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Determination of Some Abnormal Parameters in Urine of Pregnant Women Attending Antenatal Clinics in Some Districts of Jos South Lga Plateau State

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Abstract: Abnormal parameters in urine can be a sign of some pathologic conditions and more especially in pregnancy because it will constitute a danger sign to both the fetus and her mother. But if detected on time can be treated or managed for the good health of the fetus and the would be mother. Women with glycosuria in the first and second trimester had a significantly higher incidence of developing gestational diabetes and those with proteinuria have a higher chance of developing preeclampsia in the course of their pregnancy. This study was to determine the presence and/or absence of abnormal parameters in urine of pregnant women attending antenatal clinics in two districts of Jos south LGA, Plateau state. A total of 90 consented pregnant women from three different hospitals: Primary health care Vwang, Mercy seat hospital and Vom Christian hospital were enrolled alongside 90 non-pregnant women who served as our control. Their urine was examined for presence and/or absence of some abnormal parameters in urine that include glucose, protein, bilirubin, urobilinogen and ketones. 8 (8.9%) of pregnant women had at least one abnormal parameter found in their urine with age group 31-40 years having the highest number of participants 4 (4.4%) with abnormal parameters while age group 41-50 years had no participants with any abnormal parameters found in her urine. Based on trimester, 2nd and 3rd trimester had equal number of participants 4 (4.4%) with abnormal parameter found in their urine while those in 1st trimester had no participants with any abnormal parameter seen in her urine sample. This study found out that all abnormal parameters noted among the pregnant women was equally seen in non-pregnant women that served as control except that of protein in urine which can be termed as pregnancy induced proteinuria. Women should be encouraged to register for their antenatal care and carry out their routine antenatal test screening in order to detect any abnormal parameter that may constitute a danger sign to both the women and her fetus.

Keywords: Pregnancy, Abnormal parameters, glycosuria, proteinuria, trimesters, Urine and Age group.

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Introduction

Urine is a liquid by-product of metabolism in humans and many other animals. In mammals, urine is formed in the kidney and flows through the ureters to the urinary bladder and is normally voided through the urethra to the penile meatus in males or urethral meatus of the vulva in females during urination (Marvalee, 1992). About 91-96% of urine consists of water and the remainder characterized into inorganic salts, urea, organic compounds and organic ammonium salts (Rose *et al*, 2015). In healthy persons urine contains minute amount of proteins and sugars and an excess is suggestive of illness (Helmenstine, 2025). In pregnancy, trace glycosuria can be a normal finding. Routine screening of urine for glucose at each prenatal visit is the traditional standard of care. However, women with glycosuria in the first and second trimester had a significantly higher incidence of developing gestational diabetes than those whose urine tested negative for glucose (Sarah *et al*, 2012).

Glucose in urine during pregnancy can be termed as gestational diabetes mellitus. Gestational diabetes mellitus (GDM) can be defined as glucose intolerance of variable degree with onset or first recognition during pregnancy (Wilmot & Mansell, 2014). A study by Stuebe, *et al* found this condition to be associated with persistent metabolic dysfunction in women at 3 years after delivery separate from other clinical risk factors. Gestational diabetes mellitus accounts for 90% of cases of diabetes mellitus in pregnancy while preexisting type 2 diabetes accounts for 8% of such cases. Infants of mothers with preexisting diabetes mellitus experience double the risk of serious injury at birth, triple the likelihood of cesarean delivery and quadruple the incidence of newborn intensive care unit admission (Stuebe, *et al* 2011).

During a healthy pregnancy, mean fasting blood sugar levels decline progressively to a remarkably low value of 74 ± 2.7mg/dl. However, peak postprandial blood sugar values rarely exceed 120mg/dl. Meticulous replication of the normal glycemic profile during pregnancy has been demonstrated to reduce the macrosomia rate. Specifically, when the 2-hour postprandial glucose levels are maintained below 120mg/dl approximately 20% of fetuses demonstrate macrosomia. If postprandial levels range up to 160mg/dl macrosomia rates rise to 35% (Moore, 2024).

Ketonuria is a hallmark of hyperemesis gravidarum along with frequent vomiting periods, dehydration with electrolyte disturbances and loss of >5% prepregnant weight. Ketonuria is associated with starvation or stress states, medications and certain disease states such as infection, diabetes and hyperemesis gravidarum (Sarah *et al*, 2012).

Ketones are produced from the breakdown of lipids when the body's metabolic needs are not met by glucose metabolism. Any reduction in glucose supply such as from decreased oral intake or a diet low in carbohydrates will result in an increase in ketone levels. Maternal ketones are supplied to the fetus through passive diffusion across the placenta. In pregnancy the synthesis of ketones is accelerated particularly in the third trimester due to high-energy demands and increased maternal lipid metabolism in response to increased maternal insulin resistance (Robison, et al 2017).

