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Original Article

Maternal nutritional knowledge and its association with iron deficiency anemia in children

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Abstract

Background: Young children are more prone to the development of Iron Deficiency Anemia (IDA). The most important factor of IDA in children is maternal nutritional knowledge because mothers are the sole source for providing diets to their children. Therefore, this study was intended to assess the maternal knowledge of child nutrition, hemoglobin (Hb) status of children and effect of maternal knowledge of anemia on its prevalence in children.

Methodology: A cross-sectional study was conducted to evaluate the prevalence of anemia in young children. In total, 143 pairs of children (2 – 10 years) along with their mothers were randomly selected. Data was collected by conducting interviews from mothers, using a structured questionnaire for their knowledge on child nutrition. Portable hemoglobinometer was used for identifying the Hb status of children. Data was analyzed using Statistical Project of Social Science (SPSS) version 22.

Result: It was evaluated that 4 out of 5 children were anemic. Out of total participant in the study, 7.69% of mothers were found to have a poor nutritional knowledge and all of their children were anemic. Approximately 63.64% mothers had average knowledge and 86.8% of their children were anemic while the rest were okay. Moreover, 28.67% of mothers with high nutritional knowledge had 58.5% anemic children and the rest was fine. The relationship between maternal nutrition knowledge and Hb level of children was highly significant ($p<0.001$).

Conclusion: Maternal knowledge about nutrition is associated with the prevalence of anemia in their children and it is one of the major modifiable factors.

Keywords

Iron Deficiency Anemia, Hemoglobin Level, Nutritional Knowledge, Maternal Education.

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Introduction

The prevalence of anemia is widespread throughout the world and publically it is a massive health problem in many developing countries[1]. The momentous contributor to the outbreak of anemia is the deficiency of iron; therefore IDA and anemia are often used synonymously. It is widely imitated that half of all the cases of anemia are due to iron deficiency[2&3].

Iron deficiency is a nutritional disorder which affects both developing and developed countries[3]. It is a state in which an insufficient iron hinders in the maintenance of normal physiological functions. Iron deficiency results from inadequate iron absorption, increased requirement attributable to growth or resulting from a long-term negative iron balance[4]. According to World Health Organization (WHO), it is defined as a condition in which there are little or no mobilized iron stores and in which there are signs of a reduced supply of iron to tissues. The severe stages of iron deficiency are associated with anemia[3].

Iron deficiency can occur at any stage of the life cycle. It is one of the major reasons for developing anemia in young children. However, deficiency of iron itself may adversely affect long-term neurological development and its effects are usually irreversible[5&6]. Mild iron deficiency is often undiagnosed as it is characterized initially, only by fatigue and weakness[7]. Even though, IDA can contribute to childhood morbidity and mortality[8].

The prevalence of anemia in children of school-going age has gained less attention in comparison with the pre-schoolers and women of child-bearing age[9]. Young children are more prone to the development of IDA, because of their rapid growth rate which is often coupled with inadequate intake of dietary iron. According to the data provided by WHO in 2001, 30% of children between the age of 0-4 years and 48% of the children between the ages of 5-14 years were anemic in developing countries[3].

Anemia is often used as an indicator to screen for iron deficiency in population-based surveys[10]. It is estimated that globally, 60 million school-aged children suffer from iron deficiency disorders (IDD) while 120 million children suffer from IDA[11]. According to the Pakistan National Nutrition Survey 2011–2012, which was conducted by the Aga Khan University (AKU), the prevalence of Anemia in Children was 62.3%[12].

If the recommended amounts of iron are not consumed, it may lead to iron depletion[13], which progresses through several stages like mild deficiency, Iron-deficient erythropoiesis & IDA. Mild deficiency is caused by a decrease in the serum ferritin levels and iron from bone marrow. Iron-deficient erythropoiesis (erythrocyte production) results through a decline in the iron supply to erythropoietin cells and in transferrin saturation, but hemoglobin levels are usually within the normal range. And finally in IDA, iron stores are deficient; hematocrit and hemoglobin concentration declines; and the resulting microcytic, hypochromic anemia is characterized by relatively small-sized red blood cells with lower Hb levels[14].

