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International Journal of Pharmaceutical and Phytopharmacological Research

(ICV-5.09)

ISSN (Online) 2249 – 6084

ISSN (Print) 2250 – 1029

Int.J.Pharm.Phytopharmacol.Res. 2013, 2(5): 377-383

(Research Article)

Impact of Anthropometric Factors and Hematological Parameters in Anemic Pregnant Patients: Outcome of a Survey Conducted in Savar, Dhaka

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Received on: 26/04/2013 ***Accepted on:*** 30/04/2013

ABSTRACT

During pregnancy iron demand is increased to meet requirements for nutrition of mother and fetus growth. For that, the probability of iron deficient anemia is increased during this time. Anemia also influences the health of the fetus as well as the health of mother. This study was conducted to 100 pregnant women .The data was collected from hospital patient record book and analyzed by the T test, Regration and Chi-square test with SPSS (version 11.5).The variables considered in this study were age, weight, height, BMI, ESR, deferential count of WBC and Hemoglobin concentration. The entire patient age range was 18-35 years but the incident rate was high in 20 years old patient. Average weight was 42.43kg but 40% patient had only ≤ 40kg ,and BMI were (Mean ± SD) 20.17 ± 1.29916.The mean value of Hb conc. were 8.6470g/dl ,but about 6% were severe (<7.0g/dl) and 79%were moderate (9.9-7.0g/dl) anemic. ESR was (Mean ± SD) 36.59 ± 25.25870mm/hr and 12% pregnant women had 40mm/hr ESR value. Average WBC count was in normal range (400-1000/mm^3) and 28% had >1000/mm^3 WBC. We found 17% observed patient had >70% Neutrophil count and 63% of total observed patient had high lymphocyte count. The observe data revealed that low age had vital contribution to be anemic in pregnancy and infection may also was another factor that had vital impact to anemia in pregnancy.

Key Words: Anemia, Pregnancy, Hematological parameters

INTRODUCTION

The prevalence of anemia is prominent and it is the most common nutritional disease all over the world**.** [1] About 24.8% people of the world suffered by anemia**.** [2] According to WHO, hemoglobin (Hb) level of 11g/dl or less is considered as anemia during pregnancy. When the hemoglobin concentration become 10.0g/dl, 7.0-9.9g/dl and <7.0g/dl then it termed as mild moderate and sever anemia respectively**.** [3] It occurs all the stage of the life cycle but women in child bearing age group particularly the pregnant women and preschool children are the main victim of anemia**.** [4]

Table 1: Hemoglobin levels to diagnose anaemia at sea level [5]

Population	Anaemia (g/l)		
	Mild	Moderate	Severe
Non-pregnant women (15 years of age and above)	110-119	80-109	lower than 80
Pregnant women	100-109	70-99	lower than 70
Men (15 years of age and above)	110-129	80-109	lower than 80

During pregnancy iron deficiency anemia is quite common compare to other kind of anemia**.** [6] Inadequate iron intake before pregnancy, poor absorption of iron from the diet, requirement of iron for the fetus and expansion of maternal plasma volume are thought to be the prime cause for developing iron deficiency anemia (IDA) during pregnancy**.** [7]

Table 2: Classification of anaemia as a problem of public health significance.[8]

Prevalence of anaemia (%)	Category of public health significance
≤4.9 n	No public health problem
5.0–19.9 m	Mild public health problem
20.0–39.9 m	Moderate public health problem
≥40.0	Severe public health problem

The incidence of IDA in pregnant women is about 18%in developed countries and it is three fold high for the developing countries (56%)**.** [8, 2] Lack of proper education, superstition, poverty and gender bias significantly contribute to this high incidence in developing countries.

From previous studies, it is reasonably clear that, maternal death is strongly associated with severe anemia**.** [9, 10] Beside this, it is also well established that, maternal anemia increase the incident of preterm birth ,[11] low birth weight babies [11, 12] and high perinatal mortality**.**[13,14,15] More over research has found that, anemic women are more prone to birth complication then non anemic patient**.** [16]

Along with health consequences, there is a huge amount economic expense for the treatment of this disease. In south Asia, it is estimated to 5 million US $**.** [17] In south Asia, the health statuses of the pregnant women are not well. About 1/3 of maternal death is in this region and in India it is the 2nd prime cause of maternal death**.** [18] Among the SAARC countries, prevalence of anemia is highest in Nepal (74%)**.** [2] Incidence rate of anemia among Bangladesh, India, Maldives and Bhutan, are 47.0%, 49.0%, 54.0%, and 49.0% respectively**.** [2] WHO identified this problem as severe public health problem for the above countries. Again, 39.0% and 29.3% pregnant women in Pakistan and Sri Lanka respectively are anemic [2] and consider as moderate public health problem.

