

DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20195363>

Original Research Article

## Changes in blood and urine parameters among pregnant women during third trimester

Ahmed L. Osman, Abdelgadir Eltom\*, Marwan Ismail, Khalid Ahmed,  
Alaa Khalil, Eman Mohamed, Kiran Gopinath

Department of Medical Laboratories Sciences, College of Health Sciences, Gulf Medical University, Ajman, UAE

Received: 21 September 2019

Accepted: 07 November 2019

**\*Correspondence:**

Dr. Abdelgadir Eltom,

E-mail: [gadoora1977@live.com](mailto:gadoora1977@live.com)

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### ABSTRACT

**Background:** During pregnancy, the pregnant lady undergoes significant anatomical and physiological changes in order to nurture and accommodate the developing fetus. These changes begin after conception and affect every organ system in the body.

**Methods:** The study was carried out in the United Arab Emirates - Ajman (Thumbay Hospital) during the period of (March - Jun) in the year of 2018 to estimate HbA1c% levels, hematological blood parameters and urine culture in healthy pregnant women during 3<sup>rd</sup> trimester. The study was conducted on (108) healthy pregnant women during 3<sup>rd</sup> trimester. Urine culture was performed to detect the growth of bacteria after the culture, gram stain was done to differentiate the bacteria followed by biochemical test to detect the type of bacteria.

**Results:** A total 26 (79%) of patients had normal HbA1c% result while 7(21%) had elevated HbA1c% result. The results of HbA1c% in last trimester mean±SD (range) HbA1c% (n=33) were 5.5±0.52% (111.5±14.8 mg/dL). Also, our results showed strong positive correlation between HbA1% with estimated Average blood glucose (r=0.78, P value=0.00), and weak positive correlation between HbA1 with age (years) (r=0.2, P value=0.02). Bacterial culture showed that two positive results of *Stenotrophomonas maltophilia* was isolated, three cases of *Staphylococcus aureus* was isolated and three cases of *Staphylococcus saprophyticus*. Hematological profile showed a clinically significant ( $\leq 0.05$ ) in Hb mean 11.47, P value 0.001, HCT mean, 33.9 P value 0.001 and MCV mean 73.7 value 0.001. No clinically significant ( $\geq 0.05$ ) in RBCs mean 3.93, P value 0.010, MCH mean 27.3 P value 0.061 and MCHC mean 30.9 P value 0.134.

**Conclusions:** Our study conclude that estimation of HbA1c%, hematological blood parameters and urine culture level in last trimester will be helpful in diagnosis, monitoring and predicting fetal distress.

**Keywords:** Blood and urine parameters, Fetal distress, HbA1c%, Preeclampsia, Pregnancy, Third trimester

### INTRODUCTION

During pregnancy, the pregnant lady undergoes significant anatomical and physiological changes in order to nurture and accommodate the developing fetus. These changes begin after conception and affect every organ system in the body. For most women experiencing an uncomplicated pregnancy, these changes resolve after

pregnancy with minimal residual effects. It is important to understand the normal physiological changes occurring in pregnancy as this will help differentiate from adaptations that are abnormal, other than home blood glucose estimation, which may not generally mirror the genuine normal blood glucose level.<sup>1</sup> HbA1c is a valuable parameter in metabolic direction. Along these lines, supplementation with HbA1c, as is regular outside

pregnancy, appears to be proper.<sup>2</sup> Elevated third-trimester HbA1c levels are related with an expanded danger of preeclampsia, macrosomia and stillbirth.<sup>3</sup> Prompting hypotheses that the objective for HbA1c in pregnancy ought to be even lower than outside pregnancy to counteract antagonistic occasions.<sup>4</sup> Corpulence, diabetes and glycaemic control are between connected, weight pick up is related with compounding diabetic control and can be exacerbated by treatments went for controlling hyperglycemia. A few investigations watched that there is a solid connection between expanding BMI and HbA1c over all age gatherings.<sup>5</sup>

