RESEARCH ARTICLE — FOOD SCIENCE RESEARCH JOURNAL — Volume 3 | Issue 1 | April, 2012| 47-51

Impact of soy ladoo supplementation on nutritional status of malnourished preschool children

N.S. GHATGE

Malnutrition is a global health issue. It imposes a toll on child mortality, 53 per cent of deaths in children under 5 years in age are due to nutrition related in worldwide. It may be due to the role of nutrients in disease and immunity. Supplementary feeding programmes are the emerging need in under nutrition for vulnerable segment in the population. Supplementary feeding must be the additional nutrients which are providing for the optional growth and desirable change in health status in particular. Hence, supplementary foods must be based on the formulation of the required nutrients for the treating of malnutrition, return the child to physiological, immunological and biochemical normality. The organoleptic qualities like taste, texture, flavour and over all acceptability of the soy ladoo was highly scored by the panel. The nutritional qualities likes major nutrients such as energy(470.0kcal), proteins (20.1 g) and fats (22.0 g) content were found more in soy ladoo. The micro nutrients such as iron (6.3 mg), zinc (3.8 mg) and calcium (286.5 mg) were also observed higher range in soy ladoo. It was also noted that there were very less antinutrtional factors like phytate phosphorous (160mg), tannin (0.34 mg), tryspin inhibitor activity (5.5ml), acid detergent fiber (1.31g), cellulose (1.00g) and lignin (0.3ml). The *in vitro* digestibility of protein and per cent bioavailability of iron shown higher in soy ladoo. It showed better keeping qualities upto two months when stored in a tetra package at room temperature. Soy ladoo has also shown very low production cost. Hence, it was found very cheap and affordable to the below powerty line group of children.Significant improvements in nutrients intake, anthropometric measurements.The soy ladoo was given @ 50 g/child/day.

How to cite this article **:** Ghatge, N.S. (2012). Impact of soy ladoo supplementation on nutritional status of malnourished preschool children. *Food Sci. Res. J.,* **3**(1): 47-51.

Key Words **:** Anthropometric measurement, Soy ladoo, Supplementary feeding

INTRODUCTION

Soybean is an important source of quality legume protein and also oil seed crop in Maharashtra. Soybean is one of the nature's wonderful nutritional gifts. It is one of the few plants that provide complete proteins with minimum saturated fat. Regular consumption of soybean helps people feel better and live longer with enhances quality of life. Soybean contains all three macro nutrients required for good nutrition *i.e.* complete protein, carbohydrates, fat as well as vitamins and minerals including folic acid calcium, potassium and iron. Soybean protein provides all nine essential amino acids in the amount needed for human health. It is less expensive and hence used for formulation of high nutritious weaning, supplementary food and snack food. Most of these studies (Sahay and Kacharu, 1988; Chandrashekhar and Hildo Sahay Rani, 2004; Despande *et al.,* 2004) recommended that soybean can be used for snack food as well as weaning food and supplementary food to combat the malnutrition and to maintain good health and good nutritional status of preschool children. With the intention of high significance nutritive value of soybean, it is most-familiar, and more popular in children.

Before conducting the supplementary feeding progeamme, the screening of malnutrition was monitored and evaluated by use of weight for age, weight for height and body mass index (BMI) of the preschool children. Moreover, on the basis of screening the grading of malnutrition in preschool children was calculated by taking into account the average values of the weight for age, weight for height and BMI of these children. The revalent data are presented in Table 1 and 2.

ADDRESS FOR CORRESPONDENCE

N.S. GHATHE, Trimurti Home Science College, Trimurti Nagar Newasa Phata, AHMEDNAGAR (M.S.) INDIA

E-mail: nalinihemangi26@rediffmail.com

METHODOLOGY

The local varieties of soybean *i.e.* MACH-58 and bengal gram *i.e.* pragati phule were procured from the market. It was cleaned, washed, dried, coarsely grind, dehulled and made into flour separately by use of grinding machine. Soy ladoo was prepared.

