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Development of Weaning Food from Pearl Millet Malt

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Abstract

During six months where the baby is normaly fed on breast milk, thereafter infant require significantly more nutrious weaning food, as part of introducing infant to normal food habit. Moreover the desirable weight gain of infant recommended and reported for healthy one year baby is about >9kg, which is normally three times weight of infant at birth. There is need to develope an economical and well nutrient weaning food as per RDA of baby food. In present study an attempt is made to develope weaning food formulations by partly replacing wheat flour and incorporating in different combinations of roasted rice flour, skim milk powder and sugar. Four weaning food formulations were prepared by replacing 20%, 40, %, 50%, 60% (w/w) of wheat flour and by adding roasted rice flour, skim milk powder and sugar, and were accordingly designated as WFM20, WFM40, WFM50 and WFM60 .The formulations were compared with sole wheat flour weaning food, which was used as control sample (WWF0). Four weaning food formulations were compared with control sample in context to their sensory attributes, physio-chemical parameters and functional properties. Data showed that, among four weaning formulations, sensory acceptable developed weaning food was WFM50, which can be prepared by mixing 50% pearl millet malt, 30% wheat and 10% roasted rice on (w/w) flour basis. It is revealed that, palatable weaning sample was found to be more readily dispersible (+15%), with more water holding capacity (+40% increase), more digestible (+7%) and better in minerals content than control weaning food. The acceptable weaning food (WFM50) was found to be about 20 % higher in protein , about 30 % higher in zinc and iron content , with four fold increase in calcium content in comparision with sole whaeat weaning food.

Keyword: **Pearl millet Malt, Roasted rice, Wheat flour, weaning Food, infant, baby, WAC, Dispersibility, palatable, sensory attributes.**

I INTRODUCTION

Adequate nutrition during infancy and childhood is fundamental for nutritional development of child. Infancy period (0-2 years) is a "critical window" for promotion of optimal growth, health andbehavioraldevelopment [1]. Weaning foods are complementary in nature- that is, they complement mother's milk. The basic purposeof weaning food is introducing these foods is to provide the taste and variety to the baby's diet. Major cereals and millets consumed in India are rice, wheat, jowar, bajra and ragi. These grains are main staple food for energy and nutrients in Indian diets, comprising of 70-80% of their daily intake. Since cereals/millets are the cheapest, widely available source of energy, their contribution toenergy intake is the highest in poor strata of society and compatively less in upper class. Cereals are being rich sourceof calcium and iron [2]. There is a need for nutritionally balanced, energy- dense, easily digestible foods along with functional benefits, to be formulated [3]. Pearl millet is a staple food for a large section of the population in Asian and African countries. Besides supplying calories and proteins in diet, pearl millet is a good source of essential minerals, among millets, pearl millet contains a higher protein content and better amino acids balance than sorghum [4]. Rice is a staple food of the world and being a major source of carbohydrates over half the world's population. Rice also provides nutritionally significant amounts of thiamin, riboflavin, niacin and zinc with lesser amounts of other micronutrients. [5]. Germination is one of the important step used in the preparation of the ceral basd malt. Germination is a natural process occurred during growth period of seeds, where seed met with the minimum condition for growth and development [5]. Germination process is reported to increase protein content and dietary fiber, mineral bioavailability, while tannin and phytic acid content is shown to to be decreased [5]. Germination treatments of grains improve their digestibility, nutrient bioavailability and sensory properties simultaneously reducing their anti-nutrient factor. [6].

1. II MATERIALS AND METHODS

Wheat(Lokwanvarity), Pearl millet(Moti-1varity) and Rice(Chinoorvarity) was procured from local market of Jalgaon.
Moisture, ash, protein, crude fiber, and fat of wheat flour, pearl millet and rice were analyzed [6]. Carbohydrate was determined by difference method. Calorific value was estimated byusing bomb calorie meter (Rajdhani scientific instrument co.).

Preparation of Wheat flour

Wheat grains were thoroughly cleaned to remove dirt, dust, insect excreta/ feathers and mixture of other food grains. The clean graded materials were ground in the electric grinder to make fine flour andsieved by 80-100 mesh sieves.

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Preparation of Roasted Rice flour.

Rice were purchased from local market of Jalgaon were cleaned to remove dirt, dust and insects and further it was roasted at 60°C temperature to increase its palatability, finally roasted rice was grinded in the electric grinder,and sieved by 80-100 mesh sieves.

