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DEVELOPMENT OF FIBRE RICH SNACKS AND THEIR EFFECT ON WEIGHT REDUCTION AMONG OBESE BOYS

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ABSTRACT

Childhood obesity is an important public health rapidly increasing worldwide. Unhealthy eating and over consumption of snacks high in fat, calories or added sugars are considered as major contributors of childhood obesity. The present study aimed at developing fibre rich snacks and evaluating their effect on selected obese boys. Forty obese boys in the age group of 10-12 years were divided into 4 groups with 10 members in each group. Group I, II and III were treated as experimental groups and group IV as control group. Three high fibre snacks were evaluated through changes in height, weight and Body Mass Index after a period of 3 months. A maximum increase in height was observed among Group I & II after the study period. Group II supplemented with steamed snack 2 showed a highly significant reduction in weight (1.6kg),Group I (0.9kg) & Group III (1.1kg) reduction in weight. The BMI of all the experimental groups were found to decrease from 0.9 to 1.14 with a higher reduction seen among group II. The findings revealed that consumption of high fibre snacks consisting of varagu, horse gram and curry leaves was found to be very effective in weight reduction of obese boys.

Keywords : Childhood obesity, high fibre snacks, obese boys, weight reduction

INTRODUCTION

Nutrition plays an important role in the growth and development of an individual throughout life. Infancy and childhood are important milestones for nutrition and growth since they strongly predict health outcomes later in life[1]. Prevention of nutritional problems is important during childhood, in order to reduce risk during adulthood[2]. During the last two decades, obesity has become the most prevalent nutritional problem in the world, eclipsing under nutrition and infectious diseases and emerging as the most significant contributor to ill health and mortality. About 15-20 per cent of all obese people were found to be obese in childhood and an additional 10-15 per cent during adolescence[3]. The highest prevalence of childhood obesity has been observed in developed countries. However, its prevalence is increasing in developing countries also[4].Obesity is a consequence of energy imbalance, in its simplest terms and decreased physical activity or increased inactivity are probably the main factors accounted for the reduction of total energy expenditure leading to positive energy balance and increased prevalence of

obesity[5].Unhealthy eating patterns resulting in over consumption of snacks high in fat, calories or added sugars are considered a major contributor to childhood obesity[6].It is important to maintain healthy components of traditional diets such as micronutrient rich foods like fruits, vegetables and whole grain cereals and guard against heavily marketed energy dense fatty and salty foods and sugared cold drinks.

The strategy should be to recognize and eliminate risk factors of high calorie intake such as frequent snacking, frequent eating out and celebrating with food and drink[7].Dietary fiber has important health benefits in childhood and adolescence, especially in promoting regular bowel habits and reducing a child's risk of chronic diseases such as cardiovascular disease, cancer and diabetes mellitus in adulthood[8]. Fibre intake is inversely associated with body weight and body fat. The addition of dietary fibre generally decrease food intake and hence, body weight [9]**.** Hence this study was undertaken with the objectives of developing high fibre snacks and evaluate their effect on selected obese boys.

MATERIALS AND METHODS

a. Development of High Fibre Snacks

Diets particularly those low in carbohydrate reduce body weight and for a long term effect, a low carbohydrate, high protein, high fibre diet is recommended for weight loss. A beneficial physical property of dietary fibre is that it may bind intestinal material such as bile acids, cholesterol and toxic compounds[10].Varagu, ragi flour, horse gram, curry leaves and onion were the main ingredients selected for the development of three high fibre snacks for the present study. Snack1 had three variations with varagu, ragi flour, horse gram and curry leaves powder. The significance of using varagu and horse gram as millet and a legume is related to their high fibre content of 9gm and 11g/100g respectively. Curry leaves powder is a good source of calcium (830mg/100g) and fibre.

Horse gram and varagu were roasted and powdered. The flours were mixed with sliced onion, chillies, coriander leaves, and salt and made into a shape of kozukattai and steamed. Snack 2 contained varagu, horse gram and curry leaves and no ragi flour and was prepared in the same manner as snack 1. Snack 3 had varagu, roasted bengal gram flour, curry leaves powder and prepared in the same manner as for snack 1.This combination was rich in fibre and protein. Table I presents the composition of the developed snacks.