Sensory evolution:

By the use of three different combination soychakali was prepared and evaluated organoleptically with the help of trained panel of judges on a nine point Hedonic scale (Amerine *et al.*, 1965).

Anthropometric measurement:

Anthropometric measurements by applying the parameters such as height (cm), weight (kg), body mass index (kg/m^2), skin fold thickness (mm), Arm circumference (cm), wrist circumference (cm) and mid arm muscle circumference (cm) were measured in the preschool children by using standard formulae given by Jelliffe (1966). All the anthropometric measurements of the preschool children were taken before and after the supplementary feeding programme. After supplementation all these anthropometric indiceses were measured for six months by keeping one month of interval.

Chemical analysis of soyproducts:

High scored soy ladoo in sensory evaluation was selected for chemical analyses. Such as moisture content, total ash, major nutrient like crude protein, fat, carbohydrates, B complex vitamins, minerals such as iron, calcium, zinc and crude fiber with the use of method described in (AOAC 1975).

Statistical analysis:

The organoleptical qualities of soy ladoo were carried out after it's storage for 0 to 1 month and 1 to 2 month packed in polythene and tetra packaging materials at room temperature. The differences noticed among this were calculated by statistically and also anthropometric measurements before and after feeding with one month interval. The obtained data analyzed statistically were significant at P<0, 0.5 levels SE and C.D. at 5 per cent level by procedure (Gomez and Gomez, 1984).

OBSERVATIONS AND ASSESSMENT

According to weight for age, 30.6 per cent children noted as below normal level, 55.0 per cent as moderate and 14.4 per cent as normal level (Table 1). As per the ratio found in weight for height, 53.6 per cent children were noticed as moderate weight, 29.6 per cent as under weight and only 13.8 per cent treated as normal weight children. Where as in moderate BMI, the per cent of preschool children reported as 54.0 per cent, 25.6 per cent as under BMI, 15.2 per cent as normal BMI and 5.2 per cent as above normal BMI. The average value in below normal, under weight and below BMI were taken into account as 'poor' *i.e.* grade of malnutrition III, average values of moderate ratio considered as grade II of malnutrition, the average values of normal ratio taken as normal grade I of malnutrition etc (Table 2).

The per cent of grades generated in Table 2 reveals that, 54.2 per cent children were in grad II, 28.6 per cent as a 'poor' grade III and only 14.4 per cent shown as normal grade of malnutrition. Among the grade II hundred numbers moderate grade of malnutrition children were choosen for the supplementary feeding programmes. Out of these 100 moderate grade preschool children were divided equally into four groups *i.e.* each groups measured 25 numbers of children.

Before providing the supplementary foods, all the experimental group children were dewormed in previous night. The supplementary feeding programme was conducted to malnourished preschool children for six months of period. Formulated and nutritionally evaluated soy ladoo was provided separately to the group *i.e.* Group I – soy ladoo, Group II – was not given any supplementary food, hence It was termed as control group. The amount of supplementary food given to the group was 50g/day/child. A standard of ICMR about providing energy, protein and fat was maintained while supplementation of soy ladoo.

The data regarding average of anthropometric measurements of all children during six months experimental period are given into Table 3. It revealed that, the average height (cm) in group I children was 96.6±2.9. It showed normal (93.0 per cent) when compared with their standard normal height. Group II children height noted near by normal (*i.e.* 85.6 per cent) level. Where as under weight (49.5 per cent)and below their standard level. The average per cent of arm circumference measurements among all the children by group

Table 1. Screening of preschool children through weight/age, weight/height and BMI

Sr. No.	Weight / age				Weight/ height					BMI			
	Below normal	Moderate	Normal	Total	Under weight	Moderate weight	Normal weight	Above normal weight	Total	BMI	Moderate BMI	Normal BMI	Above nornal
Frequency	153	275	72	500	148	268	69	15	500	128	270	76	26
Per cent	30.6	55.0	14.4	100.0	29.6	53.6	13.8	3.0	100.0	25.6	54.0	15.2	5.2

