Effect of gestational anemia on fetal biometry

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Abstract: Background: Anemia has been long considered as a very important nutritional disorder worldwide. More than half of women wide-reaching get anemia during their pregnancy. Anemia has many shocking effects on pregnancy outcomes such as preterm delivery, and low down fetal growth. **Aim:** This study was meant to compare the fetal biometric parameters in anemic pregnant women with non-anemic ones during 2nd and 3rd trimesters of gestation. **Methods:** The study was conducted in the department of obstetrics and gynecology at Al-Elwiya Teaching Administrative Hospital. It included 40 pregnant mothers at gestational age ranging between 20wk-40wk. Twenty of these women were having anemia (Hb<11.0 g/dl) and other twenty were non-anemic (Hb ≥11.0 g/dl). Maternal Hb level was correlated with fetal biometry (BPD, FL, AC) plus AFI measured by ultrasonography. **Results:** The mean maternal Hb value as well as BPD, FL, and AC of the fetus in non-anemic pregnant women were significantly higher than that in anemic pregnant women, while there was no significant difference in the AFI measurement between the two groups. **Conclusion:** Maternal anemia during pregnancy evidently affects the fetal biometry having significant negative effects on fetal BPD, FL, and AC, while no correlation was found between maternal anemia and AFI.

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Keywords: Biparietal diameter (BPD), Femur length (FL), Abdominal circumference (AC), Amniotic fluid index (AFI), Hemoglobin (Hb).

1. Introduction:

Anemia has been judged as an exceptionally important nutrition disorder worldwide. Indeed, incidence of anemia in pregnancy is reasonably high with various negative effects on pregnancy and fetal growth. Physiological reduction in hemoglobin (Hb) is a must in the mid-trimester, which is attributed to increase in plasma volume, leading to decrease in blood viscosity [1].

Anemia generally begins as abnormalities in red blood cell indices preceding the reduction in hemoglobin levels [2]. Iron deficiency usually develops slowly with time, then, once iron stores are completely depleted, the iron accessibility to the tissues decline leading to symptomatic anemia [3]. According to WHO, pregnancy anemia exists if Hb is lower than 11.0 g/dL [4]. Low Hb concentration during pregnancy is associated with increased risk for preterm delivery as well as low birth weight baby and infantile iron deficiency [5, 6]. It reduces the oxygen supply to the fetus which can lead to fetal blood flow redistribution [7]. Fetal biometry with the help of Ultrasound scanning provides the most reliable information about the fetal growth. There are multiple fetal biometric parameters in use. But the more frequently used parameters in the third trimester are: biparietal diameter (BPD), head circumference (HC), femur length (FL) and abdominal circumference (AC). The BPD remains the standard one, against which other parameters are compared at a given gestational age; for assessment of gestational age (GA) and fetal weight. Femur length is a very useful biometric parameter in the 2nd and 3rd trimesters of pregnancy after 14 weeks of gestation [8]. Abdominal circumference is less used for the assessment of GA, but it is practical for monitoring fetal growth and weight, especially in 3rd trimester [9].

Amniotic fluid acts as a protective layer with cushion-like effect for the growing fetus against mechanical and biological injuries. It provides a mean for fetal environment examination and its assessment is especially vital in antenatal evaluation principally at 3rd trimester [10, 11].

2. Materials and methods

The present study was carried out in the department of obstetrics and gynaecology at Al-Elwiya Teaching Administrative Hospital which included 40 Iraqi pregnant women having of 20-35 years old with gestational age 20wk-40wk determined depending on the first day of the last menstrual period as well as ultrasound examination [12, 13].

Twenty of these women were anemic (hemoglobin <11.0 g/dl) and other twenty were non-anemic (hemoglobin ≥11.0 g/dl); the anemia was defined according to the WHO criteria [4]. As indices for fetal growth; the biparietal diameter (BPD), femur length (FL) and abdominal circumference (AC) also evaluation of liquor level were assessed by ultrasonography.

Exclusion criteria

Pregnant women with one of the following criteria were excluded:

-Diabetes mellitus
-hypertension
- Diagnosed renal, liver or heart disease
- TORCH infection
- Hemoglobinopathies (like Thalasssemia).

Statistical analysis of data was carried out using (SPSS Version 20). Significance of variances was assessed using T-test and a P value ≤ 0.05 was considered to be significant.

3. Results

The data of Hb value in anemic and non-anemic pregnant women were shown in (Table 1).

Table 1: Comparison of Hb value in anemic and non-anemic pregnant women

Studied group	No.	Hb (g/dl) (Mean ± SE)
Non-anemic pregnant women	20	12.05 ± 0.10
Anemic pregnant women	20	9.48 ± 0.14*

-Results were expressed in mean±SE of 20 women.

-The difference between the 2 groups was statistically significant

(*= P <0.0001).

Measurements (fetal biometry):

Fetal biparietal diameter (BPD)

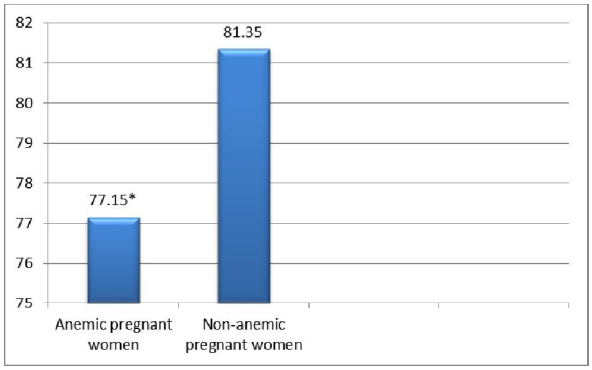

Figure 1: Fetal BPD of anemic and non-anemic pregnant women

-Results were expressed in mean±SE of 20 women.

-The difference between the 2 groups was statistically significant

(*= P <0.05).

The mean fetal BPD of non-anemic pregnant women (control group) was 81.35±3.47 mm, while at the group of anemic pregnant women; it was 77.15±3.68 mm. as shown in (Figure 1).

Fetal abdominal circumference (AC)

The mean fetal AC of non-anemic pregnant women (control group) was 27.00±1.40 cm, whereas in group of anemic pregnant women it was 25.25±1.37 cm. as shown in (Figure 2).

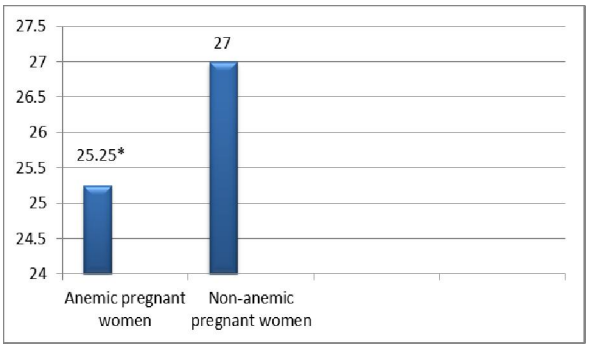

Figure 2: Fetal AC in anemic and non-anemic pregnant women

-Results were expressed in mean±SE of 20 women.

-The difference between the 2 groups was statistically significant (*= P <0.05).

Fetal femur length (FL)

The mean of the fetal FL within the group of non-anemic pregnant women was 59.05±2.98 mm, whilst in the group of anemic pregnant women; it was 56.90±3.49 mm. as shown in (Figure 3).

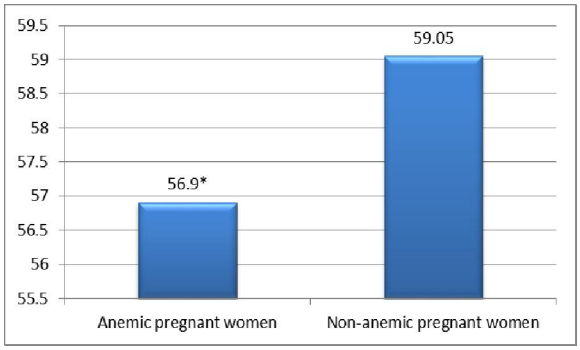

Figure 3: Compare of fetal FL within anemic and non-anemic pregnant women

-Results were expressed in mean±SE of 20 women.

