PREPARATION AND NUTRITIONAL EVALUATION OF WEANING FOOD BASED ON MUSTARD PROTEIN CONCENTRATE

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INTRODUCTION

Mustard (B. Juncea) and Rapeseed (B.Campestris) together form a major oilseed crop of India, with an annual production of nearly 2 million tonnes. The meal from decuticled kernels contains more than 45% protein. The protein of mustard and rapeseed are well proportioned in all essential amino acids. A process has been developed at CFTRI for the removal of thyrotoxic glucosinolates in the meal and prepare a protein concentrate containing 55 to 60% protein of good nutritional quality.

In India as in many other developing countries protein malnutrition develops in children when they are weaned from mothers milk and put on solid foods. Due to economic privations these children are given only starchy foods which lack the required quantity and quality of protein and in addition lack vitamins and minerals. To overcome this problem several weaning food formulations have been developed earlier.[2,3] The present study was undertaken to prepare two weaning food formulations using edible quality mustard protein concentrate (MPC), cereals, pulses with added vitamins and minerals. While preparing weaning foods germinated legumes have sometimes been used on the basis that germination improved digestibility and nutritional quality.[4] But the beneficial effects of germination have not been observed in some instances. Hence in one weaning food formulation we incorporated germinated wheat and greengram and studied the effect of germination on nutritional quality.

PREPARATION OF WEANING FOOD

Wheat, greengram and chick pea splits were subjected to mild roasting at approximately 80°C until a roasted aroma developed. The various ingredients shown in Table-1 were ground to pass through BSS 44 mesh and mixed in the proportion shown in Table 1.

Hot water was added in the proportion 6:1 and mixed to get a slurry which was passed through a homogeniser to make it uniform. The material was then dried in a twin drum roller drier using a steam pressure of 110-120 psig. Dried flakes scrapped from the surface of the roller were collected and passed through 44 mesh (BSS) sieve and packed in tins.

Germination was effected by soaking the seed material overnight in water and allowing to germinate for 24 hours. It was then dehusked and the material dried and mildly roasted. The germinated materials were incorporated in weaning food B. Weaning Food A is similar to B except that the ungerminated materials were used. The protein content of weaning foods ranged from 22 to 26 percent.

Mustard protein concentrate (MPC) used in the formulation of weaning food was prepared from dehusked kernels by removal of glucosinolates by aqueous extraction and removal of oil by extraction with food grade hexane. It had approximately 58% protein, less than 1 percent residual oil, 1.5% fibre, 6% ash and less than 0.15% glucosinolates.

PHYSICAL CHARACTERISTICS OF WEANING FOOD

The physical characteristics of the weaning food are given in Table 2.

Bulk density : This was determined by filling a graduated cylinder which was being frequently tapped on a rubber sheet. The material was weighed and the bulk density was calculated as gm. per ml.

Water holding capacity : A brass cylinder of internal diameter 5 cms and height 3 cms fitted with a wiremesh bottom was used for this determination. The wire mesh was covered on the inside with a moist filter paper disc. 5 gm of the material was spread evenly on this. The cylinder was kept in a petridish containing water. The time taken for the water to wet the material inside completely was noted. The cylinder was raised to drain the excess water. The adhering water was wiped with a filter paper and the cylinder weighed. Water absorbed per gm of material calculated.

Germination caused a considerable change in the time required for water absorption. The changes taking place in the carbohydrate fractions of the cereal and pulse may be responsible for this change.

NUTRITIONAL EVALUATION

The nutritional quantity of the product was assessed by rat bio-assay using the parameters protein efficiency ratio, net protein ratio and net protein utilization. Protein efficiency ratio (PER) was determined by the method of Osborne, Mendal and Ferry as quoted by Chick.[6] Net protein ratio (NPR) and Net Protein Utilization (NPU) was determined according to Bender and

Doell[7] and Bender and Doel[8] respectively. The results are presented in Table 4 and 5.

These parameters indicate that weaning food formulated from mustard protein concentrate is of good nutritional quality comparable with casein. Germination has shown no improvement either in PER or NPU whereas there is slight lowering of NPR. The weaning food is quite acceptable organoleptically.

