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DEVELOPMENT OF LOW COST MALTED CEREAL AND LEGUME BASED NUTRITIOUS WEANING FOOD TO COMBAT MALNUTRITION IN RURAL AREAS

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ABSTRACT

Malnutrition is one of the major public health problems among children in developing countries. It affects the child at the most crucial period i.e. stage of development, which can lead to permanent impairment in later life. A number of cereals and legumes that are readily available and found to have nutrient potentials which could be enhance by germination and complement one another if properly processed and blended especially by the rural and poor mothers during weaning period. The objective of this study was to formulate composite weaning foods using malted cereals, legumes, vegetable powders and oilseed and analyze them for sensory attributes as well as nutrients and cost of the prepared products. Malted Wheat Flour (MWF), Malted lentil flour (MLF), linseed, carrot, and potato flour was used in different levels. Four blends (treatments) were formulated and were subjected to organoleptic analysis for testing various sensory attributes via nine point hedonic scale. ANOVA was used for the statistical analysis. The nutritional composition and cost of the different formulations was evaluated. There were significant ($P< 0.05$) differences between overall acceptability of all the blends. T_3 (MWF: MLF: Potato, 45:25:15) was liked very much while T_1 (MWF: MLF: Potato, 35:30:20), T_2 (MWF: MLF: Potato, 40:25:20) and T_4 (MWF: MLF: Potato, 50:20:15) were moderately liked by the panel of judges. Energy, protein, fat, carbohydrate and calcium were higher T_3 except fibre and iron. The cost of instant baby food (Rs/ 100g) ranged from Rs 3.44 - 4.27. The study is part of the effort to provide home-based complementary foods that can be more cost effective to the low income families. The product could be served in the form of porridge with water/milk.

Keywords: Malnutrition, Germination, Weaning and Complementary Foods

INTRODUCTION

Most babies need extra food beside breast milk as they grow fast and breast milk is no longer enough to support their children (Srivastava, 2002). Complementary feeding, i.e. introduction of foods other than milk to an infant's diet, is a major step in the development of food behavior, it represents a critical stage from both nutritional and behavioural standpoints, likely to affect the infant's growth and health (Greer *et al.,* 2008; Morgan *et al.,* 2004; Zutavern *et al.,* 2008 and Sloan *et al.,* 2008).

However, the capacity of a weaning diet to meet the protein and energy requirements of infants depends on its nutritional quality as well as its dietary bulk. This can be achieved through legume supplementation of cereal-based weaning foods. However, their role appears to be limited because of several factors including low protein and starch digestibility, poor mineral bioavailability and high antinutritional factors. It has been reported that protein and thiamin mineral bioavailability and protein and starch digestibility increased, whereas phytic acid and tannin decreased during germination of legumes.

A number of cereals and legumes that are readily available and found to have nutrient potentials that could complement one another if properly processed and blended. Therefore, it is imperative that efforts to formulate composite blends and scientific studies are carried out to ascertain the nutritive adequacy of these locally available blends (cereal and legumes) for possible use as complementary foods, especially by the rural and poor urban mothers during weaning period. This study is therefore part of exploratory work towards this goal.

Legumes are known to contain lysine in a quantity that exceeds the requirements for human but with the low content of sulphur amino acids. Cereals, on the other hand, are high in the sulphur amino acids but deficient in lysine. A mutual complementation of amino acids and consequent improvement in protein quality is therefore achieved when legumes are blended with cereals in the right proportions (Raheleh Ghasemzadeh and Reihaneh Ahmadzadeh Ghavidel, 2011). Therefore a study was undertaken with the objective to developed low cost nutritious weaning using malted cereal and legume, to evaluate the organoleptic quality, nutritive value and cost of nutritious instant baby food.

MATERIAL AND METHODS

The present study entitled "Development of low cost malted cereal and legume based nutritious instant baby food to combat malnutrition in rural areas" was conducted in the Department of Foods and Nutrition, SHIATS, Allahabad.

