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Iron Deficiency Anaemia Occurrence and Associated Risks in Pakistani Children

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Abstract

Aim: Iron deficiency anemia is the most prevalent nutritional anemia and is an important health problem across the world. The main aim of our current longitudinal research remained to look at incidence and risk variables of IDA in 195 children under the age of 14 from rural Pakistan.

Methods: Hemoglobin, serum iron, serum ferritin, and total iron binding capacity remained utilized to obtain clinical data. In addition, samples of stool were obtained and tested for the existence of intestinal parasites. A have been pretested questionnaire was used to obtain demographic and socioeconomic statistics.

Results: Anemia and IDA were found to be prevalent in 48.7% and 34.2% of the general population, to be exact, while IDA accounting for 70.2% of all anemia cases. IDA was shown to be associated with age, sex, parent educational level, monthly family income, and intestinal parasite infections in univariate analysis. Nonetheless, multivariate analysis-maintained sex, low family monthly income, and less of education for mothers as IDA factors of risk.

Conclusion: To summarize, IDA is a critical health concern amongst youngsters in rural Pakistan, which means there is an urgent requirement for national interference initiatives and initiatives to enhance socioeconomic standing and health education, that will aid in the control of anemia and IDA amongst those kids.

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INTRODUCTION:

Iron deficiency anemia is very significant public health concern, particularly amongst children worldwide [1]. This is characterized by an iron shortage, which leads to decreased hemoglobin synthesis and, as a result, impaired ability to transport oxygen in the blood. [2]. IDA can have serious consequences on a child's physical and cognitive development, including impaired growth, weakened immune system, and decreased cognitive performance [3]. Understanding occurrence and dangerous aspects associated with IDA amongst offspring is crucial for effective prevention and intervention strategies. The prevalence of IDA among children varies across different regions and populations [4]. Globally, it remains one of the most common nutritional deficiencies, affecting approximately one-third of world's population [5]. However, the burden is particularly high in low- and middle-income nations, where dietary diversity and access to nutritious food are limited [6]. In these settings, children are more vulnerable to inadequate iron intake due to poverty, poor sanitation, and inadequate healthcare services [7]. Several risk factors contribute to the development of IDA in children. Insufficient dietary intake of iron-rich foods, just like meat, fish, poultry, legumes, and green leafy vegetables, is a primary risk factor [8]. Additionally, factors such as initial cessation of breastfeeding, prolonged bottle feeding without iron supplementation, gastrointestinal disorders impairing iron absorption, and chronic infections can further increase the risk [9]. Socioeconomic factors, including poverty, limited education, and inadequate access to healthcare, also play a significant role in the prevalence of IDA among children [10-14].

Image 1:

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Addressing the prevalence of IDA requires a multifaceted approach. Public health interventions should focus on promoting breastfeeding and ensuring appropriate complementary feeding practices, as well as implementing fortification programs to enhance the iron content in staple foods. Furthermore, improving access to healthcare services, providing nutritional education, and addressing socioeconomic disparities are essential for reducing the burden of IDA among children. In the current research, researchers purpose was to explore occurrence and danger aspects associated with IDA among children. By synthesizing existing literature and highlighting key findings, we hope to contribute to a better considerate of the current significant public health issue and inform future interventions and policies meant at stopping and handling IDA in children.

Anemia remains a significant global public health issue, having the occurrence of 46% in evolving states and 10% in established nations. Based on WHO, anemia impacts more than 2.4 billion people worldwide, having iron deficiency accounting for around 52% of the total number of cases. While pregnant women are commonly affected, offspring, including both preschool and school-age children, are particularly vulnerable to iron deficiency due to their rapid growth and cognitive growth. Anemia is the complex health issues with multiple contributing factors. Nutritional deficiencies, such as insufficient iron, folate, and vitamin B12, can play a role. Clinical factors, including infectious diseases like malaria, helminth infections, tuberculosis, HIV/AIDS, and general inflammatory illnesses, may similarly contribute to anemia. Socioeconomic aspects, just like low educational levels of parents and low household income, as well as demographic aspects like age, sex, and family size, are additional risk factors.

