THE DEVELOPMENT AND EVALUATION OF A SNACK FOOD FOR SCHOOL CHILDREN

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A snack food based on raw materials such as roasted gram, roasted groundnut, sesame seed, puffed rice, puffed maize and skim milk powder was developed for school children. It was compared with similar product available in the market and was observed to have higher biological value (P.E.R) and supported better growth in test animals. The food prepared with 40 per cent *gur* (sweetness) was organoleptically better accepted as compared to other levels.

INTRODUCTION

Snack foods which are locally called *Maroonda* are quite popular in certain regions of Pakistan. These foods are prepared from *gur* (brown sugar) and puffed rice or roasted gram. The nutritive value of these foods, particularly considering the quality and quantity of protein, does not seem to be very high. On the other hand, there is a wide-spread shortage of proteins in the diet of Pakistani people in general and the children in particular. Moreover, children spend long hours in schools without any nutritious food because there is no school lunch or any equivalent programme in most of the Pakistani schools. An attempt has, therefore, been made to develop a *Maroonda* type snack food from raw materials available in Pakistan which could be served to school children in a ready to eat form during school hours and could serve as a source of some good quality protein.

MATERIALS AND METHODS

The raw materials used in the preparation of these snack foods included roasted gram, roasted groundnut, sesame seed, puffed rice, puffed maize, *gur* and skim milk powder. These materials were purchased from the local market. Preliminary experiments showed that when ingredients were mixed in the following ratio, the mixture would form a slab of acceptable

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appearance and structure: Roasted gram 26.6%, puffed rice 6.6%, puffed maize 6.6%, roasted groundnut 6.6%, sesame seed 6.6%, skim milk powder 6.6%, and *gur* 40% (Designated as Formula A). This formula was then prepared by the following four methods: (1) A weighed quantity of *gur* was dissolved in a small amount of water and cooked until the solution developed sticking characteristics. The rest of the ingredients were mixed in and the mixture was placed in a wooden mould on a smooth surface. It was flattened smooth with the help of a rolling pin. When the mixture had dried out a little, it was cut into rectangular pieces. (2) The second method was similar to the first one but all the ingredients except groundnut and sesame seed were coarsely ground. (3) In the third method the ingredients were mixed and moistened slightly with a sprinkle of water. The mixture was pressed in a hydraulic press so that it formed into a slab. (4) The fourth method was similar to the third but all the ingredients except groundnut and sesame seed were coarsely ground.

Each of these methods of preparation was then attempted with three levels of *gur* (sweetness), 40, 45 and 50% in order to determine the effect of sweetness on the acceptability of this product. The samples prepared according to different methods of prepartion and with varying levels of *gur*, were evaluated organoleptically for colour, texture, flavour and overall acceptability.

Chemical and Biological Evaluation : For this phase of the study, two more recipes (designated as Formula B and Formula C) were included and the ratio of ingredients for these recipes was as follows :

Formula B: Roasted gram, 57.14%: sesame seed, 14.28%: and *gur* 28.52%.

Formula C : Roasted gram, 80.0% and *gur*, 20.0%.

Formula C : Corresponded approximately to the gram *Maroonda* available in the market.

Chemical Analysis: Prepared foods were analysed for moisture, crude protein, crude fibre, crude fat, and total ash according to the methods 14-40, 46-13, 32-15, 30-10 and 08-010 as described in the A.A.C.C. Cereal Laboratory Methods (1962). Nitrogen Free Extract (NFE) was calculated by difference.

Biological Evaluation : The prepared foods were evaluated for their biological value by rat growth trials. Five weanling albino rats of Wistar

Strain were maintained on each diet for a period of four weeks. The rats were housed individually and the feed and water were supplied *ad libitum*. The data was recorded on the weight of rats at weekly intervals and the amount of food consumed. Protein efficiency ratio was calculated as gain in weight (in grams) per gram of protein consumed.