Table 2. Grading of malnutrition in preschool children

Sr. No.	Grades of malnutrition				
	Grade III (Poor)	Grade II (Moderate)	Grade I (Normal)	About normal (obese)	Total
Frequency	143	271	72	14	500
Per cent	28.6	54.2	14.4	2.8	100

I shown a normal values *i.e.* (93.9). It was found as higher in group I and lower in control group of children (69.0) per cent. The average value in measurement of head circumference was recorded highest in children of group I (42.0±1.8 cm). The per cent measurement of these values of head circumference noted as moderate level. The average measurement of head circumference in children of control group found as below. Average value of skin fold thickness among children of control group was observed poorly under the normal level. Group I children showed a maximum average wrist circumference (5.5±0.8 cm). It was reported under moderate standard level. The average of wrist circumference among children of control group was noticed under 'poor' standard category *i.e.* (59.0 per cent). Majority of children of group were observed moderate level mid arm muscle circumference. Group I children showed a maximum average of mid arm muscle circumference (12.6±1.7 cm). The control group reported as below their moderate level of standard value. The average of body mass index found in group I children (*i.e.* 14.4±2.0), which was noted as normal level of their standard measurement. Where as BMI of control group of children was noticed as 10.6±1.5, BMI of control group children was noted as below their standard level. The average anthropometric measurements of all the children in different experimental groups were compared with their same measurements obtained before supplemtattion and presented in Tables 3 and 4 (Anne and Begam, 1985).

A significant increase in per cent of height was observed in group I children after supplementation (Table 4). It showed that, the average height of this group of children before supplementation was noted as 84.5±1.6 cm. It significant increase was found up to 96.6±2.9 cm after supplementation. This average height of the children group I recorded as normal (93.0 per cent) as compared with their standard level. The average height of children in group II was reported as 83.0±1.3 cm before supplementation and found increased significantly up to 93.9±1.9 cm after supplementation. This increased in height of group II children noted near by normal level of their standard measurement. A significant increase in height was also noticed in control group children. It shown increase in height from 85.1±89.9 cm after the experimental period.

Group I children put on body weight from 8.6 to 13.5 kg. Where as average body weight of children in control group was noticed poorly under weight as compared with their standard measurement (49.5%) (Kanwar *et al.*, 1994).

The data about average arm, chest, head and wrist circumference of experimental groups before and after supplementation was given in Table 5. It represented that, the average measurement of arm circumference in all the groups of

Table 3. Average anthropometric measurement of experimental groups

Sr. No.	Anthropometric measurement	Group I mean ± S.D.	Group II mean ± S.D.
1.	Height (cm)	96.6 ± 2.9 (93.0)	89.9 ± 2.3 (85.6)
2.	Body weight (kg)	13.5 ±1.84 (78.1)	8.5 ±1.1 (49.5)
3.	Arm circumference (cm)	14.0 ±1.9 (93.9)	10.3 ±1.4 (69.0)
4.	Chest circumference (cm)	40.8±6.4 (79.8)	36.2 ±2.0 (70.5)
5.	Head circumference (cm)	42.0±6.4 (87.0)	38.4 ± 2.9 (79.5)
6.	Skin fold thickness (mm)	10.4 ±0.9 (75.8)	8.6 ±1.2 (62.6)
7.	Wrist circumference (cm)	5.5 ±0.8 (70.6)	4.6 ±0.6 (59.0)
8.	Mid arm muscle circumference (cm)	12.6 ±1.7 (84.6)	11.2 ±1.5 (75.1)
9.	Body mass index	14.4 ±2.0 (93.3)	10.6 ±1.5 (67.9)

Group I - Experimental group with supplementation of soy ladoo
Group II - No supplementation *i.e.* control group.
Figures in paranthesis indicate percentage.

