RESEARCH ARTICLE — FOOD SCIENCE RESEARCH JOURNAL — Volume 5 | Issue 1 | April, 2014 | 39-42

Impact of soyaflakes chiwada supplementation on nutritent intake of malnourished pre-school children

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Protein calories malnutrition, deficiencies of vitamin A, iodine and iron are now a current and global nutritional problems. Supplementary feeding programmes are the emerging need in under nutrition for vulnerable segment in the population. Additional food required to supply nutrients hence, organoleptically high score evaluated soyaflakes chiwada was provided to pre-school malnourished children. The nutritional qualities like moisture (4.1 %), ash (2.4 %), crude fibre (0.8 %), crude protein (21.4 %), iron (5.3 mg), calcium (74.0mg), zinc (2.7mg), β carotene (235. ug) and B complex vitamins like B_1 (0.2mg), B_2 (0.1mg) and B_3 (2.01mg) were found in soyaflakes chiwada. No significant changes were observed in nutritional qualities of soyaflakes chiwada when it was stored in high gauge package for 1 to 2 months. It is very cheap and affordable to the below poverty line group of children. The soyaflakes chiwada was given @ 50 g/ child/day. Significant improvements in nutrient intake were seen in soyaflakes supplemented group of children. There was high significant change in major, minor and β carotene.

Key Words : Soyaflakes chiwada, Nutritional quality, Anthropometric measurement

How to cite this article : Ghatge, N.S. (2014). Impact of soyaflakes chiwada supplementation on nutritent intake of malnourished pre-school children. *Food Sci. Res. J.,* **5**(1): 39-42.

INTRODUCTION

Soybean [*Glycine max* (L.) Merril] is an important source of quality legume protein. It is one of the nature's wonderful nutritional gifts, which provides a complete proteins with quality of essential amino acids, carbohydrates, unsaturated fat, vitamins and minerals including folic acid, calcium, potassium and iron. Soybean also contains nutraceutical properties like isoflavones phytoestrogen, soluble phosphate and potassium sulphate. These properties are mostly play a vital role to prevent the risk of dreaded diseases like breast cancer, oesteoporosis, cardio-vascular diseases, kidney stones and help in beating 'menopausal blue' (Messina,1997).

Soybean is less expensive and highly nutritious. Hence, most of the studies (Chandrashekhar and Hildo Sahay Rani, 2004; Despande *et al.*, 2004; Sahay and Kacharu, 1988) recommended the use of soybean in the preparation of snack, weaning and supplementary foods after necessary processing's on it. Soyaflakes chiwada can be the best option for the traditional chiwada after enhancing the nutritional qualities with its addition.

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METHODOLOGY

Local varities of soybean *i.e.* MH-CH-58 and readymade riceflakes were procured from local market. The processing techniques like cleaning, washing, soaking, germination, degermination, dehulling, boiling, pressing under controlled condition by use of flaking machine and drying were carried out on soybean for the preparation of soyaflakes.

Sensory evaluation:

By the use of different combination and variation soyaflakes chiwada was prepared. It was evaluated by organoleptically with the help of trained pannal of judges on a nine point hedonic scale (Amerine *et al.*,1965).

Nutritional quality assessment and cost calculation of soyaflakes chiwada:

High scored soyaflakes chiwada in sensory evaluation

was selected for the nutritional quality analysis. Moisture content, total ash, major nutrient like crude protein, fat, carbohydrates, B complex vitamins including vitamin B_1,B_2 and B_3 , minerals such as iron, calcium, zinc and crude fibre were analyzed by use of methods described in (AOAC, 1984). Keeping qualities of soyaflakes chiwada were recorded after storage of soyaflakes chiwada for 0 to 1 month and 1 to 2 month packed in polythene and tetra packaging material at room temperature. The production cost of the prepared product was calculated by taking into account the cost of every ingredients used in the preparation of soyaflakes chiwada.

Statistical analysis:

The variations noticed in the nutritional qualities in the soyaflakes chiwada before and after its storage were calculated with the statistical significant differences by applying 't' test (Gomez and Gomez, 1984).

