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Formulation Of Weaning Food To Reduce Malnutrition Using Pearl Millets, Barley And Soya Bean Flour- A Study

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ABSTRACT

Preparation of homemade weaning food is a common practice in our country. It has been observed that, due to economic constraints many of the children below the age of 5 years are deprived of adequate nutritional supplements which have led to infant deaths. The reported 50% death rate has led to the budding of Niti Aayog National Nutrition strategies. Protein Energy Malnutrition can be due to many factor and lead to stunting and reduced cognitive skills of children. Contributing to this initiative taken up by the Government of India, under Women and Child Health care system with respect to providing sufficient nutritional supplements, an attempt was made to prepare weaning food which is affordable for common man and that which gives sufficient nutrients to meet the nutritional needs of children. The work plan includes malting of Pearl millet seeds and barley seeds. The two malted seeds were made into flour which is then combined with Soya bean flour in various percentages. Resulting preparations were analyzed for third nutritional parameters. Mixing malted pearl millet flour, malted barley flour and soya bean flour in the percentages 50, 25 and 25 was observed to have adequate protein (28%), carbohydrate (67%) and mineral concentrations (Ca and Fe in 108 and 18.6ppm respectively). This formulation would be adequate to meet the developing needs of infants.

Key words: Weaning food, malting of pearl millets, Barley malt, soya bean flour, nutrition diet, National Nutrition Plan

INTRODUCTION:

Malnutrition has always been a cause for concern for children below five years of age in our country and worldwide (Gastel and Winjiangaart-Annock, 2005). Developing countries face Protein Energy Malnutrition is due to inadequate nutritional supplements in the children diet during their transition from mill to semi-solid food. The latest UNICEF data states that nearly half of the children under 5 are dying due to malnutrition (UNICEF report, 2019). Malnutrition in children can be due to various factors like, poor food quality, insufficient food intake or being prone to infectious diseases (de Onis et al., 1993). Poor nutrition with worsening illnesses can lead to stunted growth associated with impaired cognitive ability, irregularity to school and poor work performance. Hence during this early period of growth children are to be given a nutritionally balanced diet which is nutritionally dense along with mother's milk (Cameroon and Hofvander, 1971; Berggren, 1982; Umetaet al., 2003). There for weaning food supplements become vital for overall growth of a child. To overcome the situations in India, The Government of India has come up with NitiAayog National Nutrition strategy, which is to reduce the death due to under nutrition in India and address the nutritional needs of children, girls and women (LANCET, 2013). Under the Health &

Nutrition and Women & Children development, the Government has conducted a survey and has come up with Take Home Ration (THR), that address their nutritional needs and helps to overcome Severely Acute Malnutritioned children's needs (NitiAayog web link).

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The present investigation is an attempt to come up with a weaning food which is sufficiently rich in nutrients to meet the needs of growing infant. Varieties of weaning flours are available in market, which are of high nutritive values. But these are beyond the economic affordability of many families in India (Laxmi Pandey and Vishaka Singh, 2019). Traditional gruels are prepared by watery suspensions of maize and sorghum flour which have low energy density and they are poor in proteins, vitamin and mineral content (Njogmeta et al, 2003). Hence, a simple method of preparing weaning food from malted flour of pearl millet, malted barley and soya bean flour was proposed. Millets and barley are the major cereals cultivated in India which are inexpensive and are widely available. They contribute to the energy need of many low income families too. They are rich in protein, calcium, Iron and B-complex vitamins (ShipraSrivastava et al, 2015). Shipra et al have concluded in their studies that germinated flour is suitable for weaning food.
With these assumptions a formulation for weaning foods was attempted.

MATERIALS AND METHODS:

Procurement of Raw materials: In the present investigation, Pearl millets, Barley and Soy beans were procurement from the local market of Visakhapatnam, Andhra Pradesh, India. These are the materials available in general seeds outlet which is procured by people.

Preparation of sample: The pearl millet seeds and Barley seeds were first sorted, cleaned thoroughly and then soaked in water for few minutes. The seeds were washed five time and then subjected to steeping for 24 hours. Samples were withdrawn intermittently to measure their moisture content. The water was drained and the seeds were tied in muslin cloth for sprouting. This germination or malting was done for 24 hours and the sprouted seeds were then kilned at 50^{o}C for 12 hours. The dehydrated seeds were ground to get fine flour, which is malt. Malt of pearl millets and barley were obtained in the same above method and they were stored in air tight containers until further use.

Treatment of Soya seeds: The soya seeds were not subjected to any of the above treatment. They were ground into fine flour and then kept in closed container for further use.

Preparation of weaning product: The three flours obtained above were mixed in different ration. They were labeled F1, F2 and F3 and the combined product was assessed for its nutritional value.