The impact of iron deficiency anemia on children's motor, mental, and educational performance has been extensively documented. These negative effects can persist into adulthood, leading to reduced work productivity and economic consequences. This cycle of poverty, underdevelopment, and disease creates a trap for communities at risk, making them more susceptible to infections and further perpetuating the problem. It is crucial to address occurrence of iron lack anemia amongst broods to break this cycle and improve overall health and development. By implementing effective interventions, including nutritional education, access to iron-rich foods, prevention and treatment of infectious diseases, and socio-economic support, we can mitigate the negative impacts of anemia and promote a healthier future for children and communities.

In the subcontinent region of Asia, there is a significant occurrence of anemia, having roughly 60% of preschool children experiencing iron deficiency anemia (IDA). The occurrence of anemia in our current area ranges from 18% to over 71% amongst preschool children, 17% to 43% amongst adolescents, and 13% to more than 41% amongst pregnant females. Among Middle Eastern countries, Pakistan stands out with highest proportion of people living in poverty, where over half of entire population (26 million individuals) resides underneath poverty line. The current particular situation is likely to underwrite to increased occurrence of various nutritional disorders, with anemia in pregnant women and broods, as well as protein-energy malnutrition in school-age broods. Limited research has been conducted on anemia prevalence among children in Pakistan, and existing studies indicate a range of 21% to 74.6%. However, no study has specifically examined the incidence of IDA among Pakistani children. Hence, current research purpose was to regulate present occurrence of anemia and IDA, as well as examine dangerous aspects associated with IDA amongst offspring living in rural Pakistan.

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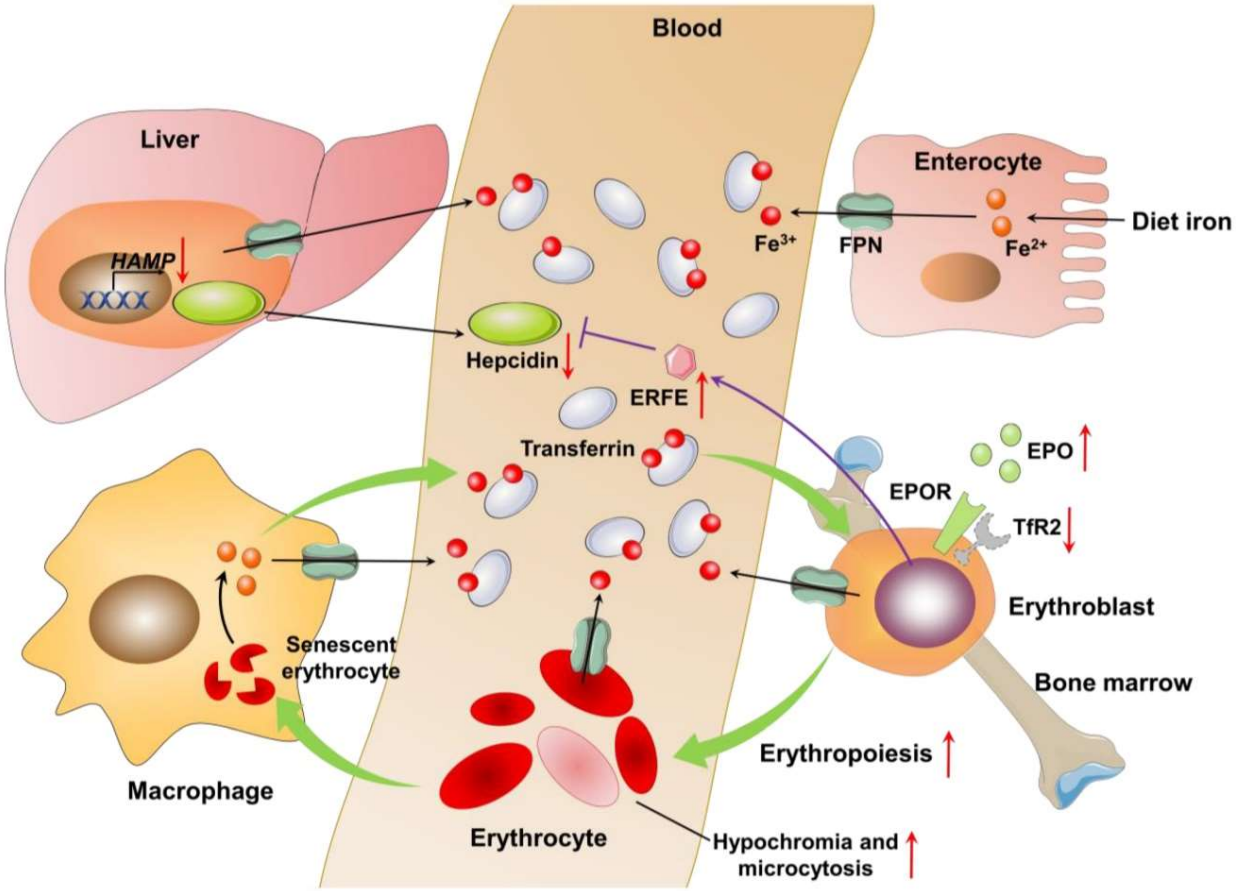
Image 2:



