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ASSESSING THE FREQUENCY OF IRON DEFICIENCY ANEMIA IN THE WOMEN OF QUETTA CITY, PAKISTAN

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Abstract

The present study aimed to estimate the prevalence of iron deficiency (ID) and iron deficiency anemia (IDA) in pregnant, lactating, and non-pregnant non-lactating (NP-NL) women in Quetta City between October and December 2017. A randomized survey collected data and blood samples from 115 women aged 20-40. Hemoglobin (Hb) and serum ferritin levels were measured. Statistical analysis was performed using SPSS. Among pregnant women, ID and IDA frequencies were 5% and 36%. Corresponding figures for lactating women were 3% and 27%, and for NP-NL women, 10% and 13%. Anemia was primarily caused by ID, and pregnant and nursing women had a higher incidence of iron deficiency. First-trimester pregnant women had the highest anemia risk. An improved diet led to reduced anemia cases across groups. In pregnant women, there were two types of anemia: moderate (low Hb) and severe (23.08% with low ferritin). Encouraging postpartum checkups for lactating mothers and early prenatal care for monitoring iron deficiency are recommended to prevent long-term consequences. Some of the results lacked statistical significance.

Keywords: *Iron deficiency, Iron deficiency anemia, Lactation, Pregnancy, Prevalence, Women's health*

INTRODUCTION

Anemia is defined by the World Health Organization (WHO) as hemoglobin (Hb) levels of 12.0 g/dl in women and 13.0 g/dl in men. Normal Hb distribution, on the other hand, varies not just with gender but also with ethnicity and physiological status (1). Globally, Iron Deficiency (ID) is the most widespread dietary deficiency, and Iron Deficiency Anemia (IDA) arises due to the dearth of iron absorption, dietary intake, and hemoglobin formation (2). IDA is a global public health problem that mostly affects infants, young children, pregnant women, and women who are menstruating, especially in undeveloped or developing countries (3). Most gestating, expecting, and lactating women are at risk as they lose more iron than men (4). Typically, iron is obtained from meals or worn-out red blood cells through the natural recycling process. Blood cannot adequately transport oxygen without the appropriate iron, which will affect every cell's capacity to function regularly throughout the body. A healthy adult contains approximately 3-5 g of iron. Approximately 60% binds to hemoglobin, 10% to muscle myoglobin, and 30% is retained in liver hepatocytes and immune system macrophages (5).

The ferritin level during pregnancy is used to diagnose IDA, and this method is regarded as the most accurate as ferritin stores iron and releases it in a controlled manner (6). Algae, bacteria, higher plants, and animals all produce ferritin, an intracellular protein that is present throughout all living things. In humans, it protects against ID and iron overload and acts as a buffer. In most tissues, ferritin is found as a cytosolic protein. However, small quantities are secreted into the serum, where they act as an iron transporter. Both plasma and serum ferritin are used as diagnostic tools for the total amount of iron stored in the body. Still, serum ferritin is mostly used as a diagnostic test for IDA (7). AWID (Anemia Without Iron

Deficiency) suggests that factors other than iron deficiency, such as vitamin deficiencies, chronic diseases, or genetic factors, contribute to reduced hemoglobin levels. Analyzing AWID separately helps in identifying and addressing these diverse underlying causes. By understanding the prevalence and characteristics of each condition, public health strategies can be tailored to address specific needs. For instance, if a population has a high prevalence of ID, programs focusing on iron-rich diet promotion or supplementation might be prioritized. If AWID is prevalent, a broader approach considering various nutrient deficiencies or health conditions may be necessary.

Quetta, the capital of Balochistan, is a culturally diverse city. It serves as a trade gateway between Pakistan and Afghanistan. Despite its significance, Quetta faces challenges from various socio-economic factors that contribute to health challenges and imbalances in diet. Assessing the prevalence of health issues like IDA is essential, especially considering the state of healthcare facilities in the region. There is still much to learn about the prevalence of anemia in pregnant, breastfeeding, and non-pregnant women, as well as how it is linked to hemoglobin and serum ferritin levels. The purpose of the study was to compare the serum ferritin and hemoglobin levels of pregnant and lactating women with those of NP-NL women in order to determine the prevalence of ID and IDA levels.

MATERIALS AND METHODS

From October to December 2017, 115 women were chosen by random sampling technique from different areas of Quetta city and split into three groups. The sample size of 115 participants was calculated using the Open Epi online calculator, with assumptions based on an estimated IDA prevalence of 15.6%, a 95% confidence interval, and a 5% margin of error.

