Original Article

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Impact of Nutrition Education on Hemoglobin Levels of 6 to 18 Months Infants

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Abstract

Iron deficiency anemia is the most common nutritional disorder, even in the current era. Adequate nutrition during infancy and early childhood is essential to ensure the growth, health, and development of children to their full potential. The objective of the study was to assess the impact of nutrition education on hemoglobin concentration of infants aged 6-18 months. *Material and Methods:* 300 mothers from Indore city participated in the study. Mothers were divided randomly in to experimental group (EG) and control group (CG). EG mothers received nutrition education at fixed interval whereas CG mothers did not receive any education. Pathological reports were considered for assessing hemoglobin levels and then grade of anemia was decided. *Results:* At baseline, the mean hemoglobin (Hb) level for EG and CG was observed to be 12.13±1.33gm% and 11.40±1.29gm% respectively. At Phase I, a significant drop in Hb concentration was observed in both EG and CG ($p<0.01$). Continuous nutrition education resulted in significant rise in HB levels in EG at Phase II as compared to CG ($p<0.01$). In CG, a significant increase in infants suffering from mild and moderate anemia was seen ($p<0.01$) whereas no change was observed in EG. *Conclusion:* There is a real need for parental education for sound and correct child rearing practices and, in particular, advice on how, when and why and with to feed the child. If nutrition could be improved at this age, there might be beneficial effects on growth and health of infants in the short run. Therefore, there is an urgent need to improve traditional complementary foods in terms of energy density and bioavailability of macro and micro nutrients.

Keywords: Hemoglobin; Anemia; Nutrition Education.

Introduction

Adequate nutrition during infancy and early childhood is essential to ensure the growth, health, and development of children to their full potential. Poor nutrition increases the risk of illness, and is responsible, directly or indirectly, for one third of the estimated 9.5 million deaths that occurred in 2006 in children less than 5 years of age. Inappropriate nutrition can also lead to childhood obesity which is an increasing public health problem in many countries [1, 2]. Ensuring optimal complementary feeding practices for young children living in developing countries is a global public health priority because of their overwhelming importance for optimal growth, development, and well-being of infants and young children [3].

Iron deficiency anemia is the most common nutritional disorder, even in the current era. Iron is essential for oxygen carrying, muscle functions, immune function and brain myelination, neurotransmission and cognitive functions. Even mild to moderate anemia in infancy and early childhood are known to leave a permanent signature on the growing brain. Iron has effects on the neurotransmitters like dopamine and probably serotonin. Iron deficiency reduces dopaminergic receptors and the reduction in dopaminergic receptors leads to increase in opiate receptors and resultant defective learning ability and cognition. The role of iron deficiency on aggravating breath holding spell, febrile seizure, and hyper-cyanotic blue spell are also being increasingly observed in clinical practice [4].

Rapid growth of infants during the first year of life requires an adequate supply of iron for synthesis of blood, muscle, and other tissues. Most health authorities recommend exclusive breastfeeding for 6 months, a practice thought to prevent development of iron deficiency anemia in term, healthy infants.

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However, if infants are exclusively breast-fed beyond that age, they are at increasing risk of developing iron deficiency anemia [5]. The paradox of nutritional problems is that they are preventable but still exist in such a large magnitude. This affects the socioeconomic development of the community and the country leads to social inequality and poverty. Also, most mother and health workers know very little of how much food a child needs for adequate growth and development. Hence, the advice given is inaccurate and often conflicting. Thus, the objective of the study was to evaluate the impact of nutrition education on the hemoglobin stats of the infants

Methodology

In the present study, 300 infants aged (6 months - 18 months) and their mothers (Middle Income group and High Income Group) from Indore city. Samples were selected according to inclusion and exclusion criteria set for the study. Premature babies, children with known anomalies, low birth weight babies, infants suffering from pneumonia, convulsions or any other metabolic disorder were some of the exclusion criteria followed for the study.

