International Journal of Multidisciplinary and Current Educational Research (IJMCER)
ISSN: 2581-7027 ||Volume|| 8 ||Issue|| 1 ||Pages 21-28 ||2026||

The Burden of Malnutrition: Correlating body mass index (BMI) with urinary schistosomiasis intensity among school-aged children in Makurdi, Nigeria

[1,]Elizabeth, Hembadoon, Jande, [2,]Iorwuese Ali Daniel, [3,]Anyiman Terwase , [4,]Friday Inalegwu , [5,]Elizabeth Une Amuta
[1,]*Department of Zoology, Joseph Sarwuan, Tarkar University, Makurdi, Benue State, Nigeria*
[2,]Sohar Extended Health Center,Sohar, Oman
[3,]*Department of paediatrics, Benue State University Teaching Hospital, Makurdi, Benue State, Nigeria*
[4,]*Department of Biological sciences, Rev. Fr. Moses Orshio Adasu University, Makurdi, Benue State, Nigeria*
[5,]*Department of Zoology, Joseph Sarwuan, Tarkar University, Makurdi, PMB 2376, Benue State, Nigeria.*

ABSTRACT : Urinary schistosomiasis, caused by *Schistosoma haematobium*, remains a neglected tropical disease with profound impact on child development. While the infection is known to cause anemia and growth stunting, the direct correlation between infection intensity and nutritional status in endemic Nigerian communities requires further documentation. This study evaluated the burden of malnutrition and its correlation with urinary schistosomiasis intensity among school-aged children in Makurdi, Benue State.A cross-sectional study was conducted across three locations in Makurdi: Katungu, Agwan Jukun, and Jibata. A total of 1,032 school-aged children were enrolled. Urine samples were analyzed using the filtration technique to determine infection prevalence and intensity. Anthropometric measurements were taken to calculate Body Mass Index (BMI). Data were analyzed using Chi-square statistics to test associations between infection, demographics, and nutritional status.The overall prevalence of *S. haematobium* was 56.69%. Infection rates varied significantly by location ($P < 0.001$), with Jibata recording 100% prevalence. Males had a significantly higher infection rate (62.73%) than Females (48.26%). Infection prevalence peaked in the 16–19 age group (91.67%). There was a strong statistical association between nutritional status and infection ($P < 0.001$); children with severe thinness had a 59.85% infection prevalence, compared to only 8.33% among children with normal weight. Haematuria was also significantly associated with heavy infection intensity ($P < 0.001$). The study reveals a hyper-endemic status of urinary schistosomiasis in the study area, particularly in Jibata, co-existing with a critical burden of malnutrition. The significant correlation between low BMI and infection suggests a vicious cycle where parasitic infection exacerbates poor nutritional status. Integrated control interventions combining mass drug administration (MDA) with nutritional support programs are urgently recommended.

KEYWORDS - BMI, Makurdi, Malnutrition, *Schistosoma haematobium,* Urinary Schistosomiasis

I. INTRODUCTION

Urinary schistosomiasis, caused by the trematode *Schistosoma haematobium*, remains one of the most prevalent Neglected Tropical Diseases (NTDs) worldwide [1]. Despite global control efforts, the burden of the disease is disproportionately concentrated in sub-Saharan Africa, which accounts for approximately 90% of the estimated 240 million active cases [2]. In Nigeria, the disease is hyper-endemic, with recent epidemiological data suggesting that over 29 million people are infected, the majority of whom are school-aged children due to their frequent contact with infested freshwater bodies [3].

While the classical clinical presentation of *S. haematobium* infection—haematuria and dysuria—is well documented, its insidious impact on childhood nutritional status is increasingly becoming a focal point of public health research [4]. The relationship between parasitic intensity and malnutrition operates through a "vicious cycle" mechanism where chronic blood loss leads to iron-deficiency anemia, while the host's immune response to trapped eggs diverts energy and nutrients away from growth and development [5]. Recent studies have indicated that children with heavy parasitic loads exhibit significantly lower levels of essential micronutrients, including iron, zinc, and calcium, compared to their uninfected peers [6]. This nutrient theft contributes to growth stunting, physical wasting, and cognitive impairment, which are captured by deficits in Body Mass Index (BMI) for age [5].

