



## Clinical nutritional status of Malnourished Preschool Children after Supplementation of Soyaladoo

Ghatge N.S.

Pravara Rural Education Society's, Home Science and BCA College, Loni., Taluka-Rahata, District-Ahmednagar, INDIA

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### Abstract

Malnutrition is the greatest world health problem, more than 50 per cent of the children are found undernourished world wide. Hence supplementary feeding must be the additional nutrients which are providing for the optional growth and desirable change in health status. Supplementary foods must be based on the formulation of the required nutrients for the treating of malnutrition. Hence the organoleptically high scored soyaladoo was prepared analyzed for nutritional qualities likes major nutrients such as energy (470.0kcal), proteins (20.1 g) and fats (22.0 g) content found more in soyaladoo. The micro nutrients such as iron (6.3 mg), zinc (3.8 mg) and calcium (286.5 mg) were also observed higher range in soyaladoo. Soyaladoo has also shown very low production cost. Hence, it found very cheap and affordable to the below poverty line group of children. The soyaladoo was given @ 50g/child/day for six months. 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). i. Significant changes in clinical examination of hair, face, lips eyes, ears, throat skin, bones and joints, nails and abdomen shown after supplementation of. soyaladoo in preschool children.

**Keywords:** Clinical examination, Soyaladoo and Supplementary Feeding.

### Introduction

Soybean is an important legume and oil seed crop in Maharashtra. It is one of the nature's wonder for nutritional gift which provides good quality protein with minimum saturated fat and high calorie value<sup>1</sup>. Soybean also contains the nutraceutical properties like isoflavones, 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<sup>2</sup>.

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 researcher<sup>3-5</sup> recommended that soybean can be used for the snacks food as well as weaning and 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 soybean after proper processing techniques in the preparation of soya products with its effect on the treatment of malnourished preschool children to overcome the problem.

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 soyaladoo, prepared and evaluated nutritionally.

### Material and Methods

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. Soyaladoo was prepared by use of following formulations.

**Sensory evaluation:** By use of these different combinations the soyaladoos were prepared and evaluated by organoleptically with the help of trained panel of judges on a nine point "Hedonic scale" given by Amerine M.A., Pangborn R.M. and Roessler E.B.<sup>6</sup>.

**Chemical analysis of soyaladoo:** High scored soyaladoo in sensory evaluation was determined for moisture content, total ash, major nutrients like crude protein, fat, carbohydrates, B complex vitamins, minerals such as iron, calcium zinc and crude fiber with the use of methods described in by AOAC<sup>7</sup>.

**Statistical analysis:** The statistical analyses of organoleptic qualities of soyaladoo and clinical nutritional parameters were carried out. The obtained data was analyzed by statistical significant at  $p < 0.05$  level, S. E. and C.D. at 5 per cent level by the procedure given by Gomez K.A. and Gomez A.A.<sup>8</sup>.

**Selection of malnourished children:** Selection of preschool malnourished children were done by evaluating weight for height and body mass index

**Clinical Examination of Experimental 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<sup>9</sup>.

**Results and Discussion**

**Biochemical compositions and storage stability of soyladoo:** The data given in table 1 proximate, biochemical compositions and sensory qualities in soyladoo 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 β

carotene in soyladoo were noticed at significant level after two months of storage (table-1)

The per cent of proximate compositions such as fat and protein were found decreased at highly significant level i.e. 31.34 to 28.15 and 27.89 to 25.02 respectively in the ladoo stored upto 2 months of period. Where as the value of B complex vitamins such as vitamins B<sub>1</sub> (0.50 to 0.31 mg) vitamin B<sub>2</sub> (0.38 to 0.29 mg) and vitamin B<sub>3</sub> (2.51 to 2.09mg) were observed reduced significantly in the soyladoo for 2 months.

**Clinical examination of hair, face and lips of experiment groups of children:** The data about clinical signs and symptoms observed in term of hair, face and lips of experimental groups of preschool children was given in table o 1 to 6.

