Proceedings of the Pakistan Academy of Sciences: B
Life and Environmental Sciences 60(4): 621-626 (2023)

ISSN (Print): 2518-4261; ISSN (Online): 2518-427X
http://doi.org/10.53560/PPASB(60-4)761

Pakistan Academy of Sciences

Research Article

Deficiency of Iron: A Risk Factor in Pregnant Women in the District Swat

Naseer Ullah[1*], Irum Hassan[1], Maria Rahman[1], Akhtar Rasool[1,2], Ikram Ilahi[3], Muhammad Attaullah[3], Syed Ihteshamullah[1], and Muhammad Israr[4]

[1]Centre for Animal Sciences and Fisheries, University of Swat, Khyber Pakhtunkhwa, Pakistan
[2]Centre for Biotechnology and Microbiology, University of Swat, Khyber Pakhtunkhwa, Pakistan
[3]Department of Zoology, University of Malakand, Khyber Pakhtunkhwa, Pakistan
[4]Department of Forensic Sciences, University of Swat, Khyber Pakhtunkhwa, Pakistan

Abstract: Iron is an essential element for the body, its requirements increase during pregnancy. Improper use of iron may lead to anaemia in the mother. Anaemia may lead to complications such as abortion, stillbirth, and congenital abnormalities in the fetus of pregnant women. This study is aimed to determine the iron level and problems associated with iron deficiency in pregnant women in Swat District. Samples were collected from eight hundred pregnant women. The iron status was determined by measuring haemoglobin levels using Sahli's Method and the Haematology Analyzer. In total, 54% women were anaemic. The age group 41-45 was highly anaemic (100%) followed by 15-20 (74%) while the 31-35 age group was the least anaemic (42%). The Underweight was the highly anaemic group (83%) and the obese were the least anaemic group (12%). Pregnant women with second trimester gestational age were the least anaemic (34%) while the third trimester was the highly anaemic (67%). It was concluded that iron deficiency is a common issue in pregnant women in District Swat.

Keywords: Pregnancy, Anaemia, Haemoglobin, Swat.

1. INTRODUCTION

Iron is the fourth most plenteous component in the earth's crust [1]. In the world, the most related nutrient insufficiency is iron insufficiency. From iron insufficiency anaemia almost 500 to 600 million people are effected [2]. In pregnancy, iron supplementation is very essential and its supplementation had a defensive effect on adverse pregnancy outcomes [3]. Among pregnant women on an international level iron deficiency is the commonest nutritional insufficiency [4]. The metabolic processes include tissue oxygenation in that iron is a crucial component. An average individual has a total of 3-5 grams of iron. An average diet can supply up to 15 mg of iron per day. In several developed countries iron deficiency is the most common nutritional problem reaching an epidemic level worldwide. In Pregnancy, the risk of iron deficiency rises because pregnancy is related to increased demand for iron. Least iron stores in their newborn baby will increase the risk of iron deficiency. Further risk increases due to initially stopping breastfeeding and prematurity of reduced iron accumulation [5].

In pregnancy, the amount of haemoglobin and other red blood cells reduces because the volume of plasma is more than that of red blood cell mass. When there is a rise in red cell mass then the whole haemoglobin circulating also rises. This in turn depends relatively on the iron status of the individual. For pregnant women, the normal haemoglobin level is 12-16 g/dl and a value less than 12 is well-thought-out as iron deficiency and those less than 10.5 as anaemia. The pregnancies of anaemic women are less in duration than those of non-anaemic women. The absorption of iron can be influenced by several dietary factors [6]. The pregnant women having normal or high haemoglobin levels mean (>10 g/dl) gave birth to normal babies having weight (3.3 kg) while those having lower haemoglobin means (<10 g.dl) gave birth to babies having 2.6 kg weight [7]. In

Received: September 2022; Revised: November 2023; Accepted: December 2023
*Corresponding Authors: Naseer Ullah < naseer@uswat.edu.pk >

iron-deficient women, the haemoglobin level is decreased due to the incapability to increase plasma volume. The requirements for iron are more in pregnancy than in the non-pregnant state [8].

