Original Article

Supplementing iron bioavailability enhanced mung bean

Vijayalakshmi Purushothaman MSc PhD[1], Amirthaveni M MSc PhD[1], Samson CS Tsou PhD[2] and Shanmugasundaram S MSc PhD[3]

[1]*Avinashilingam University for Women, Coimbatore, India.*
[2]*Former Director General AVRDC*
[3]*Former DirectorProg-I AVRDC*

Iron deficiency anaemia is a major public health problem. The high incidence is either due to insufficient intake of iron or poor bio availability. Enhancing the bio availability is as important as increasing the intake. The absorption could be enhanced by including ascorbic acid and β carotene containing fruits and vegetables into recipes of iron containing food preparations. The effect of supplementation of iron bio-availability enhanced mung bean preparations was studied on 75 women who were compared against 75 who served as controls and another 75 who consumed regular traditional recipes. The methodology included identification of suitable mung bean variety, assessing iron in vitro bio availability, mapping the anaemic women, estimating their iron levels, supplementation for one year and studying the effect of supplementation. Mung bean supplementation had increased serum protein levels from 5.36 to 6.73 g/dl, serum iron levels had increased from 16.6 to 46.7 µg/dl. The TIBC levels decreased from 555 to 508 µg/dl while serum ferritin levels increased from 3.56 to 5.94µg/dl and Hb levels from 7.54 to 8.29 g/dl. Thus, improving the bioavailability of iron of food preparations, will improve the iron status of women.

Key Words: Mung bean, Invitro, bio availability, serum iron, serum ferritin

INTRODUCTION

Anaemia poses a threat to the life and health of the women as it results in premature birth of child, contributes to low birth weight and poor viability of the infant, increases mortality and morbidity rate of children, easily susceptible to other illness, affects work performance of employees in factory, industry and agriculture, impairs learning capacity of growing children and reduces capacity to do sustained work among adult men and women. WHO (1991)[1] reported anaemia to be a major health disorder affecting populations in all spheres of life. It is estimated that 500 million to 1 billion individuals in the world are affected by nutritional anaemia (Nutrition Report, 1992).[2]

The higher incidence of iron deficiency anaemia is due to either insufficient intake of dietary iron or poor bioavailability or both or heavy worm load in the intestine. Bioavailability of iron from the dietary source depends on the iron content of the diet, actual composition of the diet and the absorption rate. Hence, enhancing the dietary intake of iron from food sources and also enhancing the bioavailability of iron from the commonly used foods is very essential to combat against anaemia.

The present study aimed at identifying the suitable variety of mung bean for supplementation, developing and standardizing traditional recipes and modifying the same, estimating the in vitro bioavailability of iron in the standardized and modified recipes and studying the effect of supplementation of standardized and iron bioavailability enhanced mung bean preparations and nutrition education on the nutritional status of selected women.

SUBJECTS AND METHODS

Different varieties of mung beans namely CO4, CO5, Vamban I and Vamban from TamilNadu Agricultural university, Coimbatore and Pusa-Bold-I variety obtained from IARI, New Delhi were procured and the mung beans were physically examined for their size, colour, appearance, uniformity, cleanliness and hard seeds and subjected to various processing procedures like soaking, sprouting, roasting and grinding of soaked seeds. Pusabold 1 variety appeared to be most suitable for the supplementation.

Details relating to the socio economic background, food intake, clinical assessment and nutritional knowledge, attitudes and practice of the selected women were collected. Two rural areas were selected as the venue for the study and 290 women in the age group of 20-30 years were available as subjects. Estimation of haemoglobin was carried out on all the women, to select the 225 anaemic women for the study.

Corresponding Author: Dr Vijayalakshmi Purushothaman, Dean, Faculty of Community Education and Entrepreneurship Development, Avinashilingam University for Women, Coimbatore- 641 043, Tamil Nadu, India.
Tel: 91- 0422-240241, 91-0422-2433325; Fax: 091-0422-2443620
Email: drvijip@yahoo.com.in; drvijip@hotmail.com
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Recipes namely, mung bean sundal, mung bean masiyal (traditional), mung bean cabbage kootu, mung bean tomato masiyal and mung bean sundal with carrot (bioavailabilityenhanced) were selected for supplementation. The quantities of the recipes were so planned that in any given recipe iron content and protein content of the recipes were kept almost the same at 2.80 mg and 12.8 to 13.1 grams respectively.