Urinary tract infections (UTIs) in pregnant women continue to pose a clinical problem and a great challenge for physicians. Although the incidence of bacteriuria in this population is only slightly higher than in non-pregnant women, its consequences for both the mother and the unborn child are more severe. There is a much higher risk (up to 40%) of progression to pyelonephritis, and possibly increased risk of pre-eclampsia, premature birth and low neonatal birth weight.<sup>6</sup> The most common bacteria that can causes UTI such as Enterobacteriaceae, generally found in the gastrointestinal tract of which *Escherichia coli* isolated from 63-85% of cases, and the rest with *Klebsiellapneumoniae* (~8%), *coagulase-negative Staphylococcus* (up to 15%), *S. aureus* (up to 8%), and bunch *B streptococci* (GBS) (2-7%).<sup>7</sup>

Moreover, pregnancy characterized by numerous physiological blood changes, which may look satisfactory in a non-pregnant state.<sup>8</sup> During pregnancy, the total blood volume increases by about 1.5 liters. An increase in blood volume, therefore, is more pronounced in multiple pregnancies and in iron deficiency cases.<sup>9</sup> Plasma expansion occurs at 10-15% in 6-12 weeks of gestation. The number of white blood cells in the pregnancy is increased with a minimum reference set being usually 6000/com. Increased number of leukocytes, occurring during pregnancy due to physiological stress caused by the pregnant state. Neutrophils are the main type of leukocytes on differential charges. Lymphocytes decrease during pregnancy during the first and second trimester and increase during the third trimester of pregnancy.<sup>10</sup>

## METHODS

This is cross-sectional study was carried out in the United Arab Emirates - Ajman (Thumbay Hospital) during the period of (March - Jun) in the year of 2018 to estimate HbA1c% levels, hematological blood parameters and urine culture in healthy pregnant women during 3<sup>rd</sup> trimester. The study was conducted on (108) healthy pregnant women during 3<sup>rd</sup> trimester. Urine culture was performed to detect the growth of bacteria after the culture, gram stain was done to differentiate the bacteria followed by biochemical test to detect the type of bacteria. Sysmex analyzer a XT-1800I hematology analyzer was used for complete blood count hemoglobin (Hb), RBCs and red cell indices were considered to be

measured directly, two hydraulic subsystems were used to determine the hemogram, the RBC channel, red cell indices and a separate Hb channel. The study was approved by ethical committee for approval as per GMU research polices. The samples were analyzed in Tosoh GX automated HPLC analyzer. Urine sample cultured in CLED agar (cystine-lactose-electrolyte-deficient agar) by using disposable loop, then incubated for 24 hours at 37 degree in the incubator aerobically. Reagents, standard were checked for storage, stability and preparation before starting work. The precision and accuracy of the method used in this study were checked each time by using control material.

## Study population

Healthy pregnant women in third trimester.

## Inclusion criteria

- Normal pregnant ladies in third trimester without disease.

## Exclusion criteria

- Pregnant ladies in third trimester with symptoms of disease.

The proposal of the study will be submitted to the ethical committee for approval as per GMU research polices.

## Statistical analysis

The mean and SD of all continuous variable such as Hb, RBCs, TWBCs, Plts, Indices, DLC and Hb1c will be calculate to see the change of these parameters with normal reference range One sample Z- test will be whether there is any significant change in parameters with normal value.

## RESULTS

The study was conducted on (108) healthy pregnant women during 3<sup>rd</sup> trimester). HbA1c%, urine culture and complete blood count were performed on pregnant. The mean average for age, HbA1c% and Estimated average glucose were (29±5.2) years, (5.5±0.52) and (111.2±14.8) mg/dL respectively (Table 1).