In Benue State, particularly in Makurdi, the ecology of the Benue River and its tributaries supports a high density of *Bulinus* snail intermediate hosts, sustaining year-round transmission [7]. Recent surveillance in Makurdi, including the North Bank area, has confirmed that the disease remains a significant public health threat, with prevalence rates varying widely based on local sanitation and water contact behaviors [8] [9]. However, while prevalence studies are common, there is a paucity of recent data specifically correlating the intensity of egg excretion with anthropometric indices (BMI-for-age) in this specific locale. Understanding this correlation is critical, as it moves the conversation from simply treating the infection to addressing the broader nutritional rehabilitation of the affected child. This study, therefore, aims to assess the burden of malnutrition and its statistical correlation with urinary schistosomiasis intensity among school-aged children in Makurdi, Nigeria. By evaluating the link between egg load and BMI Z-scores, this research seeks to provide evidence for integrating nutritional support into routine school-based deworming programs.

II. MATERIALS AND METHODS

Study Area : The study was conducted in Makurdi, the capital city of Benue State, located in the North Central geopolitical zone of Nigeria. The city lies between latitude 7°44′ N and longitude 8°32′ E. Makurdi is situated along the banks of the Benue River, a major hydrological feature that supports extensive fishing and agricultural activities but also serves as a significant transmission site for water-borne parasitic diseases. The area experiences a tropical climate with distinct wet and dry seasons, with an average annual rainfall of approximately 1,190 mm to 1,240 mm, creating favorable environmental conditions for the survival of Bulinus species, the intermediate snail host of *Schistosoma haematobium* [7]. Three specific locations were selected for this study based on their proximity to water bodies and reported high risk of infection: Katungu, Agwan Jukun, and Jibata (Figure 1).

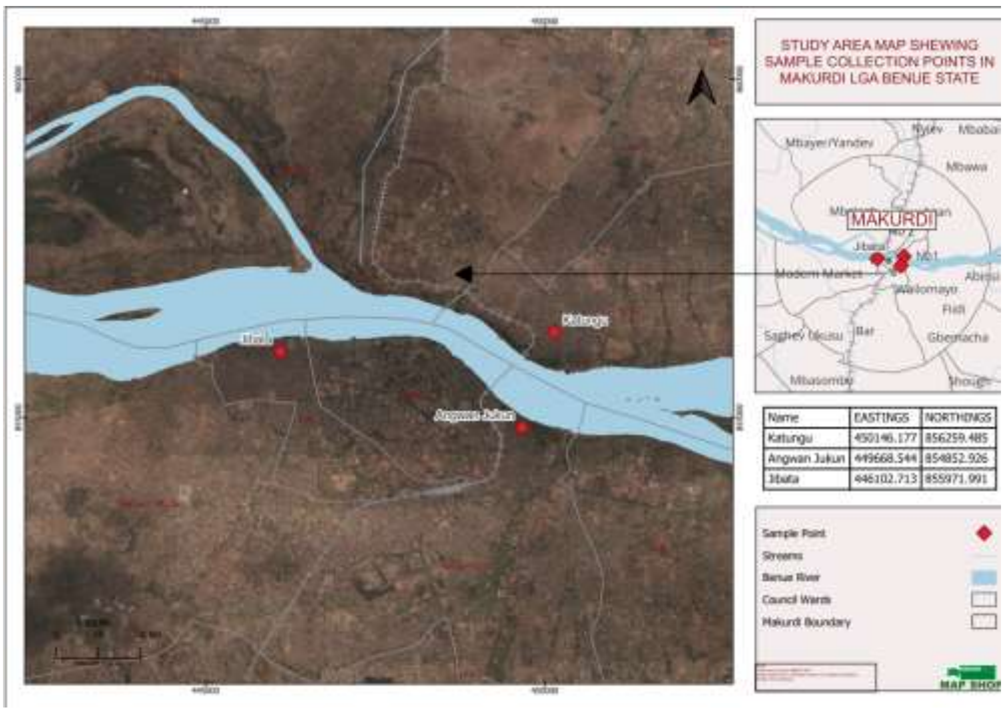


Figure 1: A spatial map highlighting study locations

Study Design and Population : A cross-sectional study design was employed to assess the prevalence and intensity of urinary schistosomiasis and its correlation with nutritional status. The study population comprised school-aged children (5–19 years) attending primary and secondary schools in the selected communities. This age group was targeted as they represent the highest risk group for infection due to recreational water contact behaviors.