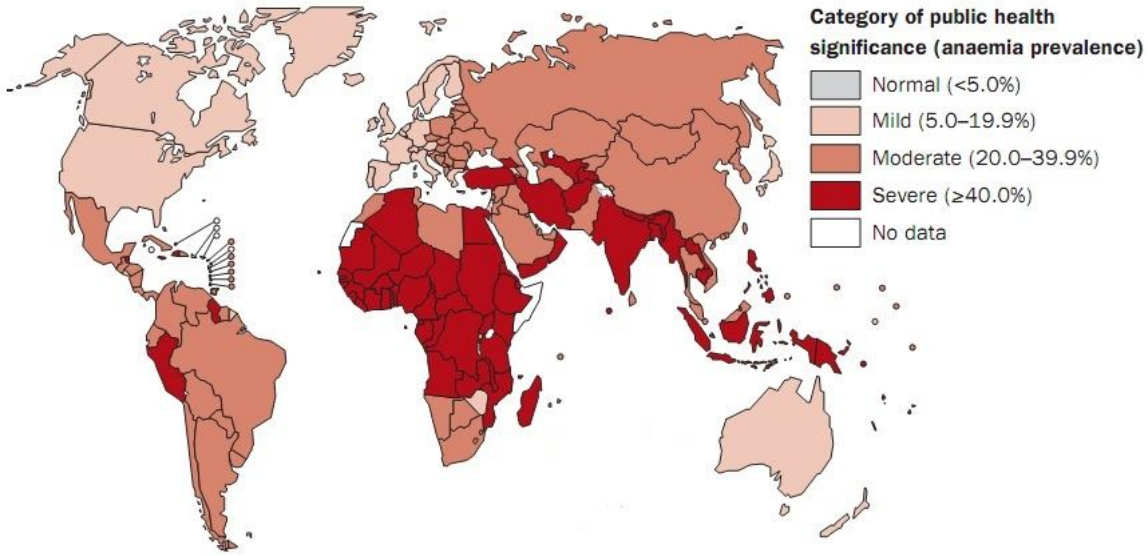

Fig. 1: Anemia as a public health problem by country: pregnant women.[2]

In Bangladesh about 7.0% people of total population are extreme poor and they are living on less then 16 penny a day. About 36.0% and 83% people lives on 1$ and 2$ a day respectively. Due to the poor socio economic status (SES) there is a limited access to health care facilities and preventive measures and thus SES increase the risk of becoming anemic. More over, about 70% people of Bangladesh lives in rural area and health care facilities are insufficient.

This study was aimed to find the association between the anthropometric and hematological parameters in anemic pregnant women.

MATERIALS AND METHODS

This study was performed by using hospital based record of Gono shasthay medical college hospital, Savar, Dhaka. Data was collected from 01.07.2011 to 30.12.2011 of anemic pregnant women those were admitted at Gono Sashthay Kendro Medical College Hospital. The most of the patient were come from surrounding areas of the hospital. The majority of the patient live below the poverty line. Among these patient above 65% women were worker and approximately 30%-35% were house wife. The data which partake in this study were Age, Weight, Height, BMI, Hemoglobin, ESR, WBC, Eosinophil, Neutrophil, lymphocyte, and Monocyte and these data were analyzed by SPSS (version 11.5). The sample size in this study was 100.

We were trying to find out any relation among Hb and other blood component by Regression, T- test and Chi- Square test. Anemia was classified as per the WHO severity grading criteria.

