International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(1): 3006-3010

Received: 11-11-2019
Accepted: 15-12-2019

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Impact of drumstick (*Moringa oleifera* Lam.) supplement on the anthropometric and biochemical status of school children

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DOI: https://doi.org/10.22271/chemi.2020.v8.i1at.8728

Abstract
The study entitled "Impact of drumstick (*Moringa oleifera* Lam.) supplement on the nutritional status of school children" was conducted at the Department of Home Science, College of Agriculture, Vellayani. The major objective was to study the impact of drumstick (*Moringa oleifera* Lam.) supplement on the nutritional status of primary school children. Moringa soup supplement which was formulated provided at the rate of 15 g / child / day to experimental group for sixty days for impact study. Dietary surveys revealed an absolutely ill balanced diet with an uniform pattern comprising of rice and fish. Nutritional status revealed that 66.6 percent children were below the standard weight and 50 percent children were below the standard height for their age. Data on height for age profile, weight for age, mid upper arm circumference ratio and blood haemoglobin indicated favourable progress in the case of children belonging to experimental group. Meanwhile in the control group there was no variation. An assessment of anthropometric measurements of the children of experimental group indicated a significant increase when compared with the control group. Hence, it can be concluded that the *Moringa oleifera* based supplementary food tried in the above feeding trial is found to be a suitable one for popularizing as a supplementary food for the children and it is recommended to provide in the mid - day meal programme for improving their health status.

Keywords: Moringa oleifera, supplementary food, respondents

Introduction
As today's children are the citizens of tomorrow, their survival, protection and development are the pre-requisite for the future development of humanity. National Family Health Survey (NFHS) - 3 (2005 - 2006) studies found that the present scenario of health and nutritional status of the school age children in India is very unsatisfactory and vulnerable. Findings of a study conducted by Prema and Hema (2009) on under nutrition and risk of infections in school children revealed anaemia and other micronutrient deficiencies are common among Indian school children. These deficiencies led to problems of eye sight and poor working capacity and poor school performance. The high prevalence of malnutrition among the school children especially in the coastal areas might lead to unsatisfactory classroom performance, and multiple health problems. Though various supplementary feeding programmes are being implemented in the country, our children are still malnourished especially with reference to vitamin A and iron. Moreover, the consumption of leafy vegetables among the coastal group is much low. It is in this context, the supplementation of leafy vegetables in processed form to the children as the supplementary food become significant. Hence the present study is proposed with the aim of incorporating drumstick supplement which has already been standardized in the department of Home Science, along with the midday meal of the primary school students of the coastal area to improve their nutritional status.

Materials and Methods
Selection of area
The area selected for the study was an Upper Primary School in Chennavely in Mararikulam sea coast of Alappuzha district. Chennavely is a small fisher folk village which comprises of 18 wards. Basic criteria for selection of this village were:
(a) Children in the village were at higher risk of health-related problems; especially

about 90 percent of children were anaemic.
(b) Children in this area had low cognitive development and had poor learning capacity.
(c) Most of the children suffer from micronutrient deficiencies.

Selection of respondents
The respondents were purposively selected for ascertaining the conduct of the programme. Through an informal discussion, the significance of the present trial was explained to the school authorities and parents and they were persuaded their children to attend a medical camp so as to identify children of having poor health, anaemia and micro-nutrient deficiencies. Subjects were identified through clinical examination by conducting two medical camps in the school with the help of a physician belonging to Alappuzha Medical College. During the camp, the blood samples were collected from the subjects for heamoglobin estimation. These camps were conducted before and after the supplementation programme.

Criteria for the selection of the subjects were
1. Children in the age group 7-9 years
2. Children with the symptoms of under nutrition, anaemia, and micro - nutrient deficiencies.

Among 50 children from the medical camp, 30 were screened to have clinical symptoms and these 30 children were purposively selected for the feeding trial and used as experimental group (EG). Remaining 20 children were kept as control group (CG). Written consent of the subjects to participate in the study was also obtained.