Group one had 39 pregnant women, group two had 37 lactating women, and the remaining 39 were nonpregnant-nonlactating (NP-NL). The socio-demographic data were collected using a structured questionnaire tailored for this study, aiming to obtain a comprehensive understanding of participants' backgrounds. The questionnaire, administered from October to December 2017, covered various aspects, including age, social habits, menstrual history, and pregnancy-related details. A crucial component of the questionnaire focused on dietary and nutritional habits, incorporating specific inquiries to elucidate participants' consumption patterns. For instance, participants were asked about the frequency and quantity of meat intake, types of leafy vegetables in their regular diet, and details about any dietary supplements they were currently using, including type, dosage, and duration. Additionally, participants were asked about potential dietary restrictions or preferences and recent changes in their dietary habits. The Ethical Review Committee (ERC) of the Sardar Bahadur Khan Women's University in Quetta ensured the questionnaire's ethical administration, with participants providing written informed consent to uphold their privacy and confidentiality during the data collection process. For the purpose of determining the hemoglobin concentration and serum ferritin (SF), blood samples were taken either with or without EDTA (ethylenediamine tetraacetic acid).

Table I. Cut-off points for anemia diagnosis in women based on hemoglobin and serum ferritin levels

	Pregnant and Lactating Women			
	Normal	ID	IDA	AWID
Hb level, g/dl	>11	>11	<11	<11
Serum Ferritin (ng/ml)	>12	<12	<12	>12
	Nonpregnant-Nonlactating Women			
Hb level, g/DL	>12	>12	<12	<12
Serum Ferritin (ng/ml)	>12	<12	<12	>12

*ID: Iron Deficiency; IDA: Iron Deficiency Anemia; AWID: Anemia Without Iron Deficiency, Hb: Hemoglobin

The levels of hemoglobin were analyzed through a chemical analyzer (Microlab 300) using the Merck Kit (8). This assay employs a colorimetric method based on the reaction between hemoglobin and a specific reagent in the Merck Kit. The absorbance of the resulting solution was measured at a specified wavelength using the Microlab 300, allowing for accurate and precise determination of hemoglobin levels in the collected blood samples. The Falcon tubes with coagulated blood were centrifuged at 4000 rpm for 15 minutes to obtain serum. This approach, recognized for its reliability, provided precise hemoglobin concentration determinations. The serum samples were collected from the pathology laboratory of the Bolan Medical Complex, Quetta, and saved into properly marked vials as aliquots and stored at -80 °C until biomarker assessment.

The serum ferritin levels were determined using a human ferritin enzyme immunoassay kit (BIOCHECK, INC., 323 Vintage Park Dr., Foster City, CA 94404) with an enzyme linked immunosorbent assay (ELISA) reader (Thermo Fisher Scientific, Finland) (9). After obtaining blood samples, Falcon tubes containing coagulated blood were centrifuged at 4000 rpm for 15 minutes to separate serum. The serum samples were then collected from the pathology laboratory of the Bolan Medical Complex in Quetta and aliquoted into properly marked vials. These aliquots were stored at -80 °C until biomarker assessment. The actual measurement of serum ferritin levels was performed using the enzyme immunoassay kit, following the manufacturer's instructions. The ELISA reader was employed to quantify the results, providing accurate and precise assessments of serum ferritin concentrations (9). These methods are widely acknowledged for their reliability and validity in accurately assessing serum ferritin concentrations. The enzyme immunoassay kit is known for its specificity and sensitivity, while the ELISA reader enhances result precision. According to WHO guidelines the Cut-Off Points for Anemia Diagnosis in Women based on hemoglobin and serum ferritin level are given in Table I. IBM SPSS version 20.0 was utilized for statistical analysis in this study, and the results were estimated by ANOVA, with a P-value < 0.05 considered statistically significant. During the study, data gaps and exclusions occurred due to incomplete questionnaire responses, non-compliance, technical issues, outliers, participant withdrawals, and ineligibility. These were considered in data analysis to maintain result reliability.