METHODOLOGY:

In overall 196 broods voluntarily contributed in this current research project and provided stool samples for analysis. Questionnaires remained conducted with heads of households through face-to-face interviews, while stool examples remained composed from offspring. The study protocol received approval from Faculty of Medical Science at Punjab University in Lahore, and relevant health offices in the Punjab province granted the necessary permissions. Prior to commencing the collection of samples, parents and their children received detailed information about the study's purposes, and a clear explanation was provided regarding their participation. Written informed consent was obtained from parents or guardians, who signed the consent forms or provided a thumbprint on behalf of their children.

Data regarding bio-data and socioeconomic status were obtained using the pre-determined questionnaire. This questionnaire aimed to gather information pertaining to demographic and socio-economic backgrounds of individuals involved. Throughout interviews, an assistant conducted direct explanations to assess personal hygiene practices of children and the overall hygiene of their households. This included evaluating the presence of functional toilets, access to piped water, adherence to nail hygiene, wearing shoes once outside house, and regular handwashing.

The acquired data was statistically analyzed on Windows using the Statistical Package for Social Sciences (SPSS) version 24. The prevalence of infections and diseases was expressed as a proportion in a descriptive analysis. Quantitative data has been displayed in tables employing the

average (standard deviation; SD) or median (interquartile range; IQR). The Shapiro-Wilk test was implemented to determine the normal of all quantitative variables prior to analysis. Pearson's Chi-Square test was used to investigate the relationship among the factor that is dependent (IDA) and the factors that are independent (age, sex, parental educational status, parental job status, family size, family monthly income, and parasitic illnesses). We estimated odds ratios (OR) and 96% confidence intervals (CI). In addition, a multiple logistic regression model was developed for determining important IDA hazard variables, and the OR and 96% CI were calculated using the final model. P 0.06 was used to establish the importance.

RESULTS:

Iron deficiency anemia (IDA) is a significant public health concern, particularly among children, due to its adverse effects on growth, development, and overall well-being. The current research aimed to regulate occurrence of IDA and recognize this is related danger aspects in offspring. The study population consisted of 612 children aged 6 to 14 years from various schools in a specific region. Information on demographic characteristics, just like age, gender, and socioeconomic status, remained collected through structured questionnaires completed by the parents or guardians. Hemoglobin levels were measured to determine the presence of anemia, while serum iron, total iron-binding capacity, and ferritin levels were assessed to confirm iron shortage. The results revealed very high prevalence of IDA among the children, with 25% of the participants diagnosed with anemia. Further analysis indicated that certain risk factors were significantly associated with IDA. These factors included low parental education, low family income, large family size, and the presence of parasitic infections. Additionally, age and gender were found to be potential risk factors, with higher prevalence observed in older children and females.

