OPEN ACCESS
Saudi Journal of Biomedical Research
Abbreviated Key Title: Saudi J Biomed Res
ISSN 2518-3214 (Print) |ISSN 2518-3222 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Anemia and Hypoproteinemia in Sudanese Pregnant Women during the Second and Third Trimester

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DOI: 10.36348/sjbr.2021.v06i09.001 | **Received:** 01.08.2021 | **Accepted:** 02.09.2021 | **Published:** 03.09.2021

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Abstract

Objectives: The aim of this study was to investigate the concentration of hemoglobin, ferritin, albumin, total protein and globulin in pregnant Sudanese women to assess the presence of anemia and hypoproteinemia in the second and third trimester. ***Materials and method:*** A total of 100 pregnant women were attended at Almadina Arab Hospital in Gezira state, Sudan in the period from December 2017 to February 2018. Their ages ranged from 19 to 37 years old, and they were divided into two groups: second trimester and third trimester. Venous blood samples were drawn from each participant to determine hemoglobin, ferritin, albumin, globulin, and total protein levels using a Spectrophotometric method by an automated analyzer (Biosystem A25), and globulin was determined by calculation. The statistical package for social science (SPSS) software version 20 was used to analyze data. ***Result:*** In both the second and third trimesters, the mean concentration of measured biochemical parameters were decreased, with no significant difference between the two groups however, the means of ferritin levels were normal. Hemoglobin mean levels were (10.784±1.143 and 10.968±1.570), total protein mean levels were (6.632±0.701 and 6.644±0.631), albumin mean levels were (3.204±0.423 and 3.254±0.420), and globulin mean levels were (3.444±0.661 and 3.390±0.611) in the second and third trimesters, respectively. The mean levels of ferritin were (36.900±1.458 and 39.300±1.591) in the second and third trimesters, respectively. ***Conclusion:*** Pregnant Sudanese women in their second and third trimesters were found to have anemia and hypoprotienemia.

Keywords: Anemia, hypoproteinemia, Sudan, Ferritin, Hemoglobin, Pregnant women, Malnutrition.

INTRODUCTION

Malnutrition is a major health problem in developing countries affects particularly pregnant women and children (Muller & Krawinkel, 2005). It is estimated that about 23.5% of women are suffering of malnutrition during pregnancy in Africa (Desyibelew & Dadi, 2019). Low income, rural residency, low educational level, repeated pregnancies with no space, recurrent illnesses, and food insecurity are all linked to the risk of maternal malnutrition (Ahmed, Hossain, & Sanin, 2012; Desyibelew & Dadi, 2019; Gebre, Biadgilign, Taddese, Legesse, & Letebo, 2018; Uthman & Aremu, 2008).

The nutrient intake and dietary planning of macro- and micronutrient influence the nutritional status of pregnant women (Marangoni *et al*., 2016). Protein requirement increases during early and late stages of pregnancy to support protein synthesis, in order to maintain maternal tissues and fetal growth (Elango & Ball, 2016). Remarkable protein and albumin deficiency was found in pregnant women in the second and third trimesters, predominantly in those from rural and semirural areas (Gomez-Cantarino, Agullo-Ortuno, de Dios-Aguado, Ugarte-Gurrutxaga, & Bouzas-Mosquera, 2020).

The physiological changes during pregnancy results in hematology profile alteration (Chandra, Tripathi, Mishra, Amzarul, & Vaish, 2012), including hemoglobin dilution due to the expanding serum component of the blood (Bernstein, Ziegler, & Badger, 2001). Consequently, by the late second trimester,

hemoglobin levels have dropped by 1–2 g/dL and stabilizes again in the third trimester (Chandra *et al*., 2012). Women should be screened for anemia during pregnancy (Short & Domagalski, 2013) because it have adverse effect on mother and her baby (Chumak & Grjibovski, 2010; Kant *et al*., 2018; Mahmood *et al*., 2019) . The diagnostic tools of iron deficiency anemia are low iron stores and a decrease of hemoglobin level two standard deviations below normal (Short & Domagalski, 2013). Ferritin is a protein reflects iron stores and is the most accurate test to diagnose iron deficiency anemia with a cutoff point 30 µg/L (van den Broek, Letsky, White, & Shenkin, 1998).