Preparation of Pearl Millet Malt.

Pearl millet was purchased from local market of Jalgaon, were cleaned to dirt and dust and allowed for germination and germination was carried out as follows. [2]

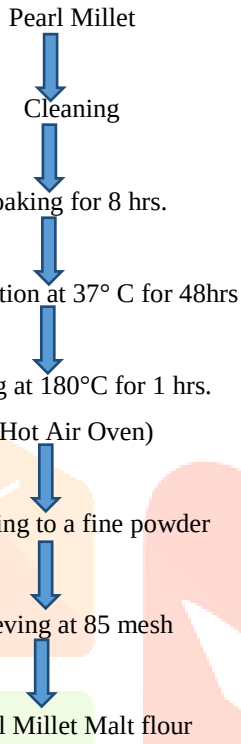

Fig.1 Flowsheet of preparation of pearl millet malt

TABLE 1
WEANING FOOD FORMULATIONS(100GM)

Sample	WWF0	WFM20	WFM40	WFM50	WFM60
Wheat flour	90gm	40gm	30gm	30gm	25gm
Pearl millet malt flour	0gm	20gm	40gm	50gm	60gm
Roasted rice flour	0gm	30gm	20gm	10gm	5gm
Skim milk powder	5gm	5gm	5gm	5gm	5gm
Sugar powder	5gm	5gm	5gm	5gm	5gm

WWF0- Wheat flour (control sample), WFM20- 20% Malt Weaning Food, WFM40- Malted Weaning Food (30:40:20), WFM50 - Malted Weaning Food (30:50:10), WFM60- Malted Weaning Food (25:60:5).

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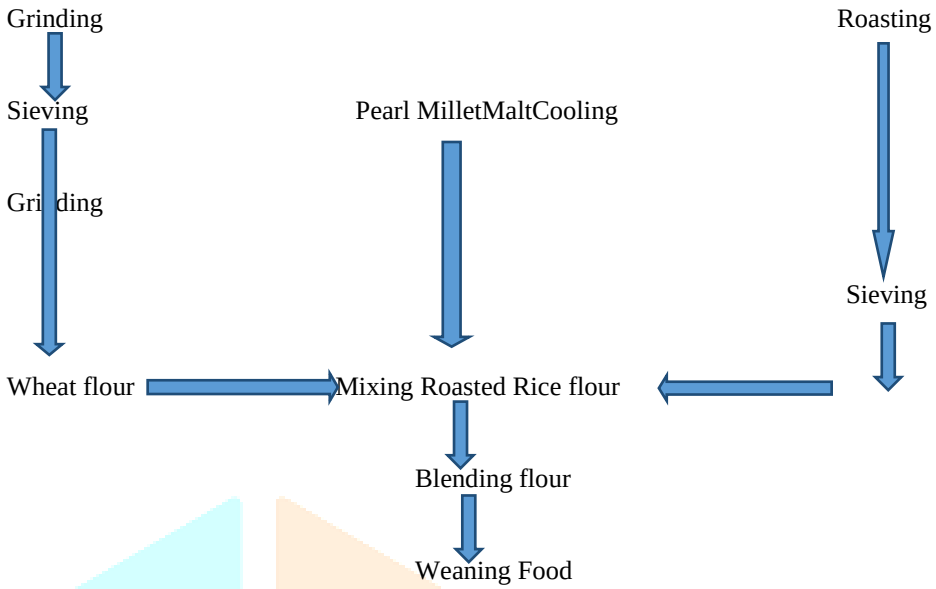

Fig: 2. Flow sheet of preparation of weaning food

Determination of bulk density

Bulk density was determined by Bhattacharya and Ali, 1976 [13] method, 1g of sample is weighed into glass test tubes. Mildly tapped 2-3times on the bench. Volume of the sample occupied was noted and calculated.

$$B.D = \frac{\text{Weight (gm)}}{\text{Volume (ml)}}$$

Determination of Water Absorption capacity

It was determined by Sosulski et al, 1976[14] method. One gram of each flour samples was weighed into glass tube and volumes were noted.10 ml of distilled water was added. Samples were allowed to stand for 4 hrs. at RT before being centrifuged at 2000 rpm for 20 min. Excess water was decanted by inverting the tubes and samples were allowed to drain and volumes were noted. The weights of water absorbed were calculated by difference.

$$\text{Water absorption capacity \%} = \frac{\text{Final weight} - \text{Initial weight of sample}}{\text{Initial weight of sample}} \times 100$$

Dtermination of Dispersiblity

It was determined by AACC [7] method. 10 grams of flour sample was weighed into 100 mL measuring cylinder, distill water was added to volume of 100ml. the cylinder were stirred vigorously and stand too allowed for three hours. The volume of settled particles was recorded and subtracted from 100. The difference was reported as percentage Dispersiblity.