Socio economic status of the respondents
In order to elicit the information regarding personal and socio – economic back ground of the respondents and their families, details like age, religion, family type and size, educational status, occupation and monthly income of the family were ascertained using structured and pretested interview schedule.

Dietary habits of the respondents
The questionnaire consisted of questions regarding food habits, meal pattern, and frequency of use of various foods etc.
Interview method was used to conduct the diet survey. The dietary habits of the selected respondents were studied by conducting dietary survey by interview method using a suitably designed questionnaire.

General health status of the respondents
Nutritional status is defined as the state of health enjoyed as a result of good nutrition. It is one of the critical indicators of health; therefore, regular nutritional assessment is important to maintain the health of participants (Kamath, 1986) [5]. In this study, anthropometry and biochemical methods were made to assess the nutritional status of the respondents where height, weight, MUAC were calculated. Body mass index from weight and height measurements were calculated.

Anthropometric Measurements
Nutritional anthropometry is the measurements of human body at various ages and levels of the nutritional status of the respondents and this is based on the concept that an appropriate measurement should reflect morphological variation occurring due to the significant functional and physiological change (Bamji *et al*., 2005) [1]. In this study, anthropometry, clinical examination and biochemical methods were made to assess the nutritional status of the respondents where height, weight, MUAC were calculated. Body mass index from weight and height measurements were calculated.

Weight
For weighing, platform weighing balance was used as it is portable and is convenient to use in the field. The weighing scale was checked periodically for accuracy. The scale was adjusted to zero before each measurement. The subjects having minimum clothing were asked to stand on the platform of the scales, without touching anything and looking straight ahead. Each reading was taken twice to ensure correctness of the measurements.

Height
To determine height, a stadiometer was used. The respondents were asked to remove their slippers and to stand with centre of the back touching the wall with feet paralleled and heels, buttocks, shoulder and back head touching the wall. The moving head piece of the stadiometer was lowered to reset flat on the top of the head and the measurements wa taken. An average of the three measurements of height of the respondents was taken.

Mid Upper Arm Circumference
In this study, this measurement was also taken for comparison with normal weight children and the standard suggested by Gnanasundaram *et al*., (1994) [4].

Estimation of Haemoglobin
Biochemical assessment is another important tool for assessing the nutritional status of the subject. There are several biochemical indicators of malnutrition specified for different nutritional deficiencies. The heamoglobin content of the subject was estimated using cyannmet heamoglobin method.

Selection of a standardized moringa soup supplement
A standardized moringa soup supplement which was developed by Saranya (2012) [10] in the department of Home Science was selected for supplementation for the respondents.

Conduct of feeding experiment
The best supplement was selected from the different combinations of the moringa soup supplement formulated by Saranya (2012) [10] in the department of Home Science for the feeding trial in this study. The efficiency of moringa food supplement among the subjects with anaemia, under nutrition and micronutrient deficiencies was tested by supplementary feeding experiment of three months duration. The subjects in the experimental group were given moringa soup and control group were not provided with moringa soup. The 30 subjects in experimental group were given the supplement for five days in a week for total period of sixty working days

Evaluation of feeding experiment
The impact of the moringa soup supplement on the subjects with anaemia, under nutrition and micronutrient deficiencies was evaluated by carrying out biochemical investigation and anthropometric measurements.
Biochemical investigation was carried out again after the 60 days period of feeding trial in order to evaluate the effect of the feeding trial on Heamoglobin level by the same expert from the Alappuzha Medical College.

Result and Discussion

Anthropometric assessment

Weight of the experimental group and control group before and after supplementation

From figure 1, it can be seen that after three months of supplementation there was difference in the weight of the respondents. Statistically there was a significant difference in th weigh before supplementation and weight after supplementation at 1% level of significance and no significant difference was found in control group. According to Christakis (2002) [2] deviations in weight for age are considered to be the most sensitive indicators of a child's growth performance and nutritional status.

