Afghanistan Journal of Infectious Diseases
AJID
https://ajid.ghalib.edu.af/index.php/ajid

January 2026, Vol. 4, No.1, pp: 16-23

Packed Cell Volume Levels of Pregnant Women Screened for Urinary Schistosomiasis Attending Antenatal Clinic at Vom Christian Hospital, Vom, Plateau State, Nigeria

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ARTICLE INFO

Type: Original Article
Received: 14/04/2025
Accepted: 30/12/2025

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To cite this article:
Kinjir H, Onah IE. Packed Cell Volume Levels of Pregnant Women Screened for Urinary Schistosomiasis Attending Antenatal Clinic at Vom Christian Hospital, Vom, Plateau State, Nigeria. Afghan J Infect Dis. 2026; 4(1): pp:16-23.

DOI:
https://doi.org/10.60141/ajid.105

ABSTRACT

Background: Urinary schistosomiasis remains a public health concern in many endemic settings associated with adverse maternal hematological outcomes. Packed Cell Volume (PCV) is an important indicator of anemia in pregnancy. We assessed the PCV levels of pregnant women attending antenatal clinic at Vom Christian Hospital, Vom, Plateau State, Nigeria and evaluated their screening outcomes in relation to *Schistosoma haematobium* infection.

Methods: This cross-sectional study involving 100 pregnant women was conducted between April and May 2019. Blood samples were analyzed for PCV using the micro-hematocrit method, and urine samples were examined for *S. haematobium* using centrifugation techniques. A structured questionnaire was administered to obtain demographic data and potential risk factors related to urinary schistosomiasis. Data were analyzed descriptively.

Results: No case of *S. haematobium* infection was detected (0.0% prevalence). PCV values ranged from 33.7% to 38.4% across participants. The highest mean PCV was recorded among housewives (36.9%) and the lowest among civil servants (35.2%). Women aged 26–30 years had the highest PCV (38.4%), while those aged 36–40 years recorded the lowest (33.7%). Participants with tertiary education showed a mean PCV of 36.5%. Second-trimester women had the highest mean PCV (36.9%), compared to 35.8% in the first trimester. Knowledge of schistosomiasis was generally low, with many respondents unaware of key symptoms or transmission routes.

Conclusion: Although no urinary schistosomiasis infection was detected, variations in PCV levels were observed across demographic groups. These findings underscore the need for continuous hematological monitoring during pregnancy, particularly in settings with potential exposure to parasitic infections.

Keywords: Packed Cell Volume, Pregnant, Schistosomiasis, Anaemia, Nigeria

Introduction

Urinary schistosomiasis is a parasitic infection transmitted through contaminated water, caused by various species of trematodes (Platyhelminthes infections, or flukes), a parasitic worm of the genus *Schistosoma* (1). It is the only blood fluke that affects the urinary tract, leading to urinary schistosomiasis, and is the second leading cause of bladder cancer, following tobacco smoking (2). Two hundred million people in 74 countries of the world are infected while about 500- 600 million people are at risk of infection (3).

According to the WHO, over 250 million people required preventive treatment for schistosomiasis in 2023, with 135 million being school-aged children and only 12% coverage among adults. Over 84% of global cases occur in sub-Saharan Africa, where access to safe water remains limited (4). Among women of reproductive age, an estimated 40 million are at risk, with 10 million pregnant women infected annually in Africa. A meta-analysis found a 13.2% pooled prevalence of schistosomiasis in pregnancy, with *S. haematobium* being the most common species. Infected pregnant women have a threefold increased risk of anemia, leading to higher chances of low birth weight, stillbirth, and preterm delivery (5,6).

In Nigeria, some rural communities are endemic for *S. haematobium* infection (7-9). Maternal schistosomiasis has a deleterious impact on birth weight and it also leads to preterm delivery. Potential fatal complications of schistosomiasis during pregnancy include ectopic pregnancy and abortion, which have been consistently linked to *S. haematobium* as well as other species. Each year, schistosomiasis leads to 70 million cases of hematuria, 1.8 million cases of bladder wall pathology, 10 million cases of hydronephrosis, and 150,000 deaths due to kidney failure (10). Jennifer et al addressed the relationship between schistosomiasis, and anaemia, the conflicting results make the magnitude of the relationship unclear (11).