**Table-1**  
**Proximate and Biochemical Composition in Soyladoo (per 100g) with its Storage Stability**

Bio-Chemical Compositions	Proximate and storage period		
	Up to 1 Month	1 to 2 Months	't' test
Moisture (%)	14.60	13.92	2.278*
Ash (%)	3.11	3.05	0.912 NS
Fat (%)	31.34	28.15	2.6.11**
Protein (%)	27.89	25.02	2.659**
Vitamins B <sub>1</sub> (mg)	0.50	0.31	2.155*
Vitamins B <sub>2</sub> (mg)	0.38	0.29	1.981*
Vitamins B <sub>3</sub> (mg)	2.51	2.09	1.920*
B. carotene ( μ g)	239.00	237.10	1.992*
Iron (mg)	7.23	7.09	0.790 NS
Calcium (mg)	168.80	168.21	0.915 NS
Zinc (mg)	4.65	4.25	0.875 NS
Crude fibre (g).	1.85	1.82	0.048 NS

\*\* - significant at 1 % level, \* - Significant at 5% level, NS - Non significant

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

Clinical signs and Symptoms	(N=25) Group I			(N=25) Group II		
	BS	AS	't' test	BS	AS	't' test
Normal luster	6 (24.0)	17(68.0)	4.8**	13(52.0)	8(32.0)	3.8**
Discoloured	9 (36.0)	3(12.0)	3.3*	9(36.0)	9(36.0)	-
Dry	4(16.0)	2(8.0)	2.9*	1(4.0)	4(16.0)	2.8*
Pigmented	3(12.0)	2(8.0)	2.7*	1(4.0)	3(12.0)	2.6**
Spaice	3(12.0)	1(4.0)	3.2*	1(4.0)	1(4.0)	-
Total	25(100)	SS25(100)		25(100)	25(100)	
Normal	10(40.0)	19 (180.0)	4.3**	15(60.0)	9(36.0)	3.6**
Odema	2(8.0)	-	--	2(8.0)	3(12.0)	2.6*
Moan	-	-	-	-	-	-
White atches	13(52.0)	5(20.0)	3.8**	8(32.0)	13(52.0)	3.5**
Total	25(100)	25(100)		25(100)	25(100)	
Normal	13(52.0)	22(88.0)	3.9**	21(84.0)	18(72.0)	2.6*
Angularstomatitis	6(24.0)	2(8.0)	2.7*	3(12.0)	4(16.0)	2.4*
Cheilosis	6(24.0)	1(4.0)	3.1*	1(4.0)	3(12.0)	3.1*
Total	25(100)	25(100)		25(100)	25(100)	

Group I - Experimental group supplemented with soyladoo. Group II - No supplementation i.e. control group, Figures in parantheses indicate percentage. NS Non Significant, BS – Before supplementation, AS – After supplementation, \* significant at 5 per cent level, \*\* significant at 1 per cent level

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

Clinical signs and Symptoms	(N=25) Group I			(N=25) Group II		
	BS	AS	't' test	BS	AS	't' test
Normal	20(80.0)	25(100)	2.8*	25(100)	25(100)	0.0 NS
Bleeding	5(20)	-	-	-	-	-
Total	25(100)	25(100)		25(100)	25(100)	
Normal	15(60.0)	25(100)	3.6**	21(84.0)	18(72.0)	2.5*
Pale	7(28.0)	-		4(16.0)	7(28.0)	2.6*
Red	3(12)	-		-	-	-
Total	25(100)	25(100)		25(100)	25(100)	
Normal	17(68.0)	23(92.0)	3.4**	20(80.0)	20(80.0)	0.0 NS
Mottled enamel	-	-	-	-	-	-
Discoloured	8(32.0)	2 (8.0)	2.8*	5(20.0)	5(20.0)	
Total	25(100)	25(100)		25(100)	25(100)	0.0 NS

Group I - Experimental group supplemented with soyaladoo, Group II - No supplementation i.e. control group. Figures in parantheses indicate percentage. \* significant at 5 per cent level, \*\* significant at 1 per cent level. NS Non Significant, BS – Before supplementation, AS – After supplementation

