ORIGINAL ARTICLE

VARIATION IN HAEMATOLOGICAL PROFILE OF PREGNANT WOMEN ATTENDING COMBINED MILITARY HOSPITAL QUETTA

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Background: World Health Organization recommends eight antenatal visits throughout pregnancy. Along with full blood count and fasting blood sugar tests, thirty-nine recommendations are given. The objective of this study was to find out significance of difference in haematological profile of pregnant women. **Methods:** This cross-sectional study on 384 pregnant women attending outpatient department of combined military hospital Quetta, Pakistan, was conducted from 1st November 2017 to 28th February 2018. Simple random sampling technique through random number table was used. Data collected through structured questionnaire from participants and their laboratory reports was grouped trimester wise. Apart from descriptive statistics, one-way ANOVA with post hoc Tukey test was used to find out significant difference at $p \leq 0.05$. SPSS Version 20 and MS Excel 2007 were used for data analysis and plotting graphs. Principles of research ethics were exercised. **Results:** Mean age (±SD) of the study participants was 27.5 (±4.8) years. Statistically significant difference was found for variables like haemoglobin, haematocrit and MCHC in different trimesters. Only 2 (0.5%) of the total participants had gestational diabetes mellitus. **Conclusion:** For getting normal reference ranges in our setting, large population-based studies are needed.

Keywords: Pregnancy; Red cell indices; Hb; Haematocrit

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INTRODUCTION

According to its new guidelines, World Health Organization recommends eight antenatal visits throughout pregnancy. For these visits, thirty-nine recommendations based on five interventions; namely nutrition, assessment of mother and foetus, prevention, common physiologic symptoms and health system, are developed. Out of these thirty-nine recommendations, full blood count (FBC) and fasting blood sugar (FBS) are already being practiced in routine. FBC include quantitative measures for red cells, white cells including differential, Platelets, and is a good indicator of anemia.[1] Total haemoglobin (Hb), mean cell volume (MCV), red cell distribution width (RDW), and reticulocyte count are other red cell related measurements included in full blood count, while mean cell haemoglobin (MCH) and mean cell haemoglobin concentration (MCHC) are rarely valued clinically.[2] Hb, MCV, MCH and MCHC are all called red cell indices.[3]

Hb is the oxygen carrying pigment in the red cells, a related value, haematocrit (Hct) or packed cell volume (PCV) is the space occupied by centrifuged packed red cells, while MCV gives the average size of red cells or in other words, the ratio between haematocrit and red cells count.[4] The measure of Hb in an average red cell is called MCH while the concentration of Hb in 100 ml of packed red blood cells is called MCHC.[4]

In pregnancy, haematological changes occur during foetal development. These changes are usually physiological.[5] Though it is a physiologic change, nevertheless regular monitoring of haematologic profile is important because pregnancy outcome is associated with the degree of change in haematologic profile.[6,7] Around sixth week of pregnancy, blood volume increases as much as half of the non-pregnant state.[8,9] Due to haemodilution, haemoglobin, haematocrit, red cell count and PCV change.[10–13] The detailed trimester wise pattern of these changes is not fully known. Researchers are encouraged by this fact to investigate these changes during normal pregnancy in terms of reference ranges.[6,14–18]

According to World Health Organization ,high blood sugar detected first at any time during pregnancy is classified as gestational diabetes mellitus and diagnosis should be made if one or

more of the three findings; fasting plasma glucose ≥7.0 mmol/L (126 mg/dl) or two hours plasma glucose level ≥11.1 mmol/L (200 mg/dl) following 75 grams of glucose taken orally or random plasma glucose ≥11.1 mmol/L (200 mg/dl) are noted.[1] Gestational diabetes increases the risk of macrosomia, birth complications and maternal type 2 diabetes.[19] During the 2nd and early 3rd trimester, insulin resistance increases exponentially. This is in contrast with early pregnancy which is a time of insulin sensitivity.[20] This fact can lead to remarkable changes in blood glucose levels during pregnancy.

National literature is deficient in pregnancy related researches on haematological profile. In order to find out whether there existed any significant variation in the haematologic profile during pregnancy among ante natal out door patients, this study was conducted.

MATERIAL AND METHODS

A cross-sectional study was conducted at Combined Military Hospital (CMH) Quetta, Baluchistan province of Pakistan from 1st November 2017 to 28th February 2018. A sample size of 384 was calculated through an online sample size calculator.[21] Level of confidence was kept as 95% and anticipated outcome proportion as 50%.

