

# Effect of soychakali feeding on anthropometric status of malnourished pre-school children

■ N.S. GHATGE

Received: 19.01.2012; Revised: 19.06.2013; Accepted: 28.06.2013

Author for correspondence :

**N.S. GHATGE**  
Pravara Rural Education  
Society's, Women's College of  
Home Science and BCA, Rahata,  
AHMEDNAGAR (M.S.) INDIA  
Email: malinihemangi26  
@rediffmail.com

■ **ABSTRACT** : To combat malnutrition 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, traditional and familiar 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. Organoleptically high score evaluated soychakali was provided as supplementary food to pre-school malnourished children. The soychakali was given @ 50 g/ child/day. Selection of pre-school malnourished children were done according to waterlow classification. The anthropometric measurements such as weight (kg), height(cm), body mass index (kg/m<sup>2</sup>), skin fold thickness (mm), arm circumference (cm), wrist circumference (cm) and mid arm muscle circumference (cm) were significantly increased after supplementation of soychakali for six months. Control group found steady, slow and non-significant change in all the anthropometric indices after experimental period.

■ **KEY WORDS** : Anthropometric Measurement, Soychakali, Supplementary feeding

■ **HOW TO CITE THIS PAPER** : Ghatge, N.S. (2013). Effect of soychakali feeding on anthropometric status of malnourished pre-school children. *Asian J. Home Sci.*, 8 (1): 295-299.

Soybean is an important legume and oil seed crop in Maharashtra. It is one of the nature's wonder and nutritional gift provides good quality protein with minimum saturated fat and high calorie value. Soybean has endowed with apithel functional food of the country as beyond traditional basic nutrition (Vinnat Kumar *et al.*, 2004). Soybean also contain the nutraceutical properties like isoflavounes, phytoestrogen, soluble phosphate and potassium sulphate in which these properties are mostly used to prevent the risk of dreaded diseases like breast cancer, osteoporosis, cardiovascular disease, kidney stone and help in beating menopausal blue (Messina, 1997).

Soybean is referred as vegetarian meat due to its high quality amino acids profile. It is less expensive legume as well as oil seed due to excellence source of macronutrients and other biological properties. Hence, it is used for the formulation of high nutritious weaning and supplementary foods. Most of the studies (Sahay and Kocharu 1988, Chandrashekhar and Rani (2004); Deshpande *et al.* (2004) recommended that

soybean can be used for the snacks food as well as weaning and supplementary food to combat the malnutrition and to maintain good health and nutritional status of pre-school children. With the intention of high significance nutritive values of soybean, the most familiar, more popular in children soy based product such as soychakali prepared and evaluated nutritionally.

## ■ RESEARCH METHODS

Local varieties of soybean MC HS 58 and rice *i.e.* Ratanagri were procured from market. It is cleaned washed dried roasted and ground separately. The different combinations were used for the formulation of and preparation of soychakali.

## Sensory evolution :

By the use of three different combination soychakali was prepared and evaluation by 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<sup>2</sup>), skin fold thickness (mm), Arm circumference (cm), wrist circumference (cm) and mid arm muscle circumference (cm) were measured in the pre-school children by using standard formulae given by (Jelliffe1966). All the anthropometric measurements of the pre-school children were taken before and after the supplementary feeding programme. After supplementation all these anthropometric indices were measured for six months by keeping one month of interval.

**Chemical analysis of soyproducts :**

High scored soychakali 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).

**Selection of manourished pre-school children :**

Selection of pre-school malnourished children were done according to Waterlow classification. National centre for Health Statistics. The pre-school malnourished children were evaluated weight for height and body mass index.

**Statcal analysis :**

The organoleptical qualities of soychakali was carried out after it 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 statically and also anthropometric measurements before and after feeding with one month interval. The obtained data was

analyzed statically significant at P < 0, 0.5 levels SE and CD at 5 per cent level by procedure (Gomez and Gomez, 1986).

