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Physiological adjustment of hemoglobin level for anemic pregnant women living in Sana'a city-Yemen.

[1] Muna kh. Al-kubaisi [2]Ahmed Kaid Allow [3] Saad Mohammed and [4]Tin Myo Han

[1] Dept. of Obstetrics & Gynecology , Kulliyyah of Medicine, IIUM, Kuantan-Malaysia

[2] Basic medical science, Kulliyyah of Medicine, IIUM, Kuantan-Malaysia, Dept of human medical physiology, Faculty of Medicine and health sciences, Sana`a University, Yemen.

[3]Basic medical science, Kulliyyah of Medicine, IIUM, Kuantan-Malaysia,

[4] Dept. of Dental Public Health, Kulliyyah of Dentistry, IIUM, Kuantan-Malaysia.

Abstract:

***Objective**: The purpose of the present study is to estimate the magnitude of the problem of anemia among pregnant women in Sana'a city-Yemen, adjusting the level of hemoglobin (Hb) for altitude by which anemia can be diagnose and to identify the risk group for anemia.* ***Method:** One thousand and three pregnant women had been involved in this study in Sana'a Yemen. The altitude in Sana'a measured using the altimeter and Hb had been adjusted for attitude. Blood was aspirated from the study group to determine the Hb level as well as age, parity, and antenatal care history collected.* ***Results**: The altitude in Sana'a was measured during the study and it was found as 2200m (7260 f) above sea level. Hemoglobin had been adjusted for altitude by the equation of Yuan 2009 (adj.=-0.032×alt+0.022×alt^2). After adjustment, Hb was found to be 12.1g/dl as a cutoff point to diagnose anemia at 2200m above sea level. The prevalence of anemia was found to be as high as 52.83%, no risk group was identified as all women with different age groups and different parity has one in two chance of having anemia.* ***Conclusion:** Anemia is a moderate problem in Sana`a city. Hemoglobin level should be adjusted to altitude before passing the level of Hb as normal. There is no risk group that could be identified.*

Key words: Sana'a, anemia, hemoglobin, high altitude, pregnancy.

Introduction

Women in the underdeveloped and the developing countries are still suffering from the problem of anemia in spite of that there is paucity of reports regarding the prevalence of anemia in Yemen specifically at the national level. It is mainly iron deficiency anemia of nutritional origin (Sadia 2007) which can be corrected by administration of iron in most of the time. Malaria and other hookworm infestations are contributing factors (Richard 2008) Anemia during pregnancy defined as hemoglobin level below 11.0 g/dl, according to the WHO definition (Stuart 2006) .In Sana'a city, which is 2200 m above the sea level (Al-Kirbash 1996); this will produce a significant hypoxia that will stimulate the Hb level to rise up keeping the oxygen carrying capacity within normal. So diagnosing anemia as Hb level below 11g/dl will be considered as under estimation of the problem. Anemia has many adverse effects on maternal morbidity and mortality, it decrease the ability to withstand the obstetrical hemorrhage, knowing that bleeding is the killer number one in the

Developing countries (Khan 2006, K. Hill 2007) Furthermore, sepsis is the 2nd cause of maternal mortality; anemic patient will be more prone to have puerperal infections. Thrombo-embolism also increases. In anemic patient; there is a delay in the general physical recovery which will increase the duration of hospital stay (Clark 2007). Regarding the fetus, there is slight increase in preterm labor and intrauterine growth restriction (F. Gray 2009, Levy 2005).

The aim of the present study is to estimate the magnitude of the problem of anemia among pregnant women, adjusting the level of Hb for altitude by which anemia can be diagnose and to identify the risk group for anemia in Sana'a city-Yemen.

Materials and Methods

The study population was 1003 pregnant women in their third-trimester from Sana'a city attending the antenatal care clinic or the labor room in two hospitals: Al-Oum *Private* Hospital and Al-sabeen *public* hospital that perform 4000-6000 deliveries per yer (Banajeh, 2005) so as to include different socio-economic levels. The Hb level estimated for the women at the time of attendance of the clinic or admission to the hospital by aspirating venous blood then assessing the Hb level by the HemoCue method as it is considered the method of choice for evaluating anemia in surveys (Alan 2003). Other demographic data collected including the age, parity .Data of antenatal care attendance was collected as part of the variables but it has been omitted because most of the patients were without antenatal care.