All those pregnant women who visited Out Patient Department for antenatal visit were included in the study. An unwilling pregnant woman or those needing emergency intervention were excluded. Probability sampling using simple random technique through the use of random numbers table was adopted.

Data was collected through interviewer administered questionnaire. Every participant was requested to see the researcher after getting routine laboratory investigation report. From that report, results of FBS, Hb, Hct, MCV and MCHC were noted on questionnaire. Reference ranges used for FBS were 3.9–5.4 mmol/l as Normal, 5.5–6.9 mmol/l as Prediabetic, and 7 mmol/l and above as Diabetic.[23] Reference ranges for other parameters were: Hb as 12–15 g/dl for adult female, Hct as 0.55–0.75, MCV as 83–101 fl and MCHC as 31.5–35 g/dl.[24]

Desirable measures of central tendency and dispersion were calculated. One-way ANOVA and post-hoc Tukey tests were applied to find out significant difference at $p<0.05$. SPSS version 20 and MS office Excel 2007 were used for data analysis and plotting graphs. Ethical Review Committee of the Institute of Health Sciences Mardan, Khyber Pakhtunkhwa, Pakistan approved the design and conduct of this study. Commandant CMH Quetta officially allowed the data collection team to collect data. All participants were given full autonomy to participate or withdraw at any time according to their free will. They were assured that only principal investigator will have access to data and all record will be destroyed after the publication of research report and no one's identity will be disclosed.

RESULTS

Out of 384 study participants, 99 (25.8%) were in 1st trimester, 75 (19.5%) in 2nd trimester while 210 (54.7%) were in 3rd trimester. Mean age (±SD) of the study participants was 27.5 (±4.8) years. Participants were arranged into three independent unpaired groups. Group 'A' included women in their 1st trimester T1, Group 'B' included women in their 2nd trimester T2 and Group 'C' included women in their 3rd trimester T3.1st, 2nd and 3rd trimesters were defined as completion of 14 weeks, beginning of 15th week through completion of 28 th week and beginning of 29th week through completion of 42nd week of gestation respectively.[22]

Out of all study participants, 350 (91.1%) were non diabetic, 31 (8.1%) were pre diabetic while 3 (0.8%) were detected to be diabetic, out of which 1 (0.3%) was known diabetic and 2 (0.5%) were detected for the first time. No one in Group A or Group B were diabetic. Only Group C had 1.4% as diabetics. 11.1%, 6.7% and 7.1% of Group A, B and C were pre diabetics respectively.

Majority of the study participants had their Haemoglobin, Haematocrit and Mean Corpuscular Volume below the normal range. Majority of participants had normal MHCH (Figure-1)

A highly significant association was found for mean Hb and Mean Hct among three groups. Non-significant relation was found for mean MCV and mean fasting blood sugar among three groups (Table-1). All significant results were further tested for statistical significance between two groups in table-2.

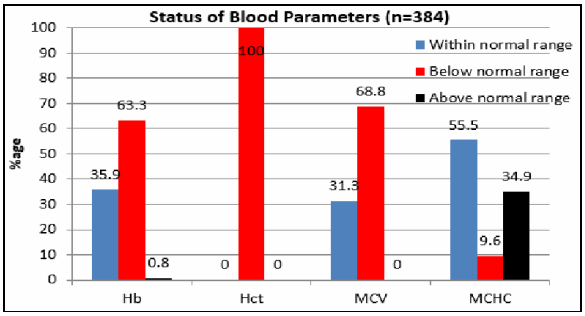

Figure-1: Distribution of different Blood parameters

Table-1: Descriptive statistics & One-way ANOVA

Outcome Variable	Group "A" T1(n_1=99)	Group "B" T2 (n_2=75)	Group "C" T3 (n_3=210)	Pooled Total n=n_1+n_2+n_3=384	F-Statistic	*p*-value
Hb Mean	12.1	11.7	11.2	11.5	14.076	**<0.00001****
St Dev	1.7	1.6	1.3	1.5		
Mode	10	10	11	11		
Range	8.5–15.6	7.8–14.9	6.3–14.7	6.3–15.6		
HCT Mean	0.36	0.33	0.33	0.34	18.957	**<0.00001****
St Dev	0.05	0.05	0.04	0.04		
Mode	0.30	0.28	0.30	0.30		
Range	0.28–0.45	0.24–0.43	0.23–0.43	0.23–0.45		
MCV Mean	80.2	80.1	80.0	80.1	0.013	0.987
St Dev	6.0	6.0	6.8	6.4		
Mode	82	82	86	82.0,86.0		
Range	61.7–95.6	58.4–93.1	59.5–96.2	58.4–96.2		
MCHC Mean	32.7	32.1	32.0	32.2	3.226	0.040*
St Dev	2.2	2.7	2.4	2.4		
Mode	30.0	32.0	30.0	30.0		
Range	23.4–37.0	23.4–37.6	24.8–36	23.4–37.6		
FBS Mean	4.1	4.0	4.2	4.1	0.564	0.569
St Dev	1.0	0.7	0.9	0.9		
Mode	4.0	4.0	3.5	4.0		
Range	2.8–11.3	2.8–6.5	2.8–8.1	2.8–11.3		
*significant **highly significant						