RESULTS AND DISCUSSION

The study was conducted in Quetta, Pakistan, assessed the prevalence of iron deficiency (ID) and iron deficiency anemia (IDA) in three groups of women: pregnant, lactating, and non-pregnant non-lactating (NP-NL). Out of 115 participants, pregnant women had ID and IDA rates of 5% and 36%, lactating women had rates of 3% and 27%, and NP-NL women had rates of 10% and 13%, respectively. Notably, ID was the primary contributor to anemia across all groups, with higher risks observed in breastfeeding and pregnant women. First-trimester pregnant women faced the highest anemia risk. Improved diets were correlated with reduced anemia cases. Severe ID (23.08%) and moderate anemia were identified in pregnant women. Ethnicity and socio-economic status seemed to influence ID and IDA rates. Iron supplement use surprisingly showed higher IDA rates. The severity of ID was also explored, with moderate and severe ID prevalence identified. Anemia severity was categorized into severe, moderate, and mild, revealing varying patterns across groups. Notably, a significant portion of the population in Quetta relies heavily on vegetables and pulses due to economic constraints, impacting nutritional intake.

DEMOGRAPHIC DATA OF PREGNANT WOMEN, LACTATING WOMEN AND NP-NL WOMEN

In the demographic analysis, the study focused on pregnant, lactating, and non-pregnant non-lactating (NP-NL) women, revealing noteworthy patterns (Table II). Pregnant women, constituting 39 contributors, exhibited a total prevalence rate of 41% for iron deficiency (ID) and iron deficiency anemia (IDA), with 36% suffering from IDA (9). Notably, women aged 35 and older were more susceptible to ID and IDA (62.5%) (Table II). Among lactating women (37 participants), the prevalence of ID and IDA was 29.72%, with the highest iron deficiency observed in the age group 24 and below (66.67%) (9). In the NP-NL women group (39 participants), a prevalence rate of 23.08% for ID and IDA was identified, with the highest incidence in the age group 30-34 (33.33%) (9), these findings align with the broader understanding that women of reproductive age face increased susceptibility to ID and IDA, particularly during pregnancy and lactation. The importance of a healthy diet for pregnant and lactating women is underscored in maintaining their health and supporting adequate milk production (10, 11).

CLINICAL DATA FOR ID AND IDA AMONG PREGNANT WOMEN

The relationships between ID and IDA are compared to some of the general traits of the participant data in Table III. Participants with marriages lasting more than 16 years had higher rates of ID and IDA than those with shorter unions. However, these differences were not statistically significant. According to the study, the incidence of ID and IDA was highest in the first trimester (50.82%) and lowest in the third trimester (25.25%), and was not statistically significant.

Participants who have had seven or more pregnancies have higher prevalence rates of ID and IDA than those who have only had three pregnancies. Frequent pregnancies and deliveries are expected to deplete iron stores, but variations in the incidence rates did not reach statistical significance. Additionally, the study found that as there were more kids, the prevalence of ID and IDA rose.

Table II. Ranges of frequencies of iron deficiency (ID) and iron deficiency anemia (IDA) in pregnant women in association with age

Age (Years)	Total	Normal	ID	IDA	AWID	P-value
			Pregnant Women			
24 and below	15	4 (26.7%)	0	0	7 (46.7%)	4.25
25-29	5	0	1 (20.0%)	2 (40.0%)	2 (40.0%)	
30-34	11	2 (18.2%)	1 (9.1%)	0	8 (72.7%)	
35 and above	8	1 (12.5%)	0	0	5 (62.5%)	2.25
			Lactating Women			
24 and below	3	1 (33.3%)	0	0	2 (66.6%)	0
25-29	13	6 (46.1%)	1 (7.6%)	4 (30.7%)	2 (15.3%)	2.20
30-34	10	6 (60.0%)	0	0	2 (20.0%)	2.20
35 and above	11	7 (63.6%)	0	0	2 (18.1%)	2.18
			Nonpregnant-Nonlactating Women			
24 and below	32	21 (65.6%)	4 (12.5%)	4 (12.5%)	3 (9.3%)	0
25-29	4	3 (75.0%)	0	0	0	1.25
30-34	3	1 (33.3%)	0	0	1 (33.3%)	1.33
35 and above	0	0	0	0	0	0

*ID: Iron Deficiency; IDA: Iron Deficiency Anemia; AWID: Anemia Without Iron Deficiency

In Pathan, Baloch, and Punjabi, the percentages of ID and IDA patients were found to be 30.43%, 42.86%, and 25%, respectively, suggesting that ethnicity may be a factor. Studies show that NP-NL and lactating women with low socioeconomic status are more likely to have ID and IDA. However, it is challenging to draw a connection between prosperity and a low incidence of ID and IDA in expecting mothers. Pregnant women, however, are unaware of the requirements for pregnancy and need a special diet during gestation to support the growth of the fetus.

