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**ORIGINAL ARTICLE**

# Association of Different Risk Factors with Iron Deficiency Anemia in Children

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## ABSTRACT

Iron Deficiency Anemia (IDA) arises from an imbalance in the body's iron production and demand, making it a prevalent form of anemia in children. While its causes are varied, many contributing factors to IDA are adjustable. If identified and addressed promptly, these factors can be modified to improve both immediate and extended health effects in children. [13]It is an established fact that iron is an important component for growth of body and our nervous system. IDA in children may permanently disturb their sensory and cognitive ability. It is therefore important to determine its risk factors to ensure early screening and prevention among children.

**Aim and Objective:** To determine correlation of different risk factors with Iron deficiency Anemia.

**Material and Methods:** This case-control study, comprising 150 participants in each group, was carried out in the Pediatric department of Jinnah Hospital Lahore over a nine-month period, spanning from May 1, 2022, to January 31, 2023. Inclusion criteria involved children aged between 6 months and 12 years. Non-Probability consecutive sampling was employed to collect data, with informed consent obtained from parents/guardians. A pre-designed proforma was utilized for data collection. Statistical analysis using SPSS v.22 involved calculating mean and standard deviation for quantitative data, and presenting frequency and percentages for categorical data. Risk assessment and association were determined using odds ratio and chi-square tests, with a p-value below 5% considered significant.

**Results:** The mean age of cases and controls was 8.47 ± 3.91 years and 8.41 ± 4.08 years respectively with 55% males. The mean Hb in cases was 8.84 ± 1.13 g/dL and in controls was 11.77 ± 3.28 g/dL. There were 71(47.3%) mothers in cases and 26(17.3%) in controls groups who were illiterate (p-value < 0.0001 & OR = 4.286), 80(53.3%) cases and 45(30%) controls that had family size > 5 (p-value < 0.0001 & OR = 2.667), and 67(44.7%) cases and 29(19.3%) controls had a history of cow milk usage ( p-value < 0.0001 & OR = 3.368). Significant association was found of the IDA with each risk factor in each strata (p-value <0.05) but there was no significant association between IDA and cow milk in females ( p-value > 0.05).

**Conclusion:** There is significant association of IDA with illiteracy of mothers, family size > 5 and usage of cow milk. IDA can be minimized by improving these conditions in order to minimize further morbidities related to IDA.

**Keywords:** Iron deficiency anemia, Cow milk, Illiteracy, Family size.

## INTRODUCTION:

Nutritional anemia is a common problem among children, because of which physicians confuse iron deficiency anemia with it leading to ignore it.[1] Iron Deficiency Anemia (IDA) basically is the imbalance of stored and produced iron versus utilized by the body which leads to insufficiency of erythrocytes.[2] IDA remains a challenging issue specially in the developing and under developed countries.[3] Literature reports that almost 25% of the global population is anemic, and almost 50% of them comprise of IDA. Almost 30% of these IDA cases are children, most of them, alarmingly, from industrialized countries.[4] This may not only cause many short term health issues such as generalized weakness, fatigue, neurological disorders, but also threaten their health in their adulthood.[5]The risk factors of IDA vary largely according to geo-ethnic, environmental and biological factors.[6] Excess in iron loss, high requirement of iron during growth spurt and rapidly expanding red cell mass may also be determinants of IDA.[7] Also, other nutritional, lifestyle related and dietary factors are involved in developing IDA.[8] Studies have reported that high risk of IDA is present in children belonging to low socio-demographic belt, low parental education and large family size.[9] Due to such a wide spectrum of determinants, it's a tough task to reach the exact causative conclusion.[10]Diagnosis of IDA is yet another crucial and difficult task given the fact that majority of the children remain asymptomatic.[11] Taking history of birth and early growth such as prematurity and early gastroenteritis issues, as well as dietary and life style information is mandatory to finalize diagnosis.[12] Similarly taking blood biomarkers information such as CBC and WBC are also important. Treatment involves obvious intake of iron through medicines, diet and lifestyle changes and continuous monitoring.[13]It is an established fact that iron is an important component for growth of body and constitutes special importance in our nervous system. IDA in children may permanently disturb their sensory and cognitive ability as well as generalized physical health.[14] However, due to commonality of nutritional anemia, IDA is usually misdiagnosed or ignored.[15] It is therefore important to determine its risk factors to ensure early screening and prevention among children. Therefore, the objective of this study was to explore the association of various risk factors with Iron Deficiency Anemia (IDA) in children.