**RESEARCH FINDINGS AND DISCUSSION**

According to weight for age 30.6 per cent children were noted as below normal 55.0 per cent as moderate and 14.4 per cent as normal (Table 1). As per the ratio found in weight for height, 53.6 per cent children 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 case of BMI, these children were classified as 54.0 per cent in moderate BMI, 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 normal BMI were taken into account as 'poor' *i.e.* grade III of malnutrition. Where as average values which are found in moderate ratio were considered as Grade II of malnutrition. The average values which are observed as normal ratio taken as normal grade I of malnutrition.

The per cent of grades reported in Table 2 reveals that, 54.2 per cent children noted as in grade 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 of moderate grade of malnutrition children were chosen for the supplementary feeding programmes. These 100 moderate grade pre-school children were divided equally into four groups *i.e.* each groups measured as 25 numbers of children.

Before providing the supplementary foods, both the experimental groups children were dewormed in previous night. The supplementary feeding programme was conducted to malnourished pre-school children for six months soyachakali was provided. Formulated and nutritionally evaluated soyachakali I was given to group I and Group II- was not given any supplementary foods, hence, this group was termed as control group. A standard of ICMR about providing energy, protein and fat was maintained while

**Table 1: Screening of pre-school 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	Poor BMI	Moderate BMI	Normal BMI	Above normal BMI	Total
Frequency	153	275	72	500	148	268	69	15	500	128	270	76	26	500
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	100.0

**Table 2: Grading of malnutrition in pre-school children**

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

supplementation of soyachakali. Accordingly the amount of soyachakali *i.e.* 50 g. was supplemented in entire period of experiment.

The data regarding average anthropometric measurements of all children of experimental period during six months experimental period was given in Table 3. Group I children height noted near by normal (*i.e.* 89.4 per cent) level. Where as the height of control group refereed as moderately normal (85.6 per cent). It seems that, the children in both the experimental groups *i.e.* I<sup>st</sup> and II<sup>th</sup> were longer in height and near by normal level of their standard height after experimental

period. The average body weight was noticed in children of group I (12.0±1.8 kg). Where as the children from control group were shown under weight (49.5 per cent) and below their standard level. The average per cent of arm circumference measurements among both the children by group I and II shown normal values *i.e.* (91.2) and (69.0), respectively. It was found as higher in group I and lower in control group of children. The growth in the chest circumference was measured as near by moderate level among the experimental group I of children, except control group. Head circumference in groups I children were noted as above the moderate standard level

**Table 3: Average anthropometric measurement of experimental groups**

Sr. No.	Anthropometric measurement	Group I Mean ± S.D.		Group II Mean ± S.D.	
		Mean	S.D.	Mean	S.D.
1.	Height (cm)	93.9	± 2.9 (89.4)	89.9	± 2.3 (85.6)
2.	Body weight (kg)	12.0	± 1.8 (69.4)	8.5	± 1.1 (49.5)
3.	Arm circumference (cm)	13.6	± 1.6 (91.2)	10.3	± 1.4 (69.0)
4.	Chest circumference (cm)	39.1	± 3.3 (76.5)	36.2	± 2.0 (70.5)
5.	Head circumference (cm)	40.1	± 6.3 (83.0)	38.4	± 2.9 (79.5)
6.	Skinfold thickness (mm)	9.3	± 1.3 (67.9)	8.6	± 1.2 (62.6)
7.	Wrist circumference (cm)	5.0	± 0.7 (64.2)	4.6	± 0.6 (59.0)
8.	Mid Arm muscle circumference (cm)	12.3	± 1.7 (82.6)	11.2	± 1.5 (75.1)
9.	Body mass index	13.6	± 2.0 (87.2)	10.6	± 1.5 (67.9)

Group I - Experimental group supplemented with soyachakali, Group II -No supplementation *i.e.* control group, Figures in parantheses indicate percentage