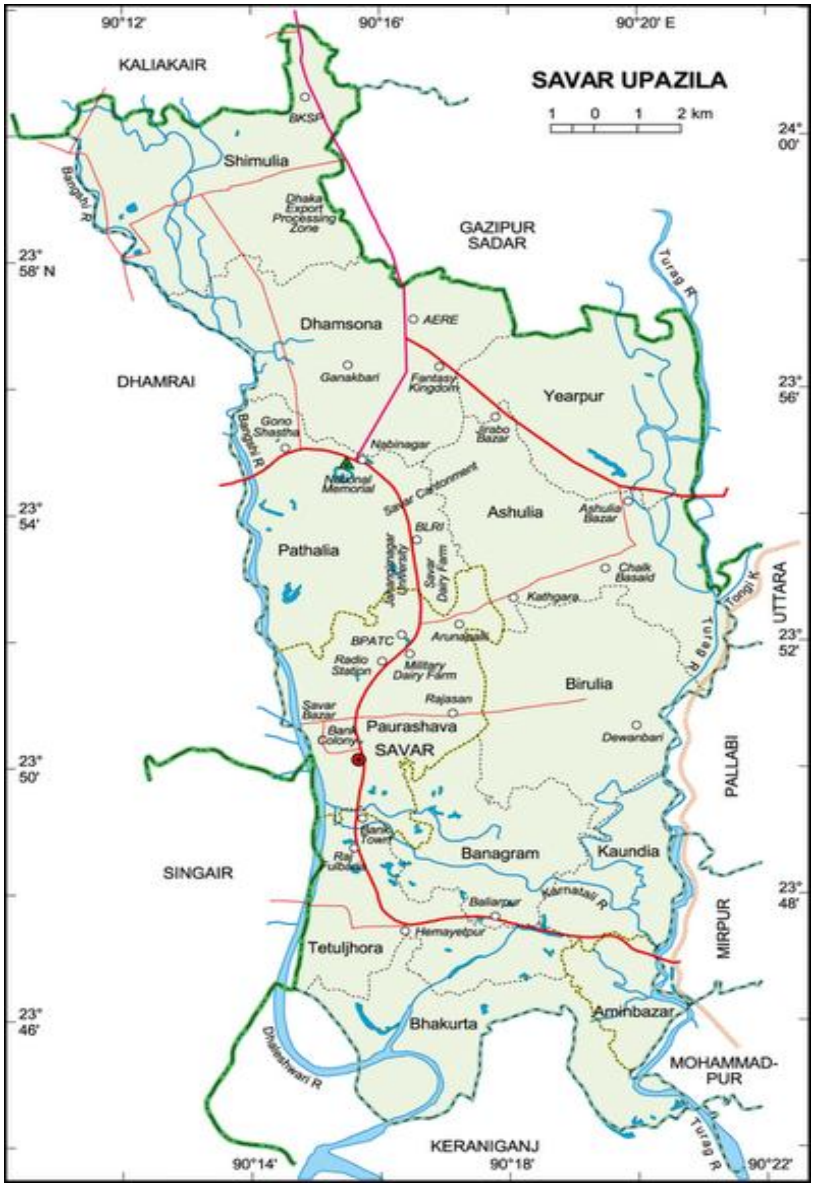

Fig. 2: Savar Upozila

RESULTS AND DISCUSSIONS

In this study we observed that the average age, height, weight and BMI of anemic pregnant patients were (Mean ± SD) 24.8300 ± 5.00718 years, 144.8100 ± 3.83681cm, 42.4300 ± 3.69071 kg, 20.1734 ± 1.29916 respectively (Tab. 3). The entire patients in this study were between 18 – 35 years. Among them, incidence rate of anemia was high in 20 years old pregnant women (> 12.5%). Prevalence of anemia was also significant among 30 years old. In this study we found that average weight anemic patient was 42.43 kg which was only 12%. But 40% patient had only ≤ 40 kg. From our study we found that the average BMI was 20.17. Maximum and minimum BMI in this study was 24 and 17.33 respectively which was only 1% in both the case.

Table 3: Anthropometric observations of anemic pregnant patients

Anthropometric Parameter	Mean ± SD	Mean ± SEM	95% Confidence Interval of the Difference	
			Lower	Upper
Age (year)	24.8300 ± 5.00718	24.8300 ± 0.50072	23.8365	25.8235
Height (cm)	144.8100 ± 3.83681	144.8100 ± 0.38368	144.0487	145.5713
Weight (kg)	42.4300 ± 3.69071	42.4300 ± 0.36907	41.6977	43.1623
BMI	20.1734 ± 1.29916	20.1734 ± 0.129916	19.9157	20.4312