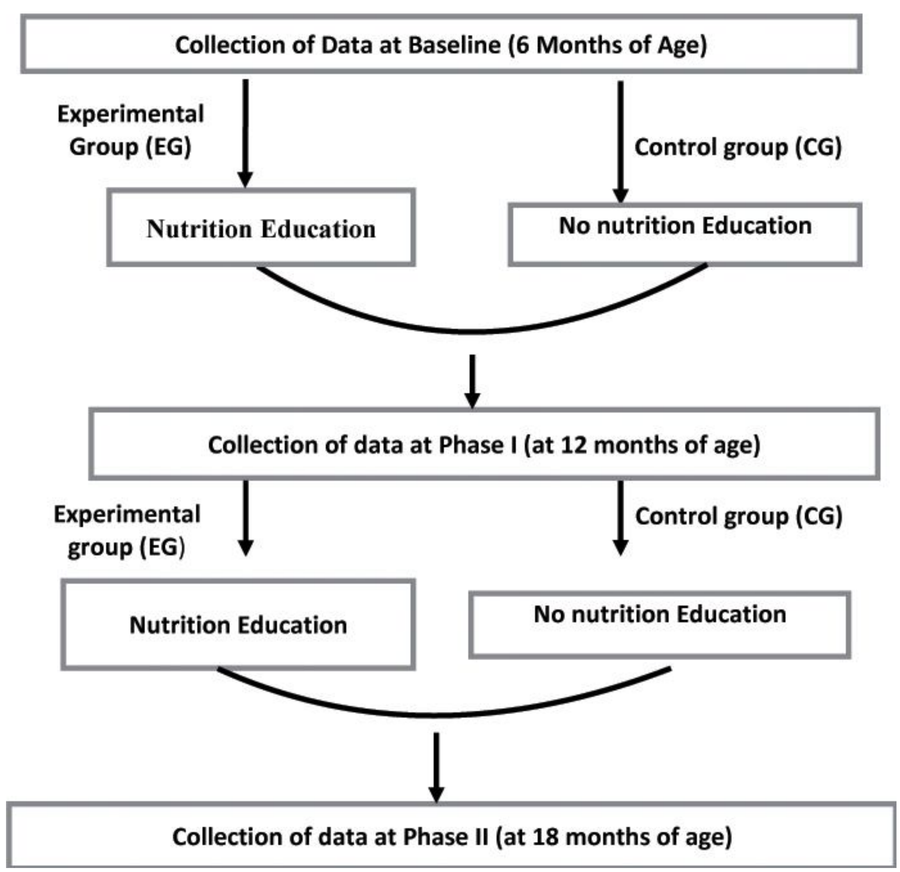
The mothers who got enrolled for the study with their consent were randomly assigned to control and experimental group. The mothers and their infants were grouped as follows:

Experimental group

This group (150 infants and their mothers) will be given nutrition education through counseling, and training through different communication skills like charts, demonstrations, leaflets, recipe booklets, diet charts.

Control group

This group (150 infants and their mothers) will not receive any nutrition education counseling, and training as this group is considered as control group for comparison in the study.



Baseline data was collected from the mothers when infants turned 6 months. Mothers were assessed (for both control and experimental group) and counseled (experimental group) at each immunization session at 9 months, 12 months, 15 months and at 18 months. Effect of nutrition education on Knowledge of mothers and complementary feeding practices was recorded at 12 months (Intervention Phase I) and at 18 months (Intervention Phase II).

For the purpose of data collection, socio demographic information was collected using semi structured questionnaire was used. For assessing the hemoglobin concentration in the blood, pathological test was conducted. The hemoglobin levels provided by the pathologists were considered authentic and were used to study the level of anemia in infants. The hemoglobin levels were assessed using Cyan Methemoglobin method by the pathologists. Hemoglobin assessment was done at Baseline, at Phase I and at Phase II.

After assessing the hemoglobin values, infants were categorized into following indices of grade of anemia.