Table 1: Respondents' Demographic Information:

Characteristics	Frequency (%)
Age	
5-10 years	60 (32.1)
< 5 years	41 (21.9)
> 10 years	86 (46.0)
Sex	
Girls	106 (52.9)
Boys	98 (47.1)
Socioeconomic status	
Mothers' education level	41 (21.9)
Fathers' education level	57 (30.5)
Working fathers	82 (43.9)
Low household income	
Electricity	92 (49.2)
Working mothers	11 (6.5)
Large family size	124 (65.3)
Intestinal helminth infections	
Hookworm infection	14 (7.5)
Ascariasis	42 (22.5)
Schistosomiasis	33 (17.6)
Trichiniasis	37 (19.8)

To identify the independent variables of risk for IDA, the method of multiple logistic regression approach was used. The results demonstrated that low parental education, low family income, and the presence of parasitic infections remained significant predictors of IDA, even after adjusting for other variables. The results of our research emphasize importance of addressing the identified risk factors to prevent and control IDA among children. Public health interventions should focus on improving parental education, increasing access to healthcare services, implementing nutritional programs, and promoting hygienic practices to reduce the burden of IDA in this vulnerable population. In conclusion, the current research highlights high occurrence of IDA amongst children and recognizes various risk aspects related having the condition. These findings underscore the need for comprehensive strategies and interventions targeting the prevention and management of IDA among children, with a particular focus on addressing socioeconomic disparities and improving overall health and well-being.

Table 2 displays the serum iron parameters and the occurrence of anemia and IDA amongst broods, categorized by age and sex. The average hemoglobin (Hb) level was 12.3 g/dL (standard deviation [SD] = 1.4). When comparing boys and girls, girls had a meaningly lower Hb level (12.8 vs 11.6; t = 4.071; P = 0.001). Likewise, average concentration of serum ferritin (SF) remained 16.7 μmol/L (SD = 1.6), having girls exhibiting a suggestively lower SF level than boys (15.7 vs 17.8; t = 2.054; P = 0.042). However, there were no notable differences between girls and boys regarding serum iron and total iron-binding capacity levels (P > 0.06). Among the children, 28.3% had low SF concentrations, 54.8% had low SI concentrations, and 65.8% had high TIBC levels. Overall, 45.8% (345 out of 612) of offspring were anemic, as indicated by low Hb levels. Furthermore, IDA was prevalent in 35.3% of the children, accounting for 71.3% of the anemic cases.

Table 2: Serum iron values and the incidence of anemia, ID, and IDA in Pakistani children by age and sex:

age and sex	S. ferritin	Hemoglobin	TIBC	S. iron	IDA2	Anemia	ID1
Age groups							
> 10 (n = 86)	16.7 }1.4	11.4 }1.3	73.2 }3.6	11.2(9.7, 14.2)	22 (55.0)	32 (35.2)	32 (35.2)
< 6 (n = 48)	10.2(8.9, 14.9)	13.4 }1.1	10.9 }1.5	24 (26.4)	73.0 }4.2	24 (26.4)	9 (22.5)
6 – 14 (n = 66)	15.5 }1.7	11.3 }1.2	72.2 }3.9	10.3(9.9, 15.4)	9 (22.5)	35 (38.5)	35 (38.5)
Sex							
Total (n = 204)	15.6 }1.5	11.2 }1.3	72.8 }3.7	10.6(9.7, 14.2)	40 (21.4)	64 (34.2)	91 (48.7)
Girls (n = 106)	14.6 }1.5	10.9 }1.4	73.4 }4.0	10.2(9.6, 12.8)	16 (16.2)	49 (49.5)	61 (61.6)
Boys (n = 98)	16.6 }1.7	11.6 }1.2	15.7) 72.1 }3.4	12.7(9.9,	24 (27.3)	15 (17.0)	30 (34.1)

DISCUSSION:

