

# Improvements in clinical nutritional status of malnourished pre-school children after supplementation of soychakali

N.S. GHATGE

Malnutrition is a world wide health issue. It imposes a toll on child mortality, 53 per cent of deaths in children under 5 years in age are nutrition related in world wide. Hence, to overcome with this innovations are made in traditional food products to feed malnourished pre-school children. Supplementary feeding programmes are the emerging need in under nutrition for vulnerable segment in the population. Hence, supplementary food soyachakali was formulated and evaluated for its organoleptic qualities like taste, texture, flavour and over all acceptability. Highly scored soyachakali was selected for feeding. The nutritional qualities likes major nutrients such as energy(465.0kcal), proteins (19.3 g) and fats (20.8 g) contents were found more in soychakali. The micro nutrients such as iron (4.9 mg), zinc (2.1 mg) and calcium (245.5 mg) were also observed higher range in soychakali. It was also noted that it contained, very less antinutritional factors. It has shown better keeping qualities upto two months when stored in a high gauge package at room temperature. Soychakali has also shown very low production cost. Hence, found very cheap and affordable to the below poverty line group of children. The soychakali was given @ 50g/ child/day. The clinical signs and symptoms about deficiency diseases in experimental group of preschool children were examined after every month till the end of experimental period (*i.e.* 6 months). Significant changes in clinical examination of hair, face, lips, eyes, ears, throat, skin, bones and joints, nails and abdomen shown after supplementation of soyachakali in pre-school children.

**Key Words :** Clinical nutrition status, Soychakali, Supplementary feeding

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## INTRODUCTION

Soybean belongs to family Leguminace and sub family Papilionidae. It is a legume as well as an oil crop. It is one of the natures wonder and nutritional gift for the human nutrition. Therefore, many researchers have recommended soybean supplementations in different forms of by products for the malnutrition treatment. Soybean is a native crop of eastern Asia where it served as an important part of the diet. The Japnese obtain 12-13 per cent of their protein from soybean products. Soybean has expanded in the last 30 year from minor to major cash crop. The cultivation of soybean now ranks second to corn and above wheat, potato, oat, cotton and other variety of crops.

Hence, by keeping in view the feasibility in the preparation of formulated foods and due to nutritional

significance of soya bean, its low cost, locally available and high amino acid profile it is planned to use the soyabean after proper processing techniques in the preparation of soya by products with its effect on the treatment of malnourished preschool children to overcome the problem. Hence, it is used for the formulation of high nutritious weaning and supplementary foods. Most of the studies (Sahay and Kachru, 1988; Chandrashekhar and Hildo Sahay Rani, 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 preschool children. With the intention of high significance nutritive values of soybean, the most familiar, more popular in children soybased products such as soychakali, prepared and evaluated nutritionally.

## AUTHOR FOR CORRESPONDENCE

N.S. GHATGE, Pravara Rural Education Society's, Home Science and B.C.A. College, Loni, AHAMEDNAGAR (M.S.) INDIA  
Email: nalinihemangi26@rediffmail.com

## METHODOLOGY

Local varieties of soybean MC HS 58 and rice *i.e.*

Ratanagri were procured from market. It was 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 was performed on a nine point Hedonic scale (Amerine *et al.*, 1965).

#### 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 fibre with the use of method described (AOAC, 2013).

#### Statistical analysis :

The statistical analyses of organoleptic qualities of soychakali and clinical nutritional parameters were carried out. The obtained data were analyzed by statistical significant at  $p < 0.05$  level, S. E. and CD. at 5 per cent level by the procedure given by Gomez and Gomez (2013).

#### Selection of malnourished children :

Selection of preschool malnourished children was done by evaluating weight for height and body mass index.

#### Clinical examination of experimentle group of preschool children :

The clinical signs and symptoms about deficiency diseases in experimental group of preschool children were

examined after every month till the end of experimental period (*i.e.* 6 months). Clinical examination of hair, face, lips, eyes, ears, throat, skin, bones and joints, nails and abdomen was carried out (Jelliffe, 1966).

## OBSERVATIONS AND ASSESSMENT

The findings of the study have been presented in the following sub heads :

#### Biochemical compositions and storage stability of soychakali:

The data given in Table 1 reveal the storage changes in proximate, biochemical compositions and sensory qualities in soychakali kept in different packages for 0 to 1 and 1 to 2 months at room temperature. The changes in per cent of moisture and the content of B complex vitamins and  $\beta$  carotene in soychakali were noticed at significant level after two months of storage (Table 1).

