



Original Research Article

Interventional study to improve the haemoglobin level using moringa olifera powder on anaemic children in selected district of Karnataka

Umashankar S¹, Priya T Nandimath^{1,*}¹Padmashree School of Public Health, Bangalore, Karnataka, India

ARTICLE INFO

Article history:

Received 20-02-2021

Accepted 30-03-2021

Available online 10-04-2021

Keywords:

Anaemia

Moringa olifera

ABSTRACT

Introduction: Anaemia is a serious concern for the young children as it affects the cognitive performance, development (cognitive and behavioral), coordination, language development and scholastic achievement. Various interventions have been undertaken during last 50 years such as green revolution, PDS, ICDS, etc. Nutritional deficiencies remain with the same burden and nutritional anemia being one of the major concerns in India. Hence it becomes quite evident that alternative strategies should be tried to improve the nutritional anemia and reduce the morbidity associated with it, such as use of locally available, traditional food to increase the bioavailability of iron and to improve the nutritional behavior through nutritional education. The present study was proposed with an aim to assess the role of Moringa Olifera powder in improving haemoglobin level among the anaemic children.

Materials and Methods: A case control study was conducted at a village, Chikaballapur district of Karnataka. 312 school children were screened for Haemoglobin level; Out of 312 students 124 school children fulfilled the inclusion criteria. 66 children were recruited to control group and interventional group respectively. The children in the interventional group were administered with 3gms per day (1/2 a tea spoon) of Moringa Olifera powder along with their food for 3 months and regular supplements provided at school. Control group was advised to continue with the regular meal and regular supplements provided at the school. Haemoglobin levels were estimated before and 3 months after the intervention.

Results: Out of 58 children in the interventional group 33 (56.9%) were females and 25 (43.1%) were males and out of 66 children in the control group 34 (51.55) were females and 32(48.5%) were males. The mean Haemoglobin level of the children in the interventional group before the intervention was 10.332 which increased to 10.967 after the intervention. Similarly the mean Haemoglobin level of children in the control group before the intervention was 9.950 which remained 9.873 after the intervention. The increase in the mean haemoglobin level in the interventional group was significant with the p value of 0.045. After the intervention the children with moderate anaemia decreased from 38(65.5%) to 23(39.7%) and 13 (22.4%) children turned normal in the experimental group and in the control group the children with moderate anaemia increased from 52(78.8%) to 55(81.8%).

Conclusion: There a statistically significant marginal improvement in haemoglobin level in the interventional group after three months.

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1. Introduction

Anemia develops when there are not enough healthy red blood cells in the body. Anemia can be a temporary condition or a consequence of other health condition, or it

can be a chronic problem.¹ According to NFHS 3, children between the ages of 6 and 59 months, majority i.e. 70 percent are anaemic. This includes 26 percent who are mildly anaemic, 40 percent who are moderately anaemic and 4 percent who suffer from severe anaemia. Boys and girls are equally likely to have anaemia. Children of mothers who have anaemia are much more likely to be anaemic.²

* Corresponding author.

E-mail address: priyanandimath@gmail.com (P. T. Nandimath).

People with anemia may feel tired, fatigue, or experience shortness of breath which can cause problems carrying out routine activities. It can cause reduced work capacity in adult and impact motor and mental development in children and adolescents. There is a strong evidence that iron deficiency can affect cognition in adolescents.³ Anaemia is a serious concern for the young children as it affects the cognitive performance, development (cognitive and behavioural), coordination, language development and scholastic achievement. Anaemia also increases the morbidity of infectious diseases.