The WHO defines anemia as a hematologic condition and a sign of an underlying disorder, characterized by a decrease in the number of red blood cells or a reduction in the concentration of hemoglobin in the bloodstream, resulting in levels below 10.5 g/dL(12). Packed cell volume (PCV), also known as hematocrit, is the percentage (volume%) of red blood cells in the blood. It typically measures 47% in men and 42% in women. As a key component of a complete blood count, hematocrit levels can provide insights into potential health issues. An unusually low hematocrit level may indicate anemia (13).

According to the WHO, the etiologies of anemia encompass a range of factors, including pregnancy and childbirth, recurrent infections (such as malaria and hookworm), inadequate nutrition influenced by socioeconomic determinants (including poverty and limited educational attainment), and hematologic disorders characterized by either impaired erythrocyte production or increased erythrocyte destruction. This study was conducted to determine the PCV levels of pregnant women attending Vom Christian Hospital and to screen them for schistosomiasis.

Materials and Methods

Study area

This study was conducted at Vom Christian Hospital, located in the Vwang district of Jos South Local Government Area, Plateau State, Nigeria. Vom is a notable town in central Nigeria, known for its scenic landscapes, high altitude, and temperate climate, which distinguish it from much of the surrounding region. The town is part of the broader Plateau State, renowned for its diverse ethnic groups, rich cultural heritage, and as a hub for agriculture, particularly the cultivation of crops such as potatoes and maize. Vom Christian Hospital, established in 1922 by the early Sudan United Mission (SUM), has a 300-bed capacity and provides various essential health services.

These include AIDS prevention in collaboration with the AIDS Prevention Initiatives in Nigeria (APIN), among other community health initiatives.

Study population

One hundred Pregnant women attending the antenatal clinic at Vom Christian hospital Vom constituted the study population. They were recruited on a voluntary basis.

Ethical considerations

A preliminary advocacy visit was conducted to obtain informed consent from the Chief Medical Director of Vom Christian Hospital. Subsequently, individual informed consent was sought from the pregnant women, with explicit assurances regarding the confidentiality of their information and the anonymity of their identities. A comprehensive explanation of the study protocol was provided to each participant to ensure their understanding. Only those who voluntarily consented to participate in the study were enrolled as study subjects.

Eligibility criteria

Pregnant women attending the weekly antenatal clinic who provided informed consent were included. However, individuals with diabetes, hypertension, HIV, or AIDS were excluded. This exclusion aimed to minimize confounding factors and maintain homogeneity within the study population, ensuring a clear focus on the relationship between urinary schistosomiasis and PCV in pregnancy.

Sample Collection and Questionnaire Administration

A total of 100 blood and 100 urine samples were collected, resulting in 200 samples overall. The blood samples were analyzed to determine PCV levels, while the urine samples were tested for the presence of urinary schistosomiasis. In addition, 100 self-administered questionnaires were distributed to the participating pregnant women to gather demographic information, as well as to identify potential risk factors for urinary schistosomiasis, such as water contact behaviours, sanitation practices, and socio-economic conditions.

Sample examination

The blood sample collected using heparinised capillary tubes were processed by microhematocrit method as described by Ochei and Kolhatkar, (14) under strict laboratory standards.

Urine sample

Urine samples were collected between 10:00 and 14:00 hours into clean, dry universal containers. It was then analyzed microscopically by urine centrifugation method as described by Cheesbrough, (15) for the presence of *S. haematobium*.

Data Analysis

The data were analyzed using simple percentages. Statistical tests to assess differences in infection rates and determine significant associations between various factors and the presence of urinary schistosomiasis among the pregnant women were not applicable due to zero prevalence.

Results

The prevalence of *S. haematobium* in this study was 0.0%, with no women exhibiting evidence of infection. Their PCV levels ranged from 33.7% - 38.4%. Housewives and civil servants recorded the highest and least PCV of 36.9% and 35.2% respectively. All the women sampled were married. The age groups 26-30 years and 36-40 years recorded the highest and lowest PCV levels, of 38.4% and 33.7% respectively. Those with tertiary school education had the highest PCV of 36.5% (Table 1).