Indicatives of anemia for 6 months to 6 years children

Indicators of anemia	Hemoglobin levels (gm %)
Non anemia/Normal	>11
Anemic	<11
Mild anemic	>10-10.9
Moderate anemia	>7-9.9
Severe anemia	>6.9

Ref: WHO technical Report series, No 405, 1968; and Nelson Textbook of Pediatrics, 17th Edition

A planned package of nutrition education was formulated keeping the obtained baseline information in mind as per the goal and objectives of the study. Nutrition education as an intervention was carried out only for experimental group for a period of one year at planned intervals. Nutrition education program comprised of sequential interactive sessions on various aspects of infant and young child feeding practices based on up to date scientific literature available as guidelines for infants. Majority of the subjects in the initial scrutiny were found not having proper feeding practices like type of food offered, consistency of feeds, meal frequency etc. To mitigate the gap in communication, the experimental group received interpersonal counseling. The progress towards achieving goals is the last and the most important part of the study. Understanding the attitude is the basis to putting a plan into action. Evaluation was made at each visit for the participant. The subjects were evaluated on nutrition education given in the previous sessions and were always motivated to place their queries, problems in front of the researcher, who tried to solve their problems in appropriate manner with proper scientific evidence.

Statistical analysis was done. The responses of frequencies of 300 subjects were calculated and analyzed by using the raw data. The raw data were entered into the computer database. Statistical software, SPSS version 21.0 was used for statistical analysis. MS Excel was used for graphical representation. Z-test was used to identify the significance of mean differences in hemoglobin concentration between baseline and post observations in experimental and control groups. Chi-square test was used to find the association between experiment and control group.

Results

In the present study, at baseline, the mean hemoglobin level for EG and CG was observed to be 12.13±1.33gm% and 11.40±1.29gm% respectively. After administration of nutrition education to the EG, a significant increase in hemoglobin concentration was observed at Phase I ($p<0.01$). At Phase I in CG the mean hemoglobin concentration was 10.25±1.45gm%. The drop in hemoglobin level was highly significant ($p<0.01$) with a mean difference of 1.45 between baseline and Phase I (Table 1). When compared the mean difference in hemoglobin concentration between experimental and control group, from baseline to Phase I, no significant change was observed between the two groups ($p>0.05$) (Table 2).

Table 1: Comparison in hemoglobin concentration between baseline and post nutrition education stage (phase 1) for experimental and control group

Group	Variable	Sampling Stage	Spread Mean ± SD		MD	Z-value	LOS
Exp	*Hemoglobin*	*Baseline*	12.13	1.335	0.96	**6.69**	p<0.01*
		Phase I	11.17	1.43			
Ctrl	*Hemoglobin*	*Baseline*	11.40	1.29	1.15	**9.29**	p<0.01*
		Phase I	10.25	1.45			

Table 2: Comparison in the mean difference of hemoglobin concentration between experimental and control group of baseline and phase I stage

Parameter	Experiment MD (A)	Control MD (B)	Difference (A-B)	Z Value	LOS
Hemoglobin	0.96	1.15	0.19	**1.02**	p>0.05

Table 3: Comparison in hemoglobin concentration between baseline and post nutrition education stage (Phase II) for experimental and control group

Group	Variable	Sampling Stage	Spread Mean ± SD		MD	Z-value	LOS
Exp	***Hemoglobin***	*Baseline*	12.13	1.335	0.47	**12.40**	p<0.01*
		Phase II	12.26	0.86			
Ctrl	***Hemoglobin***	*Baseline*	11.40	1.29	1.09	**7.22**	p<0.01*
		Phase II	10.31	1.33			

As see in Table 3, at Phase II, the mean hemoglobin of EG and CG was 12.26±0.86gm % and 10.31±.33gm% respectively. In the EG, delivering nutrition education showed a significant rise in hemoglobin concentration from baseline to Phase II (p<0.01). Contrary to experimental group, control group showed a significant decline in hemoglobin concentration at Phase II with a mean difference of 1.09 (p<0.01). The mean rise in hemoglobin concentration of EG after receiving nutrition education was highly significant as compared to the mean decrease in hemoglobin concentration in CG (p<0.01) (Table 4).