OBSERVATIONS AND ASSESSMENT

The experimental findings obtained from the present study have been discussed in following heads:

Formulation of the soyaflakes chiwada:

The data regarding formulation of soyaflakes chiwada on the basis of different variations such as soyaflakes composition with rice flakes, use of flavouring agent, colouring agent, shortening agent, groundnut and roasted Bengal gram dhal with its score of sensory evaluation is presented in the Table 1 - 5. Soyaflakes mixing with 40 per cent of rice flakes was scored more with its organoleptic qualities.

Combination of soyaflakes:

Rice flakes (40:50g, rank high *i.e.* 7.6 as compared with other *i.e.* 6.4 for 40:50 and 6.0 for 50:40 soyaflakes and rice flakes combination, respectively (Table 1).

Assessment of nutritional quality:

The data given in Table 1 revealed the changes in proximate, sensory qualities and nutritional composition in soyaflakes chiwada before and after processing and its storage up to 1 month and 1 to 2 months kept in different packages at room temperature. The moisture and ash content of soyaflakes chiwada before and after processing was 6.6 to 4.9 per cent and 2.4 to 2.3 per cent, respectively. There was no significant change seen in ash and moisture content between raw and finished form of chiwada. Similarly there was no significant change found in carbohydrates (49.5 to 48.3 g) content in chiwada before and after processing. The change in B complex vitamins content in soyaflakes chiwada before and after processing were noted as vitamin B_1 (0.33 to 0.31 mg), vitamin B_2 (0.29 to 0.26 mg) and vitamin B_3 (2.09 to 2.01 mg). Where as mineral content has been reduced at negligible amount before and after processing in the soyaflakes chiwada. Decrease in the content of iron, zinc and calcium before and after processing were reported as (5.5 to 5.30 mg,) (2.8 to 2.70mg) and (100.11 to 99.11 mg), respectively. The difference in crude fibre content noted as 1.30 to 0.80 g before and after processing. The significant change has been

Table 1: Nutritional quality of soyaflakes chiwada with its storage stability

Sr. No	Nutrition qualities	Soyaflakes chiwada (100)g			Storage stability					
					Polythene package			Tetra package		
		Raw form	Finished form	't'test	Upto1 month	1 to 2 months	't'test	Upto1 month	1 to 2 months	't'test
1.	Moisture(%)	6.6	4.9	0.89 NS	4.8	4.6	0.104 NS	4.8	4.7	0.052 NS
2.	Ash(%)	2.4	2.3	0.64 NS	2.3	2.27	0.015 NS	2.3	2.29	0.005 NS
3.	Crude protein(g)	28.3	27.7	0.80 NS	27.7	26.9	0.418 NS	27.7	26.5	0.628 NS
4.	Crude fat(g)	9.1	15.3	2.69*	15.3	15.0	0.157 NS	15.3	14.9	0.209 NS
5.	Carbohydrate (g)	49.5	48.3	0.54 NS	48.0	47.2	0.41 NS	48.0	48.0	-----
6.	Energy(kcal)	394.8	489.5	4.55**	487.0	485.0	1.04 NS	487.0	484.0	1.570 NS
7.	B Carotene (ug)	219.4	202.2	2.64*	202.0	201.0	0.523 NS	202.0	201.5	0.261 NS
8.	Vitamin B_1(mg)	0.33	0.31	0.26 NS	0.31	0.30	0.0052 NS	0.31	0.29	-----
9.	Vitamin B_2(mg)	0.29	0.26	0.12 NS	0.25	0.25	0.010 NS	0.25	0.24	0.0052NS
10.	Vitamin B_3(mg)	2.09	2.01	0.109 NS	2.01	2.01	0.005 NS	2.01	2.00	0.005NS
11.	Crude fibre (g)	1.30	0.80	0.60 NS	0.80	0.80	----	0.80	0.80	----
12.	Iron (mg)	5.50	5.30	0.104 NS	5.30	5.30	0.052 NS	5.30	5.20	0.157 NS
13.	Zinc(mg)	2.80	2.70	0.052 NS	2.70	2.70	0.026 NS	2.70	2.64	0.026 NS
14.	Calcium (mg)	100.11	99.11	1.21 NS	100.11	100.11	1.21 NS	100.11	1.21	1.21 NS

