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RESEARCH ARTICLE

EFFECT OF *MORINGA OLEIFERA* LEAF PROTEIN CONCENTRATE (MLPC) ON  
MODERATE ANEMIC ADOLESCENT GIRLS

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ABSTRACT

Moringa leaves have been known as a potential protein source. Moringa plants could be an alternative source of protein with the potential to overcome the problems of malnutrition. This is because the flour has a protein content of Moringa leaves which are three times higher than milk powder. Hence an effort was undertaken to evaluate the efficacy of *Moringa oleifera* Leaf Protein Concentrate (MLPC) on the health status of moderately anemic adolescent subjects. MLPC was prepared and made into capsules and supplemented to experimental group I (n=5) and standardized MLPC incorporated recipe was given to experimental group II (n=5) for a period of 15 days and the control group (n=5) was not given any supplementation. The result revealed that experimental group I who received the MLPC capsules has showed significant raise in haemoglobin than experimental group II. Therefore, *Moringa oleifera* Leaf Protein Concentrate was recommended for the improvement in the health status of moderate anemic adolescent girls.

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INTRODUCTION

Iron deficiency anemia is characterized by a defect in hemoglobin synthesis, resulting in red blood cells that are abnormally small (microcytic) and contain a decreased amount of hemoglobin (hypochromic) (Stang *et al.*, 2005). Worldwide, Iron-deficiency anemia is a significant problem and especially in developing countries it is widespread yet the most neglected micronutrient deficiency disorder among children, adolescence girls, and pregnant women (Paul, 2010). Young women may be at the greatest risk of developing early stages of iron depletion. The prevalence was found to be 16 per cent in women ages 20 to 49 years compared to five per cent in women ages 50 to 79. Even marginal iron status is a potential problem in women and may pose a particular risk to those consuming either a vegan or vegetarian diet (Susan *et al.*, 2012). India is one of the countries with the largest prevalence of anemia. The prevalence is the highest among the adolescents, 97.8 per cent. More than half of the pregnant women in the country are mildly anemic and 42.6 per cent are moderately anemic.

The situation is the worst for adolescent girls, 27.1 per cent of whom are severely anemic (Chellan, 2010). Protein is essential for growth and development of living organism and it constitutes 80-90 per cent of all organic substances in animal body (Penchar, 2006). Protein deficiency is one of the major nutritional problems in the developing world. There is still an estimated one billion people suffering from protein deficiency and malnutrition (Ghaly *et al.*, 2010). Leaf Protein Concentrate is also a good source for protection against neoplastic, cardiovascular disorders and immune deficiency.

It also has anti-tumoural activity and strong mutagenic activity, nutraceutical that demonstrate specific health or medical benefits including the prevention and treatment of disease beyond basic nutritional functions (Tripathi *et al.*, 2014). Moringa leaves have been known as a potential protein source. Moringa plants could be an alternative source of protein with the potential to overcome the problems of malnutrition. This is because the flour has a protein content of Moringa leaves which are three times higher than milk powder (Agyepong, 2009). Leaves of *Moringa oleifera* are also known as a great source of vitamins and minerals including calcium, copper, sulphur, vitamin A and B-vitamins. In addition, *Moringa oleifera* is very rich in iron and it was estimated that, the 100g dried leaf powder contains about 28.29 mg to improve iron and blood status (Osman *et al.*, 2012). Due to its beneficial effects,

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dry *Moringa* leaf powder has been used in a supplementary feeding program of the Integrated Child Development Scheme (ICDS) in India (Daniell, *et al.*, 2011). Hence an effort was taken to study the “Effect of *Moringa oleifera* Leaf Protein Concentrate (MLPC) on Moderate Anemic Adolescent Girls” with the following objectives

- Extract *Moringa oleifera* Leaf Protein Concentrate (MLPC) and to analyze its nutrient content and shelf life
- Prepare *Moringa oleifera* Leaf Protein Concentrate (MLPC) Capsules
- Formulate, standardize and analyze nutrient content of *Moringa oleifera* Leaf Protein Concentrate (MLPC) Incorporated Recipes
- Evaluate the efficacy of *Moringa oleifera* Leaf Protein Concentrate (MLPC) on Moderate Anemic Adolescent Girls.

## MATERIALS AND METHODS

To extract leaf protein concentrate, *Moringa oleifera* was selected on the literature available. The MLPC was prepared by adopting the procedure given by Aletor (2012). Fresh drumstick leaves were taken and sticks and stems were removed. It was then washed in running water, dried over a muslin cloth till moisture is removed. Then the leaves were ground and filtered to extract the juice using clean muslin cloth. *Moringa* Leaf Juice (MLJ) was then heated at 80°C - 90°C for 10 minutes to get a coagulated mass. This coagulum was taken separately after filtering through a muslin cloth. The whey fraction was discarded. A second extraction was also done by diluting the extracted coagulum with the water.

The protein coagulum obtained was then spread out in a flat plate evenly and sundried to remove the moisture and to get a dry powder. The plate was covered with perforated basket to prevent it from insect, birds and dust contamination. The prepared MLPC was subjected to nutrient analysis (Energy, Carbohydrate, Protein, Fibre, Fat, Calcium, Phosphorus and Iron) and shelf life analysis (Total Aerobic Count method). Using MLPC, capsules of MLPC weighing 0.5g were made which was used for the study. The MLPC incorporated recipes like kanji, kozhukattai, idiyappam, chapathi, cookies were prepared into three variations (V1-1.0g, V2-1.5g, V3-2.0g) 50g of each recipe. These formulated recipes along with control recipes were subjected to organoleptic evaluation using Hedonic scale by 20 semi-trained panel members.