Table 4. Average height and body weight of experimental groups before and after supplementation

Sr. No.	Anthropometric measurement	Group I mean ± S.D.			Group II mean ± S.D.		
		BS	AS	't' value	BS	After 6 month	't' value
1.	Height (cm)	84.5 ± 1.6 (80.4)	96.6 ±2.9 (93.0)	2.9*	85.1 ±1.6 (81.0)	89.9 ±1.7 (85.6)	2.4*
2.	Body weight (kg)	8.6 ±1.2 (49.7)	13.5 ±1.8 (78.1)	3.2**	8.1 ±1.1 (47.3)	8.5 ±1.1 (49.5)	0.91 NS

Group I - Experimental group with supplementation of soy ladoo. Group II - No supplementation *i.e.* control group.
Figures in paranthesis indicate percentage. * and ** indicate significance of values at P=0.05 and P=0.01, respectively
NS= Non-significant BS= Before supplementation AS – After supplementation

Table 5. Average arm, chest, head and wrist circu,ference of experimental groups before and after supplementation

Sr. No.	Anthropometric measurement	Group I mean ± S.D.			Group II mean ± S.D.		
		BS	AS	't' value	BS	After 6 month	't' value
1.	Arm circumference (cm)	11.4 ± 1.6 76.5)	14.0 ±1.9 (93.9)	3.4*	9.1 ±1.4 (61.1)	10.3 ±1.4 (69.0)	1.8 NS
2.	Chest circumference (cm)	35.6±3.2 (69.6)	40.8±6.4 (79.8)	3.1*	34.0±4.0 (66.5)	36.2 ±2.0 (70.5)	1.8 NS
3.	Head circumference (cm)	38.6 ±6.0 (79.9)	42.0 ±6.4 (87.0)	2.9*	36.2 ±2.1 (74.9)	38.4 ±2.9 (79.5)	1.51 NS
4.	Wrist circumference (cm)	3.9±0.7 (50.1)	5.5 ±0.8 (70.6)	3.0*	4.6 ±0.6 (59.0)	4.6 ±0.6 (59.0)	0.00 NS

Group I - Experimental group with supplementation of soy ladoo. Group II - No supplementation i.e. control group.
Figures in paranthesis indicate percentage. *and ** indicate significance of values at P=0.05 and P=0.01, respectively
NS= Non-significant BS= Before supplementation AS= After supplementation

Table 6. Average skin fold thichness, in arm muscle circumference and body mass index of experimental groups before and after supplementation

Sr. No.	Anthropometric measurement	Group I mean ± S.D.			Group II mean ± S.D.		
		BS	AS	't' value	BS	After 6 month	't' value
1.	Skinfold thickness (mm)	7.5 ±1.3 (54.3)	10.4±0.9 (75.8)	2.8*	8.5±1.2 (62.0)	8.7±1.2 (62.6)	0.4 NS
2.	Mid Arm muscle circumference (cm)	9.5 ± 1.6 (63.8)	12.6 ±1.7 (84.6)	3.3**	11.0±1.5 (73.8)	11.2±1.5 (75.1)	0.8NS
3.	Body mass index	12.1±1.7 (82.0)	14.4±2.0 (93.3)	3.3**	11.8 ±1.5 (75.5)	10.6±1.5 (67.9)	2.71*

Group I - Experimental group with supplementation of soy ladoo. Group II - No supplementation *i.e.* control group.
Figures in paranthesis indicate percentage. * and ** indicate significance of values at P=0.05 and P=0.01, respectively
NS= Non-significant BS= Before supplementation AS= After supplementation

experimental children *i.e.* I recorded as normal with their standard measurements after supplementation. Highest score in average arm circumference was noticed in the children of group I (*i.e.* 93.9 per cent). Very positive impact was noticed in the better growth of arm circumference of children after the soy ladoo by products supplementation. Control group of children shown non significant difference in the arm circumference measurement after six months of experimental period.

