Prevalence of Iron Deficiency Anemia in Pregnant Women of District Mardan, Pakistan

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Abstract

Background: Iron depletion is the most common nutrient deficiency worldwide and is the leading cause of anemia. Anaemia in pregnancy is a common clinical problem contributing to increased maternal and foetal morbidity. Previously few studies have highlighted this problem in developing country like Pakistan but the situation needs further exploration in pregnant women of less developed areas. The current study aimed to estimate the prevalence of iron deficiency anemia (IDA) among pregnant women of district Mardan, Khyber Pakhtunkhwa (KP), Pakistan.

Methods: The study consisted of 300 pregnant women in the age group (18-40) years. Blood samples were collected from each pregnant woman and a questionnaire was completed at the time of blood collection. Hematological and biochemical profiles were determined and the collected data was analyzed using SPSS.

Results: In the current study the overall prevalence rate of iron deficiency anemia in pregnant women was (76.7%). Iron deficiency anemia was most prevalent in the second trimester (45.7%) as compared to first (16.1%) and third (38.2%) trimester pregnancy. Of the anemic cases, 42.6% have low iron stores and 43.5% have serum ferritin in (76.7%). Iron deficiency anemia was most prevalent in the second trimester (45.7%) as compared to first (16.1%) and third (38.2%) trimester pregnancy. Of the anemic cases, 42.6% have low iron stores and 43.5% have serum ferritin in a range of 12-30 ng/ml. In 60% of cases CRP was raised and 72.2% were multiparous. Of the study population, 65% were uneducated and 87% belonged to lower middle class.

Conclusion: This study concluded that anemia is highly prevalent among the antenatal women of this area and iron deficiency considered to the culprit behind this disease. Multiparty, low socio-economic status and low education are the contributory factors of iron deficiency anemia. There is a great need for further health education promotional programs to improve heath of pregnant women.

Keywords: Pregnancy; Haematological and biochemical profiles; Mardan; Anemia; Iron deficiency

Introduction

Anaemia from Greek Anaimia, "meaning without blood" is as a condition in which either the number of red blood cells (RBCs) decreased or their oxygen-carrying capacity reduce to meet the body normal physiologic functions. Anemia is especially common in women of reproductive age and particularly during pregnancy. Anemia is a well-studied and well known risk factor in pregnancy for both mother and fetus life. Anaemia is associated with increased pre-term labour (28.2%), pre-eclampsia (31.2%) and maternal sepsis [1,2]. Three types of anemia during pregnancy are severe anaemia when hemoglobin concentration is less than 7.0g/dL, moderate when hemoglobin falls between 7.0-9.9g/dL and mild anaemia when hemoglobin level range from 10.0 to 11.0g/dL [3,4]. Anemia has a variety of converging contributing factors including nutritional, genetic, frequent labour, multiparity, abortions and infectious disease, however, iron deficiency is the cause of 75% of anaemia cases [1,5,6]. The major causes of iron deficiency include insufficient intake of iron-rich foods and poor bioavailability of consumed iron in relation to the need during pregnancy [7]. The demand for iron increases about six to seven times from early pregnancy to the late pregnancy [8].

Iron deficiency anemia (IDA) is a well-reported problem during pregnancy in both developed and developing countries including Pakistan. In the world the number of anaemic people around 1.62 billion among which 56 million are pregnant women [5]. Prevalence of iron deficiency anemia among women in developing countries was calculated from 40% to 88%. In Pakistan the prevalence of anemia among pregnant women living in urban areas was reported from 29% to 50% [9]. Some studies have shown that the frequency of Iron deficiency anemia varies in the pregnant women of Karachi (64%), Lahore (73%) and Multan (76%) [10-12]. Although the differences among the reported prevalence rates in the studies might be due to variations in the main characteristics of their target population, methodological differences such as laboratory tests. But Despite its known effect on the population, very limited data is available on the biochemical deficiency of micronutrient like iron in pregnant women of the studied region of Khyber Pakhtunkhwa (KP). Identifying the prevalence of anaemia and determining its causes in individuals of high-risk groups, such as in pregnant women is a dire need of the day particularly in developing countries like Pakistan, where the social conditions pose serious challenges to women. Therefore, this study was carried out to determine the prevalence of anemia and true iron deficiency in the pregnant women of district Mardan and to compare it with previously done studies.

