



## Hemoglobin Concentration Level during Pregnancy and Its Association with Birth Weight

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### Authors' contributions

This work was carried out in collaboration between all authors. Author GV designed the study, wrote the protocol, analyses of the study and wrote the manuscript. Author SK managed the field study, authors MB and MS supervised and collected the data. All authors read and approved the final manuscript.

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### ABSTRACT

**Introduction:** The study aimed to assess the relationship between early pregnancy Hemoglobin (Hb) concentration and weight gain status in pregnant women and birth weight.

**Material and Methods:** This is a retrospective study that was carried out on the 1994 under-five-year children. Among 118 villages in Gorgan and Aq-Qala districts, 20 villages were chosen by random sampling. Birth weights, birth stature, means of Hb in early pregnancy and maternal weight gain during pregnancy have been recorded by health care file available from Primary Health Care System. Hb concentration divided in three classifications: Low (Anemia) =Hb<11 g/dl, Normal= 11-12.4 g/dl and High>=12.5 g/dl (11). SPSS 16.0 software was used for statistical data analysis.

**Results:** The mean and standard deviation of maternal serum Hb, birth weight and weight gain during pregnancy were 12.0±1.1g/dl, 3.3±0.5 kg, and 10.5±4.1kg, respectively. Anemia

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(Hb<11g/dl) was common in 16.8% (336 cases) of mothers in gestational period. The mean of weight gain in first, second and third trimesters and in eighth and in ninth months in pregnancy have significantly positive association with serum Hb concentration (P=0.001). However birth weight was not statistically significant differences among three Hb groups. Totally, weight gain during pregnancy was 10.50 kg with lower rate in anemic group (11>Hb g/dl).

**Conclusion:** Low Hb concentration during pregnancy is a main health problem in rural area in the north of Iran. The positive association between serum Hb concentration and weight gain was seen in pregnancy, while it was not significant association with birth weight.

*Keywords: Hemoglobin; pregnancy; birth weight.*

## 1. INTRODUCTION

Anemia has been known as a main health problem in pregnancy [1]. Smoking, inadequate prenatal care, low pregnancy BMI, multiparity, low age, infection with sexually transmitted disease were significantly associated with lower Hemoglobin (Hb) [2]. Pica practices are significantly associated with lower maternal hemoglobin concentration at delivery but they are not associated with pregnancy outcomes [3].

Severe anemia is associated with the risk of low birth weight (LBW), spontaneous abortion, premature birth and fetal death in pregnant women [3,4,5] and serum Hb concentration both in low and high levels is an indicator for possible pregnancy complications outcome and elevated Hb (>14.4 g/dl) during pregnancy resulted with poor plasma volume expansion and should not be mistaken for good iron status [6]. The association between maternal anemia and birth weight have been approved in previous studies [7,8].

In a study in Nepal [9], severe anemia and Ht<24% have been increased the risk of LBW and preterm delivery, but they were not shown in Ht>40% groups. In other studies [2,10] a U-shaped distribution was found between Hb concentration and adverse birth outcomes in pregnant women.

Of 1, 7 million populations in the Golestan province (north of Iran and southeast of Caspian Sea), 586640 person are living in Gorgan and Aq-Qala districts. The proportion of rural residence in two areas is 25.6% and 69.3%, respectively. Agriculture is the main job in rural area and different ethnic groups such as Fars-native, Turkman and Sisstani are living in this region [11].

Regards to anemia as a health problem in pregnant women in the north of Iran [12] this

study has been designed. The main aim of this study is determine relationship between early pregnancy Hb concentration and weight gain status in pregnant women and birth weight.