TABLE I: COMPOSITION OF THE DEVELOPED SNACKS

Snack 1

Ingredients (g)	N_1	N_2	N_3
Horse gram flour	32.5	45.0	55.0
Varagu flour	32.5	20.0	10.0
Ragi flour	10.0	10.0	10.0
Curry leaves powder	10.0	10.0	10.0
Onion	15.0	15.0	15.0
Total	100.0	100.0	100.0
Acceptability scores out of 25	23.0	21.5	19.5

Snack 2

Ingredients (g)	S_1	S_2	S_3
Horse gram flour	20.0	30.0	37.5
Varagu flour	55.0	45.0	37.5
Curry leaves powder	10.0	10.0	10.0
Onion	15.0	15.0	15.0
Total	100.0	100.0	100.0
Acceptability scores out of 25	18.4	22.7	20.2

Snack 3

Ingredients (g)	K_1	K_2	K_3
Varagu flour	65.0	55.0	45.0
Roasted bengal gram flour	10.0	20.0	30.0
Curry leaves powder	10.0	10.0	10.0
Onion	15.0	15.0	15.0
Total	100.0	100.0	100.0
Acceptability scores out of 25	17.5	21.9	23.8

b. Acceptability Scores of the Formulated Snacks

Acceptability testing of different formulations of steamed snacks 1,2,3 was conducted using organoleptic evaluation based on characteristics such as appearance, colour, flavour, taste and texture with the help of a score card by a group of panel members. The scores are given in Table II.

TABLE II: ACCEPTABILITY SCORES OF THE DEVELOPED SNACKS

(MAXIMUM SCORES=25)

No of panel numbers	SCORES								
	Steamed snack 1			Steamed snack 2			Steamed snack 3		
	N_1	N_2	N_3	S_1	S_2	S_3	K_1	K_2	K_3
1.	23.0	21.5	18.5	18.5	23.5	22.5	16.0	21.5	24.5
2.	22.5	22.0	20.5	19.3	22.5	20.5	17.5	22.5	24.5
3.	23.5	21.5	19.5	17.4	23.0	21.5	18.0	22.0	23.5
4.	24.0	22.5	18.5	18.5	22.5	19.0	18.5	23.0	24.5
5.	23.0	22.0	19.5	20.0	19.0	21.2	16.0	22.5	24.0
6.	22.5	20.0	20.5	17.5	22.5	20.5	18.5	21.5	23.5
7.	23.5	19.5	19.5	16.5	23.5	19.0	19.0	22.5	23.5
8.	24.0	21.5	20.5	20.0	24.0	18.5	18.0	20.0	22.5
9	22.5	22.0	18.5	18.4	23.5	20.0	17.5	21.5	24.5
10.	21.5	22.5	19.5	18.3	23.0	19.5	16.5	22.0	23.0
Total	230	215	195	184	227	202	175	219	238
Mean	23.0	21.5	19.5	18.4	22.7	20.2	17.5	21.9	23.8
Highest score	**23**				**22.7**				**23.8**
Selected combination	**N_1**				**S_2**				**K_3**

Among the three variations of steamed snack1, N_1 had a highest mean score of 23 out of 25 and S_2 had a highest mean score of 22.7 among the three variations of steamed snacks 2. Among the three variations of steamed snack 3, K3 was selected with highest mean score of 23.8.

c. Conduct of the Study

Forty obese boys in the age group of 10-12 years were divided into four groups. Thirty boys constituted three experimental groups (I, II and III) and ten boys formed the control group. Three different snacks with highest acceptability scores (N1- 23, S2 - 22.7 and K3-23.8) were given to the three experimental groups for a period of three months. Steamed snack 1 for experimental group I, steamed snack 2 for experimental group II and steamed snack 3 for experimental group III were given as replacement of the evening snack for a period of four months. Dry ingredients of the different snacks were given to the mothers of the obese boys during holidays and they were asked to prepare the snacks (in the same method as explained by the investigator) and give to their children. Effect of high fibre snacks was evaluated through changes in height, weight and body mass index (BMI) after a period of four months.

RESULTS AND DISCUSSION

a. Nutrient content of the developed snacks

The nutrient content of the developed snacks is given in Table III.

TABLE III: NUTRIENT CONTENT OF THE DEVELOPED SNACKS

S.No	Nutrients	Steamed Snack 1	Steamed Snack 2	Steamed Snack 3
		Per serving (50g)	Per serving (50g)	Per serving (50g)
1	Energy (kcal)	111	126	84
2	Carbohydrate(g)	21.8	25.2	25.3
3	Protein(g)	5.32	5.55	5.64
4	Fat(g)	0.35	0.40	1.20
5	Fibre(g)	4.64	4.49	2.84
6	Calcium(mg)	127.7	94.1	59.8
7	Iron(mg)	1.27	1.21	1.63

With regard to energy content steamed snack 2 ranked first with an energy value of 126 kcal per serving, followed by steamed snack 1 with 111kcal and steamed snack 3 with 84 kcal per serving. The calorie content of all the snacks per serving was found to range from 84 to 126 kcal. Steamed snack 3 and steamed snack 2 had slightly high carbohydrate content of 25.3g and 25.2 g followed by 21.8 g in steamed snack 1 .There was not much difference in the carbohydrate content among the three snacks. Protein content of the three snacks was found to be 5.32g, 5.55g, and 5.63g respectively per serving which were not much different from each other. Fat content was found to be 1.2g being the maximum in steamed snack 3 whereas steamed snack 1 and steamed snack 2 contained 0.35g and 0.4g per 50g respectively. Low fat content is more appropriate for weight reduction. Steamed snack 1 had high fibre content (4.64g), followed by Steamed snack 2 (4.49) and Steamed snack 3 (2.84g) respectively. Fibre is highly significant and forms a component of many of weight reduction diets.

b. Cost of the formulated snacks

The cost of the formulated snacks was calculated based on the prevalent market prices .The cost of 100g of steamed snack 1(N1)was Rs.2.50 whereas per serving it was Rs.1.25.The cost of steamed snack 2 (S2) was Rs. 3.0 per 100g and per serving it was Rs. 1.50 respectively. The cost of steamed snack 3 (k3) was Rs1.75 per serving and Rs 3.50 per 100g. The slight higher cost of steamed snack 3 may be due to inclusion of roasted bengal gram. Among the three snack replacements; there was not much difference in cost. The developed snacks were less costly and more nutritious when compared to baked, fried, processed and packaged snack items which are sold in the market.

c. Changes in the Anthropometric Measurements of Selected Obese boys before and after snack replacement

The anthropometric measurements of the selected obese boys before and after snack replacement are given in Table IV.

TABLE IV: MEAN ANTHROPOMETRIC MEASUREMENTS BEFORE AND AFTER SNACK REPLACEMENT

N =40

Details	Mean ± SD		Mean difference ±SD	t – value
	Before	After		
Height (cm)				
Group I	148.7±6.79	150.3±6.2	1.6±0.9	5.67**
Group II	149.6±7.07	151.2±6.9	1.6±0.5	9.79**
Group III	150.2±5.13	151.7±4.97	1.5±0.6	8.33**
Control	136.7±3.70	138.2±4.03	1.5±0.64	7.12**
Weight (kg)				
Group I	56.03±10.9	55.10±10.9	0.9±0.6	4.85**
Group II	47.40±5.90	45.8±5.90	1.6±0.7	6.97**
Group III	51.98±9.50	50.84±9.13	1.1±0.6	6.45**
Control	41.80±3.76	44.69±3.3	2.9±0.8	11.49**
Body Mass Index (BMI)				
Group I	25.14±2.90	24.23±1.68	0.9±0.50	6.14**
Group II	21.20±2.20	20.01±2.10	1.14±0.14	8.73**
Group III	22.97±3.50	22.05±3.40	0.9±0.21	13.27**
Control	22.34±1.57	23.41±1.50	1.06±0.58	5.80**