Analysis of weaning food: Weaning food was subjected to analysis for its nutrient composition. Laboratory analysis was done for the following parameters:

Determination of Moisture content: Moisture content was analyzed using hot air oven. One gram sample was weighed at kept at 105^{o}C for 24h. Loss in weight of the sample was determined using the formula:

$$\text{Moisture (\%)} = \frac{\text{Weight of original sample} - \text{Weight of dried sample}}{\text{Weight of original sample}} \times 100$$

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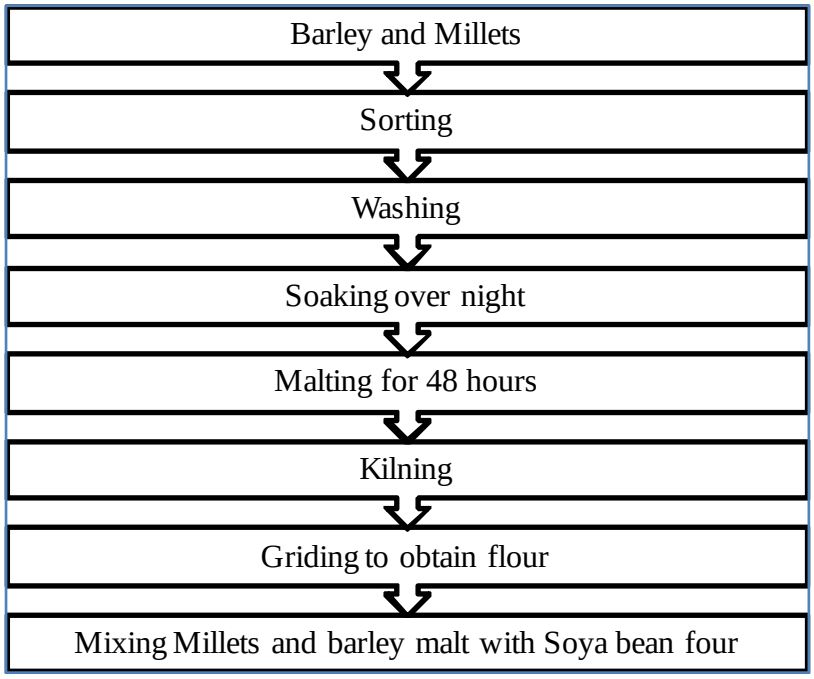
Sprouting of seeds (protocol)



Determination of Ash: The sample is kept in furnace at 600^{o}C for 8h (Methods of AOAC, 2005).

$$\text{Ash content (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

Determination of Total carbohydrate: Estimation of total sugars was done by Anthrone method (Jose TarquinioPrisco et al, 1981). The value is represented in terms of percentage of carbohydrate per 100gm of seeds.

Determination of crude protein: This was done by Micro Kjeldahl method (AOAC, 2005). Percentage nitrogen present in the weaning formulation was calculated using the following formula:

$$\text{Nitrogen (\%)} = \frac{(S-B) \times 0.014 \times D}{W \times V} \times 100$$

Where, D= Dilution factor, S-B = Titre value, W = weight of sample, 0.014 is constant value. Crude protein is obtained by multiplying total nitrogen content with a factor- 6.25. Thus, crude protein (%) = % of N x 6.25.

Determination of minerals: The mineral contents were determined using ash residue of each formulation. The formation was digested with perchloric acid and nitric acid (1:4). The samples were left to cool and contents were and 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).

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RESULTS AND DISCUSSION

Nutritional composition of Pearl millets, Barley and Soya beans flour:

The nutritional composition of the three varieties of nutrient sources was analyzed before and after malting of selected seed varieties (Millets and Barley). The results obtained were tabulated in table 1. According to the reports of ICAR, Indian Institute of Millet research, pearl millets are reported to have high protein content as compared to other millets (Dayakar Rao et al, 2017). The present variety has around 14 g per 100 grams of dry seeds of pearl millets. Results indicate that there was aincrease in protein content and carbohydrate content while during malting of seeds. This may be due to the increase in synthesis of enzymes by seeds for mobilization of food reserves to meet the need of growing embryo. As a result starch degradation and protein synthesis take place leading to increase in both the variables. Mineral content showed variation. Malting has resulted in increase in calcium content while the iron levels have decreased. Hence malted pearl millets may be regarded as good source for calcium required by growing children. These results were in accordance with the results of Josephs O. Owheruo (2019). The report also shows that malted pearl millets are good sources for minerals like, magnesium, potassium, sodium and zinc indicating its suitability to be used in weaning food preparation.

Table 1: Results from analysis of variables of Pearl millets, barley and soya bean flour

Grain variety	Moisture (%)	Ash (%)	Carbohydrate (%)	Protein (%)	Iron ppm	Calcium ppm
Pearl millet (before malting)	2	3	68	10	119 $\pm$ 1	36.4$\pm$ 0.5
Pearl millet (After malting)	6	2	80	12	64 $\pm$ 0.5	90 $\pm$ 1
Barley (Before malting)	4.5	2.9	67	11.5	2.5	59
Barley (After malting)	11	1.78	76	13	0.5$\pm$0.1	65$\pm$ 1
Soya Bean flour	6.9	4.5	31	38	8.9 $\pm$ 1	200 $\pm$ 1

Analysis of Barley before and after malting showed similar results as Pearl millets. The carbohydrate and protein content has increased after malting, while the ash content decreased due to mobilization of resources and increase in moisture content of seeds. The iron and calcium levels showed similar variations as barley and are in accordance with the findings of AbolfaziNikhah (2012). Soya beans are known for their high protein content. Owing to its high protein content it is used as substitute for milk or meat by vegans. The proteins content obtained after analysis is 38% which is almost near to many research publishers (Deepika Sharma et al, 2013).

