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# NUTRITION EVALUATION OF SOYPROTEIN ISOLATE

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## Abstract

A supplementary food was prepared on the basis of kulanthaiamuthu composition for the treatment of protein calorie malnourished children aged five to ten years. According to the formulae four supplementary foods of SPI incorporation 10, 15, 20 percent were prepared using wheat, ragi, bajra and sorghum. On the basis of sensory evaluation bajra based SPI incorporated supplementary food mix were chosen for the feeding trial. Two groups of girl children in age of five to ten years each were selected. Total number of children participated in the present study was 100. First group constituted control group; the second group of children supplemented with 100g of bajra based SPI incorporated supplementary food mix in the form of laddu along with their home diet for a period of 100 days. The anthropometric parameters like height, weight, and mid-upper arm circumference were measured before and after the administration of supplementary food. Before the supplementation the height, weight, skin fold thickness and mid arm circumference and biochemical estimation like haemoglobin and serum protein found to be lower than the standard. After the supplementation the height increased from0.1-0.3cm,weight from 0.5-1.0kg,skinfold thickness from 0.1-0.2cm,midarm circumference from0.1-0.2cm,haemoglobin level from1.1-2.5g per dl and serum protein from 2.0-2.5 g per dl increased. The data obtained from the study subjects were quantified, classified, tabulated and expressed in percentages. The paired' test was used for pre and post treatments comparison.

KEYWORD Supplementation; Bajra; Anthropometric; Children; Soya Protein Isolate.

## INTRODUCTION

Human childhood may be divided in to three stages Infancy, Weaning and Pre-school stage. Although breast feeding is beneficial for the optimum growth of the children, prolonged breast feeding without appropriate complementary feeding is crucial contributory factor for malnutrition among young children. Therefore, supplementation has to be implemented after four to six months to overcome malnutrition and related complications. These supplementary foods are worked as balanced diet for pre-school children. When the child is 1 to 1.5 years old, breast milk may not be available to it or milk is no longer sufficient to meet its nutritional requirements. It needs some more calories and other nutrients as supplement to milk till he/she is ready to eat adult's food. This is the post weaning stage of a child. In this stage proper nutritional care

of the child is essential to ensure normal growth. It helps to avoid malnutrition in pre-school children [1]. Problem of malnutrition in children continues to be critical in most underdeveloped and developing countries like India. This problem associated with inadequate protein and amino acids supply to the growing child. Malnutrition and poor growth during infancy affect a large portion of the world's population; more than 800 million children under 5 years of age suffer from malnutrition and growth failure. Such morbidity is responsible for more than 10 million deaths per year in this age group. Malnutrition accounts for the higher infant mortality rate in India (95/1000 live births) compared to that in developed countries [2]. Several types of supplementary foods are being marketed in India. Some are Balamul, Farex, Cerelac and Nustem. They contain about 14% protein and are nutritionally balanced. Most of these baby foods being nutritious blends of cereals, legumes and milk, are excellent supplements to child milk food and they are convenient to feed also. But they are quite expensive and are beyond the purchasing power of the parents belonging to middle and lower income groups. Due to this, parents belonging to lower income strata feed their own children with foods that the adults eat [3]. Flax et al. [4] studied 504 Malawian mothers attitudes towards the use of two supplementary foods lipid-based nutrient supplements (LNS) versus corn-soy blend (CSB) for moderately malnourished children and found that both the supplementary foods were highly acceptable, children learned to eat them within two weeks, and mothers were willing to use them again. The cereals commonly used are wheat, rice maize etc. cereals in general provide about 350 calories per 100g. They are however, relatively poor source of protein, the content varying from 7.7 in rice to about 12% in wheat. Pulses are good source of protein (17-24%) they also provide vitamins, minerals and fibers. Pulses being rich in lysine and threonine, they complement the amino acid of cereals based diet [5]. Soybean being rich in protein and lysine can play an important role in the enhancement of protein quality of cereal based diet which may help in the reduction of malnutrition of the community and easily available to anyone [6]. The present investigations were carried out to formulate and develop low cost SPI incorporated supplementary food and to study the nutritional impact of the school going children