The functional deficits which are accompanied by IDA include gastrointestinal disturbances, inadequate cognitive and immune function, decreased physical capacity, and regulation of body temperature. In young children, IDA can result in psychomotor and cognitive abnormalities. Certain evidence indicates that the consequences of iron deficiency early in life persist throughout adulthood[15].

Dietary factors which effect iron level includes the form of iron consumed, storage of iron in

the body, and other dietary factors. Vitamin C is generally believed to increase iron utilization. Many studies proved that a negative correlation exists between the consumption of cow's milk and iron levels during childhood and an inhibitory effect of dietary fiber on the absorption of non-heme iron[16].

In addition to dietary factors, several non-dietary factors also affect iron status. Personal hygiene, parental education, household income, and a number of children in the family are also important determinants. A strong association exists between a child's nutritional status and the educational level of his or her parents. Maternal education may become a source of making a healthy decision and helps in meeting the child's nutritional requirements. Whereas, lower knowledge is associated with diminished cognition, reduced physical capacity, and decreased immunity as well as impaired psychomotor and mental development in children[9]. Studies in developing countries have evaluated that children of formally educated or literate mothers had a reduced risk of stunting[17]. Maternal schooling also contributes to micronutrient deficiencies, through its effects on nutritional knowledge[18]. Another study indicates that nutritional education has a positive influence on the iron status possibly by improving the intake of dietary iron[16]. Moreover, lack of awareness among mothers about Anemia is an additional risk factor associated with reduced hemoglobin level in their children[9].

Hb level is the most reliable indicator of anemia at the population level. Measuring Hb concentration is relatively easy and inexpensive, and this measurement is frequently used as a proxy indicator of iron deficiency[19&20]. Certain age groups which are most likely to have inadequate iron stores include infants and young children, teenagers, women of childbearing age & adults with internal bleeding[13].

Pakistan lacks the current data on the prevalence of anemia in children of school-age[7]. As school-aged children have received less attention in terms of anemia[3], therefore the purpose of conducting this study was to focus on children of 2 - 10 years for the occurrence of anemia.

Keeping all these points in mind, this study was intended to identify the maternal nutritional knowledge of IDA and its prevalence in their children aged 2 – 10 years. The objectives of this study were to assess the maternal knowledge on child nutrition, identify the hemoglobin level of children aged 2 – 10 years and to discover the relationship between nutritional knowledge of mothers and Hb status of their children.

The results of this study can be used by public health workers to design policies aimed at reducing the huge burden of anemia in children.

Methodology

A cross-sectional study was conducted in July 2017. Children from 2-10 years were conveniently obtained from different areas of Karachi, Pakistan. The study subjects consisted of mothers and their children (aged 2-10 years). The criterion obtained was solely based on the ages of children. The sample size of 143 pairs of children with their mothers was obtained through personal contacts.

The tools for data collection were a questionnaire, to evaluate maternal knowledge (independent variable); and hemoglobinometer, to check the Hemoglobin status of the child (dependent variable). The questionnaire which was used to assess mother's educational level and knowledge about anemia consisted of demographic information, such as, gender and age of children, income level, etc. Questions related to maternal nutritional knowledge, knowledge

regarding causes and effects of anemia, and signs and symptoms which mothers think their children encounters were all included in the questionnaire. Pretesting of the questionnaire was carried out to anticipate the response of the respondents and to evaluate the time required for data collection.

For the evaluation of prevalence, Hemoglobin (Hb) test was used. Children's Hb level was analyzed by pricking their pointer finger and collecting their blood samples in microcuvette, which contain dry Vanzetti's reagent (Azide methemoglobin reagent). The test was conducted instantly by placing microcuvette in the device, which displayed result within 20-30 seconds. Hb was measured by using HemoCue 201 which was sponsored by a company named S. Ejazuddin.