Sample Size and Sampling Technique : The minimum sample size was determined using the single proportion formula as described by Pourhoseingholi et al. [10]. The calculation was based on an expected prevalence of 23.75%, as reported in a recent study in Makurdi by Okita et al. [9].

The sample size was calculated as follows:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where:

- **n** = Minimun sample size required.
- **Z** = Standard normal variate at 95% confidence level interval (1.96).
- **P** = Expected prevalence (23.8% or 0.238)
- **d** = Precision/margin of error (0.05).

Substituting the values:

$$n = \frac{1.96^2 \times 0.238 \times (1-0.238)}{0.05^2} \sim 279$$

While the calculated minimum sample size was approximately 278, a total of 344 school-aged children were enrolled in each study location to maximize statistical power and account for potential non-responses or data incompleteness.

Ethical Consideration : Ethical clearance for this study was obtained from the Benue State Ministry of Health Ethical committee (Reference No: MOH/STA/204/1/293). Written informed consent was obtained from parents or guardians, and verbal assent was obtained from all participating children. All data were treated with strict confidentiality.

Sample Collection : A structured questionnaire was administered to obtain demographic data. Universal sterile bottles were distributed to the pupils and all participants were instructed to provide terminal urine samples between 10:00 AM and 2:00 PM, the peak period for *S. haematobium* egg excretion. Height and weight were measured to assess nutritional status of participants. Weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale with children wearing light school uniforms and no shoes. Height was also measured to the nearest 0.1 cm using a measuring tape with the child standing upright against a vertical surface. Body Mass Index (BMI) was calculated as weight (kg) divided by the square of height (m^2) using WHO Anthropometric calculation and all Z-score was recorded for each participant. Nutritional status (thinness) was classified according to the World Health Organization (WHO) reference standards for school-aged children and adolescents.

- Severe Thinness: < -3 SD
- Thinness: < -2 SD
- Normal: -2 SD to +1 SD

Laboratory Analysis : Urine samples were transported to the Zoology laboratory of the department of Biological sciences, Rev. Fr. Moses Orshio Adasu University, Makurdi, for immediate analysis. The urine filtration technique, considered the gold standard, was used. Ten milliliters (10 ml) of urine were drawn into a syringe and passed through a polycarbonate membrane filter (13 mm diameter, 12–14 µm pore size). The filter was placed on a glass slide, and examined under a light microscope at x10 and x40 objectives. The slides containing *Schistosoma haematobium* eggs with characteristic terminal spines were recorded as positive (plate 1). Infection intensity was classified based on the egg count per 10 ml of urine in accordance with WHO guidelines:

- Light Infection: < 50 eggs/10 ml of urine.
- Heavy Infection: > 50 eggs/10 ml of urine.
- Visible (macro) haematuria was noted, and micro-haematuria was assessed using chemical reagent strips (Combi-9) where applicable.