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

Clinical signs and Symptoms	(N=25) Group I			(N=25) Group II		
	BS	AS	't' test	BS	AS	't' test
Normal	21(84.0)	22(88.0)	0.6S	24(96.0)	24(96.0)	-
Nightblindness	1(4.0)	1(4.0)	-	1(4.0)	1(4.0)	-
Bitot spot	3(12.0)	2(8.0)	1.1S	-	-	-
Conjunctival xerosis	-	-		-	-	-
Total	25(100)	25(100)		25(100)	25(100)	
Normal	24(96.0)	24(96.0)	-	25(100)	25(100)	-
Deviated	1(4.0)	1(4.0)	-	-	-	-
Total	25(100)	25(100)		25(100)	25(100)	
Normal	21(84.0)	25(100)	-	19(76.0)	19(76.0)	-
Waxy	2(8.0)	-	-	3(12.0)	3(12.0)	-
Discharged	2(8.0)	-	-	3(12)	3(12)	-
Total	25(100)	25(100)		25(100)	25(100)	0.0 NS
Normal	22(88.0)	25(100)	-	21(84.0)	21(84.0)	-
Enlarged	-	-	-	-	-	-
patches	2(8.0)	-	-	4(16.0)	4(16.0)	-
Tonsils	1(4.0)	-	-	-	-	-

Group I - Experimental group supplemented with soyaladoo. Group II - No supplementation i.e. control group. Figures in parantheses indicate percentage. \* significant at 5 per cent level, \*\* significant at 1 per cent level. NS Non Significant, BS – Before supplementation, AS – After supplementation

**Table-5**  
**Clinical examination of skin, bones and joints, nails and abdomen of experimental groups of children**

Clinical signs and Symptoms	(N=25) Group I			(N=25) Group II		
	BS	AS	't' test	BS	AS	't' test
Normal	11(44.0)	24(96.0)	6.4**	17(68.0)	20(80.0)	1.3NS
Unclean	06(24.0)	-		-	-	-
Dirty	02(8.0)	-		3(12.0)	-	-
Pale	6(24.0)	1(4.0)	0.7NS	5(20.0)	5(20)	-
Total	25(100)	25(100)		25(100)	25(100)	-
Normal	17(68.0)	25(100)	4.7**	15(60.0)	20(80.0)	2.5*
Scabis	5(20.0)	-	-	6(24.0)	4(16.0)	-
Excema	3(12.0)	-	-	4(16.0)	1(4)	-
Total	25(100)	25(100)	-	25(100)	25(100)	-
Normal	24(96.0)	24(96.0)	-	25(100)	25(100)	-
Deformities	1(4.0)	1(4.0)	-	-	-	-
Osteomycities	-	-	-	-	-	-
Knockness	-	-	-	-	-	-
Rickets	-	-	-	-	-	-
Rossary	-	-	-	-	-	-
Total	25(100)	25(100)	-	25(100)	25(100)	0.0 NS
Normal	17(68.0)	25(100)	4.7**	21(84.0)	20(80.0)	1.3 NS
Potbelly	8(32.0)	-	-	4(16.0)	5(20.0)	1.3 NS
Enlarged liver	-	-	-	-	-	-
Total	25(100)	25(100)		25(100)	25(100)	07.0NS

Group I - Experimental group supplemented with soyaladoo, Group II - No supplementation i.e. control group. Figures in parantheses indicate percentage.\* significant at 5 per cent level, \*\* significant at 1 per cent level. NS Non Significant, BS – Before supplementation, AS – After supplementation