## 2. MATERIALS AND METHODS

This is a retrospective study that carried out on the 1994 under –five-children. With resumption of 18% prevalence rate of anemia in pregnant women [12], a confidence level of 95% and a maximum marginal error about 0.02, the sample size was calculated at least 1417 subjects. Among 118 villages in Gorgan and Aq-Qala districts, 20 villages were chosen by random sampling. All of under-five-children in these villages have been studying. Socio-demographic characteristics were recorded by 20 trained interviewers using a questionnaire. Birth weight , birth stature, mean of Hb in early pregnancy, maternal weight in first, second and third trimesters and in eighth and ninth months of pregnancy have been recorded by health care file available from Primary Health Care System.

Hb concentration divided in three classifications: Low (Anemic) =Hb<11 g/dl, Normal= 11-12.4 g/dl and High>=12.5 g/dl [13].

SPSS 16.0 software was used for statistical data analysis. We used the t-test and ANOVA for comparing of mean of groups and P-value under 0.05 included significations. Subjects, who were not interested to contribute, have been excluded from this study.

This study was approved by Ethical Research Committee of Golestan University of Medical Sciences (G-P-35-1112). Verbal informed consent was received from all cases.

## 3. RESULTS

The mean and standard deviation of maternal serum Hb, birth weight, birth stature and weight

gain during pregnancy were 12.0±1.1 g/dl, 3.3±0.5 kg, 49.9±2.5 cm and 10.5±4.1 kg, respectively. Anemia (Hb<11g/dl) was common in 16.8% (336 cases) of mothers in gestational period (Table 1).

The mean of maternal weight during pregnancy compared with serum Hb concentration present in Table 2. The mean of weight gain in first, secondary and third trimesters and in eighth and in ninth months in pregnancy have significantly positive association with serum Hb concentration (P=0.001). However birth weight and birth stature were not statistically significant differences among three Hb groups. Totally, weight gain during pregnancy was 10.50 kg with lower rate in anemic group (11>Hb g/dl).

**Table 1. Characteristics of study's subjects. (No=1994)**

Variables	Mean±SD
Maternal age(year)	27.92±5.7
Hb concentration (g/dl)	12.0± 1.11
Birth weight(kg)	3.3±0.5
<b>Sex (neonate)</b>	No(%)
Male	1014(50.9)
Female	980(49.1)
<b>Hb categorize</b>	
Anemia	336(16.8)
Normal	983(49.3)
High	675 (33.9)

#### 4. DISCUSSION

The serum Hb status in early pregnancy and its association with weight gain in pregnancy and with birth weight will be discussed. We observed 16.8% of pregnant women as anemic patient (Hb<11 g/dl). Other studies in Iran found a little difference with our results. This rate in whole of Iran was 33% [14], in Bandar Abbas [15] was 17.5%. , in Kerman [16] was 1.7%, in Zahedan [17] was 6.4% and in rural area in Gorgan [18] was 18.2%. In other countries, the low serum Hb

concentration was reported 22.1% in Chinese pregnant women [19] and 60% in Tanzanian adolescence pregnant women [20]. As like as other studies, low Hb concentration in pregnant women is a main health problem in rural area in the north of Iran.

In present study, we observed the positive association between serum Hb concentration in early pregnancy and weight gain in pregnancy, while there is no significant association between it and birth weight. The results of studies in other areas were not similar. Low Hb concentration has been recognized as a risk factor in a review study [21]. Ren [19] and Shirima [20] found a reverse correlation between serum Hb concentration and birth weight. Hajian [22] reported that the risk of LBW in low Hb pregnant women is 1.65 times more than in high Hb pregnant women in Iran. However in Lawoyins' study [23], the positive association between Hb and birth weight was shown only in premature neonate children. In some studies, the relationship between Hb and birth weight was U-shape, so that the risk of LBW increased in low and high Hb concentration level [2,21,24,25]. The risk of SGA (Small for gestational age) and prematurity among pregnant women with low Hb reported in some studies [6,9].

Birth weight is related to some biological and environmental factors same as ethnicity, maternal BMI, maternal age, nutritional status, trace element deficiency, anemia and metabolic disorders [1]. Dissimilarity of our results with other studies can be related to these factors and should be assess in further studies.