The data was entered and analyzed using SPSS version 22. Data used to describe general characteristics of the sample was expressed through frequency and percentages. Questions regarding causes and effects of anemia were given one mark for each question. Subjects scoring < 5 marks were categorized as having poor knowledge, 5-9 marks as average knowledge and 10-14 marks as having high knowledge. Criteria for assessing anemia were defined as hemoglobin concentration less than 11.1 g/dl for children 2 – < 5 years and 11.5 g/dl for 5 – 11 years.

The association between maternal knowledge of IDA and Hb level of their children was conducted by applying multivariate logistic regression and chi-square test. The p-value <0.05 was considered as a cut-off value for significance.

Results

The study sample comprised of 286 subjects out of which 143 were children of 2-10 years of age and 143 mothers of the 143 children already recruited for the study. The demographic characteristics were asked from the mothers through a questionnaire, are summarized in table 1. The study subjects comprised of 71 girls and 72 boys. The only criteria obtain for the selection of children was based on their ages which were between 2 – 10 years. Out of 143 children, 25.9% were 2 – 4 years, 37.8% were 5 – 7 years and 36.4% were 8 – 10 years of age.

In this study, 62.9% of mothers belong to joint families whereas mothers living in nuclear families were found to be only 37.1%. As reported by the mothers, none of the family consisted of less than 3 family members. 14.7% of the families reported that they had 3-4 members, 35.7% had 5-6 members whereas most of the families i.e. 49.7%, had more than 6 members.

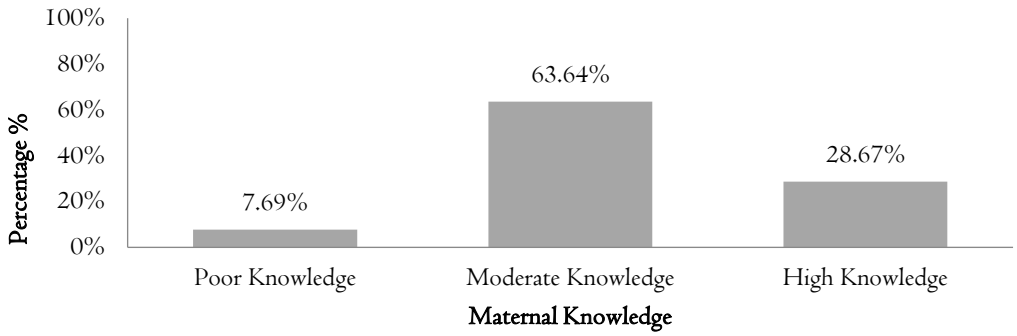
The education level of mothers revealed that 29.4% of mothers have studied up to intermediate. To analyze the economic status of the households, family income was asked. The majority of the sample (46.2%) reported that their family income lies in between 36,000 – 55,000.

Table 1: Demographic Characteristics

Demographic Characteristics	Categories	Frequenc	Percentage
Gender	Girl	71	49.7
	Boy	72	50.3
Age	2-4	37	25.9
	5-7	54	37.8
	8-10	52	36.4

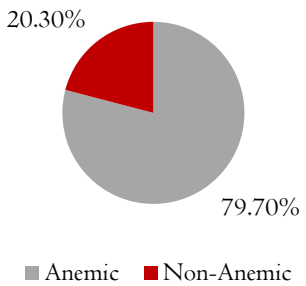
Type of family system	Joint	90	62.9
	Nuclear	53	37.1
Number of family members in the household	< 3	0	0
	3-4	21	14.7
	5-6	51	35.7
	> 6	71	49.7
Education level of mothers	Primary classes	17	11.9
	Secondary classes	16	11.2
	Matriculation	31	21.7
	Intermediate	42	29.4
	Graduation	24	16.8
	Higher level	13	9.1
Income Level of Family	< 15,000	9	6.3
	16,000-35,000	34	23.8
	36,000-55,000	66	46.2
	56,000-75,000	16	11.2
	76,000-100,000	18	12.6