**Table-6**  
**Clinical examination of skin, bones and joints, nails and abdomen of experimental groups of children**

Clinical signs and Symptoms	(N=25) Group I			(N=25) Group II		
	BS	AS	't' test	BS	AS	't' test
Normal	11(44.0)	24(96.0)	6.4**	17(68.0)	20(80.0)	1.3 NS
Unclean	06(24.0)	-		-	-	-
Dirty	02(8.0)	-		3(12.0)	-	-
Pale	6(24.0)	1(4.0)	0.7NS	5(20.0)	5(20)	-
Total	25(100)	25(100)		25(100)	25(100)	-
Normal	17(68.0)	25(100)	4.7**	15(60.0)	20(80.0)	2.5*
Scabis	5(20.0)	-	-	6(24.0)	4(16.0)	-
Excema	3(12.0)	-	-	4(16.0)	1(4)	-
Total	25(100)	25(100)	-	25(100)	25(100)	-
Normal	24(96.0)	24(96.0)	-	25(100)	25(100)	-
Deformities	1(4.0)	1(4.0)	-	-	-	-
Osteomycities	-	-	-	-	-	-
Knockness	-	-	-	-	-	-
Rickets	-	-	-	-	-	-
Rossary	-	-	-	-	-	-
Total	25(100)	25(100)	-	25(100)	25(100)	0.0 NS
Normal	17(68.0)	25(100)	4.7**	21(84.0)	20(80.0)	1.3 NS
Potbelly	8(32.0)	-	-	4(16.0)	5(20.0)	1.3 NS
Enlarged liver	-	-	-	-	-	-
Total	25(100)	25(100)		25(100)	25(100)	07.0 NS

Group I - Experimental group supplemented with soyaladoo. Group II - No supplementation i.e. control group. Figures in parantheses indicate percentage. \* significant at 5 per cent level, \*\* significant at 1 per cent level, NS Non Significant, BS – Before supplementation, AS – After supplementation

The data about clinical signs and symptoms of hair of different experimental groups of children was found as normal luster, discolored, dry, pigmented and space (thin hair). Group I children (from 24.0 to 68.0 per cent) after supplementation. The normal luster hair in control group of children was recorded as 52.0 per cent before experiment, it was found decreased as 32.0 per cent after experiments. Discolorations of hair was mostly decreased after supplementation in group I children. No change in discoloration of hair in control group children found after experiments. Dry texture of hair found improved among all the experimental groups of children except control group. The problems of pigmented hair which has noted in children before supplementation were reduced after supplementation in soyaladoo supplemented group of children. The complaints of space (thin) hair was also decreased in Group I children.

In group I the preschool children noted normal face (40.0 per cent), odema (8.0 per cent) and white patches on face (52.0 per cent) before supplementation. Normal face found increased up to 80.0 per cent, the signs and symptoms of odema and white patches, observed decreased by cent per cent and 20.0 per cent respectively after supplementation in the I group of children. 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 signs and symptoms like discolouration, dryness and space 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 and II children before supplementation. 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 8.0 per cent of children noted reduced their signs and symptoms of angular stomatitis after supplementation, which was found 24.0 per cent before supplementation in this group. Symptoms of cheilosis found 24.0 per cent before supplementation and decreased to 4.0 per cent after supplementation. However, the children with normal lips found increased from 52.0 to 88.0 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. A similar observations were recorded by Anadan S., Rajendran P. and Subramanian S.<sup>10</sup> in the preschool children.

Deficiency of vitamin C i.e. bleeding gumes was noticed as 5(20.0 per cent), 5(20.0 per cent) and 4(16.0 per cent) in groups

I children before supplementation. Intake of food and vegetables are found where rare in these children hence they may be suffered this deficiency. The signs and symptoms of deficiency of vitamin C disappeared in group I the preschool children after 6 months of experiment. Deficiency of iron and vitamin C reflected on health of tongue. Symptoms like pale and red bleeding cracks on either sides appears due to deficiency of iron and vitamin C. Such types of signs and symptoms were observed in preschool children. Majority groups of children had normal tongue. Number of children from different experimental groups were increased of their tongue in normal status after supplementation. The preschool children who recorded more per cent (28.0) pale tongue in group I. Where as red tongue children were also reported more in group I. The signs and symptoms of red tongue were decreased in group I 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 per cent of normal tongue children after the experimental period. It shown that, 21 children of normal tongue decreased to 18 numbers with more complaints, signs and symptoms of related deficiency. Before supplementation more children with normal teeth found group I as 17 i.e. (68 per cent). Number of children in group I increased significantly with normal teeth after supplementation. Where as the children from different groups who affected with discolored teeth also improved after supplementation. There was no any significant difference noticed in normal teeth or discolored teeth children in control group before and after experiment.