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

Table 2: Average nutrients intake of experimental groups

Sr. No.	Nutrients	Group I Mean ± S.D.	Group II Mean ± S.D.
1.	Calories (K.cal)	924.3± 3.1(63.3)	634.2± 5.3(43.4)
2.	Protein (g)	16.6±4.1(64.0)	10.0±2.7(38.5)
3.	Fat (g)	14.5±3.0(58.0)	10.3±2.1(41.3)
4.	Vitamin B_1 (mg)	0.54±0.1(72.0)	0.31±0.1(41.3)
5.	Vitamin B_2(mg)	0.62±0.1(72.9)	0.33±0.07(38.8)
6.	Vitamin B_3 (mg)	0.60±0.1(62.0)	0.40±0.9(42.0)
7.	Vitamin C(mg)	25.8±0.9(62.5)	22.4±1.4(56.0)
8.	β Carotene (µg)	1080±7.3(67.5)	757.1±7.9(47.3)
9.	Iron (mg)	6.7±2.6(68.8)	5.6±2.2(56.1)
10.	Calcium (mg)	221.9±3.1(55.3)	168.6±5.5(42.0)
11.	Zinc (mg)	4.6±0.8(46.0)	3.8±0.6(38.0)

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

seen only in crude fat, energy and β carotene contents in soyaflakes chiwada before and after processing. The crude fat content was (9.1 to 15.3) g before and after processing. The energy content was (394.8 to 489.5) kcal and β carotene was (219.4 to 202.2 µg) before and after processing.

The soyaflakes supplemented group had 924.3 ±3.1 Kcal (63.3 %). The control group had lower calorie intake *i.e.* 634.2 ±5.3 Kcal (43.4 %) Table 2.

The soyaflakes chiwada group showed 16.6±4.1 g (64.0 %) protein. The control group observed the protein intake only 10.0±2.7g (38.5 %). In soyaflakes chiwada the mean intake of fat was in group I as14.5±0.3g. Only 10.3±2.1g. average fat intake was found in control group of children 0.54±0.1 mg in vitamin B_1 as 0.54± 0.06 mg which was reported only 41.3 per cent. The control group consumed only 0.31±0.1mg (38.8 %). The intake of riboflavin was 0.60±0.1 mg. Minimum average intake of niacin was observed in control group 0.40±0.9 mg. Group I showed vitamin C intake as 25.8±0.9 mg which was reported as below the adequate level (*i.e.* 62.5 %).

Intake of vitamin C (*i.e.* 22.4±1.4 mg) was noticed in control

Table 3: Average major nutrients intake of experimental groups before and after supplementation

Sr. No.	Nutrients	Group I Mean ± S.D.			Group II Mean ± S.D.		
I.	Major nutrients	BS	AS	't' value	BS	After 6months	't' value
1.	Calories(K.cal)	624±85.2(42.6)	924.3±3.1(63.3)	10.1**	634±86.6(43.8)	635±86.5(43.4)	0.15 NS
2.	Protein (g)	7.6±1.0(29.4)	16.6±4.1(64.0)	3.2**	9.0±1.3(34.3)	10.0±2.7(38.5)	0.70 NS
3.	Fat (g)	7.5±1.0(29.9)	14.5±3.0(58.0)	2.6*	10.00±1.3(40.0)	10.3±2.1(41.3)	1.10 NS

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

Table 4: Average vitamins intake of experimental groups before and after suppllementation

Sr. No.	Vitamins	Group I Mean ± S.D.			Group II Mean ± S.D.		
		BS	AS	't'value	BS	After 6months	t 'value
1.	Vitamin B_1 (mg)	0.40±0.1(58.7)	0.54±0.1(72.0)	2.7 *	0.30±0.0(40.0)	0.31±0.1 (41.3)	1.7NS
2.	Vitamin B_2(mg)	0.5±0.1(60.0)	0.62±0.1(72.9)	2.6*	0.30±0.1(36.8)	0.33±0.07 (38)	1.3 NS
3.	Vitamin B_3 (mg)	0.4±0.1(41.0)	0.60±0.1(62.0)	3.5**	0.40±0.1(42.0)	0.40±0.9(42.0)	0.0 NS
4.	Vitamin C(mg)	24.3±3.3(60.8)	25.8±0.9(62.5)	0.12 NS	22.0±3.0(55.0)	22.14±1.4(50)	0.10NS
5.	β Carotene (µg)	326±14.5(20.4)	1080±7.3(67.5)	4.2**	326±4.5(20.4)	757.1±7.9(43)	2.8**