Graph 1: Maternal knowledge about IDA



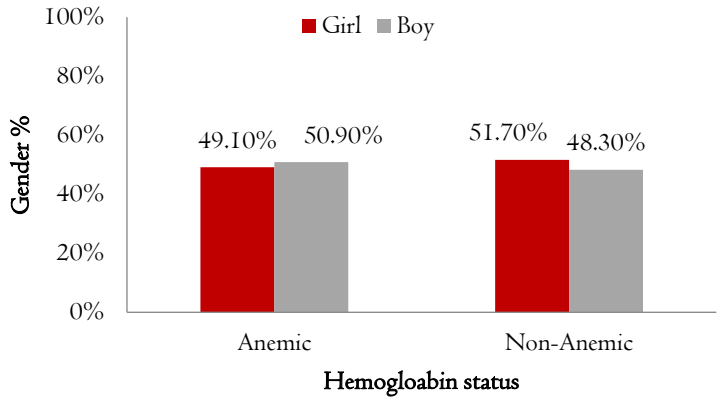
Results in Graph 1 showed that overall 7.69% of mothers had poor knowledge, 63.64% of mothers had moderate knowledge whereas 28.67% of mothers had high knowledge about IDA.

Graph 2: Hemoglobin status of the children



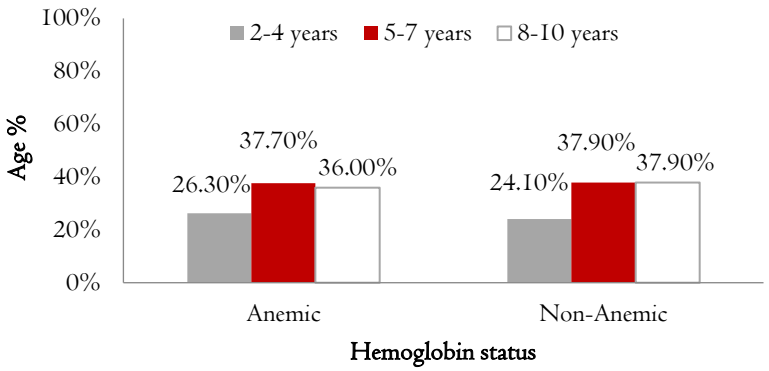
Hemoglobin status was analyzed to determine the prevalence of anemia. Graph 2 expressed that out of 143 children, 79.7% of children were anemic while only 20.3% were non-anemic.

Graph 3: Association of the gender of children and their hemoglobin status



Graph 3 showed no significant difference was found between the gender of child and hemoglobin status. Out of the total number of anemic children, 49.1% were found to be girls whereas 50.9% were boys. Moreover, out of the total number of non-anemic children, 51.7% were girls and 48.3 were boys.