The normal haemoglobin level of healthy non-pregnant women is 12 g/dl. Pregnancy is a biotic situation and usually has no impact on the general health of a pregnant woman. However, pregnancy results in hormonal, hemodynamic and haematological changes. According to World Health Organization (WHO), haemoglobin should be retained at or above 11.0 g/dl and should not be allowed to fall below 10.5 g/dl in the second trimester. The normal iron supply for non-pregnant menstruating mature women is about 1.36 mg per day. The iron requirements are decreased in the 1st trimester because of an absence of menstruation. These rise subsequently as high as ≥10 mg/day. Iron requirements are increased in pregnancy, particularly in the 3rd trimester when there may be several times more than that in the early stages of the- pregnancy. In pregnancy, the total iron requirement is approximately 840 mmg [8].

Anaemia is a serious worldwide health problem. According to the World Health Organisation (WHO), anaemia is characterised to have haemoglobin (Hb) levels below 12.0 g/dl in females and below 13.0 g/dl in males [9]. Depending on the precise kind and degree of anaemia, several clinical signs and possible problems may be present. The expenditure for the treatment of anaemia varies according on the kind and severity of coexisting diseases, ranging from $29,511 for those with congestive heart failure to $7,092 for people with coexisting rheumatoid arthritis [10]. Further, anaemia decreased globally from 40.2% in 1990 to 32.9% in 2010, with a greater frequency of anaemia seen in females than in men and in those under the age of 5 [11]. The present study is aimed to determine the iron level and problems associated with iron deficiency in pregnant women in Swat District.

2. MATERIALS AND METHODS

2.1 Study Area

District Swat is in the north of Khyber Pakhtunkhwa Province and is famous for its pleasant beauty and culture. The district is lying in the lap of the offshoot of the Hindukush Mountainous Ranges, which are the sub-ranges of the world's greater Himalayan Ranges. District Swat includes seven tehsils: Kabal, Matta, Bahrain, Charbagh, Babozai, Barikot and Khwazakhela. The area of Swat is 5,337 km^2. According to the 2017 census population of swat is 2,309,570. Geographically District Swat lies at 35.2227° N, 72.4258° E [12].

2.2 Sample Size Collection and Questionnaire distribution

The data was collected from pregnant women by getting blood samples and by filling out questionnaires including the information: name, education, place, blood pressure, blood group, height, number of children, relation with husband, number of pregnancies, number of abortions, current pregnancy age, current Hb level, diet, any other disease, congenital abnormality and stillbirth. Random sampling was done from the local population.

2.3 Collection of blood

Venous blood was collected from each individual in a test tube containing ethylenediamine tetraacetic acid (EDTA). The blood samples were taken to the central laboratory for determination of haemoglobin by Sahli's method and Haematology Analyzer.

2.4 Sahli's Method

The haemoglobin tube (STD 14.5 gm=100% concentrated) was filled with N/10 hydrochloric acid (HCl) up to 2 gm marking. The graduated tube was placed in Sahli's hemoglobinometer. The Blood samples collected from capillary or venous blood were drawn in Sahli's pipette up to 20 micro litre mark and added to a haemoglobin tube containing N/10 HCl. Through a glass stirrer, the blood and acid were mixed and then allowed to stand for 5 minutes for the formation of acid hematin. In the comparator colour plates are present and for dilution of acid, hematin distilled water was added drop by drop till it matched with the standard colour plates of a comparator. The result was read as gms/dl present on the haemoglobin tube [13].