**Aim & Objective:** To assess the correlation between various risk factors and iron deficiency anemia in children within a tertiary care hospital.

## MATERIAL & METHODS

This case-control study took place in the Pediatric department of Jinnah Hospital Lahore, utilizing non-probability consecutive sampling over a 9-month period from May 1, 2022, to January 31, 2023. A total of 300 participants, consisting of 150 cases and 150 controls, were enrolled, with a significance level of 5%, a test power of 80%, and a percentage of family size >5 set at 66.1% for children with Iron Deficiency Anemia (IDA) and 51.6% for those without IDA. [16] Children of both genders, aged between 6 months and 12 years, diagnosed with Iron Deficiency Anemia (IDA), were categorized as cases. Those with similar characteristics but without a diagnosis of IDA were designated as controls. Participants with chronic systemic diseases (such as renal, cardiac based on ECG findings, metabolic, rheumatologic, malignancy, etc.) were excluded from the study. Upon obtaining parental consent, socio-demographic and medical information of the child was collected and entered into SPSS v.22. For quantitative data like age and hemoglobin (Hb) level, mean and standard deviation were computed, while categorical data such as maternal education and consumption of cow milk were presented as frequencies and percentages. Risk assessment and association were determined using odds ratio and chi-square tests, with a significance level set at a p-value below 5%.

## RESULTS

The mean age of subjects was 8.44 ± 3.99 years while the mean age of cases and controls was 8.47 ± 3.91 years and 8.41 ± 4.08 years respectively. Overall there were 133(44.33%) cases with age

2-7 years and 167(55.67%) cases were 8-15 years old. There were 165(55%) male and 135(45%) female cases. The mean Hb in cases was 8.84 ± 1.13 g/dL and in controls was 11.77 ± 3.28 g/dL. There were 71(47.3%) mothers in cases and 26(17.3%) in controls groups who were illiterate and there were 79(52.7%) mothers of cases and 124(82.7%) mother of controls who were not illiterate. There was significant association between iron deficiency anemia and mother's illiteracy , p-value < 0.0001 and OR = 4.286 (that shows there were 4.285 times more chances of getting IDA in presence of illiterate mothers). There were 80(53.3%) cases and 45(30%) controls that had family size > 5 while there were 70(46.7%) cases and 105(70%) controls that had family size ≤ 5. There was significant association between iron deficiency anemia and family size > 5, p-value < 0.0001 and OR = 2.667 (that shows that there were 2.667 times more chances of getting IDA in presence of family size >5). There were 67(44.7%) cases and 29(19.3%) controls with history of cow milk usage while there were 29(19.3%) cases and 121(80.7%) controls with history of cow milk usage. There was significant association between iron deficiency anemia and usage of cow milk, p-value < 0.0001 and OR = 3.368 (that shows that there were 3.368 times more chances of getting IDA with history of cow milk usage). When data was stratified for age and gender we found significant association of IDA with each risk factor in each strata (p-value <0.05) but there was no significant association between IDA and cow milk in females, p-value > 0.05.

Table 1: Comparison of Different Risk Factors in Both Study Groups

| | | Study Groups | | Chi-square | p-value | OR(95% CI) |
|---|---|---|---|---|---|---|
| | | Cases | Controls | | | |
| Mother Illiterate | Yes | 71(47.3%) | 26(17.3%) | 30.852 | <0.001** | 4.286(2.52-7.29 |
| | No | 79(52.7%) | 124(82.7%) | | | |
| Family size > 5 | Yes | 80(53.3%) | 45(30%) | 16.8 | <0.001** | 2.667(1.66-4.29) |
| | No | 70(46.7%) | 105(70%) | | | |
| Cow milk | Yes | 67(44.7%) | 29(19.3%) | 22.12 | <0.001** | 3.368(2.00-5.65) |
| | No | 83(55.3%) | 121(80.7%) | | | |

** Highly significant

Table 2: Comparison of Different Risk Factors in Both Study Groups with Respect to Age Groups (Years)