Iron supplement use has an impact on IDA status, and high incidence rates have been identified and reported when compared to other groups (Yes, 47.62%) and other groups (No, 33.33%). The unexpectedly high incidence of IDA in women using iron supplements may be attributed to non-compliance due to reported side effects (e.g., heartburn, vomiting, constipation) leading to inadequate absorption or utilization of the iron supplements (14). Additionally, variations in supplement dosage, frequency, or individual differences in absorption capacity may contribute to the observed outcomes. Further investigation into adherence patterns and potential mitigating factors is warranted. The finding that participants with marriages lasting more than 16 years had higher rates of ID and IDA suggests a potential association between the duration of marriage and iron status. While the observed difference was not statistically significant, it prompts further exploration into factors related to long-term marriages that might contribute to higher rates of iron deficiency (9). Possible explanations could include lifestyle factors, dietary habits, or socio-economic conditions associated with prolonged marital unions. Understanding these associations can inform targeted interventions, such as nutritional counseling or supplementation, for individuals in longer marriages to mitigate the risk of iron deficiency and anemia (10). Further research is warranted to delve into the nuanced dynamics influencing iron status in populations with varying marital durations.

Table III. Associations between iron deficiency (ID) and iron deficiency anemia (IDA) in pregnant women in relation to general characteristics

Variables	Total	Normal	ID	IDA	AWID	P-value
		Duration of Marriage (Years)				
5 and less	20	4 (20.0%)	1 (5.0%)	8 (40.0%)	7 (35.0%)	0.754
6-15	14	2 (14.3%)	1 (7.1%)	3 (21.4%)	8 (57.1%)	
16 and above	5	1 (20.0%)	0	3 (60.0%)	1 (20.0%)	
		Stage of Pregnancy (Trimester)				
1st	17	1 (5.9%)	1 (5.9%)	9 (52.9%)	6 (35.3%)	0.611
2nd	10	3 (30.0%)	1 (10.0%)	2 (20.0%)	4 (40.0%)	
3rd	12	3 (25.0%)	0	3 (25.0%)	6 (50.0%)	
		Number of Pregnancies				
3 and less	21	4 (19.1%)	1 (4.8%)	8 (38.1%)	8 (38.1%)	0.545
4-6	7	1 (14.3%)	0	1 (14.3%)	5 (71.4%)	
7 or above	11	2 (18.2%)	1 (9.1%)	5 (45.5%)	3 (27.3%)	
		Number of Children				
None	11	1 (9.1%)	0	5 (45.5%)	5 (45.5%)	0.467
3 and less	15	4 (26.7%)	1 (6.7%)	4 (26.7%)	6 (40.0%)	
4-6	9	2 (22.2%)	1 (11.1%)	3 (33.3%)	3 (33.3%)	
7 and above	4	0	0	2 (50.0%)	2 (50.0%)	
		Use of Iron Supplements				
Yes	18	3 (16.7%)	0	6 (33.3%)	9 (50.0%)	0.234
No	21	4 (19.1%)	2 (9.5%)	8 (38.1%)	7 (33.3%)	

* ID: Iron Deficiency; IDA: Iron Deficiency Anemia; AWID: Anemia Without Iron Deficiency

CLINICAL DATA AND ID AND IDA AMONG LACTATING WOMEN

Participants with 5-7 days of menstrual duration have a higher prevalence rate of ID and IDA compared to participants with 8 or more days, but they were not statistically significant (Table IV). A notable prevalence of ID and IDA was among lactating women experiencing heavy menstrual periods, reaching 57.14%, in contrast to other groups with a prevalence of 23.33%, which is statistically insignificant. Notably, individuals with shorter intervals between menstruations exhibited a higher prevalence of ID and IDA compared to those with longer intervals. In addition, nursing mothers who had three pregnancies or fewer and varied child counts showed higher prevalence rates of ID and IDA in comparison to other groups that had four to six pregnancies and seven or more child counts. However, statistical analysis did not reveal significant differences in prevalence rates among these groups (P = 0.432). Participants who did not use iron supplements displayed a notable prevalence rate of IDA at 29.41%. This could be the result of things like having children frequently, which can cause the body's iron stores to run out faster, nutritional difficulties, the physiological effects of childbirth, and differences in access to healthcare that can affect diagnosis and treatment, and genetic or racial influences on liver function (16).