**Table 1: Statistical analysis of the (Means±SD) of HbA1c%, estimated average glucose and age.**

Variables	Test group (n=108) (Mean±SD)
HbA1c%	(5.5±0.52%)
Estimated average glucose	(111.2±14.8mg/dL)
Age in years	(29±5.2)

The results were compared according to the objectives of the study, then results were statistically analyzed. Any

value below 5.7% was considered as normal and 5.7% and above as abnormal. Normal values (< 5.7%) were found in 85.5% of the pregnant and 17.5% had abnormal values; (Table 2). The results of HbA1c% in last trimester (Mean±SD) HbA1c% (n = 33) was 5.52±0.51% and the estimated average glucose (eAG) was (Mean±SD) (111.5±14.8) mg/dL (Table 2). Also, our results showed a strong positive correlation between HbA1% with estimated average glucose (eAG) (r=0.78, P value=0.00) (Figure 2), and weak positive correlation between

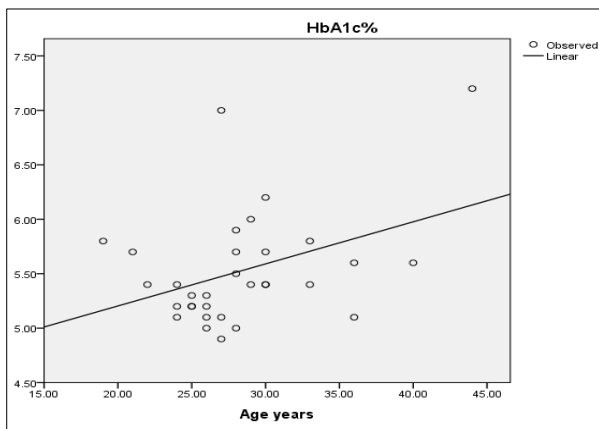
HbA1% with age (years) (r=0.2, P value=0.02); (Figure 1).

**Table 2: The number of patients with normal and abnormal HbA1c% results among test group (n=108).**

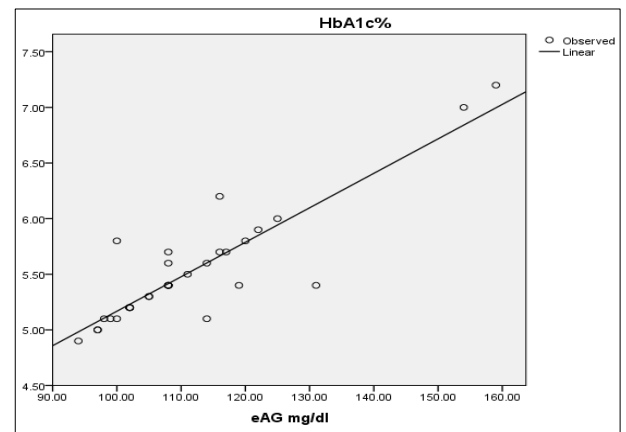
HbA1c results	Number of patients	Percent %
Normal	89	82.5
Abnormal	19	17.5%

**Table 3: Statistical hematological result of cases in third trimester.**

Trimester parameters	3 <sup>rd</sup> trimester		Normal range	Normal mean	Sig
	Mean				
RBC X 10 <sup>12</sup> /L	3.93		3.8-4.8	4.3	0.010
Hb x g/dL	11.47		12.0-15.0	13.5	0.001
HCT %	33.9		36.0-46.0	41	0.001
MCV fL	73.7		83.0-100	13.5	0.001
MCH pg/cell	27.3		27.0-32.0	29.5	0.061
MCHC g/dL	30.9		31.5-34.5	32.5	0.134



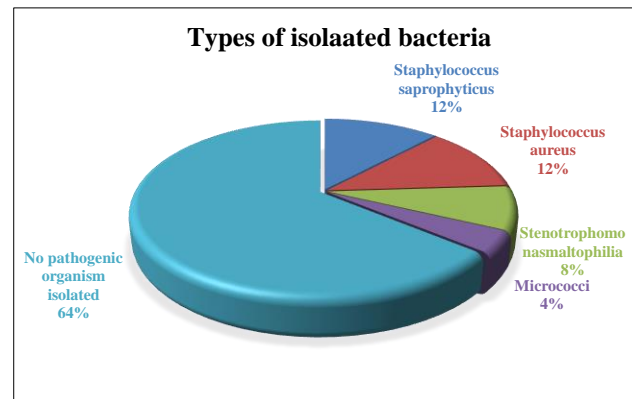
**Figure 1: Correlation between HbA1c % With Age in Years (r=0.2, P value=0.02).**



**Figure 2: Correlation between HbA1c % with eAG mg/dl (r=0.78, P value=0.00).**

In this study 9 (36%) urine samples out of twenty-five study participants have significant bacteriuria. Four different bacteria were isolated in this study. The majority of the isolates pathological bacteria was *Staphylococcus saprophyticus* with frequency rate of 12% and *Staphylococcus aureus* (12%), followed by *Stenotrophomonas maltophilia* (8%), and *Micrococci* (4%). Non-pathological bacteria isolate was (64%) (Figure 3).

Haematological profile showed a clinically significant ( $\leq 0.05$ ) in Hb Mean 11.47, P value 0.001, HCT mean 33.9 P value 0.001 and MCV mean 73.7 value 0.001. No clinically significant ( $\geq 0.05$ ) in RBCs mean 3.93 P value 0.010, MCH mean 27.3 P value 0.061 and MCHC mean 30.9 P value 0.134 (Table 3).



**Figure 3: Pie chart showing the percentage of the types of isolated bacteria.**

## DISCUSSION

In this study the majority of pregnant women had normal results (any value below 5.7% was considered as normal and 5.7% and above as abnormal). Total of 108 patients eighty-nine (82.5%) of them are below the normal range which is 5.7% but they were considered at risk because they were in the upper-limit. Nineteen patients (17.2%) are above the normal range of 5.7% and they are at high risk of preeclampsia, macrosomia and stillbirth.

In the present study our results showed a significant positive correlation between HbA1c% and age; increase of age increasing in HbA1c% is risk factor to pregnant women with higher ages this agree with other finding a possible explanation for the observed association of higher A1C with increasing age in individuals with NGT is that factors unrelated to glucose metabolism are affecting A1C levels. One such explanation may be changes in the rate of glycation associated with aging.<sup>11</sup> Our result showed that, the mean concentration of the HbA1c% in case group was (5.523±0.516) is near to upper limit of normal range (5.7%) this in agreement with the study on primigravida in their third trimester who were nondiabetic was found to have a mean HbA1c% value of 5.29%±0.514%, HbA1c% values ranged from 4.5% to 6%. The HbA1c% value was significantly associated with weight gain during pregnancy. The range of HbA1c% which had favorable outcome was 4.5%-5%. Hence, we may conclude that the upper cutoff of HbA1c% for a safe outcome is 5% for a nondiabetic pregnancy so that adverse outcomes can be minimized.<sup>12</sup> Radder et al reported that HbA1c % values reduced in the first trimester, while upper reference was 5%, but increased in the third trimester to no higher than 5.9%. They speculated that the low HbA1c% in the first trimester was ascribed to the low blood glucose before and after a meal and the increased HbA1c% in the third trimester was attributed to the increase in postprandial glucose.<sup>11</sup>

In addition to that, the present study indicated significantly strong positive correlation between HbA1% and estimated Average glucose ( $r=0.78$ ,  $P$  value =0.00) this in same with study done by Shobha.<sup>13,14</sup> The average plasma blood glucose corresponding to HbA1c% value of 5% is 101 mg/dl and that corresponding to mean value of 5.29% is 111 mg/dl (range for 5.29%±0.514% is 90-129 mg/dl) hence, it may be concluded that HbA1c can indeed be utilized for the monitoring of glycemic level, as a screening test, even in nondiabetic pregnancies. The correlation coefficient between HbA1c% and blood glucose is 0.80. Generally, HbA1c% of 6% is equivalent to blood glucose of 135 mg/dl (7.5 mmol/l). An increment of HbA1c% by 1% may cause the increase in blood glucose by 35 mg/dl (1.95 mmol/l).<sup>15</sup>

One of the aims of this study to identify the bacteria that is present in the urine and also to detect the most abundant bacteria among pregnant women over the last

three months. Midstream urine sample was collected in urine containers without any preservatives.

The technique used in our study was bacteria culture. In this study, the result shows that two positive results of *Stenotrophomonas maltophilia* was isolated, three cases of *Staphylococcus aureus* was isolated and three cases of *Staphylococcus saprophyticus*.

*S. maltophilia* was considered an unusual organism to isolate in the diagnostic microbiology laboratory. *S. maltophilia* frequently colonizes humid surfaces such as the tubes used in mechanical ventilation and indwelling urinary catheters as well as medical devices such as suction catheters and endoscopes. The growth of *S. maltophilia* in microbiological cultures of urinary specimens is difficult to interpret due to its low pathogenicity and not a proof of infection.<sup>16</sup>

*S. aureus* is a relatively uncommon cause of urinary tract infection in the third trimester pregnant women.

In certain patients, *S. aureus* causes ascending urinary tract colonization and infection. Urinary tract instrumentation and the presence of an indwelling catheter increase the risk of *S. aureus* carriage in the urinary tract. In specific patient populations, however, *S. aureus* can be an important primary urinary pathogen. For example, MRSA urinary tract infection occurs in both an endemic and epidemic fashion among patients undergoing urologic surgical procedures. Gram-positive organisms such as *Staphylococcus saprophyticus* are fewer common causes of UTI.<sup>17</sup>

*S. saprophyticus* is second only to *E. coli* as the most frequent causative organism of uncomplicated UTI in women. Most infections occur in young sexually active women. The highest rate of *S. saprophyticus* infection was 42.3%, among women aged 16-25 years.<sup>18</sup>

The physiology of a normal pregnancy involves major changes in the hematological parameters and biochemical coagulation system. These changes appear to be related to the development of the uteroplacental circulation and provide a protective mechanism during delivery. In this study, we focus in the primary hematological changes during pregnancy related to Hb, RBCs, HCT, MCV, MCH and MCHC, among healthy pregnant women during third trimester. The current study showed a clinically significant ( $\leq 0.05$ ) in Hb, HCT and MCV when its compare with normal references values. Our findings are supported by many studies conducted among pregnant healthy women.<sup>19,20</sup> Also, this finding is contradictory with similar study done by Li et al, among pregnant women and concluded that there was no significant difference of hemogram changes.<sup>21-22</sup> Also, our result showed no clinically significant ( $\geq 0.05$ ) in RBCs, MCH and MCHC among those women. This finding supported that during pregnancy, the total blood volume increases by about 1.5 L, mainly to supply the



demands of the new vascular bed and to compensate for blood loss occurring at delivery.<sup>23</sup>

## CONCLUSION

Estimation of HbA1c% level in last trimester will be helpful in predicting fetal distress and this can help the obstetrician to anticipate a difficult labour. Moreover, as it was found out in this study at least one value of HbA1c% in the last trimester can predict fetal distress. According to hematological profiles (Hb, RBCs, HCT, MCV, MCH and MCHC). We concluded that pregnancy during third trimester among healthy pregnant women did not alter in findings of RBCs, MCH and MCHC and no significant changes in these parameters among pregnant women. Hb, HCT and MCV showed differences and were statistically significant. This may be due to difference in iron metabolism, iron status, hormone regulations but this cannot affect the pregnancy outcome.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Osman AL, Eltom A, Ismail M, Ahmed K, Khalil A, Mohamed E, et al. Changes in blood and urine parameters among pregnant women during third trimester. *Int J Reprod Contracept Obstet Gynecol* 2019;8:5022-6.