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# Impact of soyladoo feeding on biochemical analysis of malnourished pre-school children

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Malnutrition is the greatest threat to global public health. It has estimated that 178 million children are malnourished around the World. Whereas 40 per cent children are found under nourished among them 6.4 per cent are estimated severely malnourished in India. 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, return the child to physiological, immunological and biochemical normality. The organoleptically high scored soyladoo was prepared analyzed for nutritional qualities likes major nutrients such as energy (470.0 kcal), proteins (20.1 g) and fats (22.0 g) content found more in soyladoo. The micro nutrients such as iron (6.3 mg), zinc (3.8 mg) and calcium (286.5 mg) were also observed higher range in soyladoo. Soyladoo has also shown very low production cost. Hence, it was found very cheap and affordable to the below poverty line group of children. The soyladoo was given @50 g/child/day for six months.The biochemical parameters such as haemoglobin g/dl, serum protein g/dl, blood glucose level mg/dl; serum vitamin A µ/dl, serum iron µg/dl and serum zinc µ/dl were analyzed for the every month of interval during research work. Soyladoo supplementation shown a highly significant effect on increasing blood glucose level, blood haemoglobin, serum protein, serum vitamin A, serum iron and serum zinc status of preschool children.

**Key Words** : Clinical examination, Soyladoo, Supplementary feeding

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## INTRODUCTION

Soybean is an important legume and oil seed crop in Maharashtra. It is one of the natures wonder for nutritional gift which 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 (Kumar *et al.,* 2001). Soybean also contain 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, cardiorvasular 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 preschool children. With the intention of high significance nutritive values of soybean, the most familiar, more popular in children soybased products such as soyladoo, prepared and evaluated nutritionally.

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## METHODOLOGY

The local varieties of soybean *i.e.* MACH-58 and bengalgram *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. Soyladoo was prepared by use of following formulations.

**Sensory evaluation:**

By use of these different combonations, the soyladoos

were prepared and evaluated by organoleptically with the help of trained panel of judges on a nine point "Hedonic scale" given by (Amerine *et al.,* 1965).

**Chemical analysis of soyladoo:**

High scored soyladoo 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 (A.O.A.C., 1984).

**Statistical analysis:**

The statistical analyses of organoleptic qualities of soyladoo and biochemical parameters were carried out. The obtained data were 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 and Gomez, 1984).

**Biochemical analysis:**

The nutritional status of the preschool children before and after the experimental period was evaluated through biochemical analysis method. The parameters such as haemoglobin g/dl, serum protein g/dl, blood glucose level mg/dl, serum vitamin A µ/dl, serum iron µg/dl and serum zinc µg/dl were analyzed by using methods given by Raghuramalu *et al.* (1983).

**Selection of malnourished children:**

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

## OBSERVATIONS AND ASSESSMENT

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 soyladoo, was provided Group I– soyladoo. Group II – was not given any supplementary foods, hence, they were termed as control group. The amount of supplementary food given for each group was given as per standard of ICMR about providing energy, protein and fat was maintained while supplementation of soyladoo. Accordingly the amount of soyladoo by products *i.e.* 50 g was supplemented in entire period of experiment.

**Biochemical compositions and storage stability of soyladoo:**

The data given in Table 1 and 2 reveal the storage changes in 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 b 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. Whereas, the value of B complex vitamins such as vitamins $B_1$ (0.50 to 0.31 mg) vitamin $B_2$ (0.38 to 0.29 mg) and vitamin $B_3$ (2.51 to 2.09 mg) were observed reduced significantly in the soyladoo for 2 months.