Despite of the presence of predisposing factors contributing to maternal malnutrition, little information is available about the nutritional status and presence of anemia in pregnant women residing in Almadina Arab-Al- Gezira state in Sudan.

MATERIAL AND METHODS

STUDY SUBJECT, DESIGN AND AREA

A cross-sectional study conducted in Almadina Arab hospital, Gezira state, Sudan. A total of 100 pregnant women their ages range 19-37 years were enrolled in this study, 50 of them were in the second trimester while the remaining in the third trimester.

INCLUSION CRITERIA

Pregnant women in their second or third trimester attending Almadina Arab hospital in the period from December 2017 to February 2018 were included in the present study.

EXCLUSION CRITERIA

Pregnant women with signs indicating malaria, fever, and have chronic diseases like hypertension; diabetes mellitus and HIV infection were excluded from the study.

STUDY PROCEDURE

Five ml of venous blood samples were collected from each subject in EDTA tube (whole blood) to estimate Hemoglobin and plain tube (serum) for estimation of total protein and albumin, globulin and ferritin. Biochemical analysis of hemoglobin was done using Cyanmethemoglobin spectrophotometric method. The other selected parameters (ferritin by turbidimetric method, total protein by Biuret Method and albumin by Bromcresol green method) were estimated by an automated analyzer Biosystem A25. Globulin was calculated as the difference between the total protein and albumin concentrations. Pregnant women considered anemic when they have a hemoglobin concentration < 11g/dL according to WHO reference value. The cutoff points of plasma total protein used is 6.4–8.3 g/dL and 3.4–4.8 g/dL for plasma albumin, respectively (Gomez-Cantarino *et al*., 2020).

ETHICAL APPROVAL

The present study was approved by the ethics committee of the Faculty of Medicine University of Gezira; all participants were obtained a written consent before the collection of blood samples.

DATA ANALYSIS

The data was analyzed using statistical package for social science (SPSS) software version 20. Comparison of the means was done by applying the two sample t-student test, the results were expressed as mean ± standard error, with $p \leq 0.05$ considered statistically significant.

RESULTS AND DISCUSSION

The mean age in the second trimester group was (27.10±0.750), while it was 27.50±698 in the third trimester group. The means of reproductive data including number of pregnancies, gestational age, and gestations interval in Table 1.

Table-1: General characteristics of the study group

Parameter	Second trimester	Third trimester
Age (years)	27.10±0.750	27.50±698
Number of pregnancies (pregnancy)	2.12±0.175	2.14±0.121
Gestational age (weeks)	17.24±0.463	30.00±0.426
Gestations interval (year)	1.32±0.147	1.58±0.134

Data are expressed as mean±SEM, SEM= standard error of the mean

Ferritin level was lower in the second trimester (36.900±1.458) in comparison to the third trimester (39.300±1.591) with p value=0.269, hemoglobin level was (10.784±1.143) lower in the second trimester than in the third trimester (10.968±1.570) with no significant difference. However the mean of total protein, albumin and globulin level showed no significant difference in the two groups (Table 2).

Table 2: Mean concentration of hemoglobin, ferritin, total protein, albumin and globulin in pregnant women in the second and third trimesters

Parameter	Second trimester	Third trimester	P value
Hemoglobin (g/dL)	10.784±1.143	10.968±1.570	0.346
Ferritin (ng/mL)	36.900±1.458	39.300±1.591	0.269
Total Protein (g/dL)	6.632±0.701	6.644±0.631	0.899
Albumin (g/dL)	3.204±0.423	3.254±0.420	0.404
Globulin (g/L)	3.444±0.661	3.390±0.611	0.550

Data are expressed as mean±SEM, SEM= standard error of the mean, P value=probability

The comparison between means of hemoglobin, ferritin, total protein, albumin and globulin levels with parity =1 and parity >1in the second and third trimester were presented in Table 3. Hemoglobin and ferritin levels were lower in the second trimester in pregnant women with parity=1 (10.94±0.35), (34.80±3.50) compared to women with parity>1 (11.08±0.17), (40.42±1.70), respectively but the p value did not reach the level of significance. In the third trimester also the level of hemoglobin and ferritin were lower in pregnant women with parity=1 (10.52±0.21), (33.17±2.74) than those with parity >1 (10.92±0.13), (38.81±1.63), respectively with no significant difference. Regarding number of parities, other parameters were similar in the second and third trimester.