The prevalence of Ketonuria in pregnancy is not well characterized. Studies report a wide variation in prevalence ranging from 5% - 89% of women. This discrepancy in prevalence is difficult to explain but may be due to heterogeneity in study design and patient population.

Ketonuria has been associated with adverse pregnancy outcomes in some but not all studies. These include reduced childhood intelligence quota, oligohydramnios, fetal heart rate decelerations and non-reactive non-stress tests. The level of urinary maternal ketones that has been associated with these adverse pregnancy outcomes has been as low as 1-3mMol/L which equates to a trace and small level on a urine dipstick. While ketones have been associated with adverse pregnancy outcomes, there is no clear evidence that maternal ketone directly causes adverse pregnancy outcomes. Ketonuria may instead be a marker of maternal pathology that causes both an adverse fetal environment and elevated urinary ketone levels.

Any condition resulting in a decrease in glucose availability will lead to an increase in ketone levels. Likewise, any condition that leads to maternal dehydration will have the effect of increasing urinary ketone levels secondary to a decrease in urinary volume (Robinson, *et al* 2017).

Proteinuria has additional significance during pregnancy. Urinary protein excretion is considered abnormal in pregnant women when it exceeds 300mg/24h at any time during gestation, a level that usually correlates with 1+ on a urine dipstick. Preeclampsia is the leading diagnosis that must be excluded in all women with proteinuria first identified after 20 weeks of gestation (Sarah *et al*, 2012). During pregnancy, proteinuria has traditionally been a hallmark of preeclampsia but it is also a nonspecific indicator of renal disease and may result from an elevated plasma protein concentration, increased glomerular permeability, decreased tubular protein reabsorption, and renal hemodynamic alterations. It has been reported that the rate of isolated proteinuria in pregnancy may reach 8% whereas preeclampsia occurs among 3-8% of pregnancies (Fishel, *et al* 2022).

Normal urine sample usually contains small amount of urobilinogen which is not detectable with dipstick. Elevated levels may indicate hemolysis and hepatocellular disease associated with pregnancy related conditions such as hemolysis, elevated liver enzymes and low platelet count. Bilirubin should not be present in the urine. In obstructive hepatobiliary conditions and in certain liver diseases, such as hepatitis, conjugated (water-soluble) bilirubin is excreted in the urine. Often, this may occur prior to the development of clinical symptoms such as jaundice. Also, only conjugated bilirubin can be passed into urine in pathologic states. Presence of bilirubin in urine indicates either bile duct obstruction due to stones or cholestasis of pregnancy or intrinsic hepatic disease. Clinically apparent jaundice will also cause bilirubin to be elevated in urine samples (Sarah *et al*, 2012). Intrahepatic cholestasis of pregnancy is the most common, reversible and closely related to pregnancy condition characterized by elevated levels of bile acids in the blood stream and an increased risk of adverse perinatal outcomes. The disease is usually mild in pregnant women but can be fatal to the fetus leading to numerous complications including intrauterine death (Maciej *et al*, 2022).

Materials and Methods

Study Design

This was a true experimental case control/purposive study conducted on pregnant women attending different antenatal clinics in Jos South LGA Plateau State and non-pregnant women as control group.

Study Population

The study population comprised of pregnant women who are attending different antenatal clinics in Jos South metropolis and non-pregnant women in the same location who served as a control group.

Sample Collection

Five to ten millimeters (5-10ml) of random urine samples were collected from participants, transported to chemical pathology laboratory of Federal College of Veterinary and Medical Laboratory Technology (FCVMLT) where the samples were immediately analyzed and results recorded.

Instrument for Data Collection

A structured interviewer administered questionnaire was used to collect participant's information for age, history of drug use for diabetes and hypertension, and stage of trimester for pregnant women, then age and drug use for non-pregnant women.

Sample Analysis

Urine samples were analyzed by combi-11 standard method for presence of glucose, protein, ketone bodies, urobilinogen and bilirubin (qualitative test strips) using dipstick technique. Abnormal parameters found in the analyzed urine samples were recorded.

