



**PREVALENCE OF GASTROENTERITIS IN PRIMARY SCHOOL CHILDREN (6-12 YEARS) IN  
RELATION TO THEIR BODY MASS INDEX IN JALINGO METROPOLIS**

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**ABSTRACT**

Gastroenteritis is one of the most prevalent illnesses affecting children worldwide, particularly those in primary school age groups (6-12 years). The aim of this study was to determine the relationship between gastroenteritis and Body Mass Index (BMI) among primary school children (ages 6-12 years) in Jalingo metropolis. Three hundred (300) participants were used in this study. An overall prevalence of 30% (90/300) was recorded in the schools. Jauro Isa Primary School had the highest prevalence of *E. histolytica* at 32.0% and a 2.0% prevalence for *A. lumbricoides*. No *G. lamblia* or hookworm were reported. Female pupils had notably higher *E. histolytica* prevalence at 25.1%, and slightly higher prevalence for *G. lamblia* (3.4%). Prevalence for *A. lumbricoides* and hookworm were 1.9% and 2.9%, respectively. The observed Chi-square value of 18.004 with a *p*-value of 0.0004 indicates a significant association between sex and parasitic infection ( $p < 0.001$ ), suggesting that females had a higher overall prevalence, particularly for *E. histolytica*. The age group 10–12 years had *E. histolytica* (37.7%), *Giardia lamblia* (4.5%), *A. lumbricoides* (3.9%), and hookworm (4.5%), while the 6–9 Years had *E. histolytica* (0.7%), *Giardia lamblia* (2.1%), *A. lumbricoides* (2.7%), and hookworm (3.4%), parasites. Underweight children had the highest prevalence of *E. histolytica* (31.8%). The prevalence of *E. histolytica* was significantly higher among children who engaged in physical activity (26.9%) compared to those who did not (11.4%). The findings highlight the importance of integrating health education with school programs and improving environmental sanitation to reduce infection rates.

**1. Introduction**

Gastroenteritis is one of the most prevalent illnesses affecting children worldwide, particularly those in primary school age groups (6-12 years). It is characterized by inflammation of the gastrointestinal tract, including the stomach and intestines, which leads to symptoms such as diarrhea, vomiting, abdominal pain, and dehydration (Adane *et al.*, 2019). Gastroenteritis is caused by various infectious agents, including bacteria, viruses, and parasites, and it is especially common in areas with inadequate sanitation and poor personal hygiene practices (Gonzalez *et al.*, 2021). In developing countries, including Nigeria, gastroenteritis is a significant public health concern, particularly among young children whose immune systems are not fully developed (Nwokocha, *et al.*, 2020). Primary school children are especially vulnerable to gastroenteritis due to their frequent exposure to contaminated environments, especially in school settings where hygiene standards may be compromised (Owoeye *et al.*, 2021). The burden of gastroenteritis in Nigeria is exacerbated by the lack of adequate healthcare infrastructure, poor sanitation, and limited public health interventions targeting childhood diseases (Ortega *et al.*, 2019). In the case of Jalingo, several environmental and behavioral factors contribute to the high incidence of gastroenteritis among school-aged children. These include inadequate access to clean drinking water, poor waste disposal practices, and limited knowledge of personal hygiene practices among children and their caregivers (Ezeh *et al.*, 2021). The poor sanitary conditions in many primary schools also play a significant role in the transmission of gastroenteritis, with children frequently coming into contact with contaminated surfaces, water, and food (Abu-Saeed *et al.*, 2020). In addition to environmental factors, socioeconomic disparities

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within Jalingo contribute to the unequal distribution of health outcomes, with children from lower-income families being disproportionately affected by gastroenteritis (Ezeh *et al.*, 2021).

Body Mass Index (BMI) serves as a useful indicator of a child's nutritional status, and its relationship with infectious diseases like gastroenteritis is well-documented. Children who are underweight, as indicated by a low BMI, are at higher risk for infections because their immune systems are often compromised due to malnutrition (Darmawikarta *et al.*, 2020). Conversely, children who are overweight or obese, characterized by a high BMI, may also be more susceptible to infections because of metabolic imbalances and chronic inflammation, which can impair immune function (Patel *et al.*, 2021). In Jalingo, where malnutrition remains a major public health issue, understanding the relationship between BMI and gastroenteritis is essential for developