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# Analyzing Protein and Glucose Levels in Pregnant Women Attending Antenatal Care at Health Centers in Port Harcourt, Rivers State

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**Abstract:** *Protein and glucose serve as crucial indicators of potential maternal health complications and fetal outcomes during pregnancy. This study aimed to investigate protein and glucose level of pregnant women attending antenatal care in some health centre, in Port Harcourt, Nigeria. A total of sixty pregnant women between ages 16-45 who attended antenatal care in the selected health centres were randomly selected and their urine samples were collected and analyzed for protein and glucose levels using urinometre (combi 2). The result obtained for protein level ranged between 200± 14.0mg/dl to 350± 16.2 mg/dl while the glucose level ranged between 180± 11.0mg/dl to 200± 12.0mg/dl. The least protein level of 200± 14.0mg/dl were recorded among 7-9 months (3rd trimester) pregnancy, while the highest protein level of 350± 16.0mg/dl were recorded between 0-3 months (1st trimester). The least glucose value of 180± 11.0mg/dl was recorded among pregnant women that are in their 1st trimester, while the highest value of 200± 12.0mg/dl was recorded among pregnant women in their 2nd trimester. The result indicates significant fluctuations in protein and glucose levels across trimesters, reflecting dynamic metabolic changes during pregnancy.Factors like advanced maternal age, knowledge gaps, misconceptions, symptoms, and treatment-seeking behaviour highlighted in the questionnaire data can be considered as potential risk factors or indicators concerning protein and glucose levels during pregnancy. Addressing these factors through targeted education, early detection, and appropriate medical intervention is recommended in the study area to ensure an optimal pregnancy outcome.*

**Keywords:** Maternal health, Pregnancy complication, Proteinuria, Glycosuria

## I. INTRODUCTION

Pregnancy is a period marked by rapid and profound physiological changes from conception until birth, necessitating increased nutritional requirements to support maternal metabolism, tissue accretion, and fetal growth and development (Baker et al., 2012). The health of a woman during pregnancy is a critical determinant of her child's health, both in utero and throughout childhood (Kimmel et al., 2016). Over the nine months of pregnancy, the body undergoes numerous changes, some of which benefit the growing baby, while others can complicate the pregnancy, potentially risking the lives of both mother and child. Consequently, regular antenatal care is essential, where pregnant women receive general consultations from obstetricians to monitor and manage these changes. Pregnancy and the associated changes are a normal physiological process in response to the development of the fetus. These changes happen in response to many factors; hormonal changes, increase in the total blood volume, weight gain, and increase in foetus size as the pregnancy progresses. All these factors have a physiological impact on the pregnant woman: the musculoskeletal, endocrine, reproductive, cardiovascular, respiratory, nervous, urinary, gastrointestinal and immune systems are affected, along with changes to the skin and breasts. The full gestation period is 39-40 weeks, and a pre-term birth is classed as delivery before 37 weeks gestation, although there is variation internationally and it is thought that the length of human pregnancies also vary naturally (Jukic et al, 2013).

During pregnancy, both protein metabolism and carbohydrate metabolism are affected. One kilogram of extra protein is deposited, with half going to the fetus and placenta, and another half going to uterine contractile proteins, breast

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glandular tissue, plasma protein, and haemoglobin. Pregnant women require a caloric increase. There is an increased requirement for nutrients due to foetal growth and fat deposition. Changes are caused by steroid hormones, lactogen, and cortisol. A pregnant woman can expect to again between 20 to 30 lb (9.1 to 13.6 kg) depending on the pre-pregnancy weight. Weight gain or weight loss is a poor indication of foetal well-being. (Forbes et al, 2018). A healthy diet during pregnancy is fundamental, encompassing optimal intake of energy, macro-nutrients, and micro-nutrients, achieving appropriate weight gain, adhering to food safety recommendations, and avoiding harmful substances (O'Connor et al., 2016). Protein in the urine (proteinuria) can signal urinary tract infections (UTIs), kidney infections, or chronic kidney disease. When proteinuria arises later in pregnancy, it can be an early indicator of preeclampsia, a condition that causes high blood pressure and increases the risk of serious complications for both mother and baby (Leermakers et al., 2017). Inadequate maternal nutrition during pregnancy can lead to negative short- and long-term health outcomes, including reduced fetal growth, respiratory diseases in early childhood, and an increased risk of cardiovascular diseases, type 2 diabetes, obesity, and osteoporosis in later life (Shin et al., 2015; Pauwels et al., 2015).