Table 4: Comparison in the mean difference of hemoglobin concentration between experimental and control group of baseline and phase II stage

Parameter	Experiment MD (A)	Control MD (B)	Difference (A-B)	Z Value	LOS
Hemoglobin	0.13	1.09	0.96	**4.52**	P<0.01*

Also there was a significant increase in hemoglobin concentration from Phase I (11.17±1.43gm %) to Phase II (12.26±0.86) in EG whereas no significant change was observed in CG (Table 5). As shown in Table 6, EG had higher increase in mean hemoglobin concentration as compared to mean increase in hemoglobin concentration of CG (p<0.01).

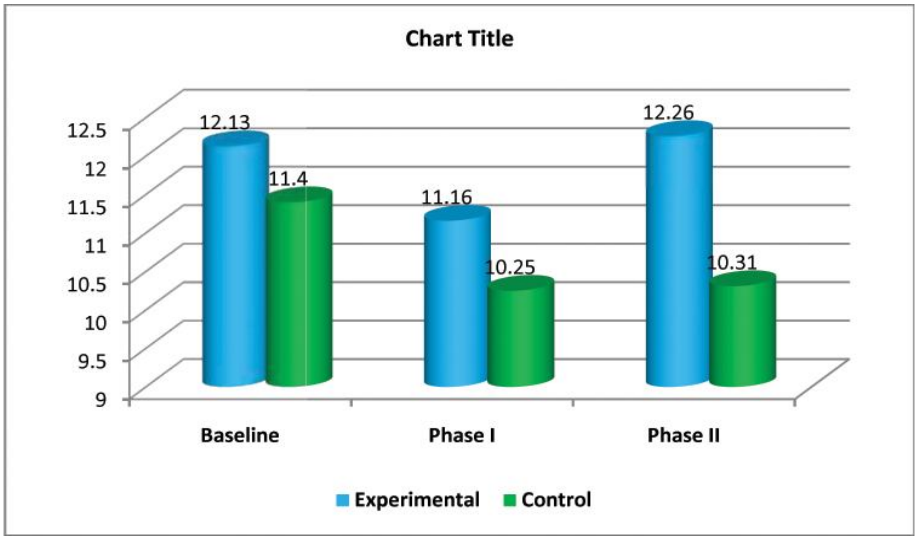
Table 5: Comparison in hemoglobin concentration between post nutrition education stages phase I and phase II for experimental and control groups

Group	Variable	Sampling Stage	Spread Mean ± SD		MD	Z-value	LOS
Exp	*Hemoglobin*	*Phase I*	11.17	1.43	1.09	**6.60**	p<0.01*
		Phase II	12.26	0.86			
Ctrl	*Hemoglobin*	*Phase I*	10.25	1.45	0.07	**1.04**	p>0.05
		Phase II	10.31	1.33			

Table 6: Comparison in the mean difference of hemoglobin concentration between experimental and control group of phase I and phase II stage

Parameter	Experiment MD (A)	Control MD (B)	Difference (A-B)	Z Value	LOS
Hemoglobin	1.09	0.06	1.03	**6.49**	P<0.01*

Fig. 1: Comparison in Hemoglobin Concentration between Baseline and Post Nutrition Education Stages (Phase I and Phase II) for Experimental and Control Groups



According to the hemoglobin levels of infants there were graded as normal, mild anemic and moderate anemic. At baseline, 82% and 12% infants from EG were normal and mildly anemic respectively. Post nutrition education, at Phase I, 70% infants were normal, 19% infants were mildly anemic and 11% infants were suffering from moderate anemia (p>0.05). At Phase II, continuous nutrition education resulted in non significant change in number of infants 71%, 15% and 14% infants were normal, mild and moderate anemic respectively (p>0.05).