## MATERIALS AND METHODS

### Procurement of raw materials:-

Soyprotein isolate were purchased from Dupont protein technology ,Haryana Bajra ,ragi, sorghum wheat, roasted Bengal gram and jiggery were purchased in bulk . from the local market Madurai Tamilnadu

### Preparation of supplementary food

The supplementary food was prepared on the basis of standardized supplementary food kuzhandai amudhu composition .wheat, ragi, bajra and sorghum based supplementary food was prepared with 10,15,and 20 percent incorporation of soy protein isolate(SPI).the formulated supplementary food was organoleptically evaluated .based on the organoleptic evaluation bajra based supplementary food was chosen for feeding trial. The flow chart for the preparation of SPI incorporated supplementary food is given in fig-1

**Fig-1.flow chart for the preparation of SPI incorporated supplementary food.**

**Millets**

↓

**Cleaning**

↓

**Washing**

↓

**Sun drying (4-8hrs)**

↓

**Roasting**

↓

**Powdering and mixing with SPI,roasted Bengal gram flour and jaggery**

↓

**Packing in polyethylene bags**

↓

**Storage at ambient condition**

**Physicochemical analysis**

Protein, fat, iron and calcium content of soy protein isolate and supplementary food mix were determined by AOAC method.

**Selection of study area**

Primary schools at othakadai a suburban area close to the college were selected for the intervention study. The Kalaimagal primary school and Ponmalar primary school at othakadai were selected for the study considering cooperation rendered by the parents, principal and staff members of the school for the convenience of continuous monitoring. Before starting the intervention study relevant information was collected to confirm that there were no noteworthy differences in characteristics between the children in the selected school or their environment that might cause compounding. The children from both the school represented a socio-economically homogenous population from lower income.

**Study design**

The impacts of intervention study two groups of 100 children in the age group of five to nine year were selected. The first group constituted as control group and the second group of children was intervention group supplemented 40g of bajra based SPI incorporated supplementary food in the form of laddu along with their home diet for a period of 100 days. The laddus were freshly prepared every day. Two laddus were given everyday each laddu weighing 20g. The prepared laddus was given to the children at11.00am and 2.30pmeveryday.

**Nutrition education**

Nutrition education is the foundation for any programme intended for nutrition improvement .nutrition education was given to the children at the time of feeding trial. They made aware of the importance of protein, and SPI incorporated laddu. They were also informed about the nutritional details of high protein content of SPI.

**Anthropometric measurement**

Nutritional anthropometry is one of the important and simple methods of assessment of growth and development especially in rapidly growing children. The anthropometric parameters like height, weight and skin fold thickness were measured before and after supplementation.

**Biochemical assay**

Subsamples (10 children) were randomly selected from each group (control and intervention) for the assay of biochemical parameters like haemoglobin and serum protein. The biochemical assay was estimated before and after supplementation of bajra based SPI incorporated supplementary food.

**Statistical analysis**

The general information of the school going children were quantified and classified tabulated and expressed in percentage. The paired "t''test was used for comparison of the children.

**Result and discussions**

Chemical composition of bajra based SPI incorporated supplementary food

The protein, fat, calcium,sodium and iron content of the bajra based SPI incorporated supplementary food were11g,1.08mg, 38mg,58mg and3.7 mg respectively.(Table1)

**Table1 Chemical composition of bajra based SPI incorporated supplementary food (40g)**

| S.No | Nutrients | SPI incorporated supplementary food mix |
|---|---|---|
| 1 | Protein(g) | 11 |
| 2 | Fat(g) | 1.08 |
| 3 | Calcium(mg) | 38 |
| 4 | Sodium(mg) | 58 |
| 5 | Iron (mg) | 3.7 |