For supplementation the following groups were formed: a. TPMR Group (Traditionally Prepared Mung bean Recipe Group)-Mung bean sundal and Mung bean masiyal were given alternatively to these women for one year: b. IBEMR Group **(**Iron Bioavailability Enhanced Mung bean Recipes), namely mung bean tomato masiyal, mung bean cabbage kootu and mung bean sundal with carrot were given alternatively for a period of one year. Both TPMR and IBEMR group received nutrition education also: c. Control Group- this group did not receive any of the above supplementary foods.

Height and weight measurements were recorded using standard procedures and BMI arrived at. Biochemical parameters like Serum total proteins and albumin, serum Iron, serum TIBC and serum ferritin were estimated for one tenth of the selected sample. Teitz NW (1976)[3]. Haemoglobin estimations were done for all the subjects.

RESULTS AND DISCUSSION

The percentage invitro bioavailability from the selected recipes are shown in Table 1. Table 2 gives the nutrient content of selected recipes.

Except cereals, intake of all other foods was much less than the recommended allowance. Energy intake was found to be more or less adequate and the protein, calcium, thiamine intakes were more than the RDA in the experimental groups with TPMR and IBEMR supplements. There was no difference in heights during the period of study among women as they were already fully grown up individuals. The initial mean weight of the women ranged from 43.2 to 44.0 kg among all the three groups at the start of the study. However, at the end of supplementation, maximum weight increment was recorded among women in IBEMR group (5.81 kg), followed by TPMR group (4.42kg). The control group recorded only 0.34 kg increase when compared to the initial values. Only 48 per cent of the women in TPMR group had normal BMI initially. After supplementation, normal BMI was noticed among 95 per cent of the women. With respect to women in IBEMR group, 49.3 per cent of the women recorded normal BMI before supplementation and 78 per cent recorded normal BMI at the end of the study, indicating the beneficial effects of supplementation. In the control group 64 per cent were found to have normal BMI through out the period with out any appreciable changes.

Table 3 shows that supplementation in IBEMR group had reduced the prevalence of clinical symptoms considerably, when compared with the control group.

Table 1. Invitro iron bioavailability from the standardised mung bean recipes

S.No	Recipes	Invitro iron bioavailability per cent
Traditionally prepared Mung bean Recipes (TPMR)		
1.	Mung bean - Sundal	7.69
2.	Mung bean – Masiyal	5.75
Iron bioavailability enhanced Mung bean Recipes (IBEMR)		
1.	Mung bean Cabbage kootu	13.1
2.	Mung bean Tomato masiyal	12.4
3.	Mung bean sundal with carrot	12.2

Table 2. Nutrient content of recipes

Recipes	Energy (K cal)	Protein (g)	Iron (mg)	Retinol (µg)	Ascorbic acid (mg)
Mung bean Sundal	284	13.0	2.8	14.3	8.5
Mung bean Masiyal	280	13.1	2.8	15.3	7.3
Mung bean Cabbage kootu	285	13.1	2.8	25.9	51.9
Mung bean tomato masiyal	282	12.9	2.8	57.1	18.2
Mung bean sundal with carrot	283	12.8	2.8	142	8.5

Table 3. Prevalence of Clinical symptoms among the selected women

Deficiency symptoms	TPMR Group (N=75)		IBEMR Group (N=75)		Control Group (N=75)	
	Initial	Final	Initial	Final	Initial	Final
Protein Energy						
- Under weight	22.7	1.3	24	Nil	12.0	8.0
Iron						
- Weakness	53.3	30.7	49.3	21.3	60	62.7
- Paleness of the eye	100	93.3	100	86.7	100	100
- Easily fatigued	36	22.7	30.7	14.7	34.7	33.3
Vitamin A						
- Delayed dark adaptation	13.3	5.3	16	2.7	18.7	16
- Dry and rough skin	82.7	72	84	70.7	78.7	78.7