Materials and Methods

Study design, study population and sampling size

This was a descriptive, cross sectional type of study. The study population comprised 300 women aged 18–40 years, at various stages of...
pregnancy belonging to different socioeconomic backgrounds. A total of 300 apparently healthy pregnant women were studied attending the outpatient department of Gynecae and Obstetric Unit of Mardan Medical Complex.

Inclusion and exclusion criteria
Healthy pregnant women, aged 18-40 years at different stages of pregnancy belonging to district Mardan were selected, whose Haemoglobin level were below 11 g/dl. While excluded pregnant women with any acute illnesses, gestational diabetes mellitus, hypertension, obesity, women with other chronic diseases, women over age 40 and women with a history of blood loss/blood transfusion in the present pregnancy.

Ethical consideration
This study was approved by the ethics committee of the Abdul Wali Khan University Mardan KP and performed in accordance with the principles of Committee. To ensure their voluntary participation, informed consent was obtained from all the participants.

Questionnaire interview
A questionnaire based interview was conducted from all the participants. All interviews were conducted face to face by the researchers themselves. During the survey the researcher explained a question that was not clear. The questionnaire included questions on socio-demographic data (age, education and family income/month), medical history (previous pregnancy, complications in previous pregnancy), clinical data (complications during this pregnancy, any blood loss and treatment received, (if any) food and drink intake.

Specimen collection and determination of hemoglobin
Blood samples were collected from 300 pregnant women who were at various stages of pregnancy. The blood samples were collected in Ethylenediaminetetraacetic acid (EDTA) tubes. Hemoglobin determinations of 300 females were done. Hemoglobin was measured by hematology analyzer (BC 3000 Plus Auto hematology analyzer, MINDRAY: Bio-medical Electronics company Ltd., Shenzhen China) at the pathology and hematology laboratory Bacha Khan medical college Mardan. Blood samples were withdrawn and collected in EDTA tubes, labeled and processed in the laboratory. The samples were then inserted into the analyzer and automated measurement was initiated. Participant's results were recorded in laboratory information system. The results compared with the previous data and any variations such as abnormal drop in hemoglobin, flagged. The procedure was repeated three times.

Measurements of blood iron stores
The blood iron stores were measured by estimation of serum ferritin in those anemic females whose hemoglobin level was less than 11 g/dl. Blood samples were collected in EDTA tubes and stored at 2-8°C for 3-5 days. Estimation of serum ferritin was done collectively of 5-10 samples. Serum ferritin estimation was done by using Elecsys and COBAS e (Trade mark of Rosche) immunoassay analyzer. The results were determined in triplicate and the mean was used for analysis.

Estimation of C-reactive protein (CRP)
CRP was estimated by latex agglutination method. The CRP latex is a slide agglutination test for the qualitative and semi-quantitative detection of C-Reactive protein in human serum. The kit was used of ANTECH Diagnostics. Add 50 ul of the sample and one drop each of positive (Human serum with CRP concentration >20 mg/L Sodium azide 0.95 g/L) and negative controls (Animal serum sodium azide 0.95 g/L) into separate circles on the test slide. The CRP latex reagent was swirled gently before using. Then 50 μl of the reagent was added to the samples. The drops mixed and spread over the entire surface with a stirrer. Different stirrers were used for different samples. The slide was put on a mechanical rotator at 80-100 rpm for 2 min. Then the slide examined macroscopically for the presence or absence of any visible agglutination. The presence of agglutination showed a CRP concentration of equal to or greater than 6 mg/L. CRP concentrations were determined in triplicate and the mean was used for analysis.