PROCUREMENT OF RAW MATERIALS

Raw materials were procured from the local market of Allahabad district of Uttar Pradesh (U.P.), India for the study.

PREPARATION OF FLOUR

Whole wheat was malted in which whole grain was steeped for 12 hrs and was germinated. Processing of linseed, potato, carrot, lentil, chickpea and soybean were done. The procedure of processing of wheat and lentil was shown in figure 1.

DEVELOPMENT OF WEANING FOODS

All the flours were mixed in different proportions. Four treatments namely T_1, T_2, T_3, T_4 respectively were formulated. The details of treatment combination were given in table 1. The porridge was prepared by using lukewarm water and jaggary was added according to the sweetness.

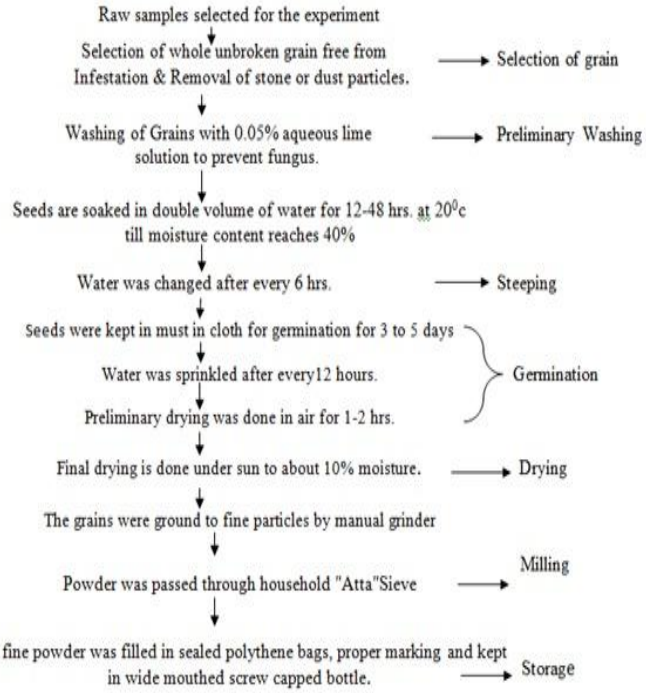

Figure 1: Preparation of malted wheat flour (MWF) and lentil flour

Table 1 Details of weaning food Combination

Food stuff / Treatment	Whole wheat flour (%)	Linseed flour (%)	Lentil flour (%)	Potato flour (%)	Carrot flour (%)
T_1	35	5	30	20	10
T_2	40	5	25	20	10
T_3	45	5	25	15	10
T_4	50	5	20	15	10

ORGANOLEPTIC ANALYSIS

The formulations were evaluated on the basis of sensory attributes by using nine point hedonic scales by a panel of seven judges.

CHEMICAL ANALYSIS

The developed weaning food was analyzed for Crude fat, fiber, ash , moisture and carbohydrate were analyzed by following the AOAC method (2000).

The soxhlet method was used for total fat determination using ether for oil extraction. Crude fiber was obtained after samples digestion with diluted acid, alkali and alcohol. Moisture was determined from sample weight loss after drying at 105° C in dehydrator until constant weight. Protein content was determined by Lowry's method and Carbohydrate was calculated by difference method and energy was calculated. Calcium estimation was done by electrolyte analyser and iron was estimated by using Spectrophotometer. All samples were analyzed in triplicate.

STATISTICAL ANALYSIS

All the data are presented as mean ± SD (standard deviation) of three replicates. Data of sensory attributes of weaning food was subjected to analysis of variance and significant difference at 5% level.

RESULT AND DISCUSSION

The formulated weaning foods were evaluated for sensory attributes and results are presented in Table 2. The mean scores obtained from sensory evaluation showed that all treatments were accepted. There were significant ($P< 0.05$) differences between overall acceptability of all the formulations.