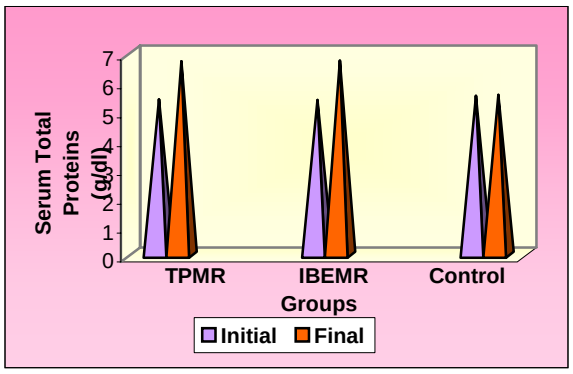

Figure 1.

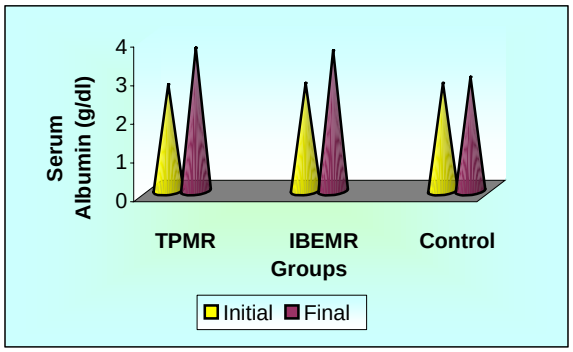

Figure 2.

Figure 1. Shows the mean serum total protein levels for the groups. The mean serum total protein levels had increased from 5.38 to 6.71 g/dl for TPMR group, from 5.36 to 6.73 g/dl for IBEMR group and from 5.51 to 5.45 g/dl for control group.

Figure 2 shows the mean serum albumin levels of different groups. The mean albumin levels had increased from 2.76 to 3.71 g/dl for TPMR group, from 2.80 to 3.64 g/dl for IBEMR group and 2.8 to 2.95 g/dl for control group. Final statistical analysis of the data revealed that the differences were significant (p<0.01) between the supplemented and non-supplemented groups, IBEMR group recording highest values.

Table 4 shows the mean serum iron, TIBC, serum ferritin and haemoglobin levels recorded by the women in TPMR, IBEMR and control groups.

Figure 3 A, B, C and D shows the mean serum iron, TIBC, Ferritin and Haemoglobin levels of different groups. The mean serum Iron and ferritin levels had improved remarkably after one year of supplementation in IBEMR group. While Serum TIBC levels of IBEMR group recorded reduced TIBC levels in comparison with other groups. Similarly the mean haemoglobin levels of women who were in IBEMR group had improved significantly. Table 5 gives the knowledge, attitudes and practices of the selected women

CONCLUSION

Thus it appears that it is possible to improve the bioavailability of iron by adding fruits and vegetables which contain good quantities of ascorbic acid and β-carotene into the regular recipes which in turn will help in improving the iron status of the women.

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AUTHOR DISCLOSURES

Vijayalakshmi Purushothaman, Amirthaveni M, Samson CS Tsou and Shanmugasundaram S, no conflicts of interest.

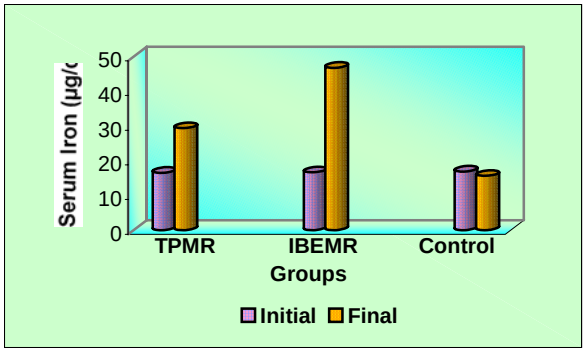

Figure 3A.