Care manager
Five care managers were working in the office and Clinic of Zarmina Ahmad at Bacha Khan Medical College And in office of Dr. Sulaiman Shams in Biochemistry Department AWKUM. The central aim of the care managers was to empower pregnant females living with iron deficiency to take a more active role in their health.

Statistical analysis of the data
All data are presented as mean ± SD. Significant differences were determined by using ANOVA in SPSS 16.0. P<0.05 was considered statistically significant.

Results
From different localities of district Mardan, 300 pregnant women were selected, for the purpose of this study. Detailed medical and obstetric history was recorded. Out of 300 women, 230 fulfilled the criteria and further studies were carried out.

Socio-demographic data of the study population
The study population comprised of 300 pregnant women, aged 18-40 years. Table 1 summarizes their socio-demographic details. It showed that out of total, 60% women were in age group 30-40 years while 40% were in age range 18-29 years. Almost 65% were not educated (never attended school or have education less than class 5) and 35% had some educational background (have completed education up to class 5 and above). Most of these pregnant women belonged to lower (annual house hold income US$<500) and middle class (annual house hold income US$500-1000) that comprised 87% of the whole group and 13% belonged to upper class (annual house hold income US$>1000). Regarding their residence, 70% of the females came from rural areas while 30% were living in the urban areas of district Mardan (Table 1).

Status of pregnancy in iron deficient women
Out of the total, almost half (45.7%) of the pregnant women were in

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Range/Group</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-29 years</td>
<td>92</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>30-40 years</td>
<td>138</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educated</td>
<td>80</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Non educated</td>
<td>150</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower class</td>
<td>92</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Middle class</td>
<td>108</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Upper class</td>
<td>30</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Areas</td>
<td>69</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Rural areas</td>
<td>161</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Socio-demographic distribution of studies population.
their 2nd trimester of pregnancy, followed by 3rd trimester (38.2%) and the rest of females (16.1%) were in their 1st trimester. The current study also reflected that most of the women (72.2%) were multi gravida, while 19.1% were having their first pregnancy and 8.7% were grand multiparous women as shown in Table 2.

Prevalence of anemia in study population

Estimation of hemoglobin level of 300 women was done. Out of total studies population, 230 women have hemoglobin level less than 11 g/dl. The current study showed the prevalence of anemia (defined by the World Health Organization as hemoglobin <11.0 g/dl) in these subjects was 76.7% (Table 3).

Prevalence of anemia based on severity of anemia

Of the total anemic cases, 68.3% had mild anemia and 29.1% had moderate anemia and 2.6% were severely anemic as shown in Table 4. Grading of anemia is done on WHO classification of anemia (Table 4).

Serum ferritin level in study population

To determine the actual prevalence of iron deficiency anemia in the study population, further analysis was carried out of those participants who had hemoglobin concentration of less than 11 g/dl. Category 1 (<12 ng/ml), requires active intervention. Category 2 (12-30 ng/ml) which still signifies low iron stores. Category 3 (31-100 ng/ml) indicates a normal level. As serum ferritin is also an acute phase reactant so its level rises in response to infections. Category 4 showed levels >300 ng/ml. The current study showed as in Table 5 that out of total 230 participants, 42.6% had Serum ferritin level below12 ng/ml while 43.5% had serum ferritin level in the range of 12-30 ng/ml which is a range that still signifies the low iron stores in almost half the population. 11.7% have S. ferritin level in 31-300 ng/ml rang and the rest of 2.2% of the participants have a high level of S. Ferritin, i.e., >300 ng/ml (Table 5).

Co-relation of anemia with low S. ferritin

Table 6 determines the Comparison of anemia with positive serum ferritin in study population. Out of severely anemic cases, 83.3% had low S. ferritin (Table 6).

CRP relative to raised S. ferritin

We performed CRP on those 5 women with raised positive S. Ferritin, i.e., >300 ng/ml. The result showed that 3 out of these 5 women had raised CRP as shown in Table 7.