Preparation of weaning food:

Preparation of weaning food was done by mixing the three flours in various percentages. The percentages used and the resulting protein percentage, carbohydrate percentages observed with variations in calcium and iron content are listed in table 2.

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Table 2: Combinations of three flours used in the preparation of weaning food

Sl.No	Pearl millet malt (%)	Barley malt (%)	Soya bean flour (%)	Protein (%)	Carbohydrate (%)	Ca ppm	Fe ppm
1	33.3	33.3	33.3	20.8	75.6	118.3	24.4
2	50	25	25	28.2	67	108	18.6
3	25	50	25	19	66	105	21.25
4	25	25	50	25.2	54.5	158	20.6
5	75	12.5	12.5	15.34	77.24	100.63	49.22
6	12.5	75	12.5	16	70.88	85	10.15
7	12.5	12.5	75	16	42.75	168.2	14.69

Figure 1: Composition of combination of weaning food indicating protein and carbohydrate content

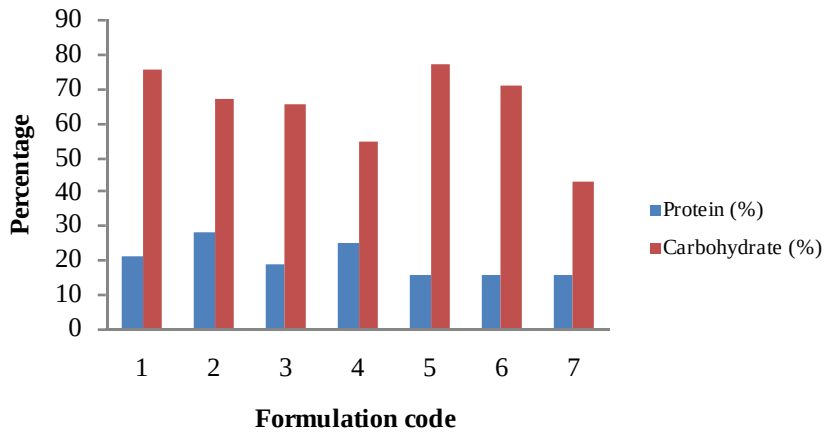
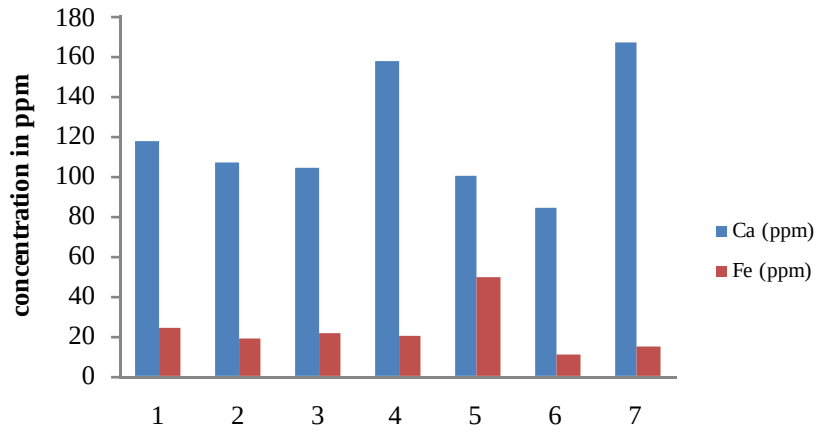


Figure 2: Composition of combinations of weaning food indicating Calcium and Iron content



Figures 1 and 2 indicate that combination 2 is ideal for preparation of weaning food for children. It consists of 50% malted pearl millet flour, and 25% each of malted barley flour and soya bean flour. This combination has resulted in around 28% protein content, 67%

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carbohydrate content, 108 mg of calcium and 18.6 mg of Iron. The other combination has lower protein content. Calcium content was found to be high in combination 7 that has 12.5% each of malted pearl millet flour and malted barley flour while it had 75% Soya bean flour. For children who need immediate protein supplements, reasonably good iron content combination 7 can be suggested.For children or women who need protein with calcium, combination 4 may be recommended. These preparations can be done by mixing them in small quantities using small scoops of each of the flour.

Conclusion: Weaning food preparation is a age old process done by traditional methods. But, the type of cereals used and their combinations were not much considered. The commercially available varieties are not affordable for a common man in our country. In this study, the combination of three flour selected- malted pearl millet flour, malted barley flour and soya bean flour when combined in the ratio of 2:1:1 (50%, 25% and 25%) has resulted in good percentage of protein (28%) and it also had sufficient carbohydrate and protein content that can meet the needs of growing child.

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