Although anaemia levels vary according to background characteristics, anaemia among children is widespread in every group and every state in India. More than half of children are anaemic even if their mother has 12 or more years of education or even if they are in their highest wealth quintile.²

The constitution of India, especially in article 47 has given the responsibility to the state for raising the level of nutrition and standard of living of its people and to improve the public health. Various interventions have been undertaken during last 50 years such as green revolution, PDS, ICDS, food for work, mid day meal nutrition education and research etc. India was able to achieve self sufficiency in food grains since 1970 but the nutritional deficiencies remain with the same burden and nutritional anemia being one of the major concern. Various programs that have direct and indirect impact to the nutritional problems have been implemented by Govt. of India. National nutritional anemia control program is one such program which is currently under RCH launched in 1970 to improve the status of nutritional anemia. But this program has not made remarkable impact on the nutritional status. Hence it becomes quite evident that alternative strategies should be tried to improve the nutritional anemia and reduce the morbidity associated with it, such as use of locally available, traditional food to increase the bioavailability of iron, improve the nutritional behavior through nutritional education.

Moringa oleifera is considered as an extraordinary tree and leaves of the Moringa tree are an excellent source of vitamin A, vitamin B vitamin C and other minerals. The leaves are also an outstanding source of calcium, protein, potassium and iron. Carbohydrates, fats and phosphorous content are low making this one of the finest plant foods to be found.

The Nutritive value of dried Moring oleifera leaves is as follows.⁴

Various studies have proven the effectiveness of drumstick leaf powder / Moring oleifera leaves as a supplement for iron deficiency anaemia. A study conducted by Vanisha S Nambiar on Effect of drumstick leaves supplementation on haematological indices revealed 28.6% reduction of anemia in Group A, by followed by 5% in

Table 1: Nutrient content (mean +/- std dev) of dried Moringa oleifera leaves

Nutrient reference	Nutrient amount in 100 g (300 mL or 1.25 cups)
Energy (Kcal, MJ)	304 +/- 87 kcal, 1.3 +/- 0.36 MJ
Moisture (mg)	7.4 +/- 2.89
Protein (g)	24 +/- 5.8
Carbohydrates (g)	36 +/- 9.2
Fat (g)	6 +/- 2.5
Fiber, crude (g)	9 +/- 7.45
Fiber, total dietary (g)	20.6 – 28.6
Oxalate (g)	2.6 +/- 1.25
Tannins (g)	1.2 – 1.4
Ca (mg)	1897 +/- 748.4
P (mg)	297 +/- 149.0
Na (mg)	220 +/- 180.0
K (mg)	1467 +/- 636.7
Mg (mg)	473 +/- 429.4
Fe (mg)	32.5 +/- 10.78
Zn (mg)	2.4 +/- 1.12
Cu (mg)	0.9 +/- 0.48
Thiamin (mg)	2.6
Riboflavin (mg)	1.29 – 20.5
Niacin (mg)	8.2
Vitamin B-6 (mg)	2.4
Folate (μ g)	540
Vitamin A (μ g RAE)B	3639 +/- 1979.8
Vitamin C (mg)	172 +/- 37.7
Vitamin E (mg)	56 – 113

group B and 4.7% in group C post supplementation of Moring oleifera leaves powder.⁵ Similarly a study was conducted Salwa M, Saleh MD and Abdel salam on effectiveness of moringa oleifera in combating mild and moderate malnutrition in pediatric age group. Everyday 10gm of ready prepared moringa powder was administered for the samples with fruit juice in two divided dose before the meals for 40days. Growth was monitored before and after intake of the intervention. It shown that after intervention, cases gained more weight than controls.⁶ Another study conducted by Ngozi M Nuam on “Moringa oleifera leaf improves iron status of infants 6-12 months” in Nigeria where forty infants were included in the study for four-week intervention. Infants in the Test Group received maize traditional complementary food (MTCF) with Moringa oleifera leaf while the Control Group had only MTCF. Mean Hb increased from 10.65 to 12.98 g dl⁻¹ in the infants of test group.⁷

With these evidences the present study was proposed with an aim to assess the role of Moringa Oleifera powder in improving haemoglobin level among the anaemic children.