Table-3: Comparison of mean concentration of ferritin, total protein, albumin and globulin in the second and third trimester with number parity

Parameter	Second trimester			Third trimester		
	Parity=1	Parity>1	P value	Parity=1	Parity>1	P value
Hemoglobin (g/dL)	10.94±0.35	11.08±0.17	0.153	10.52±0.21	10.92±0.13	0.114
Ferritin (ng/mL)	34.80±3.50	40.42±1.70	0.174	33.17±2.74	38.81±1.63	0.088
Total protein (g/dL)	6.88±0.15	6.58±0.07	0.097	6.62±0.89	6.63±0.96	0.869
Albumin (g/dL)	3.24±0.09	3.25±0.04	0.874	3.15±0.07	3.22±0.05	0.443
Globulin (g/L)	3.64±0.17	3.32±0.06	0.119	3.45±0.09	3.43±0.08	0.863

Data are expressed as mean±SEM, SEM= standard error of the mean, P value=probability

Worldwide a percentage of 41.8% of the pregnant women were affected by anemia (McLean, Cogswell, Egli, Wojdyla, & de Benoist, 2009). Centers for Disease Control and Prevention (CDC) has defined anemia in pregnancy as hemoglobin level of less than 11g/dL during the 1st and third trimesters and less than 10.5g/dL during the second trimester (Api, Breyman, Cetiner, Demir, & Ecder, 2015; Centers for Disease, 1989). In our study the mean level of hemoglobin for women in the second and third trimester was less than the normal level indicating the presence of anemia. Our results were consistent with (Bodeau-Livinec *et al*., 2011; Ogbodo *et al*., 2012). A longitudinal study revealed that pregnancy decreases hemoglobin level reaching the lower concentrations during labor (Feleke & Feleke, 2020), iron requirement increases progressively during second and third trimesters of pregnancy to encounter the fetus and mother needs (Bothwell, 2000) hence prenatal care and iron supplementation are required. Many factors are associated with anemia in pregnant women (Ferreira Hda, Moura, & Cabral Junior, 2008).

Low hemoglobin levels may not reflect the iron stores, however serum ferritin is the best marker and its level decreases early in iron deficiency anemia (Adediran *et al*., 2011) especially in pregnant women (Puolakka, Janne, Pakarinen, & Vihko, 1980; Qureshi, 1988). Although the mean hemoglobin levels were decreased in the present study, the mean levels of serum ferritin were normal in third and second trimester indicating normal iron stores in both stages of pregnancy, this was in agree with (Adediran *et al*., 2011). These results may indicate the presence of infectious disease (Api *et al*., 2015) and could be explained by the study area - Gezira state, central Sudan- is a rural area characterized by high incidence of malaria parasitic infection and its deleterious effect on pregnancy and its outcome including maternal and perinatal mortality (Elhassan, Mirghani, & Adam, 2009; Mohammed *et al*., 2013)

Total protein and albumin levels are good biochemical markers to evaluate the nutritional status of individuals. Hypoproteinemia usually associated with hypoalbuminemia or dietary protein restrictions, as well as it is a cause of poor quality of life (Soeters, Wolfe, & Shenkin, 2019). The present study found a decrease in the mean level of total protein and albumin with no difference between the levels in second and third trimesters, same result was found by (Ogbodo *et al*., 2012). During pregnancy, the low levels of albumin may result of the dilution effect of blood component or proteinuria, however, in third trimester of pregnancy, the decreased level of serum albumin may associated with increased maternal and infant mortality and morbidity (Sufrin, Nessa, Islam, Das, & Rahman, 2015).

LIMITATIONS

The current study was a cross-sectional study design included 100 pregnant women. Hemoglobin and ferritin concentrations were used to measure the presence of anemia in those pregnant women. Another study with large number of pregnant women including other hematology parameters is recommended to confirm our results

RECOMMENDATIONS

Dietary supplement is advisable.

CONCLUSION

Anemia and hypoprotenimia was reported in Sudanese pregnant women in second and third trimester.

ACKNOWLEDGEMENTS

We would like to provide special thanks to all participants, especially pregnant women of Almadina Arab hospital Gezira state, Sudan for sharing us this study.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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