The variables of the study include: hemoglobin (g/dl) level, age and parity (the number of deliveries) of the pregnant women. The altitude in Sana'a city measured by using the altimeter (field sycom) and it was found to be 2200 meter (7260 f) above sea level. By applying the adjustment equation; Yuan, 2009 (adj.=-$0.032\times alt+0.022\times alt^2$), it will show +1.15 g/dl. This will increase the reading of 11g/dl to 12.15g/dl as a cutoff for anemia. Data was analyzed using SPSS 18th version. Statistical significance was assessed using Fisher's exact, chi-square, and correlation tests; $P < 0.05$ was considered to be statistically significant.

Results

According to the age factor, the study sample (n=1003 pregnant women) was categorized into three age groups; 15-25 years old (n=525) represent 52.3%, 26-35 years old (n=348) 34.7% and age group > 35 years old (n=130)12.8%, from the sample size. The average (mean ± SD) of age of pregnant women which involved in the present study was 26.31± 6.79 (n=1003, min 16 and max 44 years old).

According to the parity factor, study sample was distributed to 3 groups; primigravida group (n=272) 27.1% of the sample size, parity group 1-4(patient having 1-4 children), (n=448) 44.6% and parity 5 and more (n=283) 28.2%. The group also showed: The minimum party factor was 0 and maximum parity was 12 with a mean of 2.99 and standard deviation of 2.902.

Table 1 demonstrated the percentage of anemia among the pregnant women attending the hospitals. Five hundred and forty pregnant women had Hb less than 12.1gm/dl.

Table 1: The percentage of anemia among pregnant women attending Sana'a hospitals.

State of women according to Hb level	Frequency	Percentage
Anemic (Hb<12.1 gm/dl)	540	53.83%
Normal (Hb≥12.1 gm/dl)	463	46.16%
Total	1003	100%

Fig.1 Hemoglobin distribution of the pregnant women (n=1003).

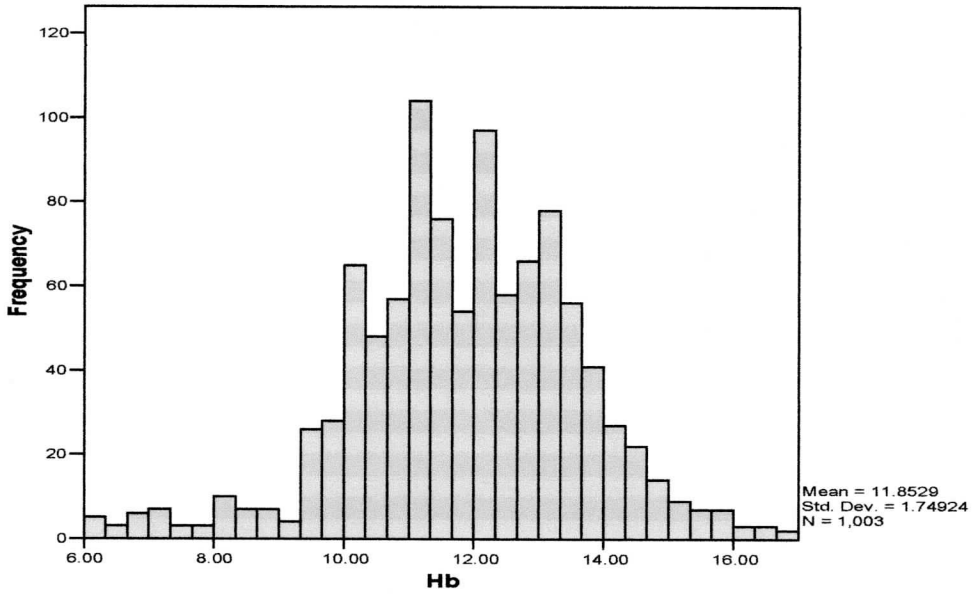


Figure 1, shows normal distribution with minimum, maximum and mean ± SD of Hb (gm/dl) level of 1003 pregnant women (6.00 gm/dl, 16.9 g/dl and 11.85 ± 1.74 respectively).