% Dispersiblity = 100 – volume of settled particles.

in- vitro Digestiblityof Protein

in-vitro protein digestibility was determined by Akeson and Stahmann, 1964 [15]. Samples were homogenized and suspended in 15ml of 0.1N HCl containing 1.5mg of pepsin and incubated at 370C for 3 hrs. The suspension was than neutralized with 0.5N NaOH and treated with 4mg of pancreatin in 7.5ml of phosphatebuffer (pH 8.0) containing 0.005M sodium azide. The mixture was gently shaken and incubated at 370C for 24h. After incubation, the sample was treated with 10 ml of 10% TCA and centrifuged at 3000rpm for 20 min. Protein in the supernatant was estimated by Micro- KheldhalMethod.

%IVPD was calculated using the following

$$\%\text{IVPD} = \frac{Digested\ protein}{\text{Total Protein}} \times 100$$

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III RESULT AND DISCUSSION

TABLE NO.2
PHYSIOCHEMICAL COMPOSITION OF FORMULATED WEANING FOOD (100GM)

Parameter	Control	WFM20	WFM40	WFM50	WFM60
Bulk density	0.66 ±0.00	0.714 ±0.00	0.71 ±0.01	0.72 ±0.00	0.73 ±0.04
% Dispersiblity	65 ±1.24	75 ±0.47	76 ±0.81	75 ±0.078	74 ±0.045
WAC (%)	187.67 ±1.38	251.53 ±0.52	255.30 ±0.60	264.26 ±1.59	287.12±0.48
Moisture (%)	8.05 ±0.13	9.95 ±0.11	9.14 ±0.04	8.73 ±0.06	8.67 ±0.02
Ash (%)	0.48 ±0.02	0.840 ±0.03	1.30 ±0.02	1.63 ±0.079	1.77 ±0.07
Protein (%)	9.84 ±0.02	9.92 ±0.12	10.97 ±0.15	11.86 ±0.11	12.43 ±0.35
Crude fiber (%)	1.57 ±0.02	1.35 ±0.03	1.63 ±0.03	1.86 ±0.03	2.07 ±0.03
Fat (%)	1.64 ±0.03	2.56 ±0.04	2.74 ±0.02	2.80 ±0.03	3.18 ±0.05
Energy (kcal)	368.51±0.46	364.24 ±0.45	372.42 ±0.49	374.56 ±1.04	378.92 ±0.52
Carbohydrate (%)	79.29 ±0.18	75.38 ±0.33	74.22 ±0.25	73.12 ±0.30	71.88 ±0.14
Iron(mg/100gm)	2.86 ±0.07	2.683 ±0.02	3.67 ±0.23	3.12 ±0.07	3.81 ±0.028
calcium(mg/100gm)	31 ±0.37	127.96 ±0.65	140.16 ±0.12	148.45 ±0.88	158.95 ±0.85
zinc(mg/100gm)	2.12 ±0.09	2.283 ±0.31	2.63 ±0.10	2.77 ±0.07	2.87 ±0.08
In-vitro protein Digestibility	75.45 ±0.54	78.57 ±0.37	80.64 ±0.25	81.47 ±0.26	83.76 ±0.24

Table no. 2 shows comparison of weaning food formulations with control sample. Bulk density was found to be in the range from 0.71 to 0.73, while water absorption capacity was in the range from 251.33% to 287.12%. Sensory acceptable and palatable weaning food formulation contain WAC of 264.26% which is much more than WAC of control sample (187.67%) The varied WAC of the samples may be due to the change in protein structure with increase in soak time. WAC describes flour-water association ability under limited water supply. Dispersiblity was about 74 to 75% Dispersiblity of WFM50 formulation was about 75% higher as compared to control sample (65%).