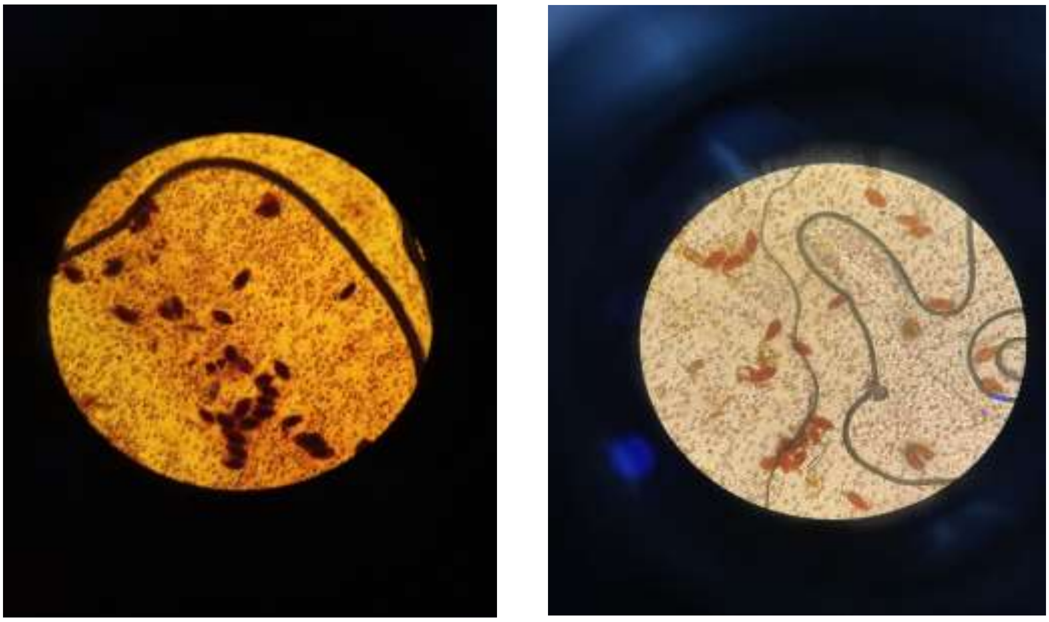


Plate 1: Images of positive slides showing infection with S. haematobium eggs (x10)

Data Analysis : Data were entered and analyzed using SPSS Version 27.0. Descriptive statistics (frequencies and percentages) were used to summarize prevalence and demographic characteristics. The Chi-square test was employed to determine the association between infection prevalence, infection intensity, and nutritional status (BMI). A P-value of less than 0.05 ($P < 0.05$) was considered statistically significant.

III. RESULTS

Overall Prevalence and Distribution by Location : A total of 1,032 school-aged children were examined for urinary schistosomiasis. The overall prevalence of *Schistosoma haematobium* infection in the study area was 56.69% (585/1,032).

There was a highly significant difference in infection rates across the three study locations ($\chi^2 = 639.11$, $P < 0.001$). Jibata recorded a saturation level of infection with a prevalence of 100.00%. Agwan Jukun followed with a prevalence of 59.30%, while North Bank recorded the lowest prevalence at 10.76% (Table 1).

Table 1: Urogenital Schistosomiasis infection in the study location

Location	Total Examined	No. Infected (%)
Katungu	344	37 (10.76%)
Agwan Jukun	344	204 (59.30%)
Jibata	344	344 (100.00%)
Total	1,032	585 (56.69%)

$\chi^2 = 639.11$, df = 2, P<0.001

Prevalence of urinary schistosomiasis by Sex and Age : Analysis of infection by gender revealed a statistically significant difference ($\chi^2 = 21.05$, P < 0.001$). Females exhibited a higher prevalence of infection (62.73%) compared to males (48.26%) as highlighted in Table 2.

Infection prevalence showed a significant linear increase with age ($\chi^2 = 88.00$, $P < 0.001$). The lowest prevalence was observed in the 1–5 years age group (29.51%), while the highest prevalence was recorded in the 16–19 years age group (91.67%), indicating that older children are significantly more exposed to infection sources.

Table 2: Sex and Age-associated prevalence in the study location

Variables	No.Examined	No. Infected (%)	χ^2	P-Value
Sex				
Male	601	377 (48.26%)	21.05	<0.001
Female	431	208 (62.73%)		
Total	1032	585 (56.69%)		
Age Group (Yrs)				
1-5	122	36 (29.51%)	88.00	<0.001
6-10	479	247 (51.57%)		
11-15	383	258 (67.36%)		
16-19	48	44 (91.67%)		
Total	1032	585 (56.69%)		

Impact of Socio-Economic Factors (Parental Occupation) : Parental occupation significantly influenced infection rates (χ^2 = 46.51, P < 0.001) as highlighted in Table 3. Children of Fishermen had the highest prevalence of infection (64.97%), followed closely by children of farmers and traders. Interestingly, children of Hunters recorded 0.00% infection.