The per cent of proximate compositions such as protein was found to decrease at highly significant level *i.e.* 22.12. to 21.01 in the chakali stored unto 2 months period. Where as the value of B complex vitamins such as vitamins B<sub>1</sub> (0.45 to 0.26 mg) vitamin B<sub>2</sub> (0.39 to 0.28 mg) and vitamin B<sub>3</sub> (1.69 to 1.27 mg) were reduced significantly in the soychakali. Similarly significant change was seen for  $\beta$  carotene (230.0 to 288.9)  $\mu$ g for 2 months. Non significant effect was noticed in the changes of minerals and crude fibre contents in the soychakali after 2 months of storage.

The clinical signs and symptoms about deficiency diseases in experimental group of preschool children was examined after every month till the end of experimental period (*i.e.* 6 months).

**Table 1.** Biochemical changes in soy product on storage

| Sr. No | Nutrient              | Soyachakali   |              | 't' test |
|--------|-----------------------|---------------|--------------|----------|
|        |                       | Up to 1 Month | 1 to 2 Month |          |
| 1      | Moisture %t           | 8.69          | 8.01         | 2.218*S  |
| 2      | Ash %                 | 13.92         | 3.06         | 0.267*S  |
| 3      | Protein g/100gm       | 22.12         | 21.01        | 3.705**S |
| 4      | Fibre %               | 51.45         | 1.40         | 0.166NS  |
| 5      | Fat %                 | 9.99          | 9.09         | 0.60NS   |
| 6      | Carbohydrates g/100gm | 54.57         | 53.07        | 5.007*S  |
| 7      | Iron g/100gm          | 7.01          | 6.99         | 0.066NS  |
| 8      | Zincmg/100gm          | 4.05          | 4.00         | 0.667 NS |
| 9      | Calcium mg/100gm      | 159.9         | 159.6        | 1.001 NS |
| 10     | BcaroteneUg/100gm     | 230.0         | 288.9        | 3.672**S |
| 11     | B1 mg/100g            | 0.45          | 0.26         | 2.155**S |
| 12     | B2 mg/100g            | 0.39          | 0.28         | 1.981*S  |
| 13     | B3mg/100g             | 1.69          | 1.27         | 1.920*S  |

\*and\*\* indicates significance of value at  $P = 0.05$  and  $0.01$ , respectively

NS = Non-significant

### Clinical examination of hair, face and lips of experimental groups of children :

The data about clinical signs and symptoms observed in term of hair, face and lips of experimental groups of preschool children is given in Table 2.

The data about clinical signs and symptoms of hair of different experimental groups of children was found as normal luster, discoloured, dry, pigmented and space (thin hair). Group I children were found highly significant in increased per cent of normal luster of hair from 12.0 to 80.0 The normal luster hair in control group of children was recorded as 52.0 per cent before experiment, it decreased at 32.0 per cent after experiments. Discolouration of hair was mostly decreased after supplementation in group I children. Control group children remained as such after experiments. Dry texture of hair was found improved among supplemented groups of children except control group. The problems of pigmented hair reduced after supplementation in supplemented groups of children. The complaints of space (thin) hair was also decreased in Group I.

Highly significant increase in per cent of normal face children was noted in Group I. It showed an increase from 12.0 to 80.0 per cent after supplementation. The opposite picture was noticed in control group of children. These children were decreased the normal face and increased the signs and symptoms of odema and white patches on face after experimentation period. Increasing the normal hair texture, lusture, thickness and decreasing the sins and symptoms like discolouration, dryness and spaice in these children after supplementation is a good indicator of improving the protein energy status. Generally the deficiency of vitamin B<sub>2</sub> reflected

by their signs and symptoms on lips. Such signs and symptoms were observed more in group I children. The children with normal lips found increased more in group I children. Angular stomatitis and cheilosis found decreased in group. The signs and symptoms of vitamin B<sub>3</sub> and B<sub>2</sub> such as angular stomatitis and cheilosis were slowly decreased in group I children. It shown that only 12 per cent of children noted reduced their signs and symptoms of angular stomatitis after supplementation. symptoms of cheilosis found decreased. However, the children with normal lips found increased from 68 to 100 per cent after supplementation of group I children. Control group of children reported decreased in per cent of normal lips of children and increased the number of signs and symptoms of angular stomatitis and cheilosis after experimentation period.