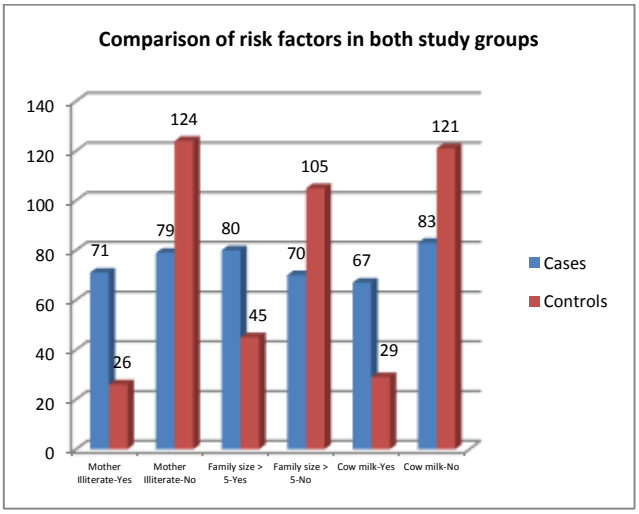
| | | Age groups | Study Groups | | Chi-square | p-value | OR(95% CI) |
|---|---|---|---|---|---|---|---|
| | | | Cases | Controls | | | |
| Mother illiterate | Yes | 2-7 Years | 26(43.3%) | 12(16.4%) | 11.672 | 0.001* | 3.887 (1.74- 8.67) |
| | No | | 34(56.7%) | 61(83.6%) | | | |
| | Yes | 8-15 Years | 45(50%) | 14(18.2%) | 18.388 | <0.001** | 4.50(2.21-9.17) |
| | No | | 45(50%) | 63(81.8%) | | | |
| Family size > 5 | Yes | 2-7 Years | 32(53.3%) | 19(26%) | 10.386 | 0.001* | 3.248(1.57-6.73) |
| | No | | 28(46.7%) | 54(74%) | | | |
| | Yes | 8-15 Years | 48(53.3%) | 26(33.8%) | 6.439 | 0.011* | 2.242(1.20-4.20) |
| | No | | 42(46.7%) | 51(66.2%) | | | |
| Cow milk | Yes | 2-7 Years | 27(45%) | 15(20.5%) | 9.113 | 0.003* | 3.164(1.48-6.78) |
| | No | | 33(55%) | 58(79.5%) | | | |
| | Yes | 8-15 Years | 40(44.4%) | 14(18.2%) | 13.081 | <0.001** | 3.60(1.77-7.34) |
| | No | | 50(55.6%) | 63(81.8%) | | | |

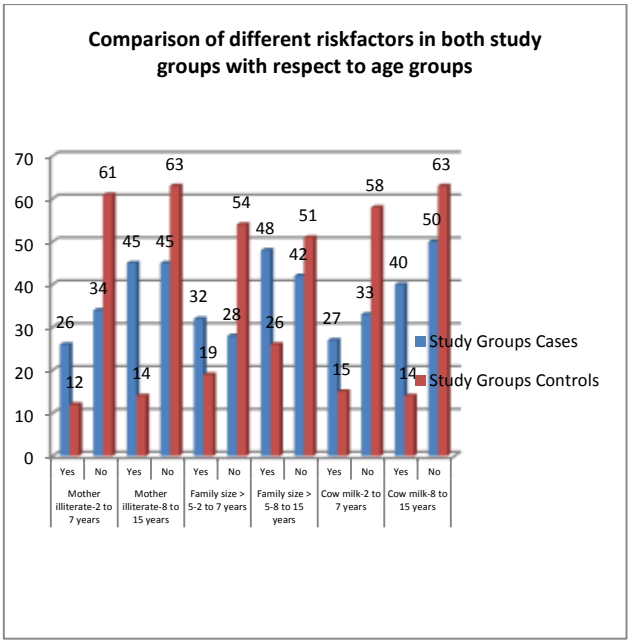
*Significant, **Highly significant

Table 3: Comparison of Different Risk Factors in Both Study Groups with Respect to Gender