Moisture content of weaning formulations was reported to be decreased from 9.95% to 8.67% , may be attributed to increase in level of pearl millet malt and hygroscopic dried malt prepared by drying at 180°C . Ash content is found to be increased from 0.84% to 1.77% , may be due to increasing level of malt. Due to germination process which leads to decrease in anti-nutritional factor like phytic acid. Results are similar to reported by Archna Suman [16]. Ash content of acceptable sample WFM50 was 1.63% which is much higher than control sample(0.48%). Protein content was reported in the range from 9.92%to 12.43%. Protein content of WFM50 was about 11.86% which is more than control sample (9.84%). Fat content(2.80%) was not increased significantly with level of malt in the formulation, as fat is utilized as energy source for the growth of sprout in germination process. Similar results were obtained by Thapar, V.K. et. al. [11]. Increase in fibre content (1.86%) may be attributed to synthesis of cellulose and hemicellulose which act as structural component. [12].

Minerals content of weaning formulations were reported to increased, calcium content increased in the range from 127.96% to 158. 95% ; while for Iron content and zinc content was in the range from 2.68% to 3.81% and from 2.28% to 2.87%, respectively . Calcium, iron and zinc content of WFM50 was found to be 148.45%, 3.12% and 2.77% respectively, which is more than control weaning food .Higher minerals in developed formulations may be attributed to higher ash content and germination of seeds in malting process.

TABLE. 3
PERCENTAGE VARIANCE OF FORMULATED WEANING FOOD AND WHEAT WEANING FOOD (100GM)

Parameter	Control	WFM50	% changes
Bulk density	0.66 ±0.007	0.72 ±0.00	+9
% Dispersiblity	65 ±1.24	75 ±0.078	+15
WAC (%)	187.67 ±1.38	264.26 ±1.59	+40
Moisture (%)	8.05 ±0.13	8.73 ±0.06	+8
Ash (%)	0.48 ±0.02	1.63 ±0.079	+239

Protein (%)	9.84 ±0.02	11.86 ±0.11	+20
Crude fibre (%)	1.57 ±0.02	1.86 ±0.03	+18
Fat (%)	1.64 ±0.03	2.80 ±0.03	+70
Energy (kcal)	368.51±0.46	374.56 ±1.04	+1
Carbohydrate (%)	79.29 ±0.18	73.12 ±0.30	-9
Iron(mg/100gm)	2.86 ±0.07	3.12 ±0.07	+9
calcium(mg/100gm)	31 ±0.37	148.45 ±0.88	+377
zinc(mg/100gm)	2.12 ±0.09	2.77 ±0.07	+30
In-vitro Protein digestibility	75.45 ±0.54	81.47 ±0.26	+7

Table no.3 result shows that, bulk density of WFM50 (0.72) was increased by 2% as compared to control sample (0.66%) which is higher from control sample 0.66 shows higher particle size of weaning food [8].

Water Absorption capacity of sensory acceptable weaning food (264.26%), and %dispersiblity was reported to be 75%, which were increased by 15 and 40% with control sample respectively for WAP and dispercibilty High WAC is also attributed to lose structure of starch polymers while low value indicates the compactness of the structure [9].

Sensory acceptable weaning food is reported to have high ash content (1.63%) as compared to control sample (0.48%). Data showed that mineral content was increased, it may be due to germination process of malting.

Protein content of Sensory acceptable weaning food was found to be 11.86%, which was increased by 20% as compared to control sample, it may be due to increase in level of malt used. Protein content was increased, it may be attriuted to formation of free amino acids and peptides during malting. This was also reported by Adjei-twum et al, 1976[10] and thapar et al, 1974[11].

Sensory acceptable weaning food contain the Crude fiber of 1.86%, which is slightly higher than control sample, it may be due to synthesis of cellulose and hemicellulose which act as structural carbohydrates. it was also similerly reported by thapar et al, 1974.

Calorific value of sensory acceptable weaning food is reported to be increased by 1%, which may be attributed to increase in fat millet malt. Mineral content of sensory acceptable weaning food ia reported to contain, Iron (3.12%), Calcium (148.45%) and Zinc (2.77%), which is increased by 9%, 377% and 30% respectively as compared to control sample.

IV CONCLUSION

Palatable, Sensory acceptable developed weaning food can be prepared by mixing pearl millet malt, wheat and roasted rice in ratio 50:30:10 (w/w). The formulated weaning food is reported to more dispersible, better water holding capacity, improved minerals content (two fold) and more digestible as compared to wheat flour based weaning food. Nutritional Value of developed weaning food is found to be increased by 20% protein, doubling inzinc (), iron()content with calcium conent() by four-fold in comparison to wheat flour based weaning food.

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