The significance of a balanced protein intake during pregnancy cannot be overstated, as protein supports structural and functional roles in the body, including the formation of keratin, collagen, enzymes, transport proteins, and hormones (WHO/FAO/UNU, 2007). The body requires an adequate supply of amino acids and total protein to support these roles. Additionally, glucose serves as a vital fuel and precursor for various metabolic intermediates necessary for biosynthetic reactions (King, 2007). Insulin facilitates glucose entry into the bloodstream, and its absence leads to hyperglycemia, characterized by blood glucose levels exceeding the normal range of 90-100 mg/100 ml or 3.9-7.0 mmol/L. Balanced dietary intake of energy and protein is crucial for pregnant women to reduce the risk of stillbirth and small-for-gestational-age neonates (WHO, 2016), although there may be pregnancy associated problems such as pelvic floor dysfunction, rib pain, nerve compression syndromes, muscle cramps, symphysis pubis dysfunction, morning sickness, edema, pre-eclampsia, back pain(Jukic et al, 2013).

Given this backdrop, it is essential to investigate the protein and glucose levels in the urine of pregnant women. Abnormal levels of these biomarkers are crucial indicators of potential complications affecting maternal and fetal health. Despite efforts to improve maternal healthcare, there is a lack of comprehensive data on the prevalence, risk factors, and implications of elevated protein and glucose levels during pregnancy. Assessing these levels among pregnant women attending antenatal care is vital to understanding the prevalence, determinants, and implications of elevated protein and glucose.

High protein levels during the first half of pregnancy can indicate minor infections such as UTIs or underlying health issues like heart diseases or kidney problems. After 20 weeks of pregnancy, elevated urine protein levels become a more significant concern. Similarly, glucose in urine during pregnancy can signal gestational diabetes, influenced by factors such as a high carbohydrate diet, obesity, and a family history of diabetes. Early detection of abnormal protein and glucose levels in the urine of pregnant women is crucial to mitigating the associated risks. Therefore, the aim of this study aims was to investigate the protein and glucose levels among pregnant women attending antenatal care. Specifically, it seeks to:Determine the protein and glucose levels among pregnant women and to identify the risk factors associated with abnormal protein and glucose levels in the study area.

## II. MATERIAL AND METHODS

**Study Area**

The study was carried out in three primary health care centres in Port Harcourt City Local Government which are Abuloma, Amadi and Okuru Ama. These health centres are known places where pregnant women register for antenatal, and they are for different visiting days.

**Study Design**

A descriptive correlational research design was adopted

Ethical Approval

This was obtained from Ministry of health Port Harcourt.

**Sample Size**

Convenient sample sizes of sixty (60) pregnant women were drawn from the three health facilities. Twenty (20) from Abuloma health centre, Twenty (20) from Amadi and Twenty (20) from Okuru Ama health centre.

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**Sampling Method**

The urine samples were selected through random sampling method.

**Sample Collection/ Instrument for Data Collection.**

Sixty (60) sterile sample bottles were given to the participants. They were asked to bring mid-stream urine. A questionnaire was also administered to the participants which were retrieved immediately. The (combi 2) urinometer strip was used to detect the presence of protein and glucose using aseptic method.

**Statistical Analysis**

Data obtained were analysed using Statistical Package for Social Science (SPSS), percentage, mean and standard deviation.

## III. RESULT

The data and results of research questions are presented: Percentage, mean and standard deviation were used for the analysis of the result.

**Protein and Glucose Level of Pregnant Women**

The result of the protein and glucose level are presented in Table1. The protein level ranged from 200±14.0 mg/dl to 350±16.2 mg/dl, while the glucose level ranged from 180±10.0mg/dl to 200±12.0 mg/dl. The lowest protein level was observed among 7-9 months pregnant women (3rd trimester) while the highest protein level was observed among 1-3 months pregnant women (1st trimester). For the glucose level, the least value of 180±10.0mg/dl was observed among 1- 3 months pregnant women in the 1st trimester and the highest value of 200±12.0mg/dl among 4-6 months (2rd trimester).