### Clinical examination of internal mouth of experimental groups of children :

Internal mouth of the experimental groups of children was examined by clinically. Signs and symptoms on gumes, tongue and teeth of these children were assessed before and after supplementation. The relevant data was presented in Table 3. However majority of the children of different supplementary group found a normal healthy gumes. If gumes are bleeding and not healthy, it becomes due to deficiency of vitamin C. The bleeding gumes were noticed 5(20.0 %) in children of group I before supplementation. This deficiency found disappeared by cent per cent in preschool children after supplementation. Deficiency of iron and vitamin C reflected on tongue. It shows pale and red bleeding cracks on either sides due their

**Table 2.** Clinical examination of hair, face and lips of experimental groups of children

| Sr.No | Clinical signs and Symptoms | Group I (n=25) |          |          | Group II (n=25) |          |          |
|-------|-----------------------------|----------------|----------|----------|-----------------|----------|----------|
|       |                             | BS             | AS       | 't' test | BS              | AS       | 't' test |
| Hair  | Normal luster               | 3(12.0)        | 20(80.0) | 5.1**    | 13(52.0)        | 8(32.0)  | 3.8**    |
|       | Discoloured                 | 40(40.0)       | 3(12.0)  | 3.9**    | 9(36.0)         | 9(36.0)  | -        |
|       | Dry                         | 6(24.0)        | 1(4.0)   | 2.8*     | 1(4.0)          | 4(16.0)  | 2.8*     |
|       | Pigmented                   | 6(24.0)        | 1(4.0)   | 2.8*     | 1(4.0)          | 3(12.0)  | 2.6**    |
|       | Space                       | -              | -        | -        | 1(4.0)          | 1(4.0)   | -        |
|       | Total                       | 25(100)        | 25(100)  |          | 25(100)         | 25(100)  |          |
| Face  | Normal                      | 3(12.0)        | 20(80.0) | 5.1**    | 15(60.0)        | 9(36.0)  | 3.6**    |
|       | Odema                       | 5(20.0)        | -        | -        | 2(8.0)          | 3(12.0)  | 2.6*     |
|       | Moon                        | -              | -        | -        | -               | -        | -        |
|       | White patches               | 17(68.0)       | 5(20.)   | 4.9**    | 8(32.0)         | 13(52.0) | 3.5**    |
|       | Total                       | 25(100)        | 25(100)  |          | 25(100)         | 25(100)  |          |
| Lips  | Normal                      | 17(68.0)       | 25(100)  | 3.5**    | 21(84.0)        | 18(72.0) | 2.6*     |
|       | Angular stomatitis          | 3(12.0)        | -        |          | 3(12.0)         | 4(16.0)  | 2.4*     |
|       | Cheilosis                   | 5(20.0)        | -        |          | 1(4.0)          | 3(12.0)  | 3.1*     |
|       | Total                       | 25(100)        | 25(100)  |          | 25(100)         | 25(100)  |          |

Group I - Experimental group with supplementation of soyachakali.

Figures in paran theses indicate percentage.

NS= Non-significant

BS – Before supplementation

GroupII - No supplementation i.e. control group.

\*and\*\* indicates of significance of value at P = 0.05 ana 0.01 respectively

AS – After supplementation

deficiency. Such types of signs and symptoms were observed in preschool children. Majority groups of children had normal tongue. 19(76.0 %) in group I children before supplementation. The preschool children who recorded pale tongue found more per cent in group I 24.0. Paleness tongue in the affected children minimized very fast after the supplementation. Where as red tongue children were also reported more in group I. The signs and symptoms of red tongue were decreased in supplemented group children after supplementation. Control group of children found adding their

numbers and increasing the signs and symptoms of deficiency due to iron and vitamin C. It also reported to decreasing the percent of normal tongue children after the experimental period. Group I children increased by highly significantly with normal teeth after supplementation.

#### Clinical examination of eyes, nose, ears and throat of experimental groups of children :

The data about signs and symptoms of relevant deficiencies in eyes, nose, ears and throat among

**Table 3.** Clinical examination of internal mouth of experimental groups of children

| Sr. No. | Clinical signs and symptoms | (n=25)<br>Group I |         |        | (n=25)<br>Group II |         |        |
|---------|-----------------------------|-------------------|---------|--------|--------------------|---------|--------|
|         |                             | BS                | AS      | t'test | BS                 | AS      | t'test |
| Gumes   | Normal                      | 20(80)            | 25(100) | 2.8*   | 25(100)            | 25(100) | 0.0NS  |
|         | Bleeding                    | 5(20)             | -       | -      | -                  | -       | -      |
|         | Total                       | 25(100)           | 25(100) |        | 25(100)            | 25(100) |        |
| Tongue  | Normal                      | 19(76)            | 25(100) | 3.1*   | 21(84)             | 18(72)  | 2.5*   |
|         | Pale                        | 6(24)             | -       | -      | 4(16)              | 7(28)   | 2.6*   |
|         | Red                         | -                 | -       | -      | -                  | -       | -      |
|         | Total                       | 25(100)           | 25(100) |        | 25(100)            | 25(100) |        |
| Teeth   | Normal                      | 20(80)            | 25(100) | 2.8*   | 2(80)              | 20(80)  | 0.0NS  |
|         | Mottled enamel              | -                 | -       | -      | -                  | -       | -      |
|         | Discoloured                 | 5(20)             | -       | -      | 5(20)              | 5(20)   |        |
|         | Total                       | 25(100)           | 25(100) |        | 25(100)            | 25(100) | 0.0 NS |