Women in their second trimester recorded the highest PCV of 36.9% while those in the first trimester recorded the least PCV of 35.8% (Table 2). Women who do not urinate in water (n=84)

had the highest PCV (35.5%) compared to those who do not (35.4%). Women who reported washing in streams (5) had a slightly higher mean PCV (36.2%) compared to those who did not (35.9%). Women who fetch water from the river have a higher average PCV of 36.4% compared to those who do not fetch (35.9%). Some signs and symptoms of *S. haematobium* infection known by the women include painful urination, itching, and discharge. None of them knew that haematuria is a sign of *S. haematobium* infection. Some respondents identified bathing in infected water and contact with contaminated water as potential transmission routes. Those who do not know the mode of transmission of *S. haematobium* were 72 in number. Twenty-seven and four women claim that worm and bacteria are the causes of *S. haematobium* infection. (Table 3).

Table 1: PCV levels of women screened for *S. haematobium* infection in relation to some of their demographic characteristics

Demographic characteristics	***Number examined***	***Prevalence of* S. haematobium *(%)***	***Average PCV (%)***
Age group (yr)			
< 15	0	0(0.0)	-
15-20	23	0(0.0)	35.9
21-25	36	0(0.0)	35.9
26-30	23	0(0.0)	38.4
31-35	11	0(0.0)	35.4
36-40	6	0(0.0)	33.7
41-45	1	0(0.0)	35.9
50 and above	0	0(0.0)	0.0
Marital status			
Married	100	0(0.0)	35.9
Single	0	0(0.0)	0
Occupation			
Housewife	15	0(0.0)	36.9
Civil servant	5	0(0.0)	35.2
Farmer	29	0(0.0)	35.4
Trader	38	0(0.0)	36.1
Other	13	0(0.0)	35.8
Educational level			
Primary	36	0(0.0)	35.7
Secondary	55	0(0.0)	36.1
Tertiary	8	0(0.0)	36.5
None	1	0(0.0)	29.0

The PCV levels range: Normal (PCV ≥34%), Mild (PCV 33-27%), Moderate (PCV 19-26%), and Severe (PCV <19%). Statistical tests were not applicable due to zero prevalence

Table 2: PCV levels of Women screened for *S. haematobium* infection in relation to Period of Pregnancy

Period of Pregnancy	***Number examined***	***Prevalence of* S. haematobium *(%)***	***Average PCV (%)***
1st-3rd month	8	0(0.0)	35.8
4th-6th month	52	0(0.0)	36.9
7th-9th month	40	0(0.0)	36.0

Table 3: Knowledge, attitude and practices of the women about schistosomiasis

Parameters	***Frequency***	***Prevalence of* S. haematobium *(%)***	***Average PCV (%)***
Urinate in water			
Yes	16	0(0.0)	35.4
No	84	0(0.0)	35.5
Wash in water/stream			
Yes	5	0(0.0)	36.2
No	95	0(0.0)	35.9
Fetch water from river			
Yes	9	0(0.0)	36.4
No	91	0(0.0)	35.9
Signs and symptoms of S. haematobium			
Haematuria	0	0(0.0)	0.0
Painful urination	25	0(0.0)	35.8
Do not know	42	0(0.0)	36.4
Itching	2	0(0.0)	38.0
Discharge	1	0(0.0)	37.0
Other	30	0(0.0)	35.4
Mode of transmission			
Bathing in infected water	3	0(0.0)	35.5
Contact with infected water	14	0(0.0)	35.7
Sexual intercourse	4	0(0.0)	35.5
Do not know	72	0(0.0)	36.0
Other	7	0(0.0)	35.0
Cause of urinary schistosomiasis			
Worm	27	0(0.0)	36.3
Bacteria	4	0(0.0)	37.3
Virus	0	0(0.0)	0.0
Witch craft	0	0(0.0)	0.0
Do not know	69	0(0.0)	35.7

Discussion

The aim of this study was to assess the Packed Cell Volume (PCV) levels of pregnant women screened for urinary schistosomiasis at Vom Christian Hospital, Vom, Plateau State. The study found that the overall prevalence of *Schistosoma haematobium* infection in the study population was 0.0%, as none of the 100 pregnant women tested were positive for the parasite. This

is consistent with findings from other studies conducted in Nigeria, where urinary schistosomiasis was reported at low or zero prevalence among pregnant women (16-19). The absence of infection may be due to effective public health measures or the relatively low endemicity of the disease in the region, as urinary schistosomiasis prevalence can vary widely by geographic location (20,21). This finding is opposed to that of Olofintoye and Odaibo (20) in Ilara community in Ekiti state which recorded 29.1% among pregnant women due to lack of alternative water supply apart from natural water bodies. This finding differs from that of Eyo et al., who reported a prevalence of 23.8%, which was linked to the reliance on natural water sources in certain endemic tropical semi-urban communities of Anambra State, Nigeria (21).

