 3
		Level of Incorporation (%)		
Red rice flakes	-	25	30	35
Ragi milk powder	50	25	30	35
Rice flour	50	-	-	-
Roasted Bengal gram	-	25	15	15
Roasted groundnut	-	10	10	5
Sesame	-	10	10	5
Jaggery	-	5	5	5

The purchased raw materials were checked for any infestation or damage. The red rice flakes, roasted Bengal gram, groundnut and sesame free from damage were then roasted and ground to fine powder. The ragi was soaked for overnight and ground, then the ragi milk was extracted [8] and dried into powder. Jaggery was also ground to fine powder. The proportion of ingredients used for each variation is shown in **Table 1**.

Acceptability of the product by organoleptic evaluation

The developed weaning mix was subjected to organoleptic evaluation to assess the maximum acceptability of the products. The quality attributes in terms of colour, appearance, flavour, texture and overall acceptability were evaluated by untrained judges using score card with 9-point hedonic scale.

Nutritional analysis of the accepted variation of weaning mix

The nutritive value of accepted variation of weaning mix was assessed using NSI diet

calculator and laboratory procedures. The nutrient assessed includes energy, carbohydrate, protein, fat, dietary fiber, iron, calcium, sodium, potassium, zinc, folic acid and vitamin A (Beta carotene).

Phytochemical analysis of the accepted variation of weaning mix

The phytochemicals like total phenolic and total flavonoids compounds of the accepted variation of weaning mix was assessed.

Statistical analysis

The data obtained from the various experiments were subjected to descriptive analysis, using SPSS software.

RESULTS AND DISCUSSION

Organoleptic evaluation of the developed variations of weaning mix

Results of Duncan multiple range tests showed that there was a significant different ($p \leq 0.05$) between the control and all the variation of weaning mix on the basis of colour, appearance, texture, taste, mouth feel and overall acceptability. Results of sensory evaluation of the weaning mix prepared with three variations are presented in the **Table 2**. It is evident that the Variation 3 obtained maximum score for all the assessed organoleptic parameters, representing that variation 3 was highly accepted by the panel members.

From **Table 3** it can be concluded that the mean of variations are significantly different between the groups. Also the p-value is 0.000 which is lower than 0.05, it can be concluded that there was a significant difference in the overall acceptability of the developed variations. The overall acceptability score exhibited was highest (8.4) in variation 3.

The related experimentation performed by Mohammed A.Satter *et al.*, 2013 on development of nutritionally enriched instant weaning food and its safety aspects included rice flakes, skim milk powder, butter, vitamin premix and sugar as the major ingredients [9].

Also, the exploration done by Imtiaz *et al.*, 2011 [10] articulated the mean sensory score for overall acceptability of weaning mix made from sprouted wheat and mung bean seed flour is ranged from 6.45 to 7.45, for overall acceptability. The weaning formulation in this exploration depend absolutely on commonly devoured, more affordable food substances domestically on hand in Bangladesh. The fact that these plan are economical, without problems on hand and nutritious should make them tremendous in solving some of the diet issues going through kiddies and children. The goal of their study was to improve weaning meals for

the young people of Bangladesh with the aid of using handy resources.

Since, the organoleptically accepted weaning mix was variation 3, it was further

subjected to nutritional and phytochemical analysis.

Nutritional analysis of the accepted variation of weaning mix

Table 2: Mean organoleptic values of the developed weaning mix

Variations	Colour	Appearance	Taste	Texture	Mouth Feel
Control	8.5±0.71 ^c	8.5±0.71 ^c	7.6±0.52 ^b	8.5±0.53 ^b	8.5±0.53 ^b
Variation 1	7.5±0.53 ^b	7.5±0.53 ^b	7.5±0.85 ^b	7.5±0.71 ^a	7.6±0.7 ^a
Variation 2	6.7±0.67 ^a	6.7±0.67 ^a	6.7±0.48 ^a	7.0±0.82 ^a	7.4±0.7 ^a
Variation 3	8.1±0.74 ^{b c}	8.1±0.74 ^{b c}	7.5±0.53 ^b	8.5±0.53 ^b	7.8±1.14 ^{ab}
Significance*	0.000*	0.000*	0.007*	0.000*	0.023*

Values are expressed as mean ± standard deviation of triplicate values. Samples with different superscripts within a column are significantly differently from one another at (p≤0.05).