2.5 Haematology Analyzer

This is a very simple method used in laboratories. Blood samples collected from pregnant women

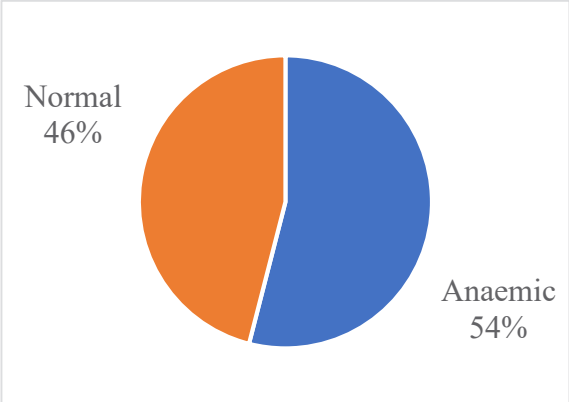

Fig. 1. Status of haemoglobin level in pregnant women.

in EDTA tubes were processed by an automated haematology analyzer. An automated haematology analyzer with an impedance method for complete blood count (CBC) measurement was used to measure Hb, mean corpuscular volume (MCV), and red blood count (RBC) [14].

2.6 Statistical Analysis

The data analysis was done by using SPSS software.

2.7 Ethical Approval

The oral and written consents was taken from the pregnant women from whom data and blood samples were taken.

3. RESULTS

A total of 800 samples were collected from pregnant women at District Swat among which 432 (54%) were anaemic as shown in Figure 1.

The highest number of samples were collected from the age group 26-30 (328) followed by the age group 21-25 (236) in which 160 and 132 cases were anaemic respectively. Samples collected from age group 41-45 were 8 which all were anaemic (Table 1). In our study, abortion was observed in 568 cases, and stillbirth in 92 cases as shown in Figure 2. The correlation between pregnancy age with HB status was also determined. Different observers belonged to different trimesters according to their pregnancy age. The pregnancy age of 124 observers was the first trimester, in which 54 were anaemic and 70

Table 1. Status of haemoglobin level in the different age groups of pregnant women.

Age groups	Normal (11.5 mg/dl)	Anaemic (<10.5 mg/dl)	Total number of observers
15-20	24	68	92
21-25	104	132	236
26-30	168	160	328
31-35	60	44	104
36-40	12	20	32
41-45	0	8	8
Total	368	432	800

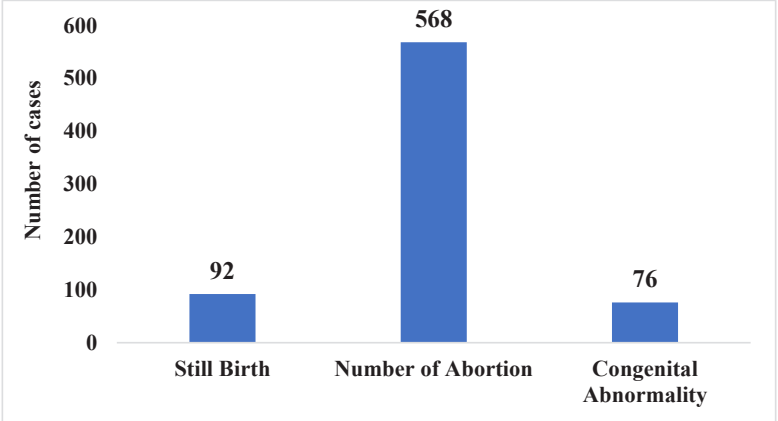

Fig. 2. Haemoglobin deficiency-related issues in pregnant women.

Table 2. Haemoglobin level in different pregnancy age groups.

Pregnancy age	Anaemic (<10.5 mg/dl)	Normal (11.5 mg/dl)	Total number of observers
First trimester	54	70	124
Second trimester	80	152	232
Third trimester	298	146	444
Total	432	368	800

Table 3. Relationship of body mass index with anaemia in Pregnant women.

Body mass index (BMI)	Anaemic (<10.5 mg/dl)	Normal (11.5 mg/dl)	Total number of observers
Normal Weight	34	58	92
Underweight	340	68	408
Overweight	34	58	92
Obesity	24	184	208
Total	432	368	800

were normal. The second-trimester pregnancy age group was comprised of 232 observers of which 80 were anaemic and 152 were normal. The third trimester age group consisted of a total of 444 individuals of which 298 were anaemic while 146 were normal (Table 2). The Body Mass Index was also determined. Total cases were divided into four groups, which were normal weight, underweight, overweight and obesity. The underweight group was more anaemic (83%) followed by normal weight and overweight (37%) (Table 3).