**Table 1 Protein and Glucose Level among Pregnant Women**

| MONTHS/ FREQUENCY | Protein mg/ dl | Glucose mg/dl | P- value |
|---|---|---|---|
| 0-3 (20) | 350±16.2 | 180±10.0 | 0.05 |
| 4- 6 (20) | 250±14.4 | 200±12.0 | |
| 7-9 (20) | 200±14.0 | 190±14.0 | |

Comparison of mean protein and glucose level among pregnant women

The results comparing the mean value of protein and glucose level among the pregnant women are shown in Table 2. The protein level was 270±16.0mg/dl while the mean glucose level was 210±15 mg/dl and was significantly different at 0.05.

**TABLE 2: Comparison of Mean Protein and Glucose Level among Pregnant Women**

| Parameter | Pregnant woman | P- value |
|---|---|---|
| Protein level (mg/dl) | 270±16.0 (n) | 0.05 |
| Glucose level (mg/dl) | 210±15 (n) | |

Values are ± SD of triplicate determinations n = number of samples analysed (60)

**Protein and Glucose Level at Different Age**

Protein and glucose level at different age are presented in Table 3. The protein and glucose ranged between 180±11.0mg/dl to 350± 16.0mg/dl and 180±11.0 mg/dl to 300± 15.0 mg/dl, respectively. The least values for the protein and glucose were recorded among 16-20 years and 21-25 years, respectively while the highest counts were both recorded among 30 years and above.

**Table 3 Protein and Glucose level at different Age of the pregnant woman**

| Age (years) | Protein (mg/ 100ml) | Glucose (mg/ dl) | P- value |
|---|---|---|---|
| **16-20 n=15** | 180±11.0mg/dl | 190± 12.0mg/dl | 0.05 |

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| | | |
|---|---|---|
| **21- 25 n=15** | 190±12.0mg/dl | 180± 11.0mg/dl |
| **26-30 n=15** | 200± 14.0mg/dl | 200± 13.0mg/dl |
| **> 30 n=15** | 350± 16.0mg/dl | 300± 15.0mg/dl |

**Response from Participants**

Responses from questionnaire administered are presented in Table 4. The response of the pregnant women on the protein and glucose level during pregnancy showed that 7 % of the pregnant women falls into age 16-20 years, 10% between 21- 25 years, 33% falls into age 26-30, while 50% between 30 years and above. For the gestation period, 40% were in their 0-3months, 40% were in their 4 -6 months and 20% falls into 7-9 months. For carrying out urine test, 80% agreed to have carried out urine test while 20% do not carry out test. Sixty percent (60%) agreed that their urine can be diagnosed with protein and glucose. Eighty percent don't know that protein in urine can be indication of infection while 80 responds that high glucose is not indication of infection. Eighty percent (80%) agreed that high protein and glucose in urine can be caused by food intake while 20 % responded that it was as result of infection. In the month diagnosed with protein and glucose, 55% were in the 7-9 months. Sixty percent (60%) of the respondent experience frequent urination, 20 % itching and discharge. For the treatment, 60% were treated while 40% were not treated.

**TABLE 4: Response from Participants**

| SN | ITEMS | RESPONSES | | | |
|---|---|---|---|---|---|
| 5 | How old are you? | 16-20 4 (7%) | 21-25 6 (10%) | 26-30 33%) | <30 (50%) |
| 6 | How many months is your pregnancy? | 0-3 40% (24) | 4-6 40% (24) | 7-9 20% (12) | |
| 7 | Do you carry out your urine test? | Yes 48(80%) | | No 12 (20%) | |
| 8 | Do you know that your urine can be diagnosed with protein? | Yes 60%(36) | | No 40%(24) | |
| 9 | Do you know that your urine can be diagnosed with glucose? | Yes 60% (32) | | No 40%(24) | |
| 10 | Do you know that your urine can be diagnosed with both protein and glucose? | Yes 80% (48) | | No 20% (12) | |
| 11 | If there is protein in your urine, what do you think? Is it infection? | I don't know 10% ( 6) | Yes 10% (6) | No 80% (48) | |
| 12 | If there is glucose in your urine, what do you think? Is it infection? | Yes 10% (6) | No 80% (48) | I don't know10% (6) | |
| 13 | Have you been diagnosed with protein in your urine before? | Yes 80% (48) | | No 20% (12) | |
| 14 | Have you been diagnosed with glucose in your urine before? | Yes 80% (48) | | No 20% (12) | |
| 15 | Have you been diagnosed with both protein and glucose in your urine before? | Yes 80% (48) | | No 20%(12) | |
| 16 | What do you think is the cause of protein in your urine? | Food intake 80% (48) | | Infection 20% (12) | |
| 17 | What do you think is the cause of glucose in your urine? | Food intake 80% (48) | | Infection 20% (12) | |
| 18 | In what month were you diagnosed with protein? | 0-3 20% | 4-6 25% | 7-9 55% (33) | |
| 19 | In what month were you diagnosed with glucose? | 0-3 20% (12) | 4-6 25% (15) | 7-9 55% (33) | |