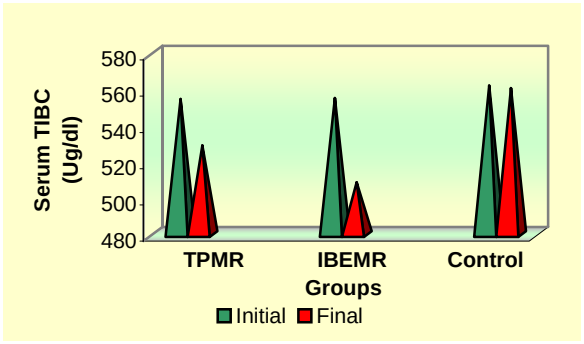

Figure 3B.

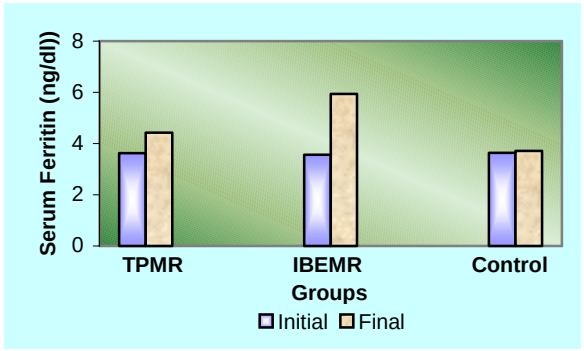

Figure 3C.

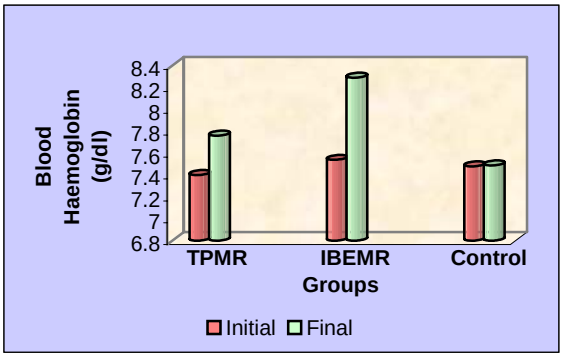

Figure 3D.

Table 4. Mean serum iron, TIBC, ferritin and haemoglobin levels of the selected women

Biochemical parameters with normal range	TPMR Group (N=75)			IBEMR Group (N=75)			Control Group (N=75)		
	Initial mean ± S.D	Final mean ± S.D	Mean increment	Initial mean ± S.D	Final mean ± S.D	Mean increment	Initial mean ± S.D	Final mean ± S.D	Mean increment
Serum iron (50-170 µg/dl)	16.5 ± 5.04	29.4 ± 8.35	12.9	16.6 ± 3.85	46.8 ± 7.36	30.1	16.9 ± 1.81	15.6 ± 3.50	-1.25
Serum TIBC (250-425.0 µg/dl)	555 ± 21.1	529 ± 19.6	-25.6	555 ± 20.9	509 ± 21.3	-46.4	562 ± 12.5	561 ± 15.5	-1.37
Serum ferritin (10-120 ηg/ml)	3.62 ± 0.83	4.43 ± 0.82	0.81	3.56 ± 1.13	5.94 ± 0.59	2.38	3.64 ± 0.32	3.71 ± 0.45	0.07
Haemoglobin level. WHO (1989) [4] (11.0-14.0g/dl)	7.40 ± 0.96	7.76 ± 0.94	0.36	7.54 ± 1.05	8.29 ± 1.04	0.75	7.48 ± 0.61	7.49 ± 0.61	0.01

Table 5. Knowledge, attitudes and practices of the selected women before and after nutrition education

Group	Criteria	Maximum score	Scores obtained		Difference in scores
			Before mean ± SD	After mean ± SD	
TPMR (50)	Knowledge	20	2.68±3.37	16.5±2.27	13.7
	Attitudes	9	4.38±2.09	8.72±1.20	4.34
	Practices	6	2.78±1.67	5.96±0.198	3.18
IBEMR (50)	Knowledge	20	2.08±1.14	17.3±2.41	15.2
	Attitudes	9	4.88±1.62	8.88±0.627	4.00
	Practices	6	2.56±1.18	5.42±0.758	2.86

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