The results obtained were statistically analyzed using mean & standard deviation using which one variation from each recipe was standardized and was analyzed for Iron and protein content. The standardized recipe which has got higher Iron content and protein content was selected for the conduct of the study. Fifty adolescent girls of (18-21 years) age group were selected from Dr. N. G. P. Arts and Science College, Coimbatore. Their socio- economic profile (family background, educational qualification and monthly income), dietary pattern, health status and nutritional status (Anthropometric Measurements - Height, Weight, BMI, Waist Hip Ratio, Biochemical Estimation – Haemoglobin, Clinical Examination- signs for anemia, Dietary survey – 24 hour

recall) were assessed using an interview schedule. Based on the biochemical estimation (Haemoglobin Level), 15 moderate anemic subjects were selected for the conduct of the study. These subjects were divided into Control group (n=5) who received no supplementation, Experimental group I (n=5) who received MLPC capsules and Experimental group 2 (n=5) who received selected standardized MLPC incorporated recipe. Both the group Experimental-I, Experimental-II received 3g of MLPC in the form capsules and recipes respectively on both morning and evening for a period of 15 days. During the conduct of the study, the subjects were asked to not to consume egg and there was no nutrition education provided. The haemoglobin level of the subjects was analyzed after the conduct of the study. The effect of MLPC on haemoglobin level of moderate anemic adolescent girls was then found out by comparing & statistically analysing the pre and post supplementation Haemoglobin values.

## RESULTS AND DISCUSSION

### Yield of MLPC

Hundred grams of fresh leaves of *Moringa oleifera* was taken ground to obtain 242g of mixture. It was then filtered which gave 160g of the extract and 82g of fibrous residue. The extract was then heated at 81°C to form coagulum. The time taken for the formation of coagulum is 10 minutes. The weight of the coagulum obtained is 53g. It was then split up into 25g each and kept for drying in Hot air oven and Sun respectively. 8g and 13g of the *Moringa* Leaf Protein Concentrate were obtained after Hot air oven and Sun drying. It can be concluded that the yield of MLPC was higher when sundried than hot air oven drying. Since, when dried at hot air oven most of the leaf protein stuck to the plate on drying hence there was some plate wastage. So the method adopted for preparation of *Moringa* Leaf Protein Concentrate (MLPC) is sun drying.

### Nutrient Content and Shelf Life Analysis of MLPC

**Table 1. Nutrient content of moringa leaf protein concentrate (MLPC)**

S.No.	Nutrients	Amount
1.	Carbohydrate (g)	72.21
2.	Protein (g)	13.46
3.	Fat (g)	3.73
4.	Energy (Kcal)	407.36
5.	Calcium (mg)	2576
6.	Iron (mg)	6
7.	Phosphorus (mg)	490
8.	Fibre (g)	11
9.	Ash (g)	1.70
10.	Moisture (g)	8.90

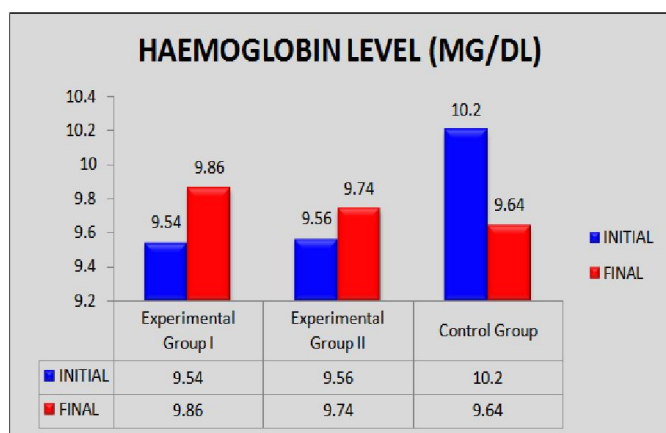
The above table shows that the *Moringa* leaf protein concentrate contain high amount of Protein and Iron content. The data on microbial growth the count of the bacteria was analysed for the *Moringa* Leaf Protein Concentrate. Analysis was carried out initially and fifteenth day during the study period. After the analysis the MLPC was fit for the consumption of 15 days.

## Formulation and Standardization of the MLPC incorporated Recipe

Among all the standardized Moringa Leaf Protein Concentrate incorporated Recipes, kanji was found to be superior and selected for the conduct of the study since it has got high amount of both protein (12g) and iron (4.70mg). It has got 44.22g of carbohydrate, 12g of protein and 0.43g of fat. The incorporate energy value was found to be 305.87 Kcal. Among minerals, it is rich in calcium (600mg) followed by phosphorus (220mg) and iron (4.7mg). The fibre content was found to be 2.4g. The moisture and ash content was 10.90g and 1.10g respectively.

## Effect of *Moringa oleifera* Leaf Protein Concentrate (MLPC) on Moderate Anemic Adolescent Girls

The results of the biochemical estimation study revealed that the mean difference of Experimental group I is 0.32 and Experimental group II is 0.18 and for the control it is -0.56. Hence it is evident that both capsules and MLPC incorporated recipe had an impact on haemoglobin level. Hence from the results, the study proved that the supplementation of MLPC in the form of capsules is highly effective than the supplementation of MLPC incorporated in the Recipe. Madukwe (2013) said that Moringa leaf protein concentrate are rich in essential nutrients and might be used in food supplementation to improve the nutritional status of individuals and communities especially the vulnerable groups. The leaf powder was also effective in management of anemia.



**Figure 1. Changes in mean haemoglobin (MG/DL) of the selected moderate anemic subjects**

## Conclusion

The findings of the study revealed that *Moringa oleifera* which is available at our door steps is a suitable food to improve haemoglobin status of adolescent girls who have the responsibility to produce healthy offspring in their adulthood and can make the country healthy and wealthy.

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