** Significant at one per cent level

Group I- fed with steamed snack 1

Group II- fed with steamed snack 2

Group III- fed with steamed snack 3

i. Height

A maximum increase in height was observed among groups I and II after the study period. The mean values for height were found to be significant at one per cent level when compared with the initial and final values for all the groups. The height increments revealed by 't'-test was at one per cent level of significance between the initial and final values in groups I, II, III and control group.

ii. Weight

Among the experimental groups, Group II supplemented with steamed snack 2 showed a highly significant reduction in weight (1.6 kg) between initial and final weight measurements and other experimental groups Group I (0.9 kg) and, Group III (1.1kg) also exhibited a significant change in weight at one per cent level. In contrast there was an increase in weight at one per cent level of significance among the control group. The changes in weight within the experimental groups were statistically significant at one per cent level.

iii. Body Mass Index

The BMI values of all the experimental groups were found to decrease ranging from 0.9 to 1.14 with a higher reduction

seen among group II due to reduction in body weight after snack replacement .The difference was found to be statistically significant at one per cent leveling comparison with control group which showed an increase in weight and correspondingly BMI values also increased.

SUMMARY AND CONCLUSION

Childhood obesity is an important public health problem rapidly increasing worldwide .The present study aimed at developing fibre rich snacks and evaluating their effect on selected obese boys. The findings revealed that consumption of high fibre snacks consisting of varagu, horse gram and curry leaves was found to be very effective in weight reduction of obese boys. Potential interventions influencing food intake will be the most appropriate set of specific actions that should be undertaken to improve an individual's life style and a broader public health perspective and policy decision will have a significant impact on the problem of childhood obesity since, a healthy child is happiness to parents, thrill of the society and hope of the nation.

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REFERENCES

1. Gibney,M.J., Macdonald,I.A. and Roche,H.M. (2003), "Nutrition and Metabolism", Blackwell Publishing Company, USA, P. 112.
2. Roberts,B.S.W. and Williams,S.R. (2000), "Nutrition Throughout Life Cycle", 4th Edition. McGraw-Hill International, Boston, P. 43.
3. Zwiauer,K.F.M. (2000), "Prevention and Treatment of Overweight and Obesity in Children and Adolescents", Eur.J.Pediatr, Vol.159, No.1, Pp. S56 - S68.
4. James,J., Thomas,P., Cavan,D. and Kerr,D. (2004), "Preventing Childhood Obesity by Reducing consumption of Carbonated Drinks: Cluster Randomised Controlled Trial", BMJ, Vol.34, Pp. 86 - 92.
5. Molnar,D. and Livingstone,B. (2000), "Physical Activity in relation to Overweight and Obesity in Children and Adolescents", Eur.J.Pediatr, Vol.159, No.1, Pp.S45 - S55.
6. Chagnon,Y.C., Rankinen,T. and Synder,E.E. (2003), "The Human Obesity Gene Map: The 2002 Update", Obes.Res, Vol.11, Pp. 313 - 367.
7. Bhave,S., Bavdekar,A. and Otiv,M. (2004), "IAP national Task Force for Childhood Prevention of Adult Diseases: Childhood Obesity", Ind. Pediatr,Vol. 41,Pp. 559 - 575.
8. Williams,C.L.(2006),"DietaryFibe in Childhood", Pediatr, Vol.149, No.5, Pp.121- 130.
9. Slavin,J.L. (2006), "Dietary Fiber and Body Weight", J.Am.Diet.Assoc, Vol.106, No.9, Pp. 1380 - 1388.
10. Gardner, C.D; Karzand, A; Alhassan, S; Krim, S; Stafford, R.S; Balise, R.R; Kraemer, H.C; King, A.C. (2007), "Comparison of the Atkins, zone, ornish and lean diets for change in weight and related risk factors among overweight premenopausal women", JAMA, Vol. 297, No. 9, Pp. 969-977.