Data Analysis

Data collected was analyzed using descriptive statistics and presented in tables and percentages

Results

This study determined the presence of abnormal parameters that comprise of glucose, protein, ketone bodies, bilirubin and urobilinogen in urine of pregnant and non-pregnant women in Vwang and Kuru districts of Jos south L.G.A, Plateau state. A total of 180 consented participants comprising of 90 pregnant women and 90 non-pregnant women from different hospitals comprising Mercy seat hospital with 45 pregnant women and 45 non-pregnant women, primary healthcare vwang (PHC) with 30 pregnant women and 30 non-pregnant women and Vom Christian hospital with 15 pregnant women and 15 non-pregnant women were enrolled in this study.

Presence and/ or absence of abnormal parameters in urine of pregnant women and non-pregnant women studied is shown in table 1.

The population of pregnant women studied based on their age ranges are as follows; less than or equal to 20 years age group have 12 participants (13.3%), 21-30 years age group have 41 participants (45.6%), 31-40 years age group have 34 participants (37.8%) while 41-50 years age group have 3 participants (3.3%). In the ≤ 20 years age group 1 (1.1%) participant had protein and no other abnormal parameters in her urine while 11 (12.2%) had no abnormal parameters in their urine.

In the 21-30 years age group, 2 (2.2%) participants have protein in their urine, 1 (1.1%) has glucose in her urine while 38 (42.2%) has no abnormal parameters in their urine. 1n the 31-40 years age group, 1 (1.1%) has ketones in her urine while 3 (3.3%) have glucose in their urine while 30 (33.3%) have no abnormal parameters in their urine. In the 41-50 years age group, all the 3 (3.3%) participants investigated have no abnormal parameters in their urine.

The population of pregnant women studied based on their trimesters shows that 9 (10%) participants are in their 1st trimester, 33 (36.7%) in their 2nd trimester and 48 (53.3%) are in their 3rd trimester. All the participants in their 1st trimester have no abnormal parameters in their urine, 29 (32.2%) of those in 2nd trimesters have no abnormal parameters in their urine, 1 (1.1%) has protein in her urine, 1 (1.1%) participant had ketones and 2 (2.2%) have glucose in her urine. 44 (48.9%) of those in 3rd trimester have no abnormal parameters in their urine while 2 (2.2%) have protein and 2 (2.2%) have glucose in their urine.

In the control subjects, among the age groups ≤ 20 years category was 31 (34.4%) in number, 21-30 years were 51 (56.7%) in number, 31-40 years were 6 (6.7%) in number while 41-50 years age group were 2 (0.2%) that were studied.

Those in 21-30 years age group had 1 (1.1%) participant who had ketones in her urine, 1 (1.1%) had bilirubin, 2 (2.2%) had glucose, 4 (4.4%) had urobilinogen while 43 (47.8%) had no abnormal parameters in their urine. Age group ≤ 20, 31-40 and 41-50 years had no abnormal parameters in their urine.

Table 3.1: Age ranges and trimester of normal and abnormal parameters in urine of study participants

Pregnant women

Age Ranges (Years)	Population N (%)	Normal result N (%)	Protein N (%)	Ketones N (%)	Urobilinogen N (%)	Bilirubin N (%)	Glucose N (%)
≤ 20	12 (13.3)	11(12.2)	1 (1.1)	0 (0)	0 (0)	0 (0)	0 (0)
21-30	41 (45.6)	38(42.2)	2 (2.2)	0 (0)	0 (0)	0 (0)	1 (1.1)
31-40	34 (37.8)	30(33.3)	0 (0)	1 (1.1)	0 (0)	0 (0)	3 (3.3)
41-50	3 (3.3)	3 (3.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Trimester (Months)	population N (%)	Normal result N (%)	Protein N (%)	Ketones (%)	Urobilinogen N (%)	Bilirubin (%)	Glucose N (%)
1st	9 (10)	9(10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2nd	33(36.7)	29(32.2)	1 (1.1)	1 (1.1)	0 (0)	0 (0)	2 (2.2)
3rd	48 (53.3)	43(47.8)	2(2.2)	0 (0)	0 (0)	0 (0)	2 (2.2)

Control

Age Ranges (Years)	population N (%)	Normal result N (%)	Protein N (%)	Ketones N (%)	Urobilinogen N (%)	Bilirubin N (%)	Glucose N (%)
≤ 20	31 (34.4)	31(34.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
21-30	51 (56.7)	43(47.8)	0 (0)	1 (1.1)	4 (4.4)	1 (1.1)	2 (2.2)
31-40	6 (6.7)	6 (6.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
41-50	2 (2.2)	2 (2.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

N= number of participants in each age group and trimester

Discussion

In this study, pregnant women were studied for abnormal parameters in their urine along with non-pregnant women who are of the same age group that served as control subjects.