**Table 2 Impact of supplementation on height (cm) of the selected children**

| Age years | Category | Std height | Mean height(cm) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Initial | Final | Difference | Initial | Final | Difference |
| 5 | Boys | 102.0 | 100.6±1.56 | 100.7±1.23 | 0.1 | 100.7±1.23 | 101.0±1.03 | 0.3 |
| | Girls | 101.5 | 101.1±1.51 | 101.2±1.60 | 0.1 | 101.2±1.56 | 101.4±1.40 | 0.2 |
| 6 | Boys | 108.5 | 106.3±1.49 | 106.4±1.27 | 0.1 | 106.6±1.07 | 106.9±0.95 | 0.3 |
| | Girls | 107.5 | 105.5±1.35 | 105.6±0.74 | 0.1 | 105.4±1.01 | 105.7±0.69 | 0.2 |
| 7 | Boys | 114.0 | 113.1±1.29 | 113.2±1.05 | 0.1 | 113.4±0.34 | 113.7±0.75 | 0.3 |
| | Girls | 113.0 | 110.8±1.26 | 111.0±1.09 | 0.2 | 111.8±0.94 | 112.1±0.63 | 0.3 |
| 8 | Boys | 119.5 | 118.2±1.23 | 118.4±1.17 | 0.2 | 118.5±0.99 | 118.8±0.59 | 0.3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Girls | 118.0 | 117.3±1.56 | 117.4±1.26 | 0.1 | 117.6±1.13 | 117.9±1.01 | 0.3 |
| 9 | Boys | 123.5 | 122.5±2.36 | 122.5±2.36 | - | 122.9±1.92 | 123.1±1.75 | 0.2 |
| | Girls | 123.0 | 122.5±2.59 | 122.5±2.59 | - | 122.7±203 | 123.0±1.82 | 0.3 |

Table 2 indicates that the mean height of the selected children. After the supplementation with SPI incorporated supplementary food for a period of 120 days the mean height of the intervention group increased slightly by 0.2-0.3cm where as in the control group the mean height increase was only 0.1-0.2 cm for the same period of time. The increments in height increased very marginally but distinctly. The increase in height may be due to the high protein content of the SPI incorporated supplementary food. The mean height of some intervention group was almost equal to that of standard after the feeding trial

**Table3 Impact of supplementation on weight (kg) of the selected children**

| Age years | Category | Std weight | Mean weight(kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Initial | Final | Difference | Initial | Final | Difference |
| 5 | Boys | 15.0 | 12.8±0.44 | 13.3±0.54 | 0.5 | 14.7±0.49 | 15.2±0.69 | 1.5 |
| | Girls | 14.5 | 11.9±0.56 | 12.4±0.69 | 0.5 | 13.2±0.44 | 14.2±0.44 | 1.0 |
| 6 | Boys | 16.5 | 15.0±1.29 | 15.5±1.69 | 0.5 | 16.2±0.18 | 17.7±0.48 | 1.5 |
| | Girls | 16.0 | 14.1±0.24 | 14.6±1.58 | 0.5 | 15.0±0.71 | 16.0±0.91 | 1.0 |
| 7 | Boys | 18.0 | 15.0±1.01 | 15.0±1.01 | - | 17.6±0.93 | 17.7±1.01 | 1.0 |
| | Girls | 17.5 | 15.9±0.62 | 16.5±0.62 | 0.6 | 16.7±0.88 | 18.7±1.08 | 2.0 |
| 8 | Boys | 19.5 | 16.6±0.57 | 16.6±0.57 | - | 17.6±0.49 | 19.1±1.49 | 2.5 |
| | Girls | 19.5 | 15.0±0.41 | 15.5±1.45 | 0.5 | 17.9±0.66 | 18.9±0.66 | 1.0 |
| 9 | Boys | 21.5 | 18.6±0.38 | 19.1±1.92 | 0.5 | 20.1±1.54 | 21.1±1.73 | 1.0 |
| | Girls | 21.5 | 18.9±0.54 | 18.9±0.54 | - | 20.0±1.11 | 21.5±2.11 | 1.5 |

Table 3 shows that the mean weight of the selected children before and after the supplementationBefore the supplementation the mean weight of both control and intervention group of to children were below the standard weight. After the supplementation with SPI incorporated supplementary food for a period of 120 days the mean weight of the intervention group increased by 1.0 to 2.5kg whereas in the control group the mean increase was only 0.5 to 1.0kg for the same period. It is interesting to note that half of the intervention group showed weight on par with the standard after the feeding trial.