In the CG, at baseline 77% infants were healthy and 18% infants were suffering from mild anemia. At Phase I, a significant decrease was observed in percentage of infants who were healthy (46%) and a significant increase was seen in mild anemic infants (33%) and moderate anemic (21%) infants (p<0.01). At Phase II, a highly significant increase in infants suffering from mild and moderate anemia was observed (25% and 27%) as compared to baseline data (p<0.01). No significant change (p>0.05) was observed between phase I and Phase II (Table 7).

Table 7: Percentage distribution of grades of anemia between baseline and post nutrition education stages in experimental and control group

Gr	Parameter	Sampling Stage	Spread Normal (%)	Mild (%)	Moderate (%)	'p' value
Experimental	*Grade of anemia*	*Baseline*	82	12	6	**0.135**
		Phase I	70	19	11	
		Baseline	82	12	6	**0.115**
		Phase II	71	15	14	
		Phase I	70	19	11	**0.657**
		Phase II	71	15	14	
Control	*Grade of anemia*	*Baseline*	77	18	5	**0.000***
		Phase I	46	33	21	
		Baseline	77	18	5	**0.000***
		Phase II	48	25	27	
		Phase I	46	33	21	**0.387**
		Phase II	48	25	27	

Discussion

In the present study nutrition education had positive impact on hemoglobin concentrations in infants. Educating to the mother about various ways to increase iron content in the diet, its bio-availability and providing foods which are rich in energy and proteins showed improvement in the hemoglobin levels of the experimental group infants as compared to the control group.

If nutrition could be improved at this age, there might be beneficial effects on growth and health of infants in the short run. Therefore, there is an urgent need to improve traditional complementary foods in terms of energy density and bioavailability of macro and micro nutrients.

Children under 2 years of age have high nutrient needs to support growth and development, yet breast-fed infants typically consume relatively small amounts of foods other than breast milk. As a result, complementary foods need to be high in nutrient density, i.e., the amount of each nutrient per 100 kcal of food. Iron and zinc are generally the most problematic nutrients during the period of complementary feeding [6], largely because their concentrations in human milk are low relative to needs.

Growth faltering is prevalent in developing countries [7] in which children are susceptible to infection and malnutrition [8, 9]. Globally, an estimated 43% of children < 4 y old are anemic [10]. Children < 2 y old are particularly vulnerable due to their increased demand for nutrients as they transition from exclusive breast-feeding to consuming complementary foods [11]. A limited variety of complementary foods has been associated with low nutrient density adequacy of the foods, which may cause malnutrition and developmental delays [12].

According to WHO, meeting micronutrient needs from complementary foods appears to be the greatest challenge [13]. One possibility could be to modify currently consumed grains by germination to reduce the anti-nutritional factors, such as phytates and tannins that interfere with the bio availability of micronutrients. As in our country mostly children consume cereals as staple food, similar observation was observed in rural Tanzania where it was seen that dietary deficiency in iron might be among the major reason for iron deficiency at this age period because of the majority of infants and young children consumed cereal based complementary foods which are low in iron content and bioavailability is also poor [14].

Quite often, the foods suggested are commercial, expensive and beyond the reach of the major sections of the community. The elaborate recipes are time consuming, besides requiring additional resources. In addition there is heavy influence of advertisements through TV, radio, popular magazines, newspapers, internet etc. on commercial instant weaning foods, and other foods which are expensive and are not suitable for all age groups [15].

Understandable, there is a real need for parental education for sound and correct child rearing practices and, in particular, advice on how, when and why and with to feed the child from what it is easily available in the household, provided enough of it is given. Thus, improving knowledge, attitudes, skills and practices of families will become the key in improving child nutrition. Perhaps, in no other branch of medicine, parental education plays such a crucial role as it is on the nutrition education of the parents.

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