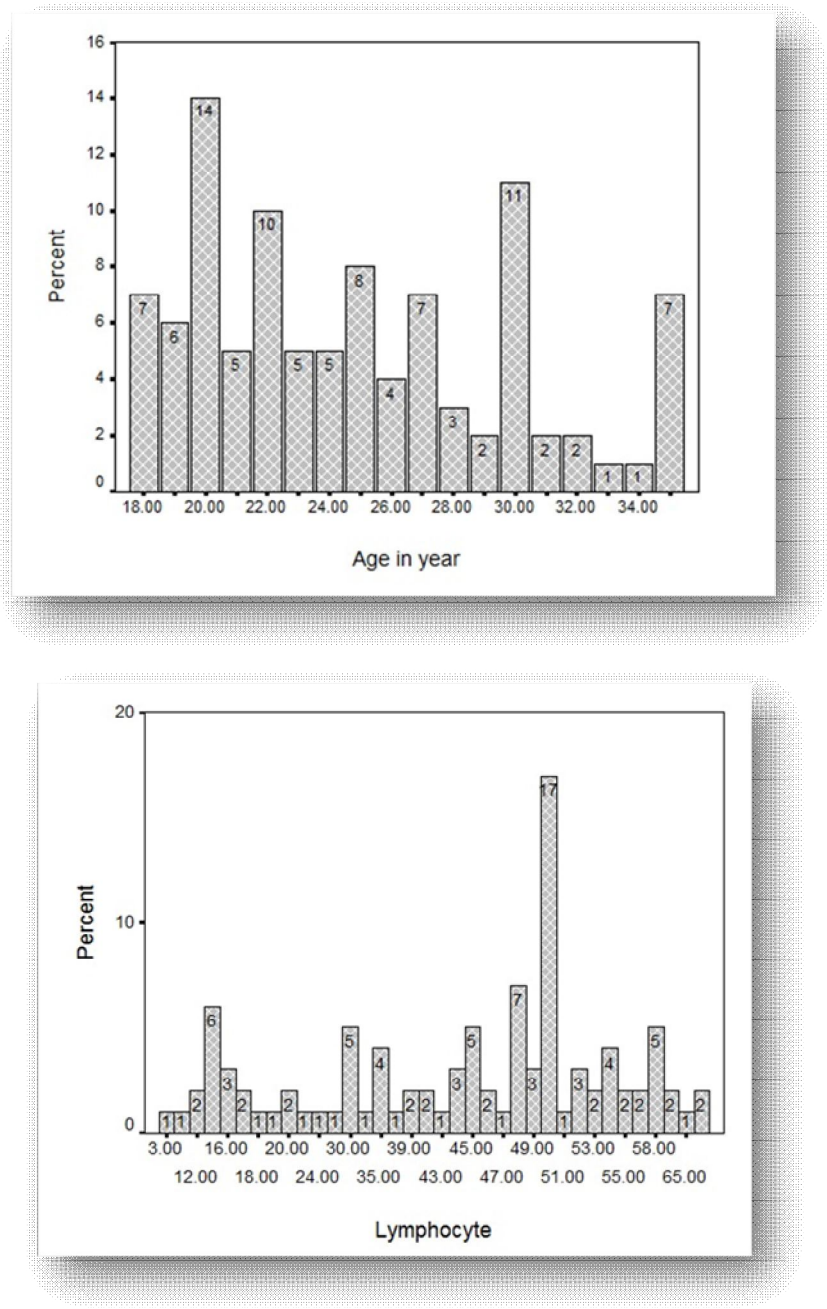

Fig 4: Lymphocyte bar chart of anemic pregnant

In this study we observed CBC report of anemic patient. CBC reports include differential count of hemoglobin (Hb), ESR, and WBC (Table-4). We found that the mean value of Hb of observed patient was 8.6470g/dl. Approximately 6% of the total observed patient were severe (<7.0g/dl) and 79% were moderate (9.9-7.0g/dl) anemic. Mean value of ESR was 36.59mm/hr which was approximately two fold higher then the normal value (< 20mm/hr). About 12% pregnant women had ESR 40mm/hr. Average WBC count was found 9423.00/mm^3 in this study. This average value was with in the normal range (4000–10000/mm^3) of WBC. Approximately 28% had more than 10000/mm^3 WBC. In this study maximum WBC count was 28000/mm^3 (1% of total observed patient). Again mean value of Neutrophil was 54.07% in this study which was fall in the normal count (40 – 70%). We found that 17% of observed patient had > 70% Neutrophil count and 9% had < 40% Neutrophil count. Rest of them (74%) had normal Neutrophil count. Mean value of Eosinophil and Monocyte was 2.2% and 2.01% respectively. We also observed the lymphocyte count and found that the mean value of lymphocyte was 41.38% and this value is quite high from the normal value (20 – 40%). 63% of total observed had high lymphocyte count.