**Biochemical analysis of experimental groups of pre-school children:**

The data of average biochemical analysis of experimental group are given in Table 2. It explained that, Group I children found more average values of blood glucose *i.e.* 72.1 mg/dl,

**Table 1.** Proximate and biochemical composition in soyladoo (per 100g) with its storage stability

| Sr. No. | Bio-chemical compositions | Proximate and storage period | | |
|---|---|---|---|---|
| | | Up to 1 month | 1 to 2 months | 't' test |
| 1. | Moisture (%) | 14.60 | 13.92 | 2.278* |
| 2. | Ash (%) | 3.11 | 3.05 | 0.912 NS |
| 3. | Fat (%) | 31.34 | 28.15 | 2.6.11** |
| 4. | Protein (%) | 27.89 | 25.02 | 2.659** |
| 5. | Vitamins $B_1$ (mg) | 0.50 | 0.31 | 2.155* |
| 6. | Vitamins $B_2$ (mg) | 0.38 | 0.29 | 1.981* |
| 7. | Vitamins $B_3$ (mg) | 2.51 | 2.09 | 1.920* |
| 8. | β–carotene (µg) | 239.00 | 237.10 | 1.992* |
| 9. | Iron (mg) | 7.23 | 7.09 | 0.790 NS |
| 10. | Calcium (mg) | 168.80 | 168.21 | 0.915 NS |
| 11. | Zinc (mg) | 4.65 | 4.25 | 0.875 NS |
| 12. | Crude fibre (g). | 1.85 | 1.82 | 0.048 NS |

** and * indicate significance of value at P=0.01 and P=0.05, respectively
NS = Non-significant

haemoglobin 10.2 g/dl, serum protein 6.28 g/dl, serum vitamin A 126.0 IU/dl 139.7 µg/dl serum iron and zinc 1.09 µg/ml. When these values converted into per cent it shown that 88.1, 83.6, 91.9, 87.0,82.2 and 77.9 per cent as blood glucose, haemoglobin, serum protein, serum vitamin A, serum iron and serum zinc, respectively noted in group I$^{st}$ children after supplementation.

Table 3 represents the data regarding average biochemical assessment in particularly blood glucose and haemoglobin level in different level in different experimental groups of children before and after supplementation. It shown that, group I children had highly significant difference in their blood glucose level in before supplementation (66.5 mg/dl) and after supplementation (72.1 mg/dl). Belloyue and Castello (2005) also found increase blood glucose level in the children after soyprotein supplementation.There was no significant difference noted I blood glucose level before and after experimental period in control of group of children.

A similar observations were recorded about haemoglobin level of these experimental groups of children, 7.7 to 10.2 g/dl increased in haemoglobin level was reported by group I children after supplementation. This increase level of haemoglobin shown as 61.7 to 83.6 in per cent in this group I children. Alan *et al.* (2004) also observed an increase of haemoglobin level in children after the supplementation of soyamilk. Control group children did not shown any significant difference in the haemoglobin level after experimentation.

The data regarding average values of serum protein, vitamin A, iron and zinc of experimental group of children compared with before and after supplementation, it was presented in Table 2, it indicated that, among these group of children group I score more increased serum protein level from 4.1 to 6.2 g/dl, which recorded as a normal protein level (91.9%). There was slight decrease in serum protein level from

**Table 2.** Average in biochemical analysis of experimental groups

| Sr. No. | Biochemical analysis | Group I mean ± S.D. | Group II mean ± S.D. | Group III mean ± S.D. | Group IV mean ± S.D. |
|---|---|---|---|---|---|
| 1. | Blood glucose (mg/dL) | 72.1±2.7 (88.1) | 65.7 ± 2.9 (72.9) | 68.7± 3.3 (76.3) | 66.0 ± 9.0 (73.3) |
| 2. | Haemoglobin (g/dl) | 10.2±1.0 (83.6) | 8.6 ± 1.1 (68.8) | 9.8 ± 1.3 (78.2) | 7.6 ± 1.02 (60.7) |
| 3. | Serum protein(g/dl) | 6.28 ±0.9 (91.9) | 5.8 ± 0.8 (86.6) | 6.0 ± 0.8 (89.7) | 4.3±0.7 (65.5) |
| 4. | Serum vitamin A (IU/dl) | 126.0±4.1 (87.0) | 112.3±2.9 (74.7) | 87.0 ± 2.3 (58.0) | 36.0±1.1 (24.0) |
| 5. | Serum iron (µg/dl) | 139.7 ± 1.9 (82.2) | 69.7±9.5 (66.4) | 128.5±9.3 (65.2) | 105.4±6.8 (48.2) |
| 6. | Serum zinc (µg/ml) | 1.09±2.1 (77.9) | 1.05±2.0 (75.0) | 1.02±2.0 (72.9) | 0.54±0.9 (24.0) |

Group I - Experimental group with supplementation of soyladoo.
Group II - Experimental group with supplementation of soychakali.
Group II - Experimental group with supplementation of soyflakes chiwada.
Group IV - No supplementation *i.e.* control group.
Figures in parantheses indicate percentage.