Table-2: The *p*-values calculated through Post-Hoc Tukey on table-1

Outcome Variable	1st VS 2nd Trimester	1st VS 3rd Trimester	2nd VS 3rd Trimester
Haemoglobin	0.104	0.001**	0.042*
Haematocrit	0.001**	0.001**	0.540
MCHC	0.219	0.032*	0.899
*significant **highly significant			

DISCUSSION

Pooled mean haemoglobin (Hb) level and mean Hb level for all trimesters were above 11 gm/dl, which is within the recommended range[25] (Table-1). However, on individual level, 63.3% of the total participants had their Hb below the normal range (Figure-1) used in this study (i.e, 12–15 g/dl for adult female[24]) and before we could label them as anaemic, we may consider 40% rise in plasma volume as compared to 20% rise in red blood cells or other words haemdilution[26] during pregnancy. A highly significant difference was noted for average Hb levels in three trimesters. This supported the findings of an earlier study by Rayis *et al*[27] and Shen *et al*[17] but not those of Purohit *et al*[18] and Mohamed *et al*[14], who reported a non-significant difference. Further, differences between T1 and T3, T2 and T3 trimester were also found to be highly significant (Table-2), just like the findings of James *et al.*[16] Findings of Rayis *et al*[27] and Kumar *et al*[28] however could establish a significant difference only between 2nd and 3rd trimester. Previous studies reported that Hb level was highest in the 1st trimester, lowest in the 2nd trimester and began to rise again in the 3rd trimester.[16,17] In this study, mean Hb pattern was somehow different; it was highest in the 1st trimester and lowest in the 3rd trimester (Table-1).

Haematocrit (Hct) or packed cell volume (PCV) of all study participants was below the normal range used in this study.[24] It is an established fact that Hct decreases during pregnancy.[16,29] The difference among three trimesters was highly significant just like the findings of Shen *et al*[17] and Purohit *et al*[18]. Difference between T1and T2, T1 and T3 trimester was also highly significant in this study. Rayis *et al*[27] also reported a significant difference for all trimesters and only between T1 and T2. T1 and T2 significance was reported by James *et al*[16] as well.

Majority of the study participants (68.8%) had their MCV below the normal range selected for this study (Figurw-1) while difference between all three trimesters was non-significant (Table-1). This supported the findings of Purohit *et al.*[18] In contrast, Rayis *et al*[27], Shen *et al*[17] and James *et al*[16] found a significant difference between all three trimesters.

About 55.5% of the total study participants had normal MCHC (Figure-1). Difference between three trimesters was found to be significant with further significance between T1 and T3 (Table-1 & 2). Similar findings were reported by Rayis *et al*[27] and Shen *et al*[17] while Purohit *et al*[18] and James *et al*[16] reported non-significant difference.

Only 3 individuals were labelled diabetic and all were in their third trimester. None of the participants in first or second trimester were found with hyperglycaemia. These findings are totally in conformity with the fact that insulin sensitivity decreases during last stages of pregnancy.[21] However no significant difference in the level of FBS was observed among participants of different trimesters (Table-1). Same results were produced by Purohit *et al*.[18] Mean values for all trimesters were within normal range (Table-1).

Design of this study can't warrant to decide reference ranges for different trimesters, as different individuals were studied in their different trimesters. Not all the parameters of haematologic profile were studied. Further, study population was undefined and participants hailed from different backgrounds. These facts can be regarded as potential limitations and care must be taken while drawing inferences.

CONCLUSION

This study provides an insight into trimester wise variations between selected haematologic parameters of a diverse population and its findings can't be used as normal reference ranges in any case. For getting normal reference ranges, large population-based studies are needed.

AUTHORS' CONTRIBUTION

SA, HA, WI: Substantial contribution to conception, design, and interpretation of data, drafting, revising, and final approval to be published. FSL, TA, MH, NS: Substantial contribution to design, interpretation of data, drafting, and revising the manuscript.

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