Height of the experimental group and control group before and after supplementation

From figure 2, it can be observed that even though there was a slight increase in the mean score of height before and after the study, it was not that satisfactory. Statistically there was a significant difference in the height before supplementation and height after supplementation at 1% level of significance and no significant difference was found in control group. Nandha (2000) stated that height or total body length is influenced by heredity apart from nutritional and other environmental factors.

Mid upper arm circumferences of the selected respondents

Figure 3, revealed that majority of respondents in both EG and CG were having MUAC on prescribed standard. According to Sreelakshmi (2003) [12] MUAC indicates the status of muscle development. This is also one of the anthropometric measurements used to measure obesity.

Biochemical assessment (Haemoglobin Level)

The biochemical assessment of nutritional status of the respondents was conducted by estimating the haemoglobin level. According to Park (1997) [9], haemoglobin level is a useful index of the overall state of nutrition irrespective of its significance in anaemia. Figure 4 shows the distribution of respondents based on their haemoglobin level before supplementation.

Conclusion

Assessment of nutritional profile and general health status revealed that after three months of supplementation there was a significant difference in the weight before supplementation and weight after supplementation in the experimental group. In the case of height even though there was a slight increase in the mean height before and after the study, it was not that satisfactory. In case of the MUAC of the respondents, there was difference in the MUAC before supplementation and after supplementation. Results of haemoglobin level showed that after three months of supplementation there was significant difference in the haemoglobin level of the respondents before and after supplementation. There was no significant difference found in weight, height, MUAC and haemoglobin in control group during this period.

Regarding the clinical symptoms it was seen that there was a decrease in the clinical symptoms of the respondents in the EG after three months of supplementation and no change was seen in CG.

There was a significant improvement among the EG after three months of supplementation. Hence a long-term implementation of this supplementary feed will help to improve nutritional status of children.

Based on the study, following recommendations are put forward,

- The supplementary feed can be considered as a provision of extra food to children beyond the normal ration of their home diets, and can take place in the home, feeding centre's, health care centre's and schools.
- Incorporation of moringa soup powder as one of the food supplements in the mid-day meal programme with the active support of kudumbasree units.
- ICDS scheme of India aims at the improvement in the nutritional status of the school children and is an ideal platform to introduce Dehydrated Drumstick Leaves into the diets of this target group as a nutritional intervention.