**Table 3.** Average blood glucose and haemoglobin level of experimental groups before and after supplementation

| Sr. No. | Biochemical analysis | Group I mean ± S.D. | | | Group II mean ± S.D. | | |
|---|---|---|---|---|---|---|---|
| I | | BS | AS | 't' value | BS | AS | 't' value |
| 1. | Blood glucose (mg/dl) | 60.4±2.2 (60.4) | 65.7±2.9 (72.9) | 3.2* | 60.9±1.9 (65.9) | 66.0±1.8 (73.3) | 1.8 NS |
| 2. | Haemoglobin (g/dl) | 8.1±1.1 (64.4) | 8.6±1.1 (68.8) | 1.4 NS | 7.2±1.0 (60.0) | 7.6±1.0 (61.7) | -0.90 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 values at P=0.05 and P=0.01, respectively
NS= Non-significant, BS – Before supplementation, AS – After supplementation

**Table 4.** Average serum protein, vitamin A, Iron and zinc status of experimental groups before and after supplementation

| Sr. No. | Biochemical analysis | Group I mean ± S.D. | | | Group II mean ± S.D. | | |
|---|---|---|---|---|---|---|---|
| II | | BS | AS | 't' value | BS | AS | 't' value |
| 1. | Serum protein (gl/dl) | 4.1±0.6 (61.1) | 6.28 ±0.9 (91.9) | 4.41** | 4.4 ±0.7 (67.7) | 4.3 ±0.7(65.5) | 1.24 NS |
| 2. | Serum vitamin A (IU/dl) | 38.6±1.2 (26.6) | 126.0±4.1 (86.9) | 4.24** | 34.0± 1.1 (23.4) | 36.0± 1.1 (24.0) | 0.71 NS |
| 3. | Serum iron (µg/dl) | 82.0±2.9 (48.3) | 139.7± 1.9 (82.2) | 5.40** | 78.0± 2.8 (45.9) | 81.9±3.8 (48.2) | 0.47 NS |
| 4. | Serum zinc (µg/ml) | 0.68 ±0.3(48.6) | 1.09 ±0.1 (77.9) | 3.73** | 0.57± 0.1 (40.7) | 0.54±0.2 (38.6) | 0.64 NS |

Group I - Experimental group supplemented with soyladoo.
Figures in parantheses 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

4.4 to 4.3 g/dl, but not shown significant difference between before and after supplementation in control group of children.

Average value of serum vitamin A was noted higher in group I children. It was highly significant more after supplementation (126.0IU/dl) as compared with before supplementation (38.6 IU/dl). This increased per cent of serum vitamin A level in group I children noted in moderate normal level of their standard value. No significant change was observed in serum vitamin A level after experimentation among control group children.

Serum iron status was found highly significant to increase from 48.3 to 82.2 per cent in group I children. Control group of children reported a non significant increase in serum iron level from 78.0 to 81.9 µg/dl (*i.e.* 45.9 to 48.2 per cent) after supplementation.

Highly significant increase was reported in the value of serum zinc among group I children. It was found to increase from 0.68 to 1.09 µg/ml. which recorded as 77.9 per cent increase after supplementation.Control group of children recorded a non significant increase in serum zinc level after supplementation.

**Conclusion:**

On the whole, it can be concluded that, the supplementary feeding through soyladoo had positive impact on improving the biochemical parameters of preschool malnourished children. Soyladoo supplementation had shown a highly significant effects on increasing blood glucose level, blood haemoglobin, serum protein, serum vitamin A, serum iron and serum zinc status of preschool children. All the analyzed biochemical parameters noted increased moderate to normal standard level. It indicated that soyladoo have effectively worked and have capacity in improving the nutritional status of malnourished preschool children.

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