-The difference between the 2 groups was statistically significant (*= P <0.05).

Assessment of amniotic fluid index (AFI)

The mean of the AFI within the group of non-anemic pregnant women was 13.50±0.47 cm, while in the group of anemic pregnant women; it was 13.40±0.75cm. There was no significant difference between the means of these two groups, as shown in (Table 2).

Table 1: AFI in non-anemic and anemic pregnant women

Studied group	No.	AFI (cm) (Mean ± SE)
non-anemic pregnant women	20	13.50 ± 0.47
Anemic pregnant women	20	13.40 ± 0.75 N.S.

-Results were expressed in mean±SE of 20 women.

-The difference between the 2 groups was statistically non significant (P =0.911).

4. Discussion

Al-Elwiya Teaching Administrative hospital was selected because it is one of the chief hospitals in Iraq specialized in obstetrics and gynecology having such overcrowded labor admissions; according to authorized records of Iraqi ministry of health. At this work; the Fetal biometric measurements were selected since they are regarded as dependable approaches to assess fetal normal growth in order to prepare for fast supervision of the "at high risk fetuses"; so as to help in decreasing the frequency of detrimental postnatal mortal outcomes [14,15]. Anemia was chosen because it is still an important health debate [16]. Ultrasound was used because it is none the less a very good tool for evaluation of fetal safety [17].

The results of the present study were in line with previous studies which affirmed that anemia in pregnant women was associated with increased risk of fetal growth restriction [18]. Furthermore; Kaur *et al.* [19] found that mean weight and femur length of the fetus differ significantly in anemic and non-anemic pregnant women. Also, [20] found that anemia can be a direct cause of decline in fetal growth due to lack of oxygen flow to placental tissue. A decrease in maternal Hb could play a role in restricting growth in fetus without doubt [21] and maternal anemia is able to determine alterations in fetal biometry [22]. Other study by [5] concluded that mid-trimester drop in Hb is a very essential physiological arrangement, and keeping the Hb level at optimal levels throughout the pregnancy would yield best neonatal outcome regarding prematurity and low birth weight. Furthermore, [23] found that fetuses of mothers with iron supplementation get biparietal diameter and abdominal circumference greater than fetuses of mothers without iron supplementation. [24, 25] concluded that maternal under nutrition and anemia was associated with reduced biparietal diameter of the fetus. Anemia during pregnancy affects the anthropometric measurement of a fetus. Severe anemia had significant negative effect on fetal anthropometric measurements and fetal biometry as well as fetal weight.

A study by [7] reported that fetal biometry (BPD, FL) and fetal weight were significantly lower in severe anemia group. Another study by [26] concluded that mean amniotic fluid index (AFI) in patients with anemia was not significantly different from patients without anemia, just like our ongoing study. The study done by [27, 28] stated that early pregnancy anemia is associated with an increased risk of low femur length. [29] revealed that one of the most frequent causes of anemia is iron deficiency, so that low to moderate dose iron supplementation in early pregnancy benefits growth of the fetus. Also, [30] reported that increasing the Hb in pregnancy by iron supplementation is required in order to have better pregnancy outcome. Some studies showed that most of the countries have adopted the policy of supplementing pregnant women with iron and folic acid with a view that increasing the Hb levels has some beneficial effect. On the other hand, the research was demonstrated that the amniotic fluid index was significantly lower in severe anemia group [7, 31].

The results of this study concluded that maternal anemia can effectively decreased fetal biparietal diameter, femur length and abdominal circumference, while no correlation was found between maternal anemia and AFI. Since maternal anemia is reported to be one of the commonest maternal causes of fetal growth restriction, perinatal morbidity, mortality and long term effect, so that we need a public health strategies to educate the population as to the need for a healthy diet and iron supplementation before conception, or at least at the beginning of the pregnancy.

References

1. Weinstein, J. R.; Thompson, L. M.; Diaz Artiga, A.; Bryan, J. P.; Arriaga, W. E.; Omer, S. B. & McCracken, J. P. (2018) Determining gestational age and preterm birth in rural Guatemala: A comparison of methods. PLoS One. 13(3): e0193666.
2. Burke, R.M.; Leon, J.S. & Suchdev, P.S. (2014) Identification, prevention and treatment of iron deficiency during the first 1000 days. Nutrients. 6(10):4093-4114.