Table 4: Hematological parameters of anemic pregnant patients

Hematological Parameter	Mean ± SD	Mean ± SEM	95% Confidence Interval of the Difference	
			Lower	Upper
WBC (/mm^3)	9423.0000 ± 3463.83494	9423.0000 ± 346.38349	8735.7000	10110.3000
Hemogloibin (g/dl)	8.6470 ± 1.03577	8.6560 ± 0.103577	8.4415	8.8525
ESR (mm/hr)	36.5900 ± 25.25870	36.5900 ± 2.52587	31.5781	41.6019
Neutrophil (%)	54.0700 ± 15.37823	54.0700 ± 1.53782	51.0186	57.1214
Eosinophil (%)	2.2000 ± 0.95346	2.2000 ± 0.09535	2.0108	2.3892
Lymphocyte (%)	41.3800 ± 15.99986	41.3800 ± 1.59999	38.2053	44.5547
Monocyte (%)	2.0100 ± 0.94810	2.0100 ± 0.09481	1.8219	2.1981

Table 5 shows the correlation coefficient between hematological and anthropometric indices of pregnant anemic patient. Age of the patient was positively significantly correlated with Height (β = 0.340), Weight (β = 0.272) and Monocyte (β = 0.217). Height was positively significantly correlated with Weight (β = 0.651), Hemoglobin (β = 0.454). Weight was positively correlated with WBC (β = 0.227), Hemoglobin (β = 0.547), Neutrophil (β = 0.265), Monocyte (β = 0.270), BMI (β = 0.733). The WBC was significantly positive in correlation with Hemoglobin (β = 0.307), ESR (β = 0.243), Neutrophil (β = 0.626), BMI (β = 0.383) and negative in correlation with lymphocyte (β = -0.580). Whereas, Hemoglobin (Hb) had significant positive correlation with Neutrophil (β = 0.299), BMI (β = 0.378), and negative with Lymphocyte (β = -0.265). The ESR had significant positive correlation with Neutrophil (β = 0.250). The Neutrophil was significantly positive in correlation with BMI (β = 0.381) and negatively correlated with Lymphocyte (β = 0.494). Monocyte had significant positive correlation with BMI (β = 0.214).

Table 5: Correlation coefficient between hematological and anthropometric indices:

Main Effect		Height	Wt	WBC	Hb	ESR	N	E	L	M	BMI
Age	1	0.304	0.272	-0.079	0.191	0.031	0.053	0.054	0.140	0.217	0.076
	2	0.002	0.006	0.433	0.057	0.756	0.600	0.595	0.164	0.030	0.452
Height	1		0.651	-0.067	0.454	-0.139	-0.028	-0.039	0.092	0.187	0.042
	2		0.000	0.508	0.000	0.166	0.785	0.699	0.361	0.063	0.678
Wt	1			0.227	0.547	-0.144	0.265	0.061	-0.127	0.270	0.733
	2			0.023	0.000	0.152	0.008	0.544	0.207	0.007	0.000
WBC	1				0.307	0.243	0.626	-0.130	-0.580	0.025	0.383
	2				0.002	0.015	0.000	0.196	0.000	0.801	0.000
Hb	1					0.060	0.299	-0.066	-0.265	0.173	0.378
	2					0.551	0.003	0.511	0.008	0.085	0.000
ESR	1						0.250	-0.110	-0.186	-0.111	-0.056
	2						0.012	0.275	0.063	0.273	0.578
N	1							0.068	-0.494	0.015	0.381
	2							0.502	0.000	0.881	0.000
E	1								0.090	0.188	0.082
	2								0.375	0.061	0.417
L	1									0.108	-0.245
	2									0.284	0.014
M	1										0.214
	2										0.032

1 = Beta value, 2 = Significance (P), P < 0.05 considered significant
Wt = Weight (Kg),WBC = White Blood Cell, Hb = Hemoglobin
ESR = Erythrocyte Sedimentation Rate, N = Neutrophil M = Monocyte, E = Eosinophil, L = Lymphocyte

In our study, we took hematological and anthropometric variables of pregnant women under consideration and wanted to find out their relation with IDA (Tab 6 and 7). We found that, Age (P = 0.001), Height (P = 0.006), Weight (P = 0.000), Hemoglobin (P = 0.000), ESR (P = 0.000), Neutrophil (P = 0.000), Eosinophil (P = 0.000), Lymphocyte (P =0.000) and Monocyte (P = 0.000) were significantly related with the diseases. Moreover, Weight, Hemoglobin, ESR, Neutrophil, Lymphocyte and Monocyte, these

variables were strongly and significantly associated with the diseases.