Table 4: Association of Schistosomiasis infection with occupation of parent in the study location

Family Occupation	No.Examined	No. Infected (%)
Farming	97	39 (40.21%)
Fishing	157	102 (64.97%)
Hunting	8	0 (0.00%)
Trading	740	426 (57.57%)
Others	30	18 (60.00%)
Total	1032	585 (56.69%)

χ^2 = 46.51, df = 4, P<0.001

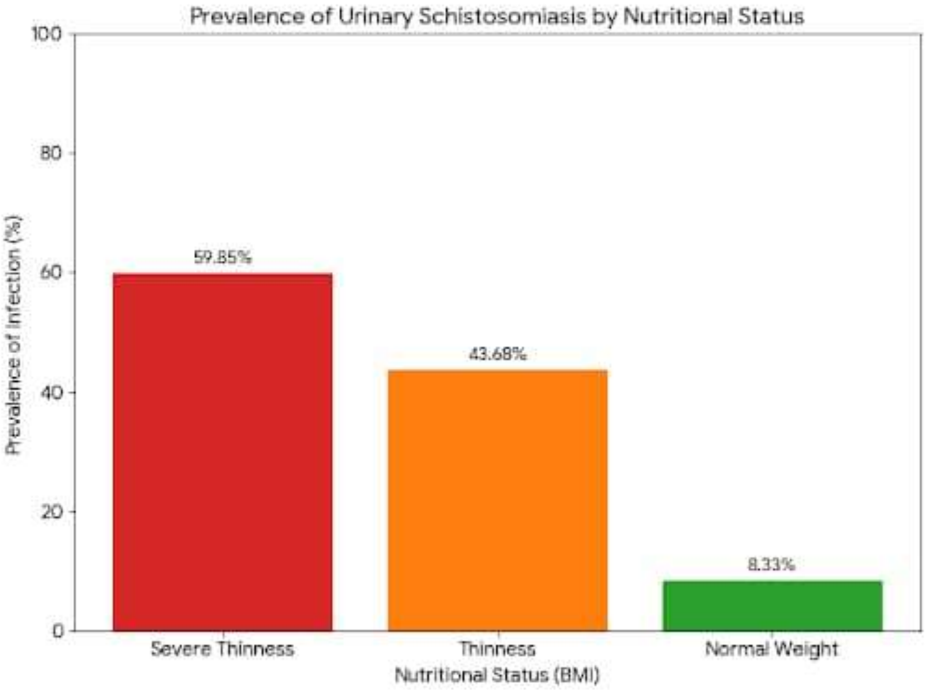
Clinical Manifestations (Haematuria) and Intensity : The relationship between haematuria and infection intensity was highly significant (χ^2 = 158.46, P < 0.001). Children presenting with both Micro- and Macro-haematuria had the highest burden of heavy infection (64.19%). Table 4 summarizes the intensity of infection based on Haematuria status.

Table 4: Association between Haematuria and Schistosomiasis prevalence intensity/10mL Urine

Haematuria	No. Examined	No. Infected (%)	Heavy Infection (%)	Light Infection (%)
Microhaematuria	81	81 (100%)	18 (22.22%)	63 (77.78%)
Macrohaematuria	76	51 (67.11%)	6 (7.89%)	45 (59.21%)
Both	363	353 (97.25%)	233 (64.19%)	120 (33.06%)
Absence of Haematuria	512	100 (19.53%)	16 (3.12%)	84 (16.41%)
Total	1,032	585 (56.59%)	273 (26.45%)	312 (30.23%)

χ^2 = 158.46, df = 3, P < 0.001

Correlation with Nutritional Status (BMI) : The study revealed a critical link between schistosomiasis and malnutrition (χ^2 = 43.92, P < 0.001). The vast majority of the study population (909/1,032)) was classified as having Severe Thinness, and this group recorded a high infection prevalence of 59.85%. In stark contrast, children with Normal had the lowest infection prevalence at 8.33%. Children classified under Thinness showed moderate prevalence rate of 43.68%.