Graph 4: Association of the age of children with their hemoglobin level



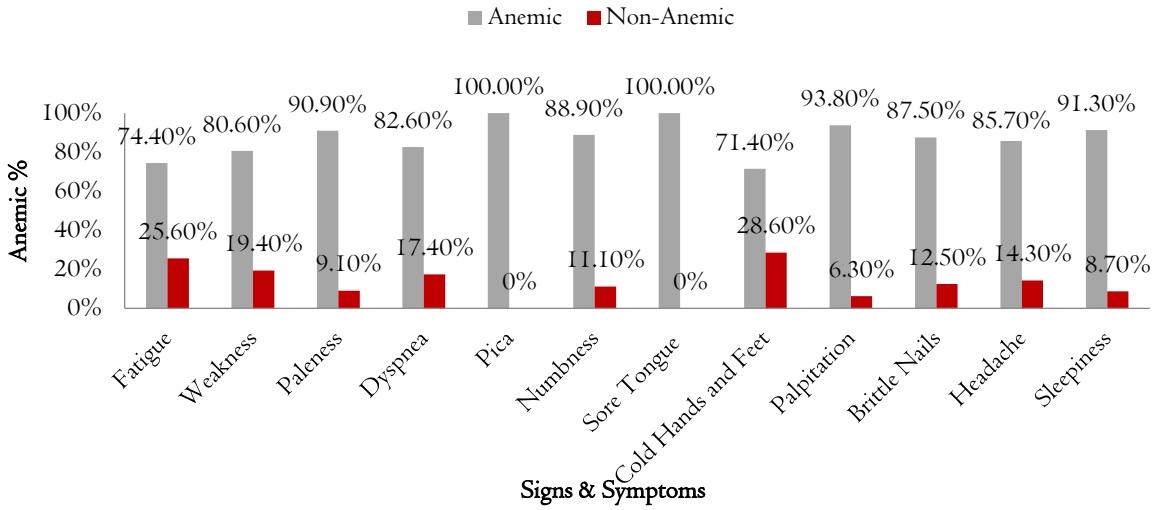
In graph 4, it was revealed that all age groups of children have equal chances of being anemic as it can occur in any age group. 26.3% children of 2-4 years, 37.7% children of 5-7 years and 36.0% children of 8-10 years were anemic. Least percentages of both anemic and non-anemic children of age 2-4 years were because of less sample size as compared to the other two age groups.

The results in table 2 showed that mothers with higher education level have higher nutritional knowledge about anemia. Out of all the mothers who studied greater than intermediate, none of them found to have poor knowledge. Whereas, a majority of mothers with higher knowledge belongs to education level up to masters or Ph.D.

Table 2: Association of maternal education level and level of nutritional knowledge

	Poor Knowledge N (%)	Average Knowledge N (%)	High Knowledge N (%)
Primary Classes	33(23.5)	100(70.6)	4(5.9)
Secondary Classes	9(12.5)	61(87.5)	0(0)
Matriculation	11(16.1)	47(67.7)	11(16.1)
Intermediate	0(0)	53(76.2)	17(23.8)
Graduation	0(0)	29(41.7)	40(58.3)
Masters or greater	0(0)	10(15.4)	59(84.6)

Graph 5: Association of hemoglobin status and signs and symptoms



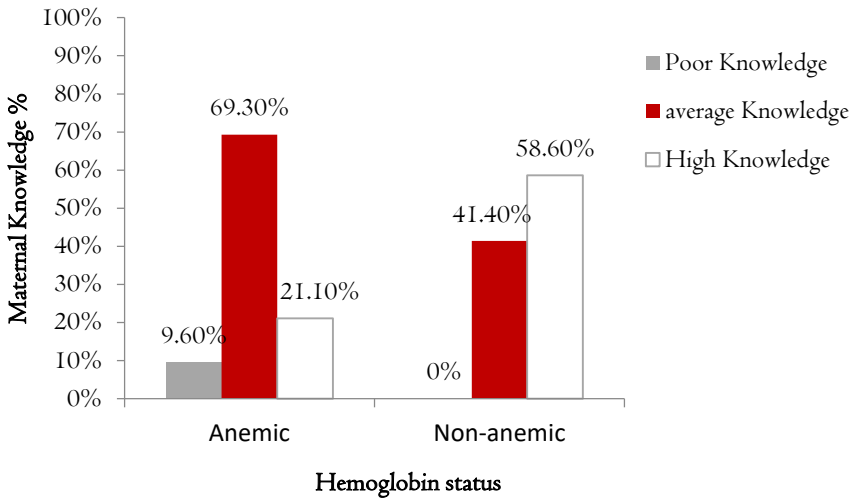
The association of hemoglobin status and reported symptoms in graph 5 showed that mostly anemic children exhibited the signs of Anemia. Generalized weakness, paleness, headache and cold hand and feet were reported by mothers of non-anemic children whereas percentages of pica (100%) and sore tongue (100%) showed that all anemic children had these symptoms.