Table IV. Associations between Iron deficiency (ID) and iron deficiency anemia (IDA) in lactating women in relation to general characteristics

Variables	Total	Normal	ID	IDA	AWID	P-value
		Menstrual Duration (Days)				
5 or less	0	0	0.00%	0	0.00%	0
5-7	33	19 (57.5%)	1 (3.03%)	9 (27.3%)	4 (12.1%)	
8 or more	4	1 (25.0%)	0	1 (25.0%)	2 (50.0%)	
		Heavy Periods Flow				
Yes	7	2 (28.5%)	1 (14.3%)	3 (42.9%)	1 (14.3%)	0.671
No	30	18 (60.0%)	0	7 (23.3%)	5 (16.7%)	
		Interval Between Periods (Days)				
15-19	3	0	0.00%	0	66.7%	0.532
20-24	2	1 (50.0%)	0	1 (50.0%)	0	
25-30	32	19 (59.5%)	1 (3.13%)	7 (21.9%)	5 (15.6%)	
		Duration of Marriage (Years)				
5 and less	15	6 (40.0%)	0	6 (40.0%)	3 (20.0%)	0.562
6-15	15	9 (60.0%)	1 (6.67%)	3 (20.0%)	2 (13.3%)	
16 and more	7	5 (71.4%)	0	1 (14.3%)	1 (14.3%)	
		Number of Pregnancies				
3 and less	18	8 (44.4%)	1 (5.56%)	6 (33.3%)	3 (16.7%)	0.432
4-6	7	5 (71.4%)	0	1 (14.3%)	1 (14.3%)	
7 and more	12	7 (58.3%)	0	3 (25.0%)	2 (16.7%)	
		Number of Children				
3 and less	21	10 (47.6%)	1 (4.76%)	7 (33.3%)	3 (14.3%)	0.419
4-6	9	5 (55.6%)	0	2 (22.2%)	2 (22.2%)	
7 and more	7	5 (71.43%)	0	1 (14.3%)	1 (14.3%)	
		Intake of Iron Supplements				
Yes	3	2 (66.7%)	1 (33.3%)	0	0	0.210
No	34	18 (52.9%)	0	10 (29%)	6 (17.7%)	

*ID: Iron Deficiency; IDA: Iron Deficiency Anemia; AWID: Anemia Without Iron Deficiency Clinical Data and ID And IDA Among NP-NL Women

These findings emphasize the critical consideration of menstrual characteristics, specifically heavy periods and intervals between menstruations, in the context of ID and IDA. Participants experiencing heavy menstrual periods exhibited elevated rates of ID and IDA, highlighting the substantial impact of menstrual blood loss on iron status (17). It has also been shown that there is a higher incidence of ID and IDA in people who have shorter menstrual cycle intervals (18, 19). These outcomes underscore the significance of evaluating menstrual patterns to assess the risk of iron deficiency, offering valuable insights for targeted interventions and healthcare strategies aimed at addressing or preventing iron-related health issues in women with specific menstrual characteristics.

Findings with respect to menstrual duration participants with <5 days and 8 and above days of menstrual duration, only ID patients were observed (30.33% and 50%) and in the group of 5-7 days, the prevalence rate of ID (5.88%) and IDA (14.71%) was 20.59 % (Table V). Differences in the incidence value were not statistically significant (P = 0.532). When compared to other groups, participants with heavy periods had a higher prevalence of ID and IDA (71.43%), and there was no statistically significant difference between the prevalence rates during heavy and normal periods. The prevalence of ID and IDA was 23.08 percent in participants with a menstrual interval of 20 to 24 days and 24 percent in those with a menstrual interval of 25 to 30 days. The findings underscore the nuanced relationship between menstrual characteristics and the prevalence of ID and IDA among NP-NL women. The absence of statistically significant differences in incidence values suggests the need for a more comprehensive exploration of contributing factors. This multifaceted nature of iron deficiency in the population can help design potential tailored interventions and healthcare strategies.