Discussion

The single most prevalent micro nutrient i.e., iron deficiency coupled with anemia in a pregnant woman has serious health threats. The prevalence of IDA in developing countries including Pakistan remains high. Pakistan, with its vital geopolitical importance, is still a long way off from its goal to overcome IDA among vulnerable population groups. According to a report of national health survey of Pakistan, 50-60% of expectant mothers are affected by IDA [13] In an effort to combat this seemingly benign problem, we first aimed to get the prevalence of anemia generally in the pregnant population of district Mardan. This study showed the prevalence of anemia in these subjects to be quite high (76.7%) as sown in Table 3, of these 68.3% had mild anemia and 29.1% had moderate anemia. 2.6% were severely anemic. Secondly the results were compared with other studies done in Pakistan and especially in KP. It showed that in a study done in district Karak, the percentage of anemia in pregnant women was 67.6%, while a study done in district Mardan showed the prevalence of anemia to be 66.6% [14,15]. Studies done in Peshawar showed the prevalence to be 53.0% [16] (Table 4).

The anemia association with education in the present study was that 65% were un-educated (never Attend school) and 35% had some educational background. The study demonstrated that less education was associated with high prevalence of anemia. This is similar to studies carried out in Korangi Karachi and district Karak that showed high incidence of anemia in illiterate pregnant females (55.6% and 88.0%, respectively) [10,14]. From the above information it is evident that lower the level of education in women, the more probability of anemia during. Most of these pregnant women in the current study

<table>
<thead>
<tr>
<th>Category</th>
<th>Serum Ferritin Level (ng/mL)</th>
<th>No. of Participants</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>&lt;12 ng/mL</td>
<td>98</td>
<td>42.6%</td>
</tr>
<tr>
<td>Category 2</td>
<td>12-30 ng/mL</td>
<td>100</td>
<td>43.5%</td>
</tr>
<tr>
<td>Category 3</td>
<td>31-300 ng/mL</td>
<td>27</td>
<td>11.7%</td>
</tr>
<tr>
<td>Category 4</td>
<td>&gt;300 ng/mL</td>
<td>5</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

Table 5: Serum ferritin level in study population.

<table>
<thead>
<tr>
<th>Type of anemia &amp; No. of Patients</th>
<th>No. &amp; % of participants S. ferritin &lt;12 ng/ml</th>
<th>No. &amp; % of participants S. ferritin 12-30 ng/ml</th>
<th>No. &amp; % of participants S. ferritin 30-300 ng/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild Anemia 157</td>
<td>68 (43.3%)</td>
<td>30 (19.1%)</td>
<td>59 (37.6%)</td>
</tr>
<tr>
<td>Moderate anemia 67</td>
<td>22 (32.8%)</td>
<td>26 (38.8%)</td>
<td>19 (28.4%)</td>
</tr>
<tr>
<td>Severe anemia 6</td>
<td>5 (83.3%)</td>
<td>1 (16.7%)</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Table 6: Comparison of anemia with S. ferritin in study population.

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>Hb in g/dl</th>
<th>S. ferritin in ng/ml</th>
<th>CRP levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.2</td>
<td>460</td>
<td>Raised</td>
</tr>
<tr>
<td>2</td>
<td>10.8</td>
<td>320</td>
<td>Normal</td>
</tr>
<tr>
<td>3</td>
<td>9.8</td>
<td>304</td>
<td>Normal</td>
</tr>
<tr>
<td>4</td>
<td>10.0</td>
<td>502</td>
<td>Raised</td>
</tr>
<tr>
<td>5</td>
<td>10.1</td>
<td>330</td>
<td>Raised</td>
</tr>
</tbody>
</table>