| | | Gender | Study Groups | | Chi-square | p-value | OR(CI) |
|---|---|---|---|---|---|---|---|
| | | | Cases | Controls | | | |
| Mother illiterate | Yes | Male | 39(44.8%) | 13(16.7%) | 15.112 | <0.001** | 4.062(1.96-8.43) |
| | No | | 48(55.2%) | 65(83.3%) | | | |
| | Yes | Female | 32(50.8%) | 13(18.1%) | 16.205 | <0.001** | 4.685(2.15-10.20) |
| | No | | 31(49.2%) | 59(81.9%) | | | |
| Family size > 5 | Yes | Male | 44(50.6%) | 25(32.1%) | 5.800 | 0.016* | 2.169(1.15-4.09) |
| | No | | 43(49.4%) | 53(67.9%) | | | |
| | Yes | Female | 36(57.1%) | 20(27.8%) | 11.936 | 0.001* | 3.467(1.69-7.11) |
| | No | | 27(42.9%) | 52(72.2%) | | | |
| Cow milk | Yes | Male | 41(47.1%) | 9(11.5%) | 24.662 | <0.001** | 6.833(3.03-15.40) |
| | No | | 46(52.9%) | 69(88.5%) | | | |
| | Yes | Female | 26(41.3%) | 20(27.8%) | 2.723 | 0.99 | 1.827(0.89-3.75) |
| | No | | 37(58.7%) | 52(72.2%) | | | |

*Significant, **Highly significant




## DISCUSSION

Iron Deficiency Anemia (IDA) poses a significant health concern in children, stemming from an imbalance in the production and demand of iron in the body.[17] Loss of iron due to malnutrition, bleeding, loss of iron component from body, excessive iron usage by body during growth periods and other issues may lead to IDA among children. [18] Due to its impact on short term and long terms health outcomes, it has become a hot topic in recent researches. [19] Adequate iron content is not only important for blood parameters but also has long term effects on cognitive, emotional and physical health of child. [14, 20] It is therefore important to identify possible determinants of IDA among children to devise early screening and prevention strategy, which was the aim of current study. In our study, the average age of cases was 8.47 years with a standard deviation of 3.91, while for controls, it was 8.41 years with a standard deviation of 4.08. Another study also reported that age younger than 24 months had significant association with IDA (OR: 1.88; 95% CI: 1.15–3.09). [21] Another study reported that among all age groups, highest prevalence of IDA was found in 6-24 months age group, compared to one that states that 1-5 years old children had highest percentage among all with IDA. [22] Several studies have supported a significant association of IDA with younger age groups. [23, 24]This study reports that 165(55%) male and 135(45%) female cases were present, which is not consistent with all literature available. One study conducted in Bangladesh reported no statistical association of gender with IDA whereas another one reported higher risk of IDA among male gender (OR: 1.86; 95% CI: 1.17–2.94). [25] Moreover, our study reported considerably higher risk of IDA among illiterate mothers (p-value<0.0001 & OR=4.286). Yet another study reported that mother's education of less than 4 school years had 1.59 times higher risk of IDA among their children compared to more educated ones. [26]Another important risk factor is the large family size. Our study reports that there were 80(53.3%) cases and 45(30%) controls that had family size > 5 while there were 70(46.7%) cases and 105(70%) controls that had family size ≤ 5. There was significant association between iron deficiency anemia and family size > 5, p-value < 0.0001 and OR = 2.667. One similar study also reported that cases had significantly more crowded families compared to controls (p=0.016). [16]Another important determinant was cow milk consumption. It is noteworthy that fortified milk has six times greater iron absorption rates compared to cow milk. This study found that there were 67(44.7%) cases and 29(19.3%) controls with history of cow milk usage while there were 29(19.3%) cases and 121(80.7%) controls with history of cow milk usage. A notable correlation was observed between iron deficiency anemia and the consumption of cow milk, with a p-value less than 0.0001 and an odds ratio of 3.368.[14] Hence all these risk factors seemingly are related to IDA and should be included in screening process of IDA among children.

## CONCLUSION

Based on the results of this study, it can be deduced that there is a noteworthy correlation between Iron Deficiency Anemia (IDA) and maternal illiteracy, family size exceeding 5, and the consumption of cow milk. IDA can be minimized by improving these conditions in order to minimize further morbidities related to IDA.

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