Group I - Experimental group with supplementation of soyachakali.  
 Figures in paran theses indicate percentage.  
 NS= Non-significant      BS – Before supplementation

Group II- No supplementation i.e. control group.  
 \*and\*\* indicates of significance of value at P = 0.05 and 0.01 respectively  
 AS – After supplementation

**Table 4.** Clinical examination of eyes, nose, ears and throat of experimental groups of children

| Sr. No | Clinical signs and symptoms | Group I (n=25) |         |       | Group II (n=25) |         |        |
|--------|-----------------------------|----------------|---------|-------|-----------------|---------|--------|
|        |                             | BS             | BS      | AS    | t'test          |         |        |
| Eyes   | Normal                      | 19(76)         | 20(80)  | 1.3NS | 24(96)          | 24(96)  | -      |
|        | Nightblindness              | 1(4)           | -       | -     | 1(4)            | 1(4)    | -      |
|        | Bitot spot                  | -              | -       | -     | -               | -       | -      |
|        | Conjunctival xerosis        | 5(20)          | -       | -     | -               | -       | -      |
|        | Total                       | 25(100)        | 25(100) |       | 25(100)         | 25(100) |        |
| Nose   | Normal                      | 25 (100)       | 25(100) | -     | 25(100)         | 25(100) | -      |
|        | Deviated                    | -              | -       | -     | -               | -       | -      |
|        | Total                       | 25(100)        | 25(100) |       | 25(100)         | 25(100) |        |
| Ears   | Normal                      | 21(84)         | 25(100) | -     | 19(76)          | 19(76)  | -      |
|        | Waxy                        | -              | -       | -     | 3(12)           | 3(12)   | -      |
|        | Discharged                  | 4(16)          | -       | -     | 3(12)           | 3(12)   | -      |
|        | Total                       | 25(100)        | 25(100) |       | 25(100)         | 25(100) | 0.0 NS |
| Throat | Normal                      | 21(84)         | 22(88)  | -     | 21(84)          | 21(84)  | -      |
|        | Enlarged                    | -              | -       | -     | -               | -       | -      |
|        | patches                     | 1(4)           | -       | -     | 4(16)           | 4(16)   | -      |
|        | Tonsils                     | 3(12)          | 3(12)   | --    | -               | -       | -      |
|        | Total                       | 25(100)        | 25(100) |       | 25(100)         | 25(100) | 0.0 NS |

Group I - Experimental group with supplementation of soyaladoo.  
 Figures in paran theses indicate percentage.  
 NS= Non-significant      BS – Before supplementation

Group II - Experimental group with supplementation of soyachakali.  
 \*and\*\* indicates of significance of value at P = 0.05 and 0.01 respectively  
 AS – After supplementation

experimental group of children before and after supplementation was reported in Table 4. However, some of them were suffered from different signs and symptoms in deficiency of vitamin A. Where as nightblindness was observed in one children each from group I and control group before experimentation. The supplementary feeding with soyaprducts did not show any positive effects for minimizing the signs and symptoms related with eyes. It may be due to these requires long terms proper supplementation.

Most of preschool children from experimental groups reported a normal nose. Overwhelming preschool children noticed normal. After supplementation there was not any change found in the prevalence of discharged ears among these children. A similar observation was noted in control group of children.

Whereas, some of children *i.e.* 12.0 per cent from I was suffering from tonsils. These tonsils in children could not found controlled by supplementation of soya-by-product.

#### Clinical examination of skin, bones and joints, nails and abdomen of experimental groups of children :

The data about clinical examination of nails, skin, bones and joints, and abdomen of experimental group of children before and after supplementation was presented in Table 5. It expressed that, maximum children from all experimental group

were having normal nails. However, some of them were had uncleaned, dirty and pale nails. Uncleaned and dirty nails reflected as unhealthy and improper personal hygenie of the children. pale nails before supplementation it was reduced cent per cent after supplementation among children in Group I. Control group of children noticed not recovered the problem of pale nails after experimentation.