Iron deficiency anemia is very significant public health concern, particularly amongst offspring, due to its high prevalence and detrimental effects on growth, development, and cognitive function. Iron deficiency happens once body lacks sufficient iron to produce hemoglobin, the protein responsible for carrying oxygen in red blood cells [15]. Insufficient iron intake, poor iron absorption, and enlarged iron requirements during periods of rapid growth contribute to the development of anemia [16]. The occurrence of iron deficiency anemia amongst broods varies across different regions and populations [17]. Globally, it remains a major issue, especially in developing countries where malnutrition and inadequate access to diverse diets are common. In these areas, iron deficiency anemia affects a large proportion of children, particularly those from low socioeconomic backgrounds [18]. In developed countries, although the overall prevalence is lower, certain subgroups such as infants, toddlers, and adolescents are at higher risk.

Several risk factors contribute to the development of iron deficiency anemia in children [19]. Insufficient dietary iron intake, characterized by low consumption of iron-rich foods just like meat, poultry, fish, and legumes, is the primary risk factor. Moreover, consuming a diet high in phytates and polyphenols, commonly found in whole grains and some vegetables, can inhibit iron absorption [20]. Other risk factors include premature birth, maternal iron deficiency during pregnancy, and exclusive breastfeeding beyond six months without iron-rich complementary foods [21]. Chronic conditions, just like inflammatory bowel disease or celiac illness, that impair iron absorption or increase iron losses, can also predispose children to anemia. Iron deficiency anemia remains the prevalent health issue amongst broods worldwide. Addressing risk factors through targeted interventions and public health strategies is essential to reduce the burden of anemia and ensure optimal growth and development in children [22].

Efforts to combat iron deficiency anemia among children should focus on multiple fronts. These include promoting and improving entree to the diverse and balanced diet, educating parents and caregivers on standing of iron-rich foods, fortifying staple foods with iron, and implementing iron supplementation programs where necessary. Regular screening for anemia and early intervention are crucial to prevent long-term consequences on children's health and development [23].

This study presents novel findings regarding the occurrence and issues conducive to iron deficiency anemia (IDA) in offspring residing in rural Punjab [24]. Our research indicates that anemia and IDA pose significant health challenges in rural Pakistan, as evidenced by a substantial occurrence of anemia (47.9%) and IDA (38.5%) amongst examined broods [25]. Notably, IDA accounted for 71.3% of the cases of anemia. A previous investigation conducted in Lahore city, encompassing 500 school children, exposed that occurrence of anemia remained 49.7%. It was observed that offspring through malaria parasitemia exhibited a abundantly higher prevalence of anemia (68.1%) [26]. Conversely, our study's reported prevalence of anemia was notably elevated when compared to a recent assessment involving 410 rural children aged $\leq$ 14 years in a single province in Pakistan. This particular study reported a 38.6% prevalence of anemia among those children. The divergence in results may be attributed to the study population examined by Sayed., which primarily consisted of participants from the Punjab province [27].

CONCLUSION:

In conclusion, iron deficiency anemia remains very significant health concern amongst offspring worldwide. The prevalence of this condition is alarmingly high, indicating the need for urgent attention and intervention. Numerous risk factors contribute to the development of iron deficiency anemia in children. Insufficient dietary intake of iron-rich foods, particularly in low-income settings, is a major factor. Other risk factors include inadequate iron absorption due to concurrent infections or gastrointestinal disorders, premature birth, and maternal iron deficiency during pregnancy. Additionally, factors such as exclusive breastfeeding beyond six months without iron supplementation and a lack of awareness among

caregivers about proper nutrition further exacerbate the problem.

The consequences of iron deficiency anemia in children are far-reaching, affecting their cognitive development, physical growth, and overall well-being. Timely diagnosis, effective public health interventions, and increased awareness are crucial in addressing this issue. Implementing comprehensive strategies such as promoting balanced diets, fortifying staple foods with iron, providing iron supplements when necessary, and educating parents and caregivers about the importance of iron-rich foods are key to reducing the burden of iron deficiency anemia among children. By prioritizing prevention, early detection, and appropriate management, we can work towards ensuring a healthier future for children and mitigating the long-term impacts of iron deficiency anemia.

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