Table V. Associations between iron deficiency (ID) and iron deficiency anemia (IDA) in lactating non-pregnant, Non-lactating (NP-NL) women in relation to general characteristics

Variables	Total	Normal	ID	IDA	AWID	P-value
		Menstrual Duration (Days)				
5 or less	3	2 (66.6%)	1 (33.3%)	0	0.00%	0
5-7	34	23 (67.6%)	2 (5.9%)	5 (14.71%)	4 (11.8%)	
8 or more	2	0	1 (50.0%)	0	0.00%	1.5
		Heavy Periods Flow				
Yes	7	1 (14.2%)	2 (28.6%)	3 (42.86%)	1 (14.3%)	0.57
No	32	24 (75.0%)	2 (6.3%)	2 (6.25%)	4 (12.5%)	
		Interval Between Periods (Days)				
15-19	1	1 (100%)	0	0.0%	0	0
20-24	13	10 (76.9%)	0	3 (23.08%)	0	
25-30	25	14 (56.0%)	4 (16.0%)	2 (8.00%)	5 (20.0%)	
		Intake of Iron Supplements				
Yes	2	0	0	1 (50.0%)	1 (50.0%)	0.46
No	37	25 (67.5%)	4 (10.8%)	4 (10.81%)	4 (10.8%)	

*ID: Iron Deficiency; IDA: Iron Deficiency Anemia; AWID: Anemia Without Iron Deficiency Dietary Nature and ID and IDA Among Study Population

The study reveals a notable association between low poultry product consumption and increased prevalence of ID and IDA among pregnant, lactating, and Non-Pregnant Non-Lactating (NP-NL) women. This finding suggests that individuals with a limited intake of poultry products may be at a higher risk of developing iron-related health issues. Poultry products are rich sources of heme iron, which is more readily absorbed by the body compared to non-heme iron found in plant-based foods (15). The observed association underscores the importance of diverse and nutrient-rich diets, particularly for women in reproductive stages, to ensure an adequate supply of dietary iron. Studies highlight how meat is a highly nutritious food, emphasizing how important it is for maintaining the body's iron levels (13). Still, there is a need for more research, especially when assessing the health effects of processed meats and their possible metabolic effects.

DISTRIBUTION OF IRON DEFICIENCY BASED ON SERUM FERRITIN LEVEL SEVERITY

On the basis of serum ferritin level, the severity of ID was classified into severe and moderate groups. The pregnant, lactating, and NP-NL women who suffered from moderate ID were 17.95%, 16.22%, and 10.26%, while 23.08%, 13.51%, and 12.82% suffered from severe ID respectively Fig. 1(a).

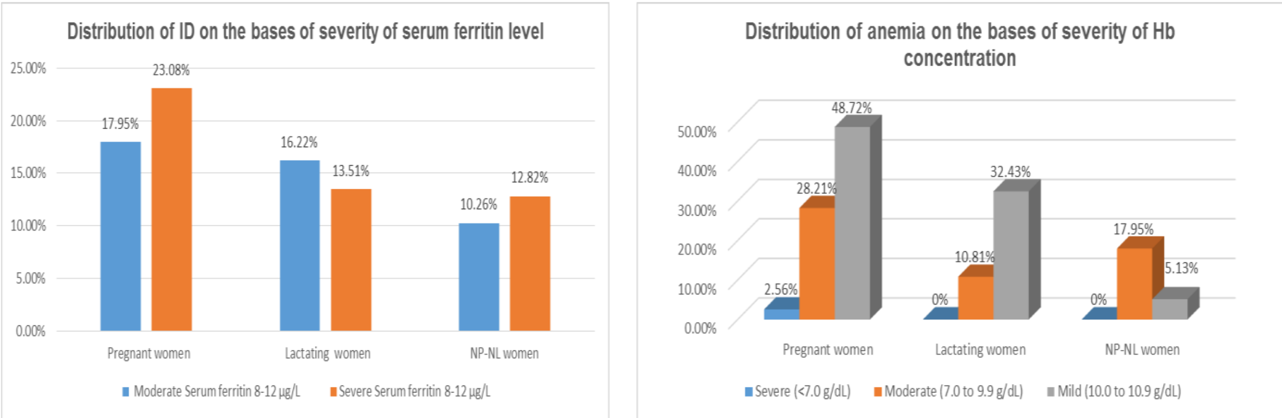

Fig. 1 (a) Distribution of ID on the bsis of the severity of serum ferritin level b) Distribution of anemia on the basis of the severity of Hb concentration

DISTRIBUTION OF ANEMIA ON THE BASIS OF THE SEVERITY OF HB CONCENTRATION

Anemia based on the severity of Hb concentration was classified into severe, moderate, and mild anemia. The pregnant women who suffered from severe, moderate, and mild anemia were 2.56%, 28.21%, and 48.72%, while none of the lactating and NP-NL women were severely anemic; only moderate and mild anemia was found Fig. 1 (b).