**Table4 Impact of supplementation on skin fold thickness of the selected children(mm)**

| Age years | Category | Std skin fold thickness | Mean skin fold thickness | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Initial | Final | Difference | Initial | Final | Difference |
| 5 | Boys | 8 | 7.5±0.47 | 7.5±0.47 | - | 7.9±0.05 | 8.0±0.05 | 0.1 |
| | Girls | 10 | 8.7±0.18 | 8.7±0.18 | - | 9.2±0.15 | 9.1±0.15 | 0.2 |
| 6 | Boys | 8 | 7.4±0.14 | 7.4±0.14 | - | 8.0±0.15 | 8.1±0.15 | 0.1 |
| | Girls | 10 | 9.1±0.12 | 9.1±0.12 | - | 9.5±0.15 | 9.7±0.15 | 0.2 |
| 7 | Boys | 8 | 7.2±0.14 | 7.2±0.14 | - | 8.0±0.22 | 8.1±0.22 | 0.1 |
| | Girls | 10 | 9.2±0.187 | 9.3±0.187 | 0.1 | 9.4±0.18 | 9.7±0.18 | 0.3 |
| 8 | Boys | 8 | 7.4±0.44 | 7.4±0.44 | - | 7.8±0.15 | 7.9±0.15 | 0.1 |
| | Girls | 10 | 9.0±0.20 | 9.0±0.20 | - | 9.3±0.24 | 9.5±0.24 | 0.2 |
| 9 | Boys | 9 | 8.1±0.38 | 8.1±0.38 | - | 8.5±0.63 | 8.7±0.63 | 0.2 |
| | Girls | 11 | 9.7±0.47 | 9.8±0.44 | 0.1 | 10.2±0.48 | 10.4±0.48 | 0.2 |

Table 4 indicates that the mean skin fold thickness of the selected children. There was hardly any difference in the skin fold thickness of children in the control group at the end of the feeding trial. In the intervention group SPI supplement brought about the increase of 0.1 to 0.3 mm in skin fold thickness some of them on par with the standard. The increase was found to be more girls than boys. There was hardly any discernable change in the control group.

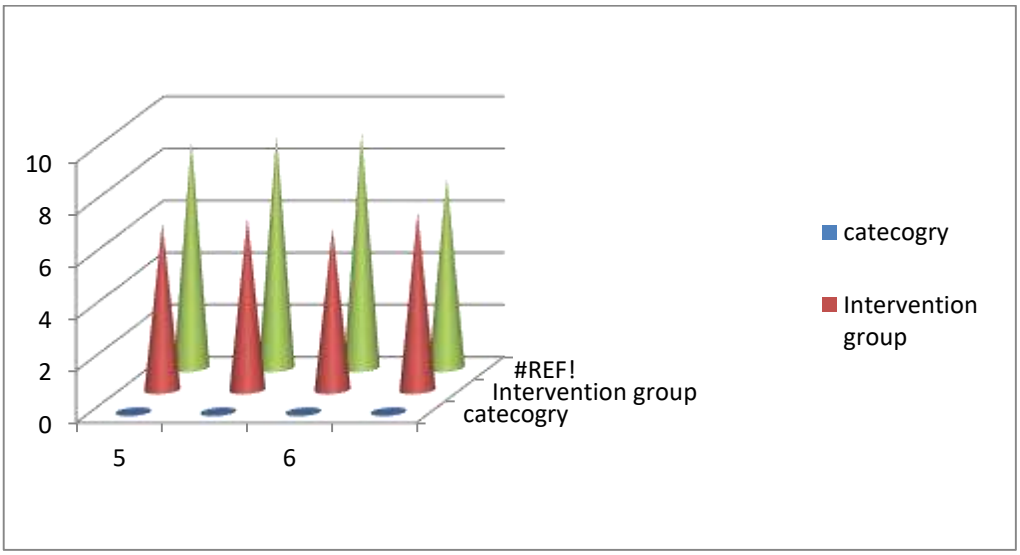
**Tale 5 Impact of supplementation on haemoglobin of the selected children(g/dl)**