Pregnant women in the 31-40 years age group had a total of four participants who had either ketones or glucose in their urine but those of same age range who are non-pregnant had no abnormal parameters observed in their urine. This shows that the presence of the abnormal parameters may be pregnancy induced. This finding is in correlation with the study of Helen et al, 2017 who observed that ketonuria in pregnancy is common affecting at least one in five women. Also, the presence of glucose in the urine of the pregnant women observed in our study is similar to what was documented by (Moore, 2024) who noted that abnormal maternal glucose regulation occurs in 3-10% of pregnancies.

Pregnant women in the 21-30 years age group had two participants who had protein in their urine and one participant who had glucose in her urine. When compared with non-pregnant women of same age group, it was observed that non-pregnant women of same age group equally had glucose in their urine but no presence of protein as observed from pregnant women. This shows that the protein observed among the pregnant women may be pregnancy induced

Also, one participant among $\leq$ 20 years age group had protein in her urine but when compared with non-pregnant women of same age group none of the participants had protein in their urine. This finding calls for attention because protein in urine during pregnancy may be associated with preeclampsia or kidney diseases as documented by Bartal *et al*, 2022.

Pregnant women who are in their 2^{nd} trimesters and 3^{rd} trimesters had protein, glucose in their urine while those in their 2^{nd} trimester also had ketones in their urine. But those in their 1^{st} trimester had no abnormal parameters observed in their urine. The presence of ketones among women in their 2^{nd} trimester is similar to the findings of Helen et al, 2017 who documented 22% of ketonuria on pregnant women who are between 16-28 weeks of gestation in their study.

Glucose in urine during pregnancy may be as result of gestational diabetes mellitus or due to renal dysfunction. Also, protein in urine during pregnancy is associated with preeclampsia or renal dysfunction. Gestational diabetes accounts for 90% of cases of diabetes mellitus in pregnancy (Moore, 2024). Moore documented that gestational diabetes mellitus and impaired glucose tolerance during pregnancy are associated with persistent metabolic dysfunction at 3 years after delivery, separate from other clinical risk factors.

Protein in urine during pregnancy which may be as a result of preeclampsia or renal disease. Preeclampsia consists of abrupt elevation in blood pressure, significant proteinuria, elevated liver enzymes and low platelet count syndrome (Moore, 2024). He also noted that preeclampsia increases with maternal age. Renal dysfunction during pregnancy can lead to varying of proteinuria, perinatal complications are greatly increased in patients with diabetic nephropathy, preterm birth, intrauterine growth restriction and preeclampsia.

Proteinuria in combination with hypertension has long been considered to be predictive of increased maternal and neonatal adverse outcomes compared with women with gestational hypertension alone (Bartal *et al*, 2022).

Ketonuria has been associated with adverse pregnancy outcomes in some but not all studies (Helen *et al*, 2017). While ketones have been associated with adverse pregnancy outcomes, there is no clear evidence that maternal ketones directly cause adverse pregnancy outcomes. Ketonuria may instead be a marker of maternal pathology that causes both an adverse fetal environment and elevated urinary ketone levels.

Helen *et al* noted that any pathology resulting in a decrease in glucose availability will lead to an increase in ketone levels. Also, any pathology that leads to maternal dehydration will have the effect of increasing urinary ketone levels secondary to a decrease in urinary volume. Our finding of ketonuria in pregnancy may be related to any of the postulations above and may not be a serious concern since it was equally observed among our control subjects.

All abnormal parameters of urine observed in pregnant women was equally noted in non-pregnant women except that of protein in urine. Protein in urine during pregnancy may be as a result of pregnancy induced proteinuria and not related to kidney dysfunction which may apply to other abnormal parameters noted since the parameters were observed in both pregnant and non-pregnant women.

Among the control subjects' abnormal parameters such as urobilinogen and bilirubin were found in their urine which was not found among the pregnant women. This may be as a result of unknown liver diseases in those control subjects since none of them admitted of taking any medication for liver disease. Bilirubin and urobilinogen are not normally found in urine and its presence indicates a liver dysfunction.

Conclusion

From our study, we can conclude that the only abnormal parameters of urine found among pregnant women that is pregnancy induced is protein in urine which was not found among our control subjects. Other abnormal parameters found may be as a result of some pathology and not pregnancy related since such parameters such as ketones and glucose were also observed in our control subjects.

Disclaimer

The products used for this research are commonly and predominantly use products in our area of research and country. We do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the researchers were not funded by the producing company rather it was funded by personal efforts of the authors.

Author Contributions

All authors made a significant contribution to this work from the conception through the study design, execution, acquisition of data, analysis and interpretation of results. They equally took part in drafting, revising and critically reviewing the manuscript and gave final approval of the version to be published.

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