The objectives of the study were: To assess the haemoglobin level of children in the age group of 5-14years and to assess the improvement in the level of haemoglobin among the anaemic children with the intervention of

Moringa Olifera powder. The objective of the study was also to create an awareness about the impact of Moringa Olifera powder on anaemia and to train the community in preparing Moringa Olifera powder

2. Materials and Methods

312 school children were selected for screening the Haemoglobin level and to recruit the study participants into control and experimental group. Out of 312 students 124 school children fulfilled the inclusion criteria. 66 children were recruited to control group and interventional group respectively. Estimation of haemoglobin level was done using digital hemoglobin meter using capillary blood. Estimation of haemoglobin percentage was done for the children in the control and interventional group before and three months after the intervention. Children with haemoglobin level- 110-119g/l ie with mild anaemia, 80-109 g/l – and with moderate anaemia were included for the study. Children with pre-existing medical conditions were excluded. Administering the Powder: The children in the interventional group were administered with 3gms per day (1/2 a tea spoon) of Moringa Olifera powder along with their food for 3 months. Control group was advised to continue with the regular meal. Training and capacity building – Awareness program was conducted to educate the families in the village about the impact of Moringa Olifera powder. The families were also thought on how to prepare the Moringa Olifera powder at home.

3. Results

The following are the results of the data collected from a total of 124 study participants. 66 students were recruited for interventional and control group respectively. Out of the 66 study participants in the interventional group 8 students dropped during the study. Hence the total participants in the interventional group were 58.

Out of the total 124 study participants 57 were males and 67 were females.

3.1. Demographic characteristics of the study participants

Out of 58 children in the interventional group 33 (56.9%) were females and 25 (43.1%) were males and out of 66 children in the control group 34 (51.5%) were females and 32(48.5%) were males (Table 2). Out of 124 study participants 74 (59.7%) children were Hindu's, 49(39.5%) were Muslims and 1 (.8%) child was Christian (Table 3). Out of 58 children in the interventional group, 28 children (48.3%) were in the age group of 11-15 years and 30(51.7%) were in the age group of 5-10 years. Similarly out of 66 children in the control group 30 children (45.57%) were in the age group of 5-10 years and 36(54.5%) were in the age group of 11-15 years. (Table 4)

Table 2: Distribution of the participants according to sex

Group	Sex	Frequency	Percent
Interventional group	Males	25	43.1
	Females	33	56.9
	Total	58	100.0
Control group	Males	32	48.5
	Females	34	51.5
	Total	66	100.0

Table 3: Distribution of the participants according to religion

Religion	Frequency	Percent
Hindu	74	59.7
Muslim	49	39.5
Christian	1	.8
Total	124	100.0

Table 4: Distribution of respondents according to age group

		Frequency	Percent
Interventional group	5 to 10 Years	30	51.7
	11 to 15 Years	28	48.3
	Total	58	100.0
Control Group	5 to 10 Years	30	45.5
	11 to 15 Years	36	54.5
	Total	66	100.0

3.2. Personal hygiene of the study participants

All the study children brushed their teeth daily. Out of 124 children 123 (99.2%) children washed their hands before and after eating food. Out of 124 children 82 (66.1%) children did not take bath daily and 42 children had bath daily (Table 5).

Table 5: Distribution of the study participants according to brushing

Brushing teeth daily	Frequency	Percentage
Yes	124	100
No	0	0
Total	124	100
Washing hands	Frequency	Percentage
Yes	123	99.2
No	1	.8
Total	124	100.0
Daily Bathing	Frequency	Percentage
Yes	42	33.9
No	82	66.1
Total	124	100.0

3.3. Attainment of menarche

Out of 67 girls only 4 of them had attained menarche.(Table 6)