Table 6: Chi-square value of anthropometric parameter

Anthropometric parameter	Chi-square value	d.f.	Significance (P value)
Age	40.040	17	.001
Height	32.160	15	.006
Weight	67.360	15	.000
BMI	39.100	64	.994

Table 7: Chi-square value of hematological parameter

Hematological parameter	Chi-square value	d.f.	Significance (P value)
WBC	63.200	50	.100
Hemoglobin	70.280	32	.000
ESR	162.080	27	.000
Neutrophil	82.400	37	.000
Eosinophil	52.700	4	.000
Lymphocyte	106.640	35	.000
Monocyte	80.840	5	.000

20 years age old pregnant women were prone to be anemic among 18 – 35 years pregnant women of this study. Average Body Mass Index (BMI) of 100 observed women was 20.17(20.1734 ± 1.29916) According to WHO, normal BMI reference value during pre-pregnancy condition is 18.50 – 24.90. Weight is proportionally related with BMI (kg/m^2) and weight must be increased during pregnancy. So the average BMI 20.17 must be considered as poor BMI at pregnancy condition. There is a guideline about amount of weight should be gain during pregnancy condition (Tab 8). According to the guideline, it is clear that most of the patient of our study had low BMI. Most of the pregnant women of this study lived in rural area and most of the people lived on hand to mouth. Due to poverty, beside male women also work too hard for their batter life. Again in the male dominating society women are always neglected in their family as well as in the society. Beside this due to the poor living standard and adverse socio-economic condition to the female, women are deprived from the essential nutrients in their daily food. Above this reasons pregnant women are more susceptible to be iron deficiency anemic.

Table 8: Weight Gain during Pregnancy, by Pre-pregnancy BMI.[19]

Pre-pregnancy BMI	Total Weight Gain		Rates of Weight Gain* 2nd and 3rd Trimester	
	Range in kg	Range in lbs	Mean (range) in kg/week	Mean (range) in lbs/week
Underweight (< 18.5 kg/m2)	12.5–18	28–40	0.51	1
Normal weight (18.5–24.9 kg/m2)	11.5–16	25–35	0.44–0.58	1–1.3
Overweight (25.0–29.9 kg/m2)	7–11.5	15–25	0.42	1
Obese (≥ 30.0 kg/m2)	5–9 1	11–20	0.35–0.50	0.8–1

In this study total WBC count was 5200 – 28000 cells/ mm^3 (mean = 9423 cells/mm^3) and upper level was much higher then the normal (4000–11000 cells/mm^3). Different researches proof that during pregnancy total WBC count get increased. Anna Klajabard et *al* [20] demonstrated mean WBC count ranges from 6100–14100 cells/mm^3. Beside this other studies revealed that total WBC count ranges from 9000 to 15,000 cells/mm^3. [21] Our maximum WBC count was 28,000 cells/mm^3 which was compatible with the other research paper. [22, 23] From the differential count of WBC, we also observed that, there was no change in mean count of Neutrophil, Eosinophil and Monocyte in compare with their normal value. Though the mean value of lymphocyte (41.38%) was with in the range (20 – 45%) but more than 50% of the patients have >45% lymphocyte count. Anemia and infection may lead the elevation of lymphocyte count.

ESR is an indirect indicator of acute phase protein concentration and is a sensitive but non-specific index of plasma protein change. In this study the value of ESR was significantly increased compare with the normal value (0–

20mm/hr). Several previous studies reported that ESR can increase 2–3 times from normal value during pregnancy**.** [24, 25] It is also known that, anemia has influence on elevation of ESR. Several studies revealed that, fibrinogen concentration increased gradually with the time of pregnancy**.** [26, 27, 28] High estrogen level and elevated protein demand for the development of mother and foetus are mainly responsible for increasing fibrinogen concentration**.** [29] Elevated fibrinogen concentration results increased rouleaux formation and thus increase erythrocyte sedimentation. Though ESR is helpful in detecting presence of inflammation and its response to treatment, but elevated ESR due to pregnancy and anemia may give false positive result.

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