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

Sr. No.	Anthropo-metric measure-ment	Group I Mean ± S.D.			Group II Mean ± S.D.		
		BS	AS	't' value	BS	After 6 month	't' value
1.	Height (cm)	83.0 ± 1.3 (79.0)	93.9 ± 1.9 (89.4)	2.8*	85.1 ± 1.6 (81.0)	89.9 ± 2.3 (85.6)	2.4*
2.	Body weight (kg)	8.2 ± 1.1 (47.4)	12.0 ± 1.8 (69.4)	2.9*	8.1 ± 1.1 (47.3)	8.5 ± 1.1 (49.5)	0.91 NS

Group I- Experimental group supplemented with soyachakali, Group II -No supplementation *i.e.* control group, Figures in parantheses indicate percentage \* and \*\* Indicate significance of value at P=0.05 and 0.01, respectively, NS=Non-significant, BS – Before supplementation, AS – After supplementation

**Table 5: Average ARM, chest, head and wrist circumference of experimental groups before and after supplementation**

Sr. No.	Anthropo- metric measure-ment	Group I Mean ± S.D.			Group II Mean ± S.D.		
		BS	AS	't' value	BS	After 6 month	't' value
1.	Arm circumference (cm)	10.9 ± 1.5 (73.0)	13.6 ± 1.6 (91.2)	3.1*	9.1 ± 1.4 (61.1)	10.3 ± 1.4 (69.0)	1.8 NS
2.	Chest circumference (cm)	34.0 ± 4.1 (66.5)	39.1 ± 3.3 (76.5)	3.1*	34.0 ± 4.0 (66.5)	36.2 ± 2.0 (70.5)	1.8 NS
3.	Head circumference (cm)	35.0 ± 6.1 (72.4)	40.1 ± 6.3 (83.0)	2.7*	36.2 ± 2.1 (74.9)	38.4 ± 2.9 (79.5)	1.51 NS
4.	Wrist circumference (cm)	4.6 ± 0.6 (59.0)	5.0 ± 0.7 (64.2)	2.1*	4.6 ± 0.6 (59.0)	4.6 ± 0.6 (59.0)	0.00 NS

Group I -Experimental group supplemented with soyachakali, Group II -No supplementation *i.e.* control group, Figures in parantheses indicate percentage \* and \*\* Indicate significance of value at P=0.05 and 0.01, respectively, NS=Non-significant, BS – Before supplementation, AS – After supplementation

**Table 6 : Average skin fold thickness, mid arm muscle circumference and body mass index of experimental groups before and after supplementation**

Sr. No.	Anthropo-metric measure-ment	Group I Mean ± S.D.			Group IV Mean ± S.D.		
		BS	AS	't' value	BS	After 6 month	't' value
1.	Skinfold thickness (mm)	8.6 ± 1.2 (62.0)	9.3 ± 1.3 (67.9)	2.7*	8.5 ± 1.2 (62.0)	8.6 ± 1.2 (62.6)	0.4 NS
2.	Mid Arm muscle circum-ference (cm)	11.4 ± 1.6 (76.5)	12.3 ± 1.7 (82.6)	2.65*	11.0 ± 1.5 (73.8)	11.2 ± 1.5 (75.1)	0.8 NS
3.	Body mass index	12.0 ± 1.7 (76.9)	13.6 ± 2.0 (87.2)	2.85*	11.8 ± 1.5 (75.5)	10.6 ± 1.5 (67.9)	2.71*

Group I- Experimental group supplemented with soyachakali, Group II-No supplementation *i.e.* control group, Figures in parantheses indicate percentage \* and \*\* Indicate significance of value at P=0.05 and 0.01, respectively, NS = Non -significant, BS–Before supplementation, AS – After supplementation

*i.e.* 86.3 and 83.0 per cent. The average measurement of head circumference in children of control group found as below of their standard level. Average skin fold thickness was recorded more in group I (67.9 per cent) pre-school children. Average value of skin fold thickness among children of control group observed poorly under the normal level. In group I children found below the standard level of wrist circumference. The average of wrist circumference among children of control group noticed under 'poor' standard category *i.e.* (59.0 per cent). Majority of group of children observed moderate level of mid arm muscle circumference. Group I children had  $12.3 \pm 1.7$  cm average mid arm circumference. Children of control group reported mid arm circumference as below their moderate level of standard value. BMI of Group I children shown as  $13.6 \pm 2.0$ , which reported as near by their normal standard level. A study conducted by Chandrashekhar and Sahay (2004) also found a significant improvement in anthropometric measurements in malnourished children after supplementation of soyaprotein isolates. However, BMI of control group children 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 supplementation and presented in Table 4 to 6.