Table 6: Distribution of girls according to the attainment of menarche

Menarche	Frequency	Percent
No	63	94.1
Yes	4	5.9
Total	67	100.0

3.4. General physical appearance of the study participants

Out of 124 children only one (.8%) child had pallor and all the children had normal appearing nails. Sclera of 38 (30.6%) students was pale and 86 (69.4%) children had clear sclera. 5 (4.0%) children had cracked lips and 119 (96.0%) had normal lips. Only 4 (3.2%) children had coated tongue. (Table 7)

Table 7: Distribution of respondent's base on general physical appearance

Skin conditions	Frequency	Percent
Normal	123	99.2
Pallor	1	.8
Total	124	100.0
Nails	Frequency	Percent
Normal	124	100.0
Total	124	100.0
Sclera	Frequency	Percent
Clear	86	69.4
Pale	38	30.6
Total	124	100.0
Condition of lips	Frequency	Percent
Normal	119	96.0
Cracked	5	4.0
Total	124	100.0
Condition of the tongue	Frequency	Percent
Normal	120	96.8
Coated	4	3.2
Total	124	100.0

3.5. Haemoglobin level of the study participants

Out 58 children in the interventional group 38(65.5%) children had moderate anemia and 20(34.5%) had mild anemia. Similarly out 66 students in the control group 52(78.8%) children had moderate anemia and 14(21.2%) children had mild anemia. (Table 8)

The mean Heamoglobon level of the children in the interventional group before the intervention was 10.332 which increased to 10.967 after the intervention. Similarly the mean Heamoglobin level of children in the control group before the intervention was 9.950 which remained 9.873 after the intervention.

The increase in the mean heamoglobin level in the interventional group was significant with the p value of

Table 8: Distribution of respondent's based on haemoglobin level

Group		Frequency	Percent
Experiment Group	Moderate	38	65.5
	Mild	20	34.5
	Total	58	100.0
Control Group	Moderate	52	78.8
	Mild	14	21.2
	Total	66	100.0

0.045 (Table 9).

After the intervention the children with moderate anemia decreased from 38(65.5%) to 23(39.7%) and 13 (22.4%) children turned normal in the experimental group and in the control group the children with moderate anemia increased from 52(78.8%) to 55(81.8%). (Table 10). Paired t Test was applied to check the significance of the effectiveness of the intervention. The mean changes in the hemoglobin level in the intervention and control group were significant with p value of 0.00. (Tables 10 and 11)

4. Discussion

Moringa oleifera is considered as an extraordinary tree with exceptionally high nutritional value. Moringa oleifera leaves powder can be used in treating the malnutrition in a local and cost-effective manner.

The present study reported that, Out 58 children in the interventional group 38(65.5%) children had moderate anemia and 20(34.5%) children had mild anemia. Similarly out 66 students in the control group 52(78.8%) children had moderate anemia and 14(21.2%) children had mild anemia. Similar study was conducted by Ferreira MU, et al⁸ on Anaemia and iron deficiency in school children, showed that 19.7% of the overall population had iron deficiency anaemia.⁸ A study conducted by Hashizume M et al⁹ showed that 27% of the school children were anemic.¹⁰ Study conducted by Baral KP, et al showed that the overall prevalence of iron deficiency anemia among adolescent population was 70.0%.⁹

From the present study it can be seen that there was an improvement in the hemoglobin level of the study participants in the interventional group after the consumption of the Moringa oleifera powder. The present study revealed that after the intervention the children with moderate anemia decreased from 38(65.5%) to 23(39.7%) and 13 (22.4%) children turned normal in the experimental group and in the control group the children with moderate anemia increased from 52(78.8%) to 55(81.8%). Similar study was conducted by Nambiar et, al¹ on Drumstick powder among 60 children results indicated that the recipes prepared with the Drumstick were highly acceptable to the ICDS authorities. Vanisha S Nambiar study revealed that supplementation of drumstick leaves reduced the anaemia by 28.6%.⁵ Study conducted by Salwa M, Saleh MD on

Table 9: Distribution of respondent's based on mean haemoglobin level before and after intervention