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| | | | | |
|---|---|---|---|---|
| 20 | In what month were you diagnosed with glucose and protein? | 0-3<br>20% (12) | 4-6<br>25% (15) | 7-9<br>55% (33) |
| 21 | What do you experience because of protein and glucose detection in your urine? | Frequent urination<br>60% (36) | Inching<br>20% (12) | Discharge<br>20% (12) |
| **22** | Where you treated because of the test result? | Yes<br>40% (24) | | No<br>60% (36) |

## IV. DISCUSSION

**Protein and Glucose level of Pregnant Women**

The investigation into mean protein and glucose levels among pregnant women across trimesters yields significant insights into the dynamic physiological changes during gestation. The observed range of protein levels and glucose levels indicates notable fluctuations in these biomarkers throughout pregnancy. The inverse relationship between protein and trimester, with the lowest protein levels observed in the 3rd trimester and the highest in the 1st trimester, suggests an intriguing pattern of protein utilization and deposition during different stages of pregnancy. This aligns with established data indicating an escalation in protein deposition as pregnancy advances, indicative of increased demands for both maternal physiological adaptations and fetal growth. Similarly, the varying glucose levels across trimesters, with the lowest in the 1st trimester and the highest in the 3rd trimester, reflect the intricacies of glucose metabolism during gestation. These fluctuations likely correspond to hormonal changes and altered insulin sensitivity characteristic of advancing pregnancy stages. The statistically significant difference between mean protein and glucose levels ($P \leq 0.05$) emphasis the distinct regulatory mechanisms and utilization patterns of these nutrients during pregnancy. This emphasizes the need for precise monitoring and maintenance of adequate protein and glucose intake to support maternal health and fetal development. This divergence highlights the complexities in estimating and addressing individualized nutritional requirements for pregnant women, necessitating a nuanced approach that considers factors like maternal weight gain and diverse nutritional contexts. The observed variations in protein and glucose levels among pregnant women across trimesters shows the dynamic nature of these biomarkers during gestation. These findings emphasize the necessity for tailored nutritional interventions to meet the evolving demands of pregnancy, ensuring optimal maternal health and fetal development. Further research is pivotal to refine and personalize nutritional recommendations, accounting for diverse physiological changes and demographic variables among pregnant women.This is in line with study of Rajavel & Ronald (2016) that said during pregnancy, an exceptional stage of life defined by rapid growth and development, adequate dietary protein is crucial to ensure a healthy outcome. Protein deposition in maternal and fetal tissues increases throughout pregnancy, with most occurring during the third trimester. Dietary protein intake recommendations are based on factorial estimates because the traditional method of determining protein requirements, nitrogen balance, is invasive and undesirable during pregnancy. The current Estimated Average Requirement and RDA recommendations of 0.88 and 1.1 g · kg−1 · d−1, respectively, are for all stages of pregnancy. Also, blood glucose concentration is maintained between 70mg/dL and 90mg/dL in fasting state in normal persons. In Nigeria, fasting blood glucose level is said to be normal when it is between 3.3mmol/L and 5.5mmol/L (Diabetes Association of Nigeria, 1998; Attah, 2012) while the range for Americans and other European Countries is between 3.9mmol/L and 5.5mmol/L (American Diabetes Association, 2004).It was observed that the level of protein and glucose differs at different gestation periods. As indicated by Butte & King, (2005), the amount of protein deposited in maternal and fetal tissues varies during pregnancy. The glucose levels during pregnancy were associated with fetal growth and neonatal birth outcomes. The developing fetus is particularly sensitive to the intrauterine environment, and gestational hyperglycemia can promote fetal growth, with changes starting to emerge as the fetus reaches term before 24 weeks' gestational age. The glycemic level during pregnancy and the intrauterine development of offspring are both continuous processes. Existing studies focused on the association of blood glucose level in the second trimester with intrauterine development, without fully considering blood glucose level in the first trimester. The blood glucose level in early pregnancy is also important. A suboptimal glucose metabolism in early pregnancy may also be associated with fetal fat development and bone growth (Sletner *et al.,* 2017). One study has suggested that the glycemic level continues to be high in early pregnancy, with intrauterine growth in the first and second trimesters decreasing (Geurtsen*et al.,* 2019); however, the mid pregnancy blood glucose level was ignored, and the measurement index that was used instead was the non-fasting plasma glucose level, which may have caused the divergence