Table 7: Comparison of raised S. ferritin with CRP levels.
belonged to lower middle class that comprised 87% of the whole group 13% belonged to upper class. This is similar to the study done in District Karak where 80% of anemic pregnant females belonged to lower class [14]. Regarding their residence in the present study, 70% of the females came from rural areas while 30% were living in the urban areas of district Mardan. The Table 2, determine that the incidence of anemia was high in the second trimester (45.7%) and the rest of females were either in their 1st trimester (16.1%) or 3rd trimester (38.2%). The fact that every 2nd pregnant woman is anemic requires some serious measures to be taken towards improvement. This study also reflected that most of the women (72.2%) were multi gravida, while 19.1% were having their first pregnancy. 8.7% were grand multiparous women as shown in Table 2. This is in conformity with the results of other similar studies which also signify that multiparity and short birth spacing lead to anemia in women [17] (Tables 1 and 2).

Another focus of the current study was to know the prevalence of actual iron deficiency in these anemic patients. Serum ferritin levels were estimated in the blood samples of these anemic subjects. While interpreting the levels of serum ferritin, the cases were divided into four categories as shown in Table 5. This study showed that in almost half the population of pregnant females (42.6%) S. ferritin level was below 12 ng/ml establishing iron deficiency as the main cause of anemia in pregnant females as shown in Table 5. In the current study, 43.5% have serum ferritin in the range of 12-30 ng/ml which is a range that still signifies low iron stores. Only 11.7% had a normal value of S. Ferritin, i.e., 31-300 ng/ml. Although women with acute or chronic infections were excluded from the study to get a clear picture regarding levels of iron stores, still in 2.2% cases the value of serum ferritin was >300 ng/ml as shown in Table 5. For better interpretation of the results, the cases were tested for CRP levels. It turned out that 60% of cases, i.e., 3 out of 5 had raised CRP as shown in Table 7. An important strength of the current study is that the study population was homogeneous in terms of race. Determination of hemoglobin with the help of auto analyzer done was performed during the study for the first time in this region. This is the first study that examines the of anemia in the population of Pashtuns women during pregnancy using serum ferritin in addition to CRP to account for infection. The rate of low birth weight babies was high in mothers who were anemic in their third trimester. Preterm deliveries occurred highly in mothers who were anemic in their second and third trimesters [18]. Therefore, the government needs to take action to improve the quality of education and socioeconomic status of females and to increase the number of health care providers.

Conclusion

It can be concluded from this study that anemia due to iron deficiency is highly prevalent in district Mardan. The results of the current study were found in conformity with the work of other researchers in our country. It was observed that the etiology of iron deficiency remains the same over the decades. Multiparity, short birth spacing, poor socioeconomic status, lack of education were responsible for high prevalence of IDA. Besides this, it was observed that majority of women attended clinic during the 2nd trimester of pregnancy. So they had lack of iron intake at the time of conception. Non-compliance of iron supplementation was also observed to be an important contributory factor. Almost all the South Asian countries including Pakistan has national level anemia control programs but this problem still persists. This study will provide a base upon which strategies against the eradication of IDA will be made. Intervention only with iron and folic acid supplements is not adequate to combat this problem but this issue requires a multi-faceted approach. Besides regular screening of hematological parameters during pregnancy, nutritional education and counseling should as a part of anemia eradication plan. Researchers should concentrate on preventive supplements and food fortification approaches. A detailed health data could be acquired such as parity, menstrual characteristics, infections, previous iron or blood transfusions, etc. The Government needs to take solid steps to improve the quality of education and socioeconomic status of females, increase the number of health care providers and intensify public education. Health behavior’s need to be changed and adherence to the prescribed programs by the government is needed. Providing long term iron supplementation and dietary modification starting from adolescence may improve the hemoglobin levels and later on prevent anemia in pregnancy.

Acknowledgement

We thank all the pregnant women of district Mardan who participate in this study. Sulaaiman Shams and Zarmina Ahmad participated in all steps of the study from its design to write up. Dr. Sulaaiman Shams, Zarmina Ahmad and Dr. Abdul Wadood critical review the manuscript and wrote the manuscript and performed statistical analysis.

References