Mean Haemoglobin level Group		Before intervention	After intervention
Interventional Group	Mean	10.322	10.967
	Std. Deviation	1.1469	1.1065
	Minimum	8.0	8.4
	Maximum	11.9	13.0
Control group	Mean	9.950	9.873
	Median	9.800	9.800
	Mode	9.6	10.6
	Std. Deviation	1.0453	.9982
	Maximum	11.9	11.8

Table 10: Distribution of participants according to their haemoglobin level before and after intervention

Group		Before intervention		After intervention	
		Frequency	Percent	Frequency	Percent
Experiment Group	Moderate	38	65.5	23	39.7
	Mild	20	34.5	22	37.9
	Normal	00	00	13	22.4
	Total	58	100.0	58	100.0
Control Group	Moderate	52	78.8	54	81.8
	Mild	14	21.2	12	18.2
	Total	66	100.0	66	100.0

Table 11: T-test

Paired t Test		Mean		Std. Deviation	Std. Error Mean
Interventional group	Hemoglobin level before intervention	10.322	58	1.1469	.1506
	Hemoglobin level after intervention	10.967	58	1.1065	.1453
Control Group	Hemoglobin level before intervention	9.950	66	1.0453	.1287
	Hemoglobin level after intervention	9.873	66	.9982	.1229

Table 12: Paired samples correlations

Group		Correlation	Sig.
Experiment Group	Hemoglobin level before intervention & Hemoglobin level after intervention	.922	.000
Control Group	Hemoglobin level before intervention & Hemoglobin level after intervention	.941	.000

effectiveness of moringa oleifera where 60 samples were taken in the age group of 4-12 and 10gms of powder was given daily for 40 days showed that cases gained weight than the controls.⁶ Study conducted by Ram Chand dhakar, on Moringa used to describing the potential benefits of the moringa utilized in treating the malnutrition in a local and cost-effective manner.⁹

There was significant marginal improvement in the haemoglobin level in the interventional group with the supplementation of 3 gms (1/2 tea spoon) of Moringa oleifera powder for the duration of 3 months. The minimal

improvement in the hemoglobin level can be attributed to the shorter duration of intervention i.e for 3 months. Hence such studies need to be scaled up for a longer duration (6 months as a therapeutic duration) for complete assessment of improvement in the hemoglobin level.

The families of the study participants were educated about the impact of the of Moringa oleifera powder in improving the Haemoglobin level. The study has also demonstrated the need for education and awareness of locally available drumstick leaves to combat anemia. The families of the study participants were also trained to locally

make the Moringa oleifera powder at their household level. They were given training on how to select the Moringa oleifera leaves, how to dry and preserve and how to use the powder. This aspect of the study has not only helped in capacity building but also has emphasized on the sustainability of the project.

5. Conclusions

There a statistically significant marginal improvement in haemoglobin level in the interventional group after three months. Moringa oleifera is a very common medicinal plant which is locally available. The present study has proved the efficacy of Moringa oleifera powder in improving the Haemoglobin level. This can be considered as a cost effective intervention in combating anemia among children. The study has also demonstrated the need for education and awareness of locally available drumstick leaves to combat anemia. The study has not only helped in capacity building but also has emphasized on the sustainability of the project by training the families in preparing the Moringa oleifera powder at household level.

6. Source of Funding

Grant –In –Aid for Advanced Research Projects for the year 2016-17 by Rajiv Gandhi University of Health Sciences, Karnataka.

7. Conflict of Interest

The authors declare that they have no conflict of interests.

8. Acknowledgement

Authors are grateful to all participants who participated in this study.

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Author biography

Umashankar S, Principal

Priya T Nandimath, Associate Professor

Cite this article: Umashankar S, Nandimath PT. Interventional study to improve the haemoglobin level using moringa olifera powder on anaemic children in selected district of Karnataka. *Indian J Forensic Community Med* 2021;8(1):39-44.