χ^2 = 43.92, P < 0.001

Figure 1: Prevalence of Schistosomiasis infection in association to Body Mass Index (BMI)

IV. DISCUSSION

The overall prevalence of urogenital schistosomiasis observed in this study was 56.69%, which classifies the study area as hyper-endemic according to World Health Organization thresholds (prevalence > 50%). This figure is significantly higher than recent prevalence rates reported elsewhere in Nigeria, such as the 32.2% reported by Bello et al. [11] in Katsina State and the 14.6% reported by Illiyasu et al. in other riverine communities of Makurdi [12]. The variation is likely driven by the inclusion of the Jibata community in this study, which recorded a saturation level of infection (100.0%). Such extreme focal prevalence suggests that Jibata lacks alternative water sources entirely, forcing total dependence on infested river points. This aligns with the findings of Surajo et al., who noted that communities with direct reliance on streams for domestic use consistently exhibit higher infection peaks compared to those with partial borehole access [13].In this study, sex was a significant determinant of infection, with females (62.73%) exhibiting a higher prevalence than males (48.26%). This finding contrasts with recent reports by Surajo et al. and Okpete et al., who observed a male preponderance in Katsina and Ebonyi States, respectively, attributing it to recreational swimming. However, the higher infection rate among females in this study aligns with the specific socio-cultural dynamics of the sampled riverine communities [13] [14]. In these settings, young girls and women bear the primary responsibility for domestic water-contact activities, including fetching water, washing clothes, and processing food at the riverbanks. This frequent, prolonged contact likely exposes them to higher cercarial densities than the transient recreational exposure of their male peers. This "domestic exposure" hypothesis is supported by Amuta & Houmsou, who noted that in communities lacking boreholes, the burden of schistosomiasis often shifts toward females due to their role as water providers [7].

The study outcome showed a highly significant relationship between age and schistosomiasis prevalence, with the 16–19 years age group being the most infected (91.67%). This finding mirrors recent data from Anorue et al., who observed the highest infection prevalence in the 11–20 years age bracket [14]. This peak in older adolescence—rather than the younger 6–10 demographic—suggests that in these specific riverine communities, Older adolescents are actively engaged in water-based economic activities (such as sand dredging or independent fishing) which results in cumulative, high-intensity exposure. Parental occupation played a critical role in infection dynamics. Children of Fishermen recorded the highest prevalence (64.97%). This strongly correlates with the recent work of Surajo et al., who identified fishing as a primary risk factor, with children involved in fishing activities showing a 36.2% infection rate compared to non-fishing peers [13]. The absence of infection among children of Hunters (0.00%) in the current study further reinforces that infection is strictly tied to water contact behavior rather than general rural residency.

A pivotal finding of this study is the establishment of a critical link between nutritional status and infection intensity. The data revealed a stark gradient: children classified as having "Severe Thinness" had an infection prevalence of 59.85%, whereas those with normal weight had a significantly lower prevalence of 8.33%. This strong inverse correlation ($P < 0.001$) provides empirical validation for the "vicious cycle" of infection and malnutrition described in recent literature. The mechanism driving this nutritional depletion is likely multifactorial. First, the presence of *S. haematobium* triggers a chronic inflammatory response, where the host's immune system diverts energy and protein away from growth towards fighting the infection, a process Agbo et al. describe as "metabolic partitioning". Second, the parasite imposes a direct "nutrient theft," competing for essential host metabolites [5]. This was explicitly quantified by Olerimi et al., whose study in suburban Nigerian communities demonstrated that infected children exhibit significantly lower serum levels of iron, zinc, and calcium compared to uninfected peers. The deficiency in Zinc is particularly concerning, as it is a critical cofactor for growth hormones and immune function; its depletion not only stunts physical growth but also impairs the child's ability to resist re-infection [6]. Furthermore, the high rate of haematuria observed in this study (significantly associated with heavy infection) points to chronic blood loss as a primary driver of iron-deficiency anemia. This finding aligns with recent surveillance in Taraba State (2025), which found that children with severe anemia were disproportionately infected with urogenital schistosomiasis [5]. Similarly, a 2025 study in Ondo State reported that co-infection of schistosomiasis with malaria exacerbates this nutritional stress, leading to higher rates of wasting than either infection alone [16]. However, the reversibility of these deficits remains complex. Fok et al. recently cautioned that while Praziquantel treatment effectively clears the parasite, "catch-up growth" (weight gain) is not immediate and requires sustained nutritional support [4]. This suggests that the 88.1% malnutrition rate observed in our study population is not merely a transient symptom but a chronic condition requiring integrated intervention. Relying solely on deworming (Mass Drug Administration) may be insufficient to restore the nutritional health of these children; instead, a "WASH-Nutrition" strategy that combines deworming with micronutrient supplementation (specifically Iron and Zinc) is urgently required.