| Age years | Category | Mean haemoglobin(g/dl) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Initial | Final | Difference | Initial | Final | Difference |
| 5 | Boys | 8.06±0.58 | 8.06±0.58 | - | 8.80±0.95 | 11.20±1.56 | 2.4 |
| | Girls | 8.00±0.40 | 8.00±0.40 | - | 8.50±0.26 | 10.50±1.33 | 2.0 |
| 6 | Boys | 8.18±0.15 | 8.20±0.15 | 0.02 | 9.50±0.70 | 10.70±1.04 | 1.2 |
| | Girls | 8.10±0.16 | 8.10±0.16 | - | 9.20±0.82 | 10.30±1.26 | 1.1 |
| 7 | Boys | 9.20±1.02 | 9.20±1.02 | - | 9.70±0.50 | 12.10±1.23 | 2.4 |
| | Girls | 8.99±0.95 | 8.99±0.95 | - | 9.30±0.48 | 11.80±1.05 | 2.5 |
| 8 | Boys | 9.60±1.53 | 9.60±1.53 | - | 9.90±0.32 | 12.40±2.38 | 2.5 |
| | Girls | 9.80±1.70 | 9.80±1.70 | - | 9.80±1.26 | 12.00±2.10 | 2.2 |
| 9 | Boys | 10.50±2.30 | 10.50±2.30 | - | 10.20±1.32 | 12.70±2.32 | 2.5 |
| | Girls | 9.40±2.15 | 9.70±0.32 | 0.30 | 10.00±1.38 | 12.20±2.65 | 2.2 |

Table 5 indicates that the haemoglobin level of the selected children before and after supplementation Haemoglobin level is an indicator for nutritional status. After the SPI supplementation the haemoglobin level of the intervention group increased appreciably ranging between1.1 to 2.5 g/dl .Among the children of the control group there was no increase haemoglobin level except in the case of six year old boys and 9 year old girls. This may be due to the incidental better food intake during the feeding study period. The mean increase I haemoglobin level (2.5g/dl) was highest in seven year old girls and 8year old boy. In six year old girls the increase in haemoglobin was only 1.1g/dl. The general increased in haemoglobin level indicated that the high protein and iron content of the supplementary food had a beneficial effect of the haemoglobin level.

**Serum protein level of the selected children after supplementation of SPI**

It was observed from the graph that the mean serum protein level of the intervention group which was lesser than the standard value of 8g/dl increased beyond the standard value after the study period. After the supplementation of SP there was appreciable increase serum protein of all the children in the intervention group. The increase in their serum protein ranged between 0.4 to 2.8gm100ml of blood. The mean serum protein of six year old girls changed little after intervention yet was lesser than the standard value. The promising changes mean serum protein level indicate that the good protein quality of SPI.




## Conclusion

SPI is a nutrient dense protein isolate which can be incorporated in to supplementary food. Forty gram of bajra based supplementary food with SPI incorporation 15 percent contributed 148Kcal, 11.0g protein,1.08mg fat,38.0mg calcium and 3.7 mg iron respectively. This supplementary food in 40g is enough to fulfill the recommended dietary allowances in the age group of five to nine years children. The supplementation with bajra based SPI incorporated Supplementary food mix has improved the biochemical profiles such haemoglobin and serumprotein level of the children indicates that the growth promoting potential SPI. Protein content of SPI highly suitable for the growing children

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