Skin with scabies and excema are mostly related deficiencies of B complex vitamin and vitamin A. However, 64.0 per cent children from group I, noted normal skin. Where as 20.0 per cent children from each group *i.e.* I found suffering from scabies. Another 20 per cent children from same group were having signs and symptoms of excema before supplementation period. The signs and symptoms related to scabies and excema disappeared after supplementation in these children.

Skin scabies and excema were also reported in 24.0 and 16.0 per cent in control group of children before experimentation. However, the per cent of normal skin children from Group I,. Whereas, 100 per cent children from each group *i.e.* I and control were did not having any problems. Signs and symptoms related with bones and joints they all were noticed normal bones and joints.

Clinical examination of abdomen in maximum children in group I shown as normal in 92.0, 84.0 and 68.0 per cent,

**Table 5.** Clinical examination of skin, bones and joint, nails and abdomen of experimental groups of children

| Sr.No          | Clinical signs and symptoms | Group I (n=25) |         |         | ‘t’ test | Group II (n=25) |        |
|----------------|-----------------------------|----------------|---------|---------|----------|-----------------|--------|
|                |                             | BS             | BS      | AS      |          |                 |        |
| Nails          | Normal                      | 15(60)         | 25(100) | 5.5**   | 17(68)   | 20(80)          | 1.3NS  |
|                | Unclean                     | -              | -       | -       | -        | -               | -      |
|                | Dirty                       | 6(24)          | -       | -       | 3(12)    | -               | -      |
|                | Pale                        | 4(16)          | -       | -       | 5(20)    | 5(20)           | -      |
|                | Total                       | 25(100)        | 25(100) |         | 25(100)  | 25(100)         | -      |
| Skin           | Normal                      | 15(60)         | 25(100) | 5.5**   | 15(60)   | 20(80)          | 2.5*   |
|                | Scabis                      | 5(20)          | -       | -       | 6(24)    | 4(16)           | -      |
|                | Excema                      | 5(20)          | -       | -       | 4(16)    | 1(4)            | -      |
|                | Total                       | 25(100)        | 25(100) | -       | 25(100)  | 25(100)         | -      |
| Joints         | Normal                      | 25(100)        | 25(100) | -       | 25(100)  | 25(100)         | -      |
|                | Deformities                 | -              | -       | -       | -        | -               | -      |
|                | Osteomyelitis               | -              | -       | -       | -        | -               | -      |
|                | Knockness                   | -              | -       | -       | -        | -               | -      |
|                | Rickets                     | -              | -       | -       | -        | -               | -      |
|                | Rosary                      | -              | -       | -       | -        | -               | -      |
|                | Total                       | 25(100)        | 25(100) |         | 25(100)  | 25(100)         | 0.0 NS |
|                | Abdomen                     | Normal         | 23(92)  | 25(100) | 1.4 NS   | 21(84)          | 20(80) |
| Potbelly       | 2(8)                        | -              | -       | 4(16)   | 5(20)    | 1.3 NS          |        |
| Enlarged liver | -                           | -              | -       | -       | -        | -               |        |
| Total          | 25(100)                     | 25(100)        |         | 25(100) | 25(100)  | 07.0 NS         |        |

Group I - Experimental group with supplementation of soyaladoo.  
 Figures in paran theses indicate percentage.  
 NS= Non-significant BS – Before supplementation

Group II - Experimental group with supplementation of soyachakali.  
 \*and\*\* indicates of significance of value at P = 0.05 and 0.01, respective  
 AS – After supplementation

respectively before supplementation. However, 8.0 per cent children from Group I reported as pot belly, which found disappeared after supplementation. 84.0 per cent children from control group recorded as normal abdomen before supplementation. These normal abdomen children decreased in non significant per cent (80.0) after experimentation. The pot belly children increased from 60.0 to 20.0 per cent after supplementation.

#### Conclusion :

On the whole it can be concluded that, a particular clinical signs and symptoms related with nails, skin, and abdomen only disappeared after supplementation of soyachakali. Signs and symptoms related with pale nails, skin scabies and eczema, pot belly of abdomen were found in very minimum per cent among the supplemented group of the children. The prevalence of the signs and symptoms of relevant deficiencies were found improved after supplementation in I group of children, except control group. These results indicate that, supplementation of soyachakali had a positive effect in improving the nutritional status of these malnourished preschool children by reducing signs and symptoms of relevant deficiencies. These findings were supported with the observation of study conducted (Alan *et al.*, 2004 and AOAC, 2013).

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