RESULTS AND DISCUSSION

The organoleptic evaluation of samples prepared by various methods and at three levels of sweetness showed that the samples prepared from coarsely ground materials and in which *gur* solution acted as the binding material, were significantly better accepted by the panel of judges as compared to other preparations with respect to the colour, flavour, texture and overall acceptability of these products. The samples prepared by hydraulic press were reported to give a feeling of dryness in the mouth. Forty per cent level of *gur* was observed to be the most acceptable level of sweetness.

Chemical and Biological Evaluation : The data on the chemical analysis of three snack food formulae is presented in Table 1. It was observed that snack food C contained the highest amount of protein (13.12%), followed by that of snack foods B and A in decreasing order. Similar trend was noted with respect to the crude fibre content of three snack foods. Crude fat contents, however, were highest in case of snack food B which was due to the high proportion of sesame seed in this formula. The total ash contents varied from 3.98 per cent in case of snack food A to 2.62 per cent in case of snack food C. High protein and low ash contents in snack food C may be due to the high ratio of gram and low quantity of *gur* in this formula.

TABLE 1: *Analysis of snack food A, B, C, (moisture free basis) (Average of 3 determinations in each case)*

Snack Food Formula	Moisture	Crude Protein %	Crude Fibre %	Crude Fat %	Total Ash %	N.F.E.
Formula A	6.08	10.50	1.53	5.80	3.98	72.11
Formula B	4.97	11.05	2.75	7.63	3.00	70.60
Formula C	5.42	13.12	3.19	4.82	2.62	70.83

N.F.E : 100—(Moisture + Crude Protein + Crude Fibre + Crude Fat + Total Ash)

Biological Evaluation : The data on the average cumulative weight gain of rats during four weeks period and the protein efficiency ratio for the three snack foods is presented in Table 2. The data have revealed that the

TABLE 2: *Weight (in grams) of rats fed on different snack foods and the protein efficiency ratio (P.E.R.)*

Formula	Gain in weight by week*					Total gain in weight	P.E.R.
	0	1	2	3	4		
Formula A	48.5	67.7	114.0	148.7	170.6	122.1	1.92
Formula B	45.9	62.5	111.3	134.44	153.6	107.7	1.83
Formula C	47.6	69.7	111.6	128.5	142.8	95.2	1.06

*Average of 5 replications

differences in the weight gain of rats was not significantly different during the first two weeks of growth. However, the rats fed on snack food A gained significantly more weight than the rats fed on snack foods B or C, at the end of four weeks. Weight gain for snack food B was again significantly better than that for snack food C. The protein efficiency ratio ranged from 1.92 in case of snack food A to 1.06 in case of snack food C and difference was statistically significant. The differences between the P.E.R. values for snack foods A and B were, however, non significant.

Snack food C although contained the highest amount of crude protein as shown by its proximate analysis but its protein was derived from a single source (gram). Gram (chick pea) has been reported to be rich in lysine but fair in tryptophane contents (Smirnova-Ikonnikova, 1962). The lysine, histidine and arginine contents of large undecorticated chick pea has been reported to be 6.5, 3.0 and 11.4 by Gonzales Del Cuepto (1960), who further observed that autoclaving of chick pea accounted for a 14 per cent loss of lysine. Gram used in the prepration of snack foods in the present study was roasted gram and it is probable that due to loss of lysine during roasting, the protein may have become imbalanced and consequently lower in P,E.R. values, especially in case of snack food C. Snack food B contained sesame seed in addition to gram. Sesame seed might have exerted some complementary effect on the proteins of gram to raise the P.E.R. of this snack food significantly. However, sesame seed protein have been shown to be deficient in methionine (Salem and Bakheit, 1964) and in lysine (Almquist and Grau, 1944). Snack food A was found to give the highest P.E.R. in the present study. This food contained protein from a variety of sources including sesame seed, gram, powdered milk and groundnut. Powdered milk is a good source of all the essential amino acids and groundnut on the other hand has been shown to be somewhat deficient in methionine, lysine, Isoleucine and

threonine by Balasundaram *et. al.* (1958). In this case milk powder might have been a source of the limiting amino acid which were not supplied by other ingredients.

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