In our study, we didn't see any association between birth weight and weight gain during pregnancy. In a similar study [20], weekly association was shown between weight gain during pregnancy and birth weight among adolescence pregnant women.

**Table 2. Mean± standard deviation of weight during pregnancy, birth weight and birth stature among three Hb level groups**

Hb categorize	1 <sup>st</sup> trimester	2 <sup>nd</sup> trimester	3 <sup>rd</sup> trimester	8 <sup>th</sup> month	9 <sup>th</sup> month	Birth weight	Birth stature	Weight gain #
Anemia	59.5(11.9)	62.5(11.9)	66.9(12.0)	68.3(11.7)	69.9(11.7)	3.2(0.5)	50.0(2.6)	10.4(3.9)
Normal	61.5(12.8)	64.6(12.8)	69.1(12.7)	70.4(12.6)	72.0(12.5)	3.3(0.5)	49.9(2.5)	10.5(4.1)
High	63.5(12.2)	66.6(12.2)	70.9(12.5)	72.3(12.3)	74.0(12.4)	3.2(0.5)	49.9(2.5)	10.5(4.3)
Total (1994)	61.9(12.5)	64.5(12.5)	69.3(12.6)	70.7(12.4)	72.3(12.4)	3.3(0.5)	49.9(2.5)	10.5(4.1)
P. Value	0.001	0.001	0.001	0.001	0.001	0.341	0.685	0.850

# weight gain during pregnancy

We did not assess the role food intake during pregnancy, Hb concentration throughout the program, ethnicity and maternal age on birth weight. In addition, the statistical power will be increased if we hence the sample size. We didn't categorize of anemia according to moderate and severe anemia. These are limiting factors for our study.

## 5. CONCLUSION

Low Hb concentration in pregnant women is a main health problem in rural area in the north of Iran. We didn't see any association between birth weight and weight gain during pregnancy. The positive association between serum Hb concentration and weight gain has been observed in early pregnancy, while there is no significant association between it and birth weight. Dissimilarity of our results with other studies and anemia subgroups situation should be assess in a comprehensive study in future.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Sukrat B, Wilasrusmee C, Siribumrungwong B, McEvoy M, Okascharoen C, Attia J, et al. Hemoglobin concentration and pregnancy outcomes: a systematic review and meta-analysis. *Biomed Res Int*. 2013;2013:769057.
2. Chang SC, O'Brien KO, Nathanson MS, Mancini J, Witter FR. Hemoglobin concentrations influence birth outcomes in pregnant African-American adolescents. *J Nutr*. 2003;133(7):2348-55.
3. Rainville AJ. Pica practices of pregnant women are associated with lower maternal hemoglobin level at delivery. *J Am Diet Assoc*. 1998;98(3):293-6.
4. Lone FW, Qureshi RN, Emanuel F. Maternal anaemia and its impact on perinatal outcome. *Trop Med Int Health*. 2004;9(4):486-90.
5. El Guindi W, Pronost J, Carles G, Largeaud M, El Gareh N, Montoya Y, Arbeille P. Severe maternal anemia and pregnancy outcome. *J Gynecol Obstet Biol Reprod (Paris)*. 2004;33(6 Pt 1):506-9. [French]
6. Scanlon KS, Yip R, Schieve LA, Cogswell ME. High and low hemoglobin levels during pregnancy: differential risks for preterm birth and small for gestational age. *Obstet Gynecol*. 2000;96(5 Pt 1):741-8.
7. Singla PN, Chand S, Khanna S, Agarwal KN. Effect of maternal anemia on the placenta and the newborn. *Acta Paediatr Scand*. 1978;67:645-648.
8. Agarwal KN, Agarwal DK, Mishra KP. Impact of anemia prophylaxis in pregnancy on maternal hemoglobin, serum ferritin and birth weight. *Indian Jour Med Res*. 1991; 94:277-280.
9. Bondevik GT, Lie RT, Ulstein M, Kvåle G. Maternal hematological status and risk of low birth weight and preterm delivery in Nepal. *Acta Obstet Gynecol Scand*. 2001; 80(5):402-8.
10. Scanlon KS, Yip R, Schieve LA, Cogswell ME. High and low hemoglobin levels during pregnancy: differential risks for preterm birth and small for gestational age. *Obstet Gynecol*. 2000;96(5 Pt 1):741-8.
11. Statistical Center of Iran. Population and Housing Census [Cited 23 May, 21012]; Available:<http://www.amar.org.ir/Portals/1/Iran/census-2.pdf>
12. Gholamreza V. Anemia in north of Iran (south-east of Caspian Sea). *Pak J Biol Sci*. 2007;10(10):1703-7.
13. WHO: Iron Deficiency Anemia. Assessment, Prevention and Control. In A Guide for Programme Managers. Geneva: World Health Organization; 2001.
14. Shikholeslam R, Abdollahi Z, Jamshidbaigi E, Salehian P and Malekafzali H. The study of Iron deficiency, anemia and iron deficiency anemia in 15-49 year age women in urban and rural area in Iran. *TEB & TAZKIEH*. 2002;47(winter):37-44. [Persian]
15. Khademi Z, Shahi A, Farshid Far Gh. R, Zare Sh, Vaziri F. Prevalence of Iron deficiency anemia in pregnant women referred to Shariati Hospital in Bandar