4. DISCUSSION

In the present study, data were collected from 800 pregnant women from a different region of Swat in which 54% of women had low HB levels because they were anaemic. The findings of the present study are similar to the one conducted in Nigeria [15]. Palupi *et al.* [6] carried a research work in developed countries and Raza *et al.* [8] in Mansehra and Abbottabad was nearly similar to our research work. The reports of Shobeiri *et al.* [16] were different from recent results as the cases in Mysore City were <4%. The reasons for the high anaemic ratio in the study area of the current research were the lack of knowledge about anaemia during pregnancy and the poor bioavailability of iron because the ratio of illiteracy is very high in women of District Swat. The work of Susanti *et al.* [14] in Jatinangor and West Java, showed that there were more anaemic observers (86.7%) as compared to the recent work because the said regions lie in the thalassemia belt area.

In the present study, the findings showed that age group that ranges from 40-45 was 100% anaemic followed by 15-20 (74%). Both groups show highly anaemic cases because they need more iron, calcium and other components which are necessary for their growth and development and when they become pregnant at this time then the need for the said components become increase. Due to which low iron stored in their body and cause iron deficiency and that's why more women were anaemic. Loy *et al.* [17] also reported the group-wise cases of Hb-deficient pregnant women in Singapore and their result was different because in their study age group range 25-34 was highly anaemic while the age group ≥35 was least anaemic. The reason was the routine measurement of plasma ferritin and nutritional issues due to which the absorption of iron may be affected.

The present study showed that underweight individuals were more anaemic (83%) while the obese were least anaemic (12%), the similar results were shown by Qin *et al*. [18] in Jiangsu Province, China. The second-trimester pregnancy age group was the least anaemic (34%) and the third-trimester pregnancy age group was the highly anaemic (67%) in our study while the work done by Ejeta *et al.* [19] also showed similar results in Western Ethiopia.

5. CONCLUSIONS

It is concluded from this study that deficiency of iron constitutes a serious and alarming health hazard to the mother and new-born. Both young and aged women are at risk of this problem. The underweight women are more affected due to this problem. Significant dangers to the health of both mothers and newborns are associated with this deficit. To address this issue and safeguard the health and safety of expectant mothers and their unborn children in the area, further efforts and interventions are required.

6. LIMITATIONS

Because of the study's limited sample size, the findings could not be a precise estimate of the district's overall population of pregnant women. Cultural barriers appeared between researchers and individuals, which may have an influence on the precision and thoroughness of the data obtained.

7. ACKNOWLEDGEMENT

The Authors acknowledge the Centre for Animal Sciences and Fisheries to provide the laboratory facilities.

8. ETHICAL STATEMENT

The study was conducted under the Declaration of PM & DC Professional Ethics and Code of Conduct, and the protocol was approved by the Ethics Committee of the University of Sawat.

9. CONFLICT OF INTEREST

The authors declare no conflict of interest.