It can be concluded that, supplementary feeding with soyaprdcut found positive impact for reducing the deficiency signs and symptoms in internal mouth i.e. bleeding gumes, pale, red tongue and discoloration of teeth among malnourished preschool children. Soyaladoo reported highly significant effect on decreasing the relevant deficiencies of internal mouth in these children.

**Clinical Examination of Eyes, Nose, Ears and Throat of Experimental Groups of Children:** The data about signs and symptoms of relevant def/iciencies in eyes, nose, ears and throat among experimental groups of children before and after supplementation was reported in table-4.

It revealed that maximum per cent of children in group I found normal eyes. However, some of them were suffered from different signs and symptoms in deficiency of vitamin A. Bitot spot was found common in groups II (20 per cent) and I (12.0 per cent) children. Whereas night blindness was observed in 2 and one child each from group I. The supplementary feeding with soyaprdcuts did not show any positive effects for minimizing the signs and symptoms related with eyes. It may require long terms proper supplementation. A similar findings were noted by Donnen Philippe, Daniel Brasseur and Michele Dramix<sup>11</sup> and by Ching P. and Birmingham M.<sup>12</sup>.

Most of preschool children from experimental groups reported a normal nose. Only one child from group I shown deviated nose which did not found difference after treated with soyaladoo in the supplementary feeding for six months. After supplementation there was no change found in the prevalence of discharged ears among these children. A similar observation was noted in control group of children. This complaints, signs and symptoms among these children remains unchanged after supplementation.

In group I 4.0 per cent from group I children were having patched in throat. These patches were found disappeared after the supplementation, In group I 4.0 per cent children were suffering from tonsils. These tonsils in children could not found controlled by supplementation of soya byproduct.

In a nut shell, it can be concluded that the clinical signs and symptoms in relation with eyes, nose, ears and throat did not responds with the supplementation of soy byproducts. Only the signs of bitot spots in the eyes, waxy ears, and patched in throat found decreased after supplementation.

**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 groups of children before and after supplementation was presented in table 5.

It expressed that, maximum children from both the experimental groups were having normal nails. However, some of them were had uncleaned, dirty and pale nails. Uncleaned and dirty nails may be due to improper personal hygiene and reflected as unhealthy nails of the children. Where as pale nails indicates the prevalence of signs and symptoms of iron deficiency 24.0 per cent from group I, children were observed pale nails before supplementation. It was reduced cent per cent after supplementation. Signs of pale nails was decreased only in 4.0 per cent in children of group I. Control group of children noticed not recovered the problem of pale nails after experimentation.

Skin scabies and excema are mostly related deficiencies of B complex vitamin and vitamin A. However, 68.0, per cent children from group I noted normal skin. Where as 20.0 per cent children from each group i.e. I 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. After six month of experiments 16.0 and 4.0 per cent children shown scabies and excema respectively in this group. However, the per cent of normal skin children from group I were increased by highly significant level after experimentation.

Except one child from group I showed deformities in bones and joints. Other wise remaining 96 per cent or 24 no., children in group I noted normal bones and joints

Clinical examination of abdomen in maximum children in group I shown as normal 68.0 per cent respectively before supplementation. However 8.0 per cent children from group I reported as pot belly before experiment, found disappeared after supplementation. 84.0 per cent children from control group recorded as normal abdomen before supplementation. This normal abdomen children were not remain same after six month of experiment. Normal abdomen children were decreased in non significant per cent (80.0) after experimentation. The pot belly children increased from 16.0 to 20.0 per cent after experimental period in control group.

## 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 soyaladoo. Signs and symptoms related with pale nails, skin scabies and excema, pot belly of abdomen were found in very minimum per cent among all the groups 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 soyladoo 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<sup>13</sup>.

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