V. CONCLUSION

This study has established that Makurdi, particularly its riverine communities, remains a hyper-endemic focus for *Schistosoma haematobium* infection. The overall prevalence and the saturation level in the Jibata community, highlights a persistent public health failure where populations with limited access to safe water remain locked in a cycle of transmission. Crucially, this research has provided empirical evidence for a significant negative correlation between infection intensity and nutritional status. The finding that children with Severe Thinness bore the highest burden of infection, while those with normal weight were largely spared, confirms that urogenital schistosomiasis is not merely a parasitic infestation but a major driver of childhood malnutrition in this region. The "vicious cycle" identified here suggests that current control strategies focusing solely on antiparasitic treatment are insufficient. Furthermore, the study identified distinct high-risk groups: older adolescents (16–19 years) and children of ***fishermen***, indicating that economic activities are driving exposure more than recreational play in these specific communities.

Based on the findings, it is recommended that schistosomiasis control strategies in Benue State be urgently redesigned to integrate nutritional rehabilitation with routine mass drug administration (MDA). Since deworming alone is insufficient to reverse the severe wasting observed, interventions should include micronutrient supplementation (Iron and Zinc) and prioritize the provision of potable water infrastructure in high-risk "hotspot" communities like Jibata to break the cycle of transmission. Furthermore, health education campaigns must be specifically tailored to target older adolescents and fishing families who face the highest occupational exposure, while routine surveillance systems should incorporate haematuria and BMI monitoring as cost-effective indicators for identifying and treating the most vulnerable, malnourished children.

REFERENCES

[1] World Health Organization [WHO]. Global report on neglected tropical diseases 2024: Stronger together, towards 2030. World Health Organization, 2024.

[2] A. K. Deol., F. M. Fleming., B. Calvo-Urbano., M. Walker., V. Bucumi., I. Gnandou., E. M. Tukahebwa., S. Jemu., U. J. Mwingira., A. Alkohlani., M. Traoré., E. Ruberanziza., S. Touré., M. G. Basáñez., M. D. French., & J. P. Webster. Schistosomiasis - Assessing Progress toward the 2020 and 2025 Global Goals. *The New England journal of medicine*, 381(26), 2519–2528, 2019. https://doi.org/10.1056/NEJMoa1812165.

[3] A. O. Ayodele., F.G. Ademulegun., S. D. Shoyinka., O. A. Oduwole. Prevalence of urinary schistosomiasis among school children. *Calabar J Health Sci.* doi: 10.25259/CJHS_18_2024

[4] L. Fok., H. D. Dai., D. M. Brett-Major., A. Animut., B. Erko., J. Linville., Y. Negash., A. Degarege. Effect of Praziquantel Treatment on the Nutritional Status of Children Infected with *Schistosoma haematobium*. *Pathogens* 2025, 14, 123. https://doi.org/10.3390/pathogens14020123

[5] O. J. Agbo . R. S. Houmsou., & O. S. Elkanah. Distribution of urogenital schistosomiasis infection in Relation to haemoglobin levels and nutritional status in primary school children in Taraba state, Nigeria. *IOSR Journal Of Pharmacy and Biological Sciences*. p-ISSN:2319-7676. Volume 20, Issue 3 Ser. 2 2025.