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between the results of that study and ours. Although offspring growth has been shown to be closely associated with maternal glycemic level, it is also associated with other factors, such as the placental capacity for glucose transport and placental glucose metabolism. This finding supports the positive associations between total and animal protein intakes with GDM risks, which is consistent with previous studies (Bao *et al.,* 2013). Liang *et al.* (2018) demonstrated that higher dietary intakes of total and animal protein during mid-pregnancy were associated with an increased risk of GDM in pregnant women in Southwest China. The results from a cross-sectional study in Singapore and a prospective cohort study in Hubei, China, have also led to similar conclusions. Furthermore, we observed a non-significant relationship between plant protein intake and GDM risk. This is consistent with several previous studies, whereas other studies have reported a negative, or even appositive, correlation, which may be explained by the discrepancies in race/ethnicity of the study populations (Chen *et al.,* 2020). Due to the distinct actions of dietary protein from different food sources on GDM risk, it is necessary to evaluate the association between dietary protein from a whole diet perspective. We observed that women with the red meat protein pattern had a higher risk of GDM than women with the plant–dairy–eggs protein pattern. Although there is no previous study on the association of dietary protein pattern and GDM risk in pregnant women, this novel ending may give support to previous studies on the excess consumption of red meat. Study on protein and glucose level at different age of the pregnant woman showed that the mean and standard deviation scores of proteins and glucose level at different age of the pregnant woman differs. In this study, it is evident that mean urine protein concentration was significantly ($P \leq 0.05$) higher in pregnant woman with increase in age. This increase in urinary protein concentration during pregnancy may be due to physiological changes that occur during pregnancy. The glucose score is in line with Afolayan, & Tella, (2019) study, who stated that fasting blood sugar level increases with increasing age in pregnant women. The study showed that fasting blood sugar level increases with increasing age. It also indicated that no significant difference in fasting blood sugar level exist between pregnant and non-pregnant women in the group analysed although blood sugar levels correlated with age, weight, and level of education. The risk for gestational diabetes increases with age above 25 years and similarities exist with National Interview Survey in Oxford, Massachusetts (2002) which states that from 50 years, the ability to adapt to glucose diminishes with aging. In this study, it was also observed that the age of the pregnant and non-pregnant women has no influence on their fasting blood sugar level. The factors could be due to hormonal, genetic and environmental constraints (Famakinwa, 2002).Protein in the urine could be caused due to several reasons including emotional or physical stress, fever, dehydration, and exposure to extreme temperatures. Testing for protein in urine (proteinuria) is a routine test that the pregnant woman in her first antenatal appointment, and may do at subsequent appointments if risk factors for certain conditions occur like; Dehydration, Inflammation, Low blood pressure, Fever, Intense activity, High stress, Kidney stones, Taking aspirin every day, very low temperatures etc. Having small amounts of protein in urine is common in pregnancy. It can happen for several reasons. It probably just means that kidneys are working harder now that one is pregnant. During early pregnancy i.e., before 20 weeks of pregnancy, protein in the urine may signal towards underlying problems with the kidneys or other health issues that aren't necessarily associated with pregnancy. This could include heart diseases, certain infections like UTI, Post-20 weeks of pregnancy, proteinuria may be a sign of preeclampsia. Protein in the urine is considered abnormal when it exceeds 300 mg/24 hours at any time during gestation. Less than 150 mg of protein in the urine per day is normal. More than this amount of protein in urine per day indicates proteinuria. Large amounts of protein in the urine (more than 3.5 grams per day) are called nephrotic-range proteinuria. It can indicate nephrotic syndrome, a serious condition that causes excessive amounts of protein to leak into the urine, which may be attributable to several different causes. The presence of large amounts of protein in the urine indicates reduced kidney function due to kidney problems. According to the National Kidney Foundation and American Kidney Fund, some 37 million Americans are living with kidney disease. Having glucose in the urine during pregnancy can be a sign of gestational diabetes. Gestational diabetes is a type of diabetes that occurs during pregnancy and resolves after delivery. It is caused by insulin resistance, which makes it difficult for the body to process and regulate blood sugar levels. As a result, excess glucose can be present in the blood and urine. Other factors that can contribute to glucose in urine during pregnancy include a high-carbohydrate diet, obesity, and a family history of diabetes. It is important to note that not all women with glucose in their urine during pregnancy will develop gestational diabetes. However, it is still important to monitor blood sugar levels and follow a healthy diet and exercise regimen to prevent complications for both the mother and baby. If left untreated, gestational diabetes can lead to high blood pressure, preterm labor, and a higher risk of developing type 2 diabetes later in life.