3. Abu-Ouf, N.M. & Jan, M.M. (2015) The impact of maternal iron deficiency and iron deficiency anemia on child's health. Saudi Med. J. 36(2): 146-149.
4. WHO. Vitamin and mineral nutrition information system. Geneva: World Health Organization; 2011. Hemoglobin concentrations for the diagnosis of anemia and assessment of severity.
5. Kumar, J.K.; Asha, N.; Murthy, D.S.; Sujatha, M.S.; Manjunath, V.G. (2013) Maternal anemia in various trimesters and its effect on newborn weight and maturity: an observational study. Int. J. Prev. Med. 4(2): 193-199.
6. Haggaz, A.D.; Radi, E.A.; Adam, I.; (2010) Anemia and low birth weight in western sudan. Trans R. Soc. Trop Med. Hyg. 104: 234-236.
7. Stefanović, M.; Milosavljević, M.; Radović-Janošević, D.; Kutlešić, R. & Vukomanović, P. (2005) Maternal anemia and fetal cerebral hemodynamic response-doppler assessment. Medicine and Biology.12 (2): 93 – 96.
8. O'Gorman, N. & Salomon, L.J. (2018) Fetal biometry to assess the size and growth of the fetus. Clinical Obstetrics & Gynaecology. 49: 3-15.
9. Greenberg, Victoria MD & Jain, Vanita MD (2017) Does a Large Fetal Abdominal Circumference in Women Without Diabetes Predict Adverse Outcomes? [5P] Obstetrics & Gynecology. 129.
10. Kofinas, A. & Kofinas, G. (2006) Differences in amniotic fluid pattern and fetal biometric parameters in third trimester pregnancies with and without diabetes. J. Matern. Fetal Neonatal Med. 19(10):633–638.
11. Fuchs, Florent AU; Aouinti, Safa AU; Souaied, Manel AU; Keller, Valentin AU & Picot, Marie-Christine AU; Fries, Nicolas AU; Ayoubi, Jean-Marc AU & Picone, Olivier PY (2018) Association between amniotic fluid evaluation and fetal biometry: a prospective French "Flash" study. Scientific Reports. 8: 7093.
12. Beddow, Meghan, E., MD; Blue, Nathan, R., MD; Savabi, Mariam, MD MPH; Katukuri, Vivek, R., MD; Fritts, Cody, BS & Chao, Conrad, R., MD (2018) Ultrasound Prediction of Small-for-Gestational Age at Birth: The More, the Merrier? [39Q]. Obstetrics & Gynecology.131:194S.
13. Gernand, A.D.; Paul, R.R.; Ullah, B.; Taher, M.A.; Witter, F.R.; Wu, L. et al. (2016) A home calendar and recall method of last menstrual period for estimating gestational age in rural Bangladesh: a validation study. J. Health Popul. Nutr. 35(1): 34.
14. Rami Kilani, P.; Aleyadeh, W.; Abu Atieleh, L; Al Suleimat, Abdul Mane; Khadra, M. & Hawamdeh, H.M. (2018) Inter-observer variability in fetal biometric measurements. Taiwanese Journal of Obstetrics and Gynecology 57(1):32-39.
15. aliūnas, B.; Bartkevičienė, D.; Drąsutienė, G.; Utkus, A. & Kurmanavičius, J. (2017) Fetal biometry: Relevance in obstetrical practice**.** Medicina. 53(6): 357-364.
16. Feleke, B.E. & Feleke, T.E. (2018) Pregnant mothers are more anemic than lactating mothers, a comparative cross-sectional study, Bahir Dar, Ethiopia**.** BMC Hematol. 18: 2.
17. Skalkidou, A.; Kullinger, M.; Georgakis, M.K.; Kieler, H. & Kesmodel, U.S. (2018) Systematic misclassification of gestational age by ultrasound biometry: implications for clinical practice and research methodology in the Nordic countries. Acta. Obstet. Gynecol. Scand. 97(4): 440-444.
18. Unger, H.W.; Ome-Kaius, M.; Karl, S.; Singirok, D.; Siba, P.; Walker, J.; Wangnapi, R.A.; Mueller, I. & Rogerson, S. J. (2015) Factors associated with ultrasound-aided detection of suboptimal fetal growth in a malaria-endemic area in Papua New Guinea. BMC Pregnancy and Childbirth.15:83.
19. Kaur, M.; Chauhan, A.; Manzar, M.D. & Rajput, M.M. (2015) Maternal Anaemia and Neonatal Outcome: A Prospective Study on Urban Pregnant Women. J.C.D.R. 9(12): QC04-QC08.
20. Yildiz, Y.; Ozgü, E.; Unlu, S.B.; Salman, B. & Eyi, E.G. (2014) The relationship between third trimester maternal hemoglobin and birth weight/length; results from the tertiary center in turkey. J. Matern. Fetal Neonatal Med. 27(7):729-732.
21. Sawant, L.D. and Venkat, S. (2013) Comparative analysis of normal versus fetal growth restriction in pregnancy: the significance of maternal body mass index, nutritional status, anemia, and ultrasonography screening. International Journal of Reproductive Medicine. 2013: 6pages.
22. Capra, L.; Tezza, G.; Mazzei, F. & Boner, A. (2013) The origins of health and disease: the influence of maternal diseases and lifestyle during gestation. Ital. J. Pediatr. 39: 7.
23. Hwang, J.Y.; Lee, J.Y.; Kim, K.N.; Kim, H.; Ha, E.H.; Park, H.; Ha, M.; Kim, Y.; Hong, Y. C. & Chang, N. (2013) Maternal iron intake at mid-pregnancy is associated with reduced fetal growth: results from Mothers and Children's Environmental Health (MOCEH) study. Nutr. J. 12: 38.
24. Rijken, M.J.; Papageorghiou, A.T.; Thiptharakun, S.; Kiricharoen, S.; Dwell, S.L.;