[6] S. E. Olerimi., E. I. Ekhoye., O. S. Enaiho., A. Olerimi. Selected micronutrient status of school-aged children at risk of Schistosoma haematobium infection in suburban communities of Nigeria. *African Journal of Laboratory Medicine* , Vol 12, No 1,| a2034 | DOI: https://doi.org/10.4102/ajlm.v12i1.2034

[7] E. U. Amuta., & R. S. Houmsou. Prevalence, intensity of infection and risk factors of urinary schistosomiasis in pre-school and school aged children in Guma Local Government Area, Nigeria. *Asian Pac J Trop Med.* 2014;7(1):34-39. doi:10.1016/S1995-7645(13)60188-1

[8] M. Egwu., N. U. Maduagwu., C. C. Ekwonu., C. A. Amugo., S. C. Ozoemena., A. M. Nduka., E. V. Chisom., C. K. Anekwe., O. B. Gift., J. N. Alegu., P. T. Azuali., N. H. Nnubia., C. S. Ngwu., I. C. Emmanuel. Prevalence of Urinary Schistosoma Infection among Internally Displaced Persons Living along University of Agriculture Road North Bank Makurdi Benue State. *Int. j. adv. multidisc. res. stud.* 2025; 5(3):1660-1665

[9] F. O. Okita., B. Agber., G. Enenche., O. Aladi., O. Omeje., O. Ogwuche., T. Luper., A. Kwaghdoo., T. Best., V. Apuu., O. Amali., E. U Amuta., T. Ikpa. Risk Factors and Urogenital Schistomiasis Prevalence Among Primary School Children in Makurdi, Nigeria. *EAJHS* 2023, 6, 460-471.

[10] M. A. Pourhoseingholi., M. Vahedi., M. Rahimzadeh. “Sample size calculation in medical studies”. *Gastroenterol Hepatol Bed Bench*. 2013;6(1):14-17.

[11] S. Bello, E. C. Eberemu, J. B. Orpin, and S. Ya’u, “Prevalence Of *Schistosoma Haematobium* Infection Among Primary School Children In Faskari And Funtua Local Government Areas Of Katsina State, Nigeria”, *FJS*, vol. 8, no. 3, pp. 311–315, Jun. 2024, doi: 10.33003/fjs-2024-0803-2516.

[12] I. M. Iliyasu., G. J. Sow., J. B. Balogun., S. A. Abdullahi. Sex-Associated Prevalence Of Plasmodium And Schistosoma Infection Among School Children And Riverine Communities Of Makurdi, Benue State-Nigeria. *J Biomed & App Sci FUD (*2023) 2:1

[13] M. Surajo, N. C. Eberemu, J. B. Orpin, and S. Y. Shinkafi, “Prevalence of Urinary Schistosomiasis among Primary School Pupils in Bindawa Local Government Area of Katsina State, Nigeria”, *SAJOLS*, vol. 2, no. 4, pp. 108–116, Dec. 2024.

[14] E. C. Okpete., O. C. Ani., C. A. Uhuo., D. E. Nwele., G. N. Nwonumara., & M. O. Elom. Biochemical Parameters Associated with the Different Intensities of Urinary Schistosomiasis among Residents of Ebonyi Local Government Area of Ebonyi State, Nigeria. *Nigerian Journal of Parasitology*, 46(2), 309–320, 2025.

[15] J. A. Ojo., S. A. Adedokun., A. A. Akindele., A. B. Olorunfemi., O. A. Otutu., T. A Ojurongbe, et al. Prevalence of urogenital and intestinal schistosomiasis among school children in South-west Nigeria. *PLoS Negl Trop Dis* 15(7): 2021 e0009628. https://doi.org/10.1371/journal.pntd.0009628

[16] E. M. Ola., T. H. Balogun., R. O. Isijola., O. G. Ajakaye. Malaria, urogenital schistosomiasis and co-infection and nutritional status of school children in Ondo state. *PLoS One* 20(8): 2025 e0329740. https://doi.
org/10.1371/journal.pone.0329740