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In addition to monitoring blood sugar levels, healthcare providers may also recommend regular prenatal check-ups, fetal ultrasounds, and non-stress tests to ensure the health and well-being of both the mother and baby. With proper management and care, most women with gestational diabetes can deliver healthy babies and return to normal blood sugar levels after delivery.

**Risk Factors Associated with Protein and Glucose Level in Pregnant Women**

The distribution of age groups among respondents indicates that a significant portion (50%) falls into the 30 years and above category. Advanced maternal age can pose certain risks during pregnancy, such as an increased likelihood of gestational diabetes or preeclampsia, both of which can influence protein and glucose levels.Protein and glucose levels have been observed to rise with age. Blood glucose values have been observed to rise with age independently of weight (Ogbera&Ekpebegh, 2014). Therefore, the likelihood of having glucose intolerance during pregnancy also increases with age. Age was more strongly correlated with blood glucose levels than advancing gestation in one study by Wilkerson and Sullivan (1963). In another study by MacAfee and Beischer (2014), age ≥23 years were observed to be the strongest predictor. Though the mechanism by which age raises glycaemic levels independent of other factors remains to be elucidated it has been proven to be a strong predictor of developing Gestational Diabetes Mellitus (Langer *et al.,* 2004).

The distribution of respondents across different gestation periods also provides insights. A notable portion of the respondents (20%) were in the 7-9 months stage. This period is crucial for monitoring proteinuria and gestational diabetes, conditions associated with elevated protein and glucose levels, respectively, that can pose risks to maternal and fetal health.The questionnaire reveals significant knowledge gaps among respondents. For instance, 80% did not recognize that protein in urine could indicate an infection. Lack of awareness about health indicators like proteinuria and gestational diabetes can lead to delayed diagnosis and management, posing risks during pregnancy.

The perception that high protein and glucose in urine are primarily due to food intake (80%) rather than considering the possibility of infection (20%) could lead to underestimating potential health risks. Misconceptions may result in delayed or inadequate medical attention for conditions linked to elevated protein and glucose levels.

Reported symptoms such as frequent urination (60%) and itching/discharge (20%) might indicate potential issues. Frequent urination could be a symptom of gestational diabetes, while itching and discharge might relate to vaginal infections, both of which can impact protein and glucose levels.

The fact that 40% of respondents did not seek treatment despite experiencing symptoms or being diagnosed with protein and glucose in urine raises concerns. Delayed or lack of treatment could lead to complications or exacerbation of conditions associated with abnormal protein and glucose levels.

## V. CONCLUSION

This study on pregnant women in Port Harcourt, Nigeria, highlights significant fluctuations in protein and glucose levels across trimesters, reflecting dynamic metabolic changes during pregnancy. Protein levels were highest in the first trimester and lowest in the third, while glucose levels were lowest in the first trimester and peaked in the second. Advanced maternal age and knowledge gaps about proteinuria and glycosuria were identified as risk factors. Many women did not seek treatment despite symptoms, emphasizing the need for improved education and healthcare access.

**Recommendation**

Based on the findings of the study, the following recommendations were made:

- Implement educational programs to raise awareness about the importance of monitoring protein and glucose levels.
- Promote regular antenatal check-ups for early detection and management.
- Address knowledge gaps with culturally appropriate materials.
- Improve healthcare access for timely diagnosis and treatment.

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