- Abbas, Iran. Medical Journal of Hurmozgan. 2004;8(1):27-31. [Persian]
16. Jalali M, Siassi F, Ghiasvand R, Jarollahi N, Gheibi F, Fatehi F, et al. Iron deficiency anemia in pregnant women in Eslamshar. Journal of Kerman University of Medical Sciences. 2005;12(4):271-277.[Persian]
  17. Navidian A, Ebrahimi Tabas E, Sarani H, Ghaljeh M, Yaghoobi Nia F. The prevalence of Iron-deficiency anemia in the pregnant women referring to health centers in Zahedan. Journal of Reproduction and Infertility Summer. 2006;72(27):132-138. [Persian]
  18. Veghari G, Mansourian AR, Marjani A. The comparison of the Anemia in pregnant and non-pregnant women in the villages of the South-east of Caspian Sea -Gorgan -Iran. J. Med. Sci. 2007;7(2):303-306.
  19. Ren A, Wang J, Ye RW, Li S, Liu JM, Li Z. Low first-trimester hemoglobin and low birth weight, preterm birth and small for gestational age newborns. Int J Gynaecol Obstet. 2007;98(2):124-8.
  20. Shirima CP, Kinabo JL. Nutritional status and birth outcomes of adolescent pregnant girls in Morogoro, Coast, and Dar es Salaam regions, Tanzania. Nutrition. 2005; 21(1):32-8.
  21. Little MP, Brocard P, Elliott P, Steer PJ. Hemoglobin concentration in pregnancy and perinatal mortality: A London-based cohort study. Am J Obstet Gynecol. 2005; 193(1):220-6.
  22. Hajian K.O. Asnafi N. The Relationship between Maternal Hemoglobin and Hematocrit Levels with Neonatal Pregnancy Complication at Birth. DANESHVAR MEDICINE AUGUST-SEPTEMBER 2006;13(64):33-38. [Persian]
  23. Lawoyin TO. The relationship between maternal weight gain in pregnancy, hemoglobin level, stature, antenatal attendance and low birth weight. Southeast Asian J Trop Med Public Health. 1997; 28(4):873-6.
  24. Zhou LM, Yang WW, Hua JZ, Deng CQ, Tao X, Stoltzfus RJ. Relation of hemoglobin measured at different times in pregnancy to preterm birth and low birth weight in Shanghai, China. Am J Epidemiol. 1998;148(10):998-1006.
  25. Veghari G. Iron supplementation during pregnancy and birth weight in Iran: A retrospective study. Pak J Biol Sci. 2009; 12(5):427-32.

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