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

Table 5: Average minerals intake of experimental groups before and after supplementation

Sr. No.	Minerals	Group I Mean ± S.D.			Group II Mean ± S.D.		
		BS	AS	't 'value	BS	After 6months	't' value
1.	Calcium(mg)	121±1.6(30.3)	221.9±3.1(55.3)	3.3**	157.0±1.4(39.3)	168.6±5.5(42.0)	0.7 NS
2.	Iron (mg)	5.1±0.7(51.3)	6.7±2.6(68.8)	1.22NS	5.6±2.2(56.1)	5.6±2.2(56.1)	0.2 NS
3.	Zinc (mg)	1.4±0.1(13.9)	4.6±0.8(46.0)	3.7*	3.8±0.5(38.0)	3.8±0.6(38.0)	0.2 NS

Group I - Experimental group supplemented with soyaladoo, Group II - Experimental group supplemented with soyachakali,Group II-Experimental group supplemented with soyaflakes chiwada , Group IV - No supplementation *i.e.* control group, Figures in paran theses indicate percentage
* and ** indicate significance of values at P=0.05 and 0.01, respectively, NS=Non-significant,BS – Before supplementation, ,AS – After supplementation

group. The intake of β carotene in group I was 1080 ±7.3 µg. Very poor intake of β carotene was noted by control group *i.e.* 757.1±7.9 µg. It was observed as below the adequate level *i.e.* 47.3 per cent. The mineral consumption *i.e.* calcium group I, it was noticed as 221.9 ± 3.1 mg. The control group consumed only 168.6±5.5 mg calcium, which was reported as poorly adequate (Ghatge, 2013).

Group I consumed iron as 6.7±2.7 mg (68.4 %). The intake of iron by control group showed 5.6±2.2 mg (56.1 %). The zinc intake by supplemented group was recorded as 45.0 and 38.0 per cent in group I and II, respectively.

Average major nutrients intake like calories, protein and fat by experimental group was compared with their before supplementation intake level. The relevant data are presented in Table 3.

The group I showed increase from 42.6 to 63.3 per cent of mean calorie intake after six months. There was no significant change noticed in average calorie intake of control group. Group I showed an increase protein intake level (16.6g) after supplementation. This group recorded increase from 29.4 to 64.0 per cent protein intake after supplementation. Where as the average intake of protein after supplementation was slightly found decreased in control group as compared with their intake before supplementation.The control group noted a non-significant fat intake as compared between their before and after six months of experimental period.

The data about average vitamin intake including vitamin B_1, B_2, B_3, vitamin C and β carotene by different experimental groups are recorded in Table 4. In group I significant increase was found form 58.7 to 72.0 per cent in thiamin intake after supplementation. In control group non - significant increase was noted in consumption of vitamin B_1 (from 0.30 to 0.31 mg) after 6 months of experimental period. In group I increased vitamin B_2 intake was found from 60.0 to 72.9 per cent vitamin B_2 (71.8) after supplementation. No significant difference was noticed in control group regarding intake of vitamin B_2 before and after supplementation.

Group I observed as significant increase in per cent of vitamin B_3 intake from 41.0 before supplementation to 62.0 per cent after supplementation. In control group there was not any change in the intake of vitamin B_3 after 6 months experimental period.

The average intake of vitamin C was not observed any difference among both the experimental groups as before and after supplementation period. β carotene intake was highly significant in group I supplementation. β carotene 20.4 to 67.5 per cent. Control group was also noted increase in β carotene intake at significant level (from 20.4 to 47.3 %) after experimental period. The data about average intake of minerals namely, calcium, iron and zinc by different experimental groups before and after supplementation are given in Table 5. It revealed that, calcium intake was found increased at highly significant level in experimental group I. It was observed nearby fifty per cent deficient in calcium intake. No significant difference was observed in the intake of calcium after experimental period in control group. Iron intake was noticed increased at highly significant level only in group I .

In group I the intake of zinc before supplementation was very poor *i.e.* only 13.9 per cent, it was increased up to 46.0 per cent after supplementation. No significant change was noticed in control group regarding intake of zinc after experiment.

Conclusion:

On whole it can be concluded that significant change was seen in major nutrient, minor and β carotene in soyaflakes supplemented groups.

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Received : *02.12.2013;* **Revised:** *09.03.2014;* **Accepted :** *22.03.2014*