A significant proportion of the population residing in Quetta relies heavily on vegetables and pulses as their primary dietary sources. Many people in this group struggle to afford wholesome, well-balanced meals because of their financial circumstances. The presence of anemia during pregnancy can lead to adverse outcomes, such as premature delivery, low birth weight in newborns, and insufficient iron storage (12). To mitigate these risks, pregnant and lactating women are often advised to incorporate iron supplements into their diets. By doing so, they can enhance their protection against severe ID and IDA (12). The study aimed to assess the prevalence of actual ID among the subjects under investigation. Serum ferritin levels were measured in blood samples obtained from these participants. Based on the interpretation of serum ferritin levels, the cases were classified into four distinct categories, as depicted in Figure I. The study revealed that 23.08% of pregnant women exhibited serum ferritin levels below 8µg/L, indicating the presence of ID as the primary underlying cause of anemia. Moreover, as illustrated in Figure II, 48.72% of pregnant women demonstrated hemoglobin levels ranging from 10.0 to 10.9 g/dl, signifying mild anemia.

The results of the study reveal a notable prevalence of ID and IDA across different demographic groups, emphasizing the vulnerability of women of reproductive age, particularly during pregnancy and lactation. The association of ID and IDA with factors like marital duration, pregnancy history, and ethnic background highlights the multifaceted nature of these conditions. Unexpectedly, the high incidence of ID and IDA in women using iron supplements raises questions about compliance and the impact of reported side effects. These findings contribute valuable insights to the understanding and management of ID and IDA in the studied population. The identification of vulnerable groups and associated risk factors can inform targeted intervention strategies. It underscores the importance of considering socio-cultural aspects, dietary habits, and supplement adherence in designing effective public health measures to combat ID and IDA in this context. Anemia can be associated with increased susceptibility to infectious diseases, as it compromises the immune system's function, leading to a higher infection risk and potentially exacerbating the severity and outcomes of infectious diseases (15). There may be confounding factors, such as dietary variations, and reliance on self-reported data poses a risk of information bias. Additionally, external factors like healthcare accessibility and socio-economic conditions might influence the results, warranting cautious interpretation. Further research into the reasons behind unexpected outcomes and the exploration of culturally sensitive interventions will enhance the practical applicability of these findings. It is imperative for the government to implement substantial measures aimed at improving the quality of education and socioeconomic status within the region. Increase the number of medical professionals and step up public education campaigns about this issue. By doing so, we can collectively work towards alleviating the burden of anemia and its associated consequences.

CONCLUSION

The findings underscore the substantial health ramifications of iron deficiency (ID) in women, especially during pregnancy and lactation, with potential persistence into postpartum periods. Reliable screening tools such as hemoglobin and serum ferritin levels are crucial for identifying ID and iron deficiency anemia (IDA) in pregnant, lactating, and non-pregnant/non-lactating (NP-NL) women. Lower hemoglobin and serum ferritin levels signify iron deficiency, emphasizing the need for healthcare professionals to advocate for iron supplementation. However, prioritizing an iron-rich diet proves a safer, more cost-effective, and more palatable strategy compared to relying solely on supplements.

Healthcare providers play a pivotal role in prescribing timely iron supplements to restore and maintain iron levels, foster enduring nutritional habits, and avert ID and IDA complications. Post-delivery checkups for lactating mothers and early, regular prenatal care for expectant women are crucial for vigilant iron deficiency monitoring. A comprehensive approach is pivotal, encompassing regular monitoring, timely intervention, and education on iron-rich dietary choices.

Recommendations for healthcare providers and policymakers stem from these insights. Encouraging iron-rich dietary choices and prioritizing supplements when needed should be integral to prenatal care. Policymakers should consider educational initiatives emphasizing the importance of early and regular prenatal care and postpartum checkups. By implementing such measures, the study envisions a significant reduction in the long-term impact of ID and IDA on the health of both mothers and infants.