Wiladphaingern, J.; Pimanpanarak, M.; Kennedy, S.H.; Nosten, F. & McGready, R. (2012) Ultrasound evidence of early fetal growth restriction after maternal malaria infection. PLoS One. 7(2): e31411.
25. Figueiredo, A.C.M.G.; Gomes-Filho, I.S.; Silva, R.B.; Pereira, P.P.S.; Da Mata, F.A.F.; Lyrio, A.O.; Souza, E.S.; Cruz, S.S. & Pereira, M.G. (2018) Maternal Anemia and Low Birth Weight: A Systematic Review and Meta-Analysis. Nutrients. 10(5): 601.
26. Madaan, S.; Mendiratta, S.L.; Jain, P.K. & Mittal, M. (2015) Aminotic Fluid Index and its Correlation with Fetal Growth and Perinatal Outcome. J. Fetal Med. 2: 61-67.
27. Sholl, T.O. & Hediger, M.L. (1994) Anemia and iron deficiency anemia: compilation of data on pregnancy outcome. Am. J. Clin. Nutr. 59: 492S-501S.
28. Rahmati, S.; Delpishe, A; Azami, M; Hafezi Ahmadi, M.R. & Sayehmiri, K. (2017) Maternal Anemia during pregnancy and infant low birth weight: A systematic review and Meta-analysis**.** Int. J. Reprod. Biomed. (Yazd) 15(3): 125–134.
29. Cogswell, M.E.; Paravnta, I.; Ickes, L.; Yip, R. & Brittenham, G.M. (2003) Iron supplementation during pregnancy, anemia and birth weight: a randomized controlled trial. Am. J. Clin. Nutr. 78: 773-781.
30. Pena-Rosas, J.P. & Viteri, F.E. (2006) Effects of routine oral iron supplementation with or without folic acid for women during pregnancy. Cochrane Database Syst. Rev. 3: CD004736.
31. Tunkyi, K. & Moodley, J. (2018) Anemia and pregnancy outcomes: a longitudinal study. J. Matern. Fetal Neonatal Med. 31(19): 2594-2598.

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