According to the results in table 3, the maternal nutritional knowledge is associated with the hemoglobin status of their children ($p < 0.05$)

Table 3: Mean difference between maternal nutritional knowledge and hemoglobin status of children.

	Nutritional Status		P-value
Maternal Nutritional Knowledge	Anemic Children Mean ±SD	Non- Anemic Children Mean ±SD	0.001
	7.62±0.544	10.24±0.501	

Graph 6: Association of maternal nutritional knowledge and hemoglobin status of children.



Results of graph 6 shows that all the mothers with poor nutritional knowledge had anemic children. Mothers with average knowledge had both anemic and non-anemic children whereas mothers with high nutritional knowledge had a greater number of non-anemic children.

Discussion

Iron deficiency anemia is one of the most common preventable disorders worldwide still its prevalence is high. Therefore this study was intended to assess the relationship between maternal nutritional knowledge about anemia and hemoglobin status of their children. Iron deficiency occurs gradually when there is inadequate consumption or absorption of iron-rich foods or increased requirements due to rapid growth rate. According to WHO, iron deficiency is initially assessed when there are signs of a reduced supply of iron to tissues[3].

IDA in children can cause psychomotor and cognitive abnormalities, gastrointestinal disturbances, reduced immunity and decreased physical capacity[15], therefore this deficiency should be overcome as soon as it is diagnosed. The focus of this study was school-age children because children of this age group rarely received attention on the prevalence of anemia in comparison to pre-schoolers and women of childbearing age[9].

It was revealed that the majority of children (79.7%) were suffering from anemia (Graph 2). No significant difference was found in the presence of anemia in different age groups of children (Graph 4).

The current study proved that the gender of the child doesn't affect their hemoglobin status (Graph 3). According to a study which was conducted in India, the same result was found that gender difference is an independent factor in the prevalence of anemia, until before the time of menarche in women[20].

It was also revealed that the mother's education level affects their nutritional knowledge (Table 2). None of the mothers with education level greater than intermediate had poor knowledge. According to a study it was proved that mothers schooling and education level contributes to micronutrient deficiencies in their children[16].

The major association found was of maternal nutritional knowledge and Hemoglobin status of their children. The

results of nutritional knowledge showed that a greater number of mothers (63.64%) had moderate knowledge (Graph 1). It was found that the mothers with poor knowledge about IDA had all anemic children, whereas mothers with high nutritional knowledge had a greater number of non-anemic children (Graph 6). A study shows that maternal nutritional education directly impacts on child's iron level, possibly by improving their intake of dietary iron[16].

According to the analysis, a significant association exists between them, i.e. $p = 0.001 < 0.05$ (Table 3). It means that if the nutritional knowledge of the mothers will increase, they will probably provide healthy food choices to their children, which will, in turn, enhance the child's nutritional status. This means that educating mothers is the source of reducing the burden of disease.

One of the considerable limitations of this study was that Iron Deficiency was evaluated by using only Hemoglobin level; no other indicator was used for the analysis of iron status, due to the high cost of other biochemical parameters that are required to precisely define an individual's iron status. For further implications, researchers may examine the presence of Anemia by Complete Blood Count (CBC), serum ferritin levels or other tests[20].

Conclusion

With the results, it was evaluated that anemia can occur in any age group of children. Even the gender of the child doesn't influence hemoglobin status. Signs and symptoms which were reported by mothers proved that all the anemic children had pica and sore tongue. It was also revealed that the majority of children who have mothers with lower education level were suffering from anemia and nutritional knowledge of these mothers was also low. Moreover, mothers with higher education level have fewer anemic children. Thus, providing nutritional education to mothers can significantly reduce the burden of anemia in children.

Conflicts of Interest

None.

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