Average measurement of chest circumference are found maximum in Group I children, it was noted as 79.8 per cent. The positive change in average of chest circumference among the children of group I, seen as significantly increased after supplementation. Average of chest circumference in control group of children found slightly increased at non significant level.

Head circumference of pre-school children in group I shown increased from 38.6 to 42.0 cm. after supplementation. The head circumference among the group I of children *i.e.* I, noted increased at significant level. There was no significant change noticed in head circumference among children of control group after experimental period.

Average wrist circumference before supplementation was as 3.9 and found increased to 5.5 cm in group I children after supplementation. A significant increase of wrist circumference was observed in the children of group. Where as no change was noticed in growth of wrist circumference among children of control group.

Average values of skin fold thickness mid arm muscle circumference (MAMC) and body mass index (BMI) of all the experimental groups of children are shown in Table 6. It highlights that, a significant change was noticed in skin fold thickness (10.4 mm) in the children of group I after supplementation than before supplementation (7.5 mm). Control group children showed no any significance difference in skin fold thickness after the experimental period.

The average value of mid arm muscle circumference (MAMC) in preschool children of group I shown an increased from 63.8 to 84.6 per cent after supplementation. This increase in MAMC of group I children was noted highly significant after supplementation. No change was noticed in MAMC values after experimentation in control group children.

Body mass index (BMI) of group I children only reported to normal level with their standard measurements (93.3 per cent). Deterioration BMI was noticed in control group.

Conclusion:

On the whole, it can be concluded that, supplementary feedings soy ladoo had positive effect on all the anthropometric measurements. Height, body weight, arm, head, chest and wrist circumference shown increased from below to moderate and normal of their standard measurements. Skin fold thickness, MAMC and BMI were also noticed increased to their standard mark. Control group was found steady, slow and non significant change in all the anthropometric indices after experimental period. Intake of soy ladoo had highly significant desirable changes in all the anthropometric measurements.

LITERATURE CITED

Amerine, M.A., Pangborn, R.M. and Roessler, E.B. (1965). *Principles of sensory evaluation of food*. Academic Press, NEW YORK.

Anne, Usha and Begum, Mash-lari, J. (1985). Nutritional status of children attending the USA School. *Indian J. Nutri. & Dietet*. **22** : 221 - 225.

A.O.A.C. (1984). *Approved methods of analysis 14th edn*. Association of Official Analytical Chemist, WASHINGTON, D.C.

Chandrashekhar, Usha and Hildo Sahay Rani, W. (2004). Supplementation studies, soyprotein isolate based food mix on 1-2 year old malnurished children improvement in the biochemical, chemical cognitive profile. *Indian J. Nutri. & Dietet*., **47**:460-466.

Deshpande, S.S., Mishra A. and Mistra, M. (2004). Preparation and organoleptic evaluation of soybased food products. *J. Food Sci. Technol.*, **38**:291-293.

Gomez, K.A. and Gomez, A.A. (1984), *Statistical procedures for agricultural research*, Willey International John Willey and Sons, NEW YORK.

Jelliffe, D.B. (1966). *The assessment of nutritional status of community*. Monograph Series, WHO, GENEVA.

Kanwar, Promila, Jatinder, Kishatwaria and Charwara, P.C. (1994). Nutritional status of scheduled caste preschool children. A study in district Kangra of Himachal Pradesh. *Indian J. Nutri. & Dietet.,* **31**:293–297.

Sahay, K.M. and Kachru, R.P. (1988). Preparation of soyblend snacks at domestic level. Soybean processing and utilization in *Indian. Tech. Bull. No*. CIAE /SPU/1/88/53.

Received : *10.12.2011;* **Revised:** *30.12.2011;* **Accepted :** *22.02.2012*