Although no cases of *S. haematobium* were detected, the study still offered valuable insights into the PCV levels of pregnant women. The range of PCV observed (33.7%-38.4%) falls within the expected range for normal pregnancy, where a slight decrease in hematocrit is often observed due to physiological changes such as increased plasma volume. These findings are consistent with other studies in sub-Saharan Africa, where the average PCV values in pregnant women range from 30% to 38%, influenced by factors such as diet, health status, and access to healthcare (21,22).

The demographic factors examined in this study provide additional insight into the variability of PCV levels. Housewives recorded the highest average PCV of 36.9%, which may be due to a relatively stable lifestyle, less physical exertion, and possibly better access to nutrition compared to other occupational groups (23,24). Civil servants had the lowest PCV of 35.2%, which may be reflective of factors such as limited time for proper rest, nutrition, or healthcare visits (25). These findings suggest that occupational factors, alongside other social determinants, could influence the health outcomes of pregnant women in Nigeria.

Age was also a significant factor in PCV variation. Women aged 26-30 years had the highest average PCV of 38.4%, consistent with studies suggesting that older pregnant women tend to have slightly higher PCV levels compared to younger women (18,25). Conversely, women in the 36-40 years age group had the lowest PCV at 33.7%, which may be influenced by factors such as nutritional status and the timing of their antenatal care visits. (26,27). Educational level was linked to higher PCV levels, with women who had tertiary education showing an average PCV of 36.5%. This finding aligns with the literature, which suggests that education, particularly higher education, is positively correlated with better health practices, including nutrition, healthcare access, and antenatal care attendance (28). Women from the Taroh ethnic group also exhibited higher PCV levels (38.0%), which may indicate differences in dietary habits, cultural practices, or genetic factors that impact hematological health (28).

Regarding the gestational age, women in their second trimester recorded the highest average PCV of 36.9%, while those in the first trimester had the lowest PCV of 35.8%. This trend can be explained by the normal physiological changes that occur during pregnancy, with blood volume expansion typically peaking in the second trimester, leading to a slight dilution of red blood cells and lower PCV during early pregnancy (15). The physiological changes in blood volume and erythropoiesis during pregnancy can affect the PCV, consistent with studies conducted in Nigeria (17).

Although no cases of schistosomiasis were detected in this study, the findings underscore the importance of regular antenatal care in maintaining the health of pregnant women. Antenatal care allows for early detection of conditions like anemia, infections, and other complications that can affect both maternal and fetal health (25). Furthermore, it highlights the need for continued

education and healthcare interventions to prevent infections, such as schistosomiasis, even in areas where the prevalence is currently low (18).

Limitations

The relatively small sample size of 100 participants may not provide adequate statistical power to detect low-prevalence infections such as urinary schistosomiasis. The absence of a control or comparison group also limits the generalizability of the findings. Although women with HIV, diabetes, and hypertension were excluded, other potential confounding factors, including malaria, nutritional deficiencies, and iron status, were not assessed. These factors may have influenced the PCV levels reported. Future studies should incorporate a larger sample size, include appropriate control groups, and consider a wider range of confounders to strengthen the validity of the findings.

This study focused exclusively on pregnant women, aligning with the research objective and the antenatal clinic setting in which data were collected. However, the absence of a comparison group, such as non-pregnant women or pregnant women from non-endemic areas, limits the broader applicability of the findings. Including such a comparison group in future studies would enhance the contextual understanding of the effects of urinary schistosomiasis on haematological parameters like packed cell volume during pregnancy.

Conclusion

The absence of *S. haematobium* infection in this study may reflect the low endemicity of the disease in the region, the findings on PCV levels offer valuable insights into the health status of pregnant women in the study area. The data suggest that demographic factors, including age, occupation, education, and gestational age, influence PCV levels and should be considered when assessing the overall health of pregnant women. Regular attendance at antenatal clinics remains crucial for ensuring optimal maternal health and preventing complications during pregnancy.

Acknowledgments

The study did not receive financial support. We appreciate the Chief Medical Director of Vom Christian Hospital for giving permission. We also appreciate the management and laboratory staff of FCVMLT, Vom where the samples were analysed.

Conflict of interest

The authors declare no conflict of interest.

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