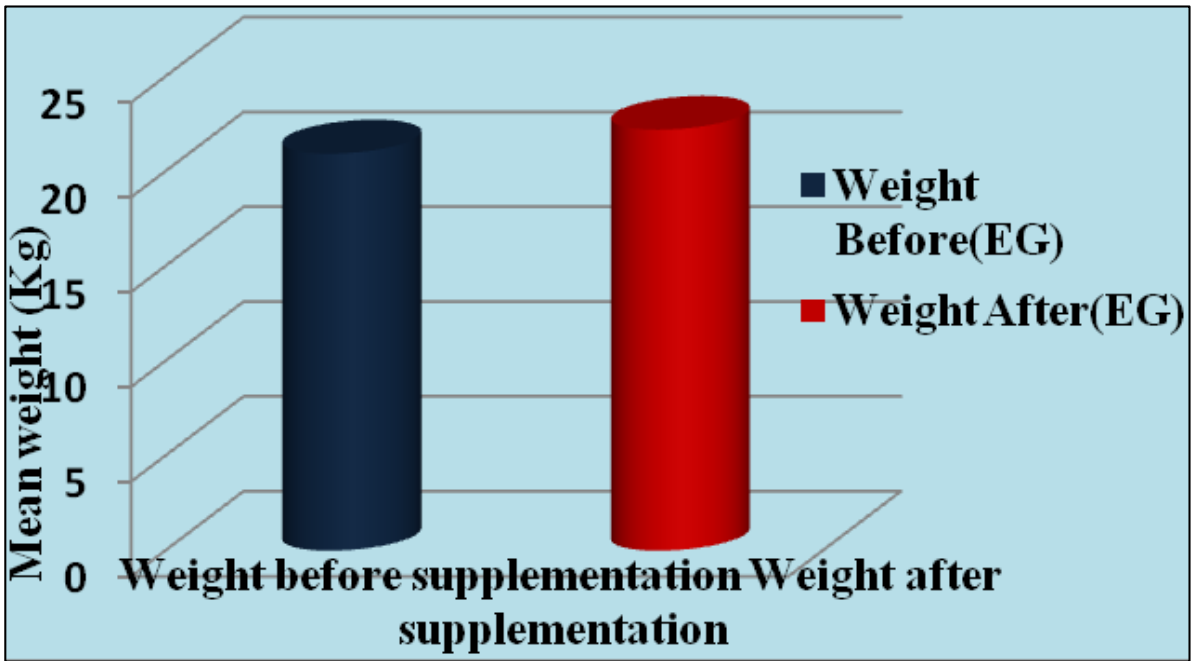

Fig 1: Weight of experimental group before and after supplementation

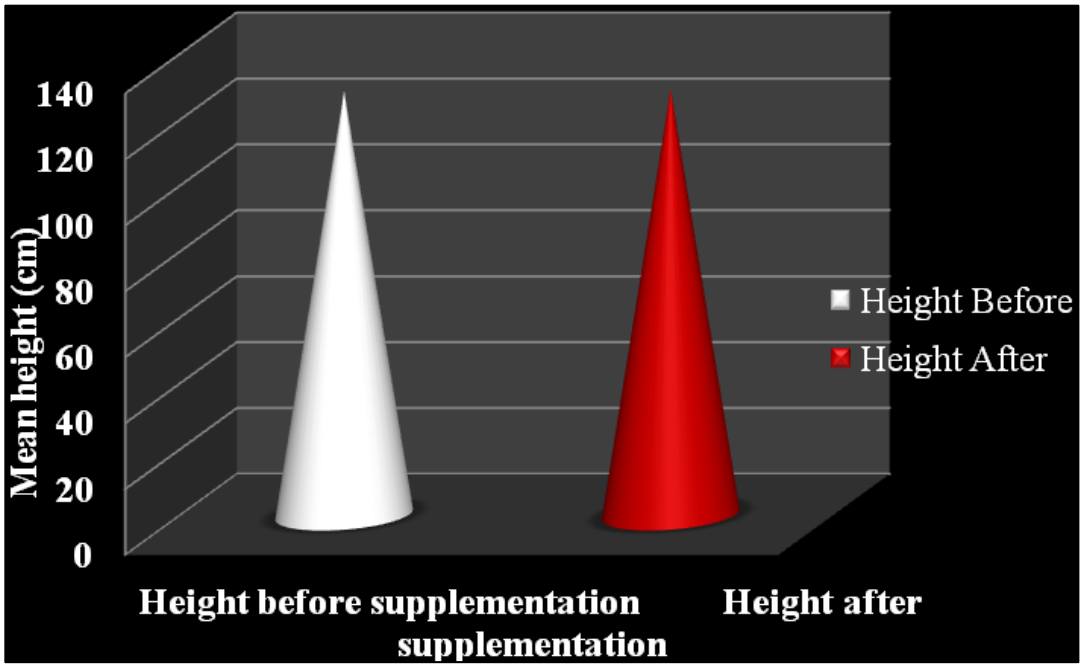

Fig 2: Height of experimental group before and after supplementation

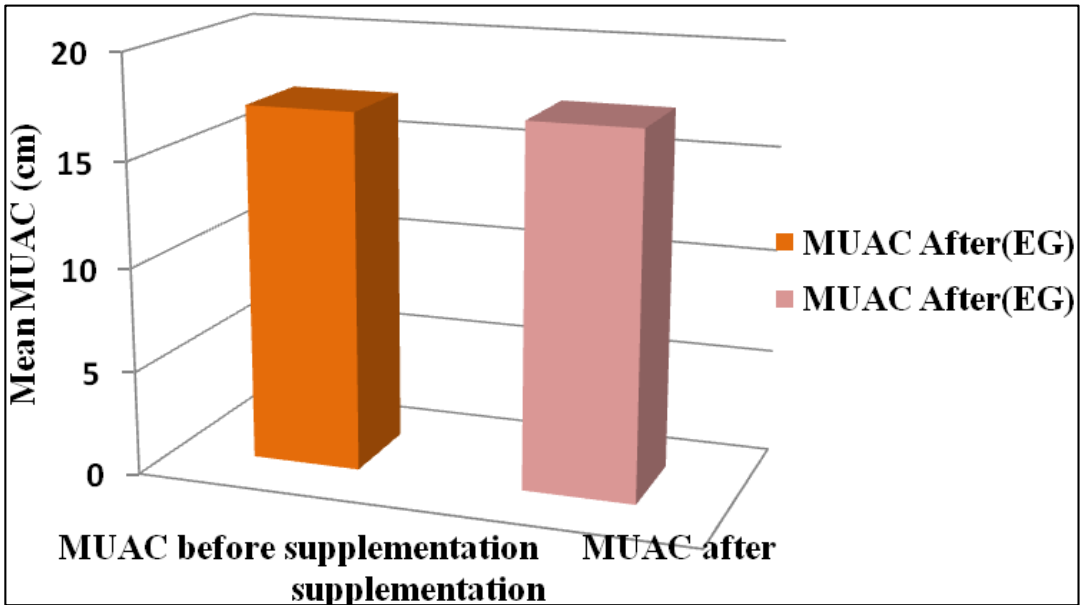