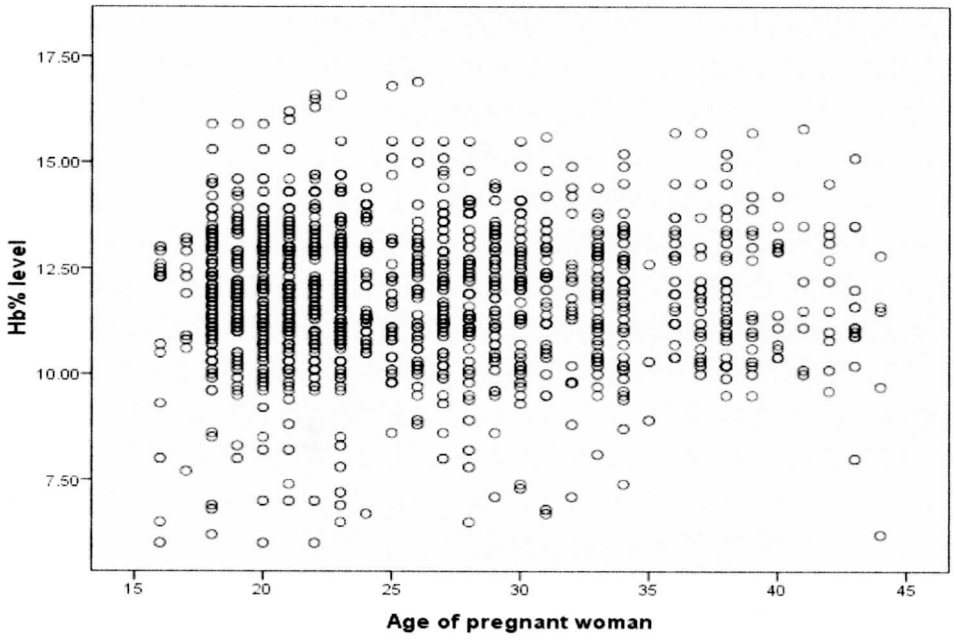
Table 2: Association between age group and anemia status.

Hb status	Age groups						
	15-25		25-35		>35		
	Freq.	%	Freq.	%	Freq.	%	Total
Anemic	282/540	52.22%	183/540	33.88%	75/540	13.88%	540
Normal	243/463	52.48%	165/642	35.63%	55/642	11.87%	463
Total	525/1003	52.34%	348/1003	34.69%	30/1003	12.96%	1003

X^2 =1,000 , "P"=0.607

There is no significant association between age and anemia in Chi square test (X^2 =1.000, p=0.607 > 0.05) and correlation nearly Zero (no correlation) between the different age groups and the anemia status as seen in the Correlation Graph , fig 2,(γ=0.002, p=0.958).

Fig 2: correlation graph between age groups and hemoglobin level.



So, this study indicated that all women have risk to get anemia regardless their age.

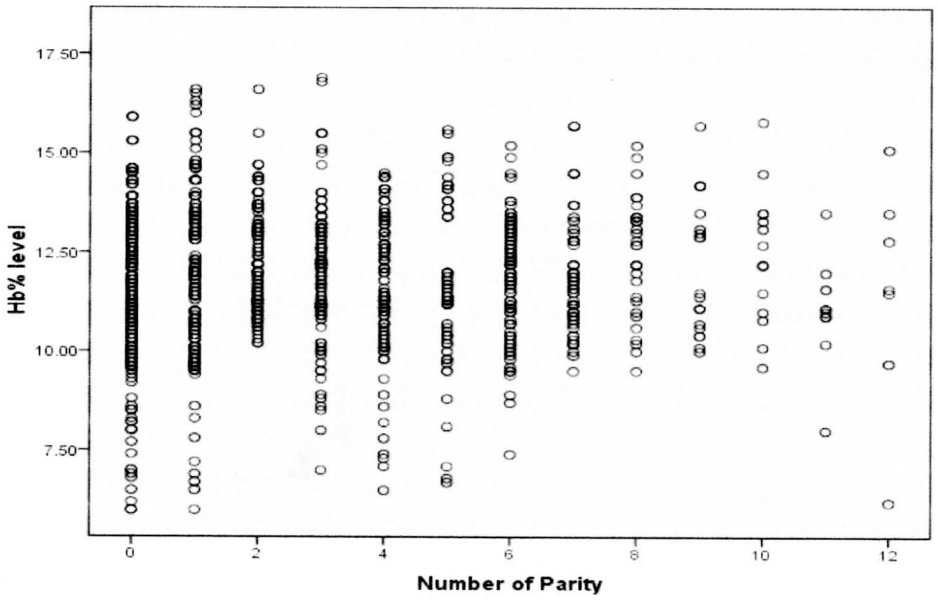
Table 3: The relationship between the parity and anemia status