A significant increase in per cent of height was observed in group I children after supplementation (Table 4). The average height of children in group I was reported as  $83.0 \pm 1.3$  cm before supplementation and found increased significantly up to  $93.9 \pm 1.9$  cm after supplementation. This increased in height of group I 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 to 89.9 cm after the experimental period.

Group I children who were supplemented with soyachakali shown increased in body weight from 8.2 to 12.0 kg. Increased body weight in group I children noted as near the moderate and below moderate level of their standard body weight. Average body weight of children in control group noticed poorly under weight as compared with their standard measurements.

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 of all the groups of experimental children *i.e.* group I recorded as normal with their standard measurements after supplementation. Very positive impact was noticed in the better growth of arm circumference of children after the soya byproduct 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 was found maximum in group I children and were reported as 66.5 and 76.5 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 but this was noted at non significant level.

Head circumference of pre-school children in group I noticed their head circumference increased from 35.0 to 40.1 cm. There was no significant change noticed in head circumference among children of control group after experimental period.

Average increased in wrist circumference in group I children which was increased from 4.6 to 5.0 cm. A significant increase of wrist circumference was observed in all the groups of children. However, this increase in wrist circumference not found at normal level. Where as no change was noticed in growth of wrist circumference among control group of children.

The average of skin fold thickness before supplementation as in group I children found a notable significant difference in skin fold thickness after the completion of experimental period. Control group children shown no any significance difference in skin fold thickness values as compared with before and after the experimental period.

This increase in MAMC of in group I found from 76.5 to 82.6 per cent No change was noticed in MAMC values after experimentation in control group children.

Body mass index (BMI) of group I children noted near by their normal standard level *i.e.* 87.2 per cent. Decreased level in BMI was noticed in control group. It was found significantly decreased BMI from 75.5 to 67.9 per cent level after experimental period.

#### Conclusion :

On the whole, it can be concluded that, supplementary feedings through soyachakali have positive effect on all the anthropometric measurements. Height, body weight, arm, head, chest and wrist circumference shown increased from below to moderate and normal level of their standard measurements also reported improvement in all the anthropometric parameters of children after implementation of mid-day meal programme.

Skin fold thickness, MAMC and BMI was also noticed increased to their normal standard mark. Control group found steady, slow and non-significant change in all the anthropometric indices after experimental period. Soyachakali reported highly significant in obtaining desirable changes in all the anthropometric measurements.

#### ■ REFERENCES

Amerine, M.A., Pangborn, R.M. and Roessler, E.B. (1965). Principles of Sensory Evaluation of Food. Academic Press, NEW YORK, U.S.A.

AOAC (1984). Approved methods of analysis (14<sup>th</sup> Ed.) Association of official analytical chemist, Washington, D.C., U.S.A.

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

**Deshpande, S.S., Mishra, A. and Mishra, 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, Wiley International John Wiley and Sons, NEW YORK, U.S.A.

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

**Messina, M.J.** (1997). *Soyfood their role in disease prevention and treatment in Liu Keshun*. Editor Soybean chemistry. Technolog and utilization Chapman and Hall, NEW YORK, 443-447.

**Kumar, Vineet, Anita, Rani and Tiwari, Prakash** (2001). Comparative activity of trypsin inhibitor among released soybean varieties strains of India. *Indian J. Nutri & Dietet.*, **38**:437-440.

**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*.

8<sup>th</sup>  
Year  
★★★★★ of Excellence ★★★★★