The data illustrated in the table 2 shows the average sensory scores of different parameters in weaning food clearly indicates that treatments T_3 (8.95) had the highest score for colour followed by T_2 (8.7), T_4 (7.83) and T_1 (7.70). In case of taste and flavour, T_3 (9.0) had the highest score followed by T_2 (8.5), T_4 (7.7) and T_1 (7.58). T_3 (8.8) had the highest mean score for consistency followed by T_2 (8.66), T_4 (7.75) and T_1 (7.6). The average sensory scores of overall acceptability of *weaning food*

shows that treatments T_3 (9.0) had the highest score followed by T_2 (8.79), T_4 (8.0) and T_1 (7.62). Among the treatments, T_3 had highest average mean scores for all the sensory attributes which indicates that an increase in the amount of lentil flour sensory attributes of the weaning food gradually decreases. There was a significant difference between the treatments at 5% probability level. The calculated value of F is greater than the tabulated value of F at 5% probability level. Therefore, it can be concluded that there was significant difference between treatments of weaning food regarding the various sensory attributes (color and appearance, taste and flavor, consistency and over all acceptability). Nazni and Suresh Kumar (2011) reported the same findings in their work.

Table 2: Mean scores of weaning food on the basis of various sensory attributes

Sensory attributes	T_1	T_2	T_3	T_4
Colour	7.70 ± 0.072^a	8.70 ± 0.07^c	8.95 ± 0.072^c	7.83 ± 0.07^b
Taste and flavour	7.58 ± 0.19^a	8.5 ± 0.07^c	9.0 ± 0.0^d	7.7 ± 0.07^b
Consistency	7.6 ± 0.07^a	8.66 ± 0.07^c	8.9 ± 0.07^c	7.75 ± 0.125^b
Overall acceptability	7.62 ± 0.125^b	8.79 ± 0.07^c	9.0 ± 0.0^c	8.0 ± 0.125^b

Similar alphabets denotes non - significant difference (0.05%)

Table 3: Nutritional composition and costing of the weaning food per 100 gm

Nutrient	T_1	T_2	T_3	T_4
Moisture (gm)	14.478	14.378	13.658	13.558
Energy(kcal)	446.5	463.95	488.65	506.1
Protein (gm)	24.772	25.187	26.197	26.582
Fat (gm)	5.848	6.023	6.113	6.228
Fibre (gm)	5.63	5.875	5.535	5.88
Carbohydrate(gm)	118.71	124.4	125.24	130.93
Calcium (mg)	148.74	150.89	153.09	155.24
Iron (mg)	10.626	11.226	12.096	12.676
Cost /100 gm	7.35	6.554	6.554	5.754

The developed instant baby food was analyzed for moisture, protein, carbohydrate, fat, fibre, calcium and iron content as methods described in AOAC (1990). The cost of food was determined on raw basis. The nutritional composition and cost of the weaning foods prepared using different composition was shown in table 3.

Result revealed that highest energy was found at T_4 (506.1 Kcal) followed by T_3, T_2 and T_1. Protein content was highest in T_4 (26.58 g) followed by T_3, T_2 and T_1. Carbohydrate content also increased with the increase in amount of banana peels powder i.e.T_4 (130.93g), T_3 (125.24 g), T_2 (25.187 g) and T_1 (24.77 g). Minerals (Calcium and Iron) are also highest in T_4 followed by T_3, T_2 and T_1. Therefore, it can be concluded that weaning food prepared by using the malted cereal and legumes are highly nutritious.

CONCLUSION

Homemade weaning diet could be beneficial for the status of ideal weaning food. This study does not condemn the use of commercial feeds, but it does convey message to the mothers that: Homemade diet is not a compromised diet but can be as enriching as any other wholesome feed if all the types of fruits, vegetables and cereals are included. Enriched homemade diet is also significant for the good dental health of the child not only for the present but for the years to come. Cost-benefit ratio is a major advantage in case of homemade diet in comparison to commercial feeds. Impaired growth and development in children can affect the rest of their lives and lower their academic performance and the ability to contribute to society (WHO, 1995) therefore, right food and at right age is essential for infant.

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