After PER determination the animals were sacrificed and the total protein, haemoglobin and RBC were estimated in blood. The results are presented in Table 6.

The blood picture of the rats fed on MPC based food shows no significant difference from a casein in terms of total protein, haemoglobin and RBC contents. These results clearly indicate that MPC can be used to prepare weaning foods of good nutritional quality comparable to milk protein.

Table 1 : Ingredients Composition of Weaning Food

	Percent
Wheat flour (roasted)	30
Rice flour	15
Mustard Protein Concentrate (MPC)	25
Chick pea flour (roasted)	10
Greengram flour (roasted)	10
Powdered sugar	6
Dicalcium phosphate	1
Sodium chloride	2
Vitamin premix*	1

* *Vitamin premix contained, Vit. A 1500 IU, Vit. D 400 IU, Vit. C 30 mg, Vit. B1 0.9 mg, Vit. B2 1.5 mg and niacinamide 6.0 mg. Vit. A and D are dissolved in small quantity of hydrogenated oil and mixed with the rest of the ingredients and sugar used as filler and mixed uniformly.*

Table 2 : Physical Characteristics of MPC Based Weaning Food

	Particle size micron	Bulk density gm/ml	Water holding capacity gms/gm product	Time for water absorption
Weaning Food A	355	0.33	4.46	5 min
Weaning Food B	355	0.52	4.23	20 min

Table 3 : Composition of Diets Used for Rats Bio-assay

	Control (Casein)	Weaning Food A	Weaning Food B
Protein source	11.7	38.4	35.3
Hydrogenated fat	10.0	10.0	10.0
Sugar	10.0	10.0	10.0
Vit. mix	1.0	1.0	1.0
Salt mixture	2.0	2.0	2.0
Corn starch	65.3	38.6	41.7

Table 4 : Protein Efficiency Ratio of Weaning Foods (Duration of experiment 4 weeks. Mean initial weight of rats 42.8 gm)

Diet	10% protein level		PER
	Wt. gain (g)	Protein intake (g)	
1. Casein (control)	79.00	23.77	3.299 ±0.116
2. Weaning Food A	87.10	26.39	3.291 (28 df)
3. Weaning Food B	80.40	24.27	3.304

@ standard error of the mean based on 28 degrees of freedom.

Results of test of significance
By Duncan's new multiple range test as given by Leon Horter in Biometrics (1960, o = 0.05, Vol. 16 PP 671-685)

Diet	2	1	3
Average PER	3.291	3.299	3.304

Note : a) Any two means not underscored by the same line are significantly different.
b) Any two means underscored by the same line are note significantly different.

Table 5 : Net Protein Ratio (NPR) and Net Protein Utilization (NPU) of Weaning Food

(Duration of the experiment, 10 days.
Randomised block-design-8 animals per group 10 % protein level)

Diet	Initial wt (g)	Grain in wt (g)	Protein intake (g)	Net Protein Ratio (NPR)	Net Protein Utilization (NPU)
1. Casein (control)	68.00	27.63	10.45	3.87	52.26
2. Weaning Food A	68.12	28.62	10.69	3.88	59.60
3. Weaning Food B	68.12	23.25	10.81	3.34	46.24

$S.E_m$ (28 df)

Results of test of significance (By Duncan's new multiple range test) (P 0.05)

Diet	1	2	3
Average NPR	3.87	3.88	3.34
NPU	52.26	59.60	46.24

Note : (a) Any two means not underscored by the same line are significantly different
(b) Any two means underscored by the same line are not significantly different.

Table 6 : Serum Protein Haemoglobin and RBC of Rats Fed on MPC Based Weaning Food.

Diet	Total Protein % (N x 6.25) gm/100 ml	Haemoglobin % gm/100 ml	RBC m/c mm
1. Casein (control) ...	7.72	15.75	8.53
2. Weaning Food A ..	6.79	16.60	9.05
3. Weaning Food B ..	6.68	15.43	8.37

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