Table 3: Mean overall acceptability of control and developed variations

Variation	Mean and S.D	Sum of square	Mean of square	F Value	P Value
Control	8.6 ± 0.52	18.900 between groups 12.200 within groups	6.300 between groups 0.339 within groups	18.590	0.000*
Variation 1	7.5 ± 0.71				
Variation 2	6.9 ± 0.57				
Variation 3	8.4 ± 0.52				

*= significant at 5% level

Table 4: Nutritional comparison between control and accepted variation of weaning mix

S. No	Parameters	Quantity (Control)	Quantity (Accepted variation- V3)
1	Moisture content (%)	10.49	6.10
2	Energy (Kcal/100 g)	324	345.74
3	Carbohydrates (%)	75.28	38.66
4	Protein (%)	15.69	43.50
5	Fat (%)	1.11	1.90
6	Total Ash (%)	-	6.34
7	Fiber (%)	1.25	9.60
8	Calcium (mg)	17.7	19.43
9	Sodium (mg)	5.50	28.63
10	Potassium (mg)	2.92	18.20
11	Iron (mg)	0.03	13.80
12	Zinc (mg)	1.80	8.10
13	Vitamin A (mg)	0.005	7.19
14	Folic acid (µg)	3.15	6.72
15	Thiamine (mg)	0.32	0.35
16	Riboflavin (mg)	0.02	0.11
17	Niacin (mg)	2.50	3.20
18	Vitamin B6 (mg)	0.14	0.16

Table 4 clearly states that on comparison with control the accepted variation of weaning mix has higher quantity of all the essential nutrients, both macro as

well as micro nutrients. The carbohydrate and moisture content alone are high in the control weaning mix. 6.34% of total ash is present in the accepted variation but it is not

present in control. The dietary fibre helps to promote healthy bowel function and protecting against constipation. The protein helps to repair and maintain vital tissues and are crucial for the growth of all organ systems including bones and muscles. Protein also helps to enhance heme iron absorption. Fat is essential for growth and development. It helps the body to absorb fat soluble vitamins.

Iron is the key nutrient and it is essential for the developing infants and children. Iron requirements are high during early stages of life because it is critically important for the production of new red blood cells and muscle cells as well as brain development. Zinc is necessary for normal brain development. It is essential for wide variety of cellular processes in all cells. It is a critical dietary nutrient, particularly in the early stage of life. In the early neonatal period, adequate sources of zinc can be obtained from breast milk. Sodium helps to regulate water balance in cells and stimulate immune function, muscle contraction, nerve function etc.

Vitamin A is important for infants and young children. They need it for healthy immune system, their vision in dim light, and for healthy skin. Thiamine (vitamin B1) helps to prevent complications in the nervous

system, brain, muscles, heart, stomach, and intestines. Niacin helps for proper metabolism and brain development. Vitamin B6 is needed for metabolism and brain development during pregnancy and infancy as well as immune function.

The formulated weaning mix when consumed regularly will satisfy all these nutritional demands effortlessly.

Phytochemical analysis of the accepted variation of weaning mix

The phytochemical analysis showed that the phenols content was 189.4mg and flavonoids content was 106.71mg.

CONCLUSION

The weaning mix had a good shelf life up to four months. It is cheaper and affordable to the population of all socio economic groups. This weaning mix has high amount of iron. Hence it will be a great solution for infant those who are suffering from iron deficiency anaemia. The weaning mix also contains good quantity of protein, dietary fibre and B complex vitamins. From the cost calculation phase, the total cost of 100g of accepted weaning mix (V3) was found to be Rs. 22.9. So, it is concluded that the developed weaning mix was low in cost. A diet that does not have enough nutrients are the most common cause of deficiency diseases among infants. Hence this study was

done with the intention of developing a weaning mix to improve the consumption of iron, protein, dietary fibre and B complex vitamins among infants, at low cost and it was found successful.

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