10. REFERENCES

1. J. Aaseth, and B. Berlinger. Handbook on the Toxicology of Metals (Fifth Edition). *Academic Press* pp. 419–425 (2022).
2. P.M. Insel, R.E. Turner, and D. Ross (Eds.). Nutrition, 2nd Edition. *Jones and Bartlett Publishers, London, UK* (2014).
3. K.M. Rasmussen. Is there a causal relationship between iron deficiency or iron-deficiency anemia and weight at birth, length of gestation and perinatal mortality*? The Journal of Nutrition* 131(2): 590-603 (2001).
4. T.S. Palihawadana, I.M.R. Goonewardene, M.B.C. Motha, and H.S.A. Williams. Iron deficiency anaemia in pregnancy: diagnosis, prevention and treatment. *Sri Lanka Journal of Obstetrics and Gynaecology* 36(3): 61-65 (2014).
5. N.M. Abu-Ouf, and M.M. Jan. The impact of maternal iron deficiency and iron deficiency anemia on child's health. *Saudi Medical Journal* 36(2): 146–149 (2015).
6. P.D. Palupi, M.S.A. Khan, and K.K. Karseno. Antianemia supplementation combination with vitamin c on hemoglobin levels among pregnant women in primary health care center, jepara, indonesia*. Jurnal Farmasi Sains dan Komunitas (Journal of Pharmaceutical Sciences and Community)* 18(2): 95-101 (2021).
7. F.M. Tabrizi, and S. Barjasteh. Maternal hemoglobin levels during pregnancy and their association with birth weight of neonates. *Iranian Journal of Pediatric Hematology and Oncology* 5(4): 211 (2015).
8. N. Raza, I. Sarwar, B. Munazza, M. Ayub, and M. Suleman. Assessment of iron deficiency in pregnant women by determining iron status. *Journal of Ayub Medical College Abbottabad* 23(2): 36-40 (2011).
9. M.D. Cappellini, and I. Motta. Anemia in Clinical Practice-Definition and Classification: Does Hemoglobin Change With Aging? *Seminars in Hematology* 52: 261–269 (2015).
10. W.B. Ershler, K. Chen, E.B. Reyes. and R. Dubois. Economic burden of patients with anemia in selected diseases. *Value in Health: the Journal of the International Society for Pharmacoeconomics and Outcomes Research* 8: 629–638 (2005).
11. N.J. Kassebaum, R. Jasrasaria, M. Naghavi, S.K. Wulf, N. Johns, R. Lozano, M. Regan, D. Weatherall, D.P. Chou, T.P. Eisele, S.R. Flaxman, R.L. Pullan, S.J. Brooker, and C.J.L. Murray. A systematic analysis of global anemia burden from 1990 to 2010. *Blood* 123: 615–624 (2014).
12. M. Rafiq, A.A.G. Hassan, and M. Saeed. Perceptions of Returnees Concerning Their Rehabilitation and Reinstatement in Swat District, Pakistan: An Evaluative Study. *Journal of Population and Social Studies [JPSS]* 30: 354-376 (2022).
13. P. Balasubramaniam, and A. Malathi. Comparative study of hemoglobin estimated by Drabkin's and Sahli's methods. *Journal of Postgraduate Medicine* 38(1): 8 (1992).
14. A.I. Susanti, E. Sahiratmadja, G. Winarno, A.K. Sugianli, H. Susanto, and R. Panigoro. Low hemoglobin among pregnant women in midwives practice of primary health care, Jatinangor, Indonesia: iron deficiency anemia or β-thalassemia trait? *Anemia* 2017: 1-5 (2017).
15. O.O. Sholeye, V.J. Animasahun, and T.O. Shorunmu. Anemia in pregnancy and its associated factors among primary care clients in Sagamu, Southwest,

Nigeria: A facility-based study. *Journal of Family Medicine and Primary Care* 6(2): 323 (2017).
16. F. Shobeiri, K. Begum, and M. Nazari. A prospective study of maternal hemoglobin status of Indian women during pregnancy and pregnancy outcome. *Nutrition Research* 26(5): 209-213 (2006).
17. S.L. Loy, L.M. Lim, S.Y. Chan, P.T. Tan, Y.L. Chee, P.L. Quah, J.K.Y. Chan, K.H. Tan, F. Yap, and K.M. Godfrey. Iron status and risk factors of iron deficiency among pregnant women in Singapore: a cross-sectional study. *BMC Public Health* 19(1): 1-10 (2019).
18. Y. Qin, A. Melse-Boonstra, X. Pan, B. Yuan, Y. Dai, J. Zhao, M.B. Zimmermann, F.J. Kok, M. Zhou, and Z. Shi. Anemia in relation to body mass index and waist circumference among Chinese women. *Nutrition Journal* 12(1): 1-3 (2013).
19. E. Ejeta, B. Alemnew, A. Fikadu, M. Fikadu, L. Tesfaye, T. Birhanu, and E. Nekemte. Prevalence of anaemia in pregnant womens and associated risk factors in Western Ethiopia. *Food Science and Quality Management* 31(6): 82-91 (2014).