Fig 3: MUAC of experimental group before and after supplementation

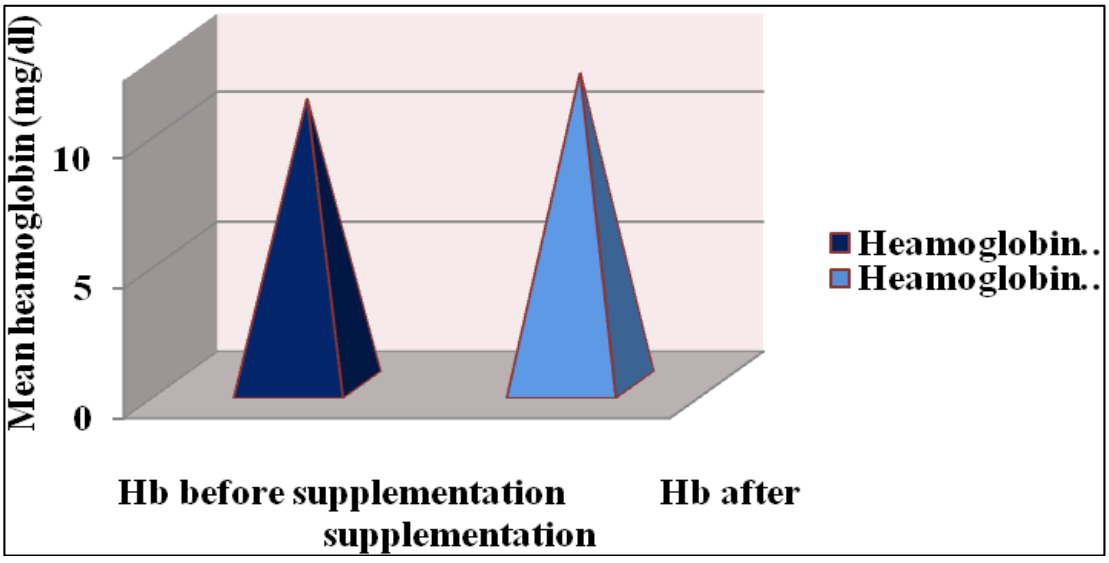

Fig 4: Heamoglobin of experimental group before and after supplementation

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