References:

1. Kattou F, Montandrau O, Rekik M, Delentdecker P, Brini K, Zannis K, Beaussier M. Critical preoperative hemoglobin value to predict anemia-related complications after cardiac surgery. Journal of Cardiothoracic and Vascular Anesthesia. 2022;36(7):1901-7.
2. Shubham K, Anukiruthika T, Dutta S, Kashyap AV, Moses JA, Anandharamakrishnan C. Iron deficiency anemia: A comprehensive review on iron absorption, bioavailability and emerging food fortification approaches. Trends in Food Science & Technology. 2020;99:58-75.
3. Natekar P, Deshmukh C, Limaye D, Ramanathan V, Pawar A. A micro review of a nutritional public health challenge: iron deficiency anemia in India. Clinical Epidemiology and Global Health. 2022;14:100992.
4. Benson CS, Shah A, Stanworth SJ, Frise CJ, Spiby H, Lax SJ, Murray J, Klein AA. The effect of iron deficiency and anaemia on women’s health. Anaesthesia. 2021;76:84-95.
5. Ju H, Liu T, Yang M, Cheng M, Wu G. Iron and atrial fibrillation: A review. Pacing and Clinical Electrophysiology. 2023;46(4):312-8.
6. Elmore C, Ellis J. Screening, treatment, and monitoring of iron deficiency anemia in pregnancy and postpartum. Journal of midwifery & women's health. 2022;67(3):321-31.
7. Plays M, Müller S, Rodriguez R. Chemistry and biology of ferritin. Metallomics. 2021;13(5):mfab021.
8. Khan M, Nisar H, Mushahid N. Clinical and Lab profile of severe and uncomplicated malaria: A prospective study from Khuzdar Balochistan. Pakistan Journal of Medical Sciences. 2021;37(7):1918.
9. Cappellini MD, Santini V, Braxs C, Shander A. Iron metabolism and iron deficiency anemia in women. Fertility and Sterility. 2022.

10. Jamnok J, Sanchaisuriya K, Sanchaisuriya P, Fucharoen G, Fucharoen S, Ahmed F. Factors associated with anaemia and iron deficiency among women of reproductive age in Northeast Thailand: a cross-sectional study. BMC Public Health. 2020;20(1):1-8.
11. Marshall NE, Abrams B, Barbour LA, Catalano P, Christian P, Friedman JE, Hay Jr WW, Hernandez TL, Krebs NF, Oken E, Purnell JQ. The importance of nutrition in pregnancy and lactation: lifelong consequences. American journal of obstetrics and gynecology. 2022;226(5):607-32.
12. Ataide R, Fielding K, Pasricha SR, Bennett C. Iron deficiency, pregnancy, and neonatal development. International Journal of Gynecology & Obstetrics. 2023;162:14-22.
13. Bibi A, Tariq N, Ali H, Butt ZE, Kausar T, Maryam M. Genotyping Of Kell Blood Group In Multiethnic Populations Of Quetta, Pakistan. Health Biotechnology and Biopharma (HBB). 2023 Jul 4.
14. Geiker NR, Bertram HC, Mejborn H, Dragsted LO, Kristensen L, Carrascal JR, Bügel S, Astrup A. Meat and human health—Current knowledge and research gaps. Foods. 2021;10(7):1556.
15. Noptriani S, Simbolon D. Probability of non-compliance to the consumption of Iron Tablets in pregnant women in Indonesia. Journal of Preventive Medicine and Hygiene. 2022;63(3):E456.
16. Tareen AM, Samad A, Mustafa MZ, Maryam M, Rizwan S, Akbar A. Immunogenic protein profiling of pathogenic Escherichia coli strains isolated from infants with diarrhea in Quetta Balochistan. Journal of King Saud University-Science. 2022;34(3):101883.
17. Lee HJ, Pak H, Han JJ, Chang MH. Comprehensive Analysis of Iron Deficiency Anemia and Its Related Disorders in Premenopausal Women Based on a Propensity Score Matching Case Control Study Using National Health Insurance Service Database in Korea. Journal of Korean Medical Science. 2023;38(37).
18. Mansour D, Hofmann A, Gemzell-Danielsson K. A review of clinical guidelines on the management of iron deficiency and iron-deficiency anemia in women with heavy menstrual bleeding. Advances in therapy. 2021;38:201-25.
19. Fernandez-Jimenez MC, Moreno G, Wright I, Shih PC, Vaquero MP, Remacha AF. Iron deficiency in menstruating adult women: Much more than anemia. Women's Health Reports. 2020;1(1):26-35.