	Primi		Para 1-4		Para ≥5		Total
Anemia status	Freq.	%	Freq.	%	Freq.	%	Freq.
Anemic	149	27.59%	237	43.88%	154	28.51%	540
Normal Hb level	123	26.56%	211	45.57%	129	27.86%	463
Total	272	27.11%	448	44.66%	283	28.21%	1003

X^2 = 0.293 , "p" =0.863

Mild correlation (γ = 0.036) but not significant (p >0.05) as shown in the correlation graph (fig.3):

Fig 3: correlation between parity and hemoglobin level.



Again all the parity groups shows the same incidence of being anemic. So women with any number of parity are considered as risk group.

Discussion

Depending on the WHO definition, anemia is diagnosed when the Hb level is below 11g/dl. . WHO reported the prevalence of anemia in Yemen among pregnant women as 58.09% at the sea level (WHO2008) But Sana'a city lies 2200 m above the sea level as measured during the study by the altimeter .The same fact was found by others (Al-Kirbash 1996). This altitude will cause a significant hypoxia, which is a potent haemopoitic stimulant. This will be reflected as higher hemoglobin level with the same oxygen carrying capacity. So the level of Hb to diagnose anemia in Sana'a should be considered below 12.1g/dl after adjustment for altitude (Yuan 2009) and this may also interfere with the palm and conjunctival inspection as a common method for clinical assessment for anemia.

According to the proposed classification of public health, the anemia in Sana'a is considered in category of moderate public health significance (WHO 2001). Of course our result didn't reflect the prevalence of anemia in Yemen overall. We choose private and public hospitals to include the different socioeconomic level of the society. Our results indicate that anemia during pregnancy is a common health problem among women admitted to hospitals.

In this study more than half (52.3%) of the pregnant women were anemic, moreover they are going to lose more blood during labor which will aggravate their condition during puerperium, lactation & baby nursing. The picture is slightly worse than the other nearby countries with the same socioeconomic status as in Egypt where the prevalence of anemia was 47% among pregnant women (Ghadah 2007). El-Sahan, 2000 reported that the overall prevalence of anemia among adolescents in Egypt was 46.6% most of which was mild to moderate, severe anemia was 1%. In some parts of Nigeria the percentage of anemic pregnant women were 40.0% (Cyril 2007) and the anemia reach up to 86% in some parts of India (Ray 2000).

Most of patients in the present study were between 15-25 years old. This sample size may reflect a rapid growth in the population (52.3% of the sample size).No risk group could be identified , all patient with different age group and parity has the same incidence of being anemic (table 2&3). This fact has been seen in other studies (Ishag 2005) Other showed slight increase in the primigravida (N.R Van 2000, R.J.Guidotti 2000) group, the present study didn`t show such correlation.

One of the limitations of the study; it did not consider the type of anemia however depending on the fact that ninety seven percent of anemia during pregnancy is due to iron and folic acid deficiency (Levy 2005, Alan 2003). Nutritional education and food fortification should be adapted to improve the situation (Guidotti 2000). The authors of the present study can recommend the routine iron and folic acid supplementation during pregnancy. With the absence of antenatal care (ANC) for most of the women in this study

there was also absence of iron and folic acid supplement. There were a weak attendance to the antenatal care clinic or there were irregular visits to the ANC units in the general public hospitals as well as to private clinics. In such situation we might get benefit from the injectable iron to make sure that the female will receive adequate dose from minimum visits, because the main advantage of the intramuscular iron therapy is the certainty of its administration (Alan 2003).

People in Sana'a city are not suffering from the problem of anemia due to malaria, because of low prevalence of malaria on high altitudes. Screening for malaria may show no benefit for decreasing the incidence of anemia there but it may be of benefit in the endemic areas (N.R.Van2000). Screening for worm infestation will be of benefit, the pregnant women can receive antihelmenthic drugs safely in the 2nd trimester such as Mebendazole (Drug safety site 2009, Nandor 2005).

Conclusion

Anemia during pregnancy is a moderate problem in Sana'a city. Adapting lower Hb level to diagnose anemia in places with high attitude will delay achieving improvement in the situation among women especially in the child bearing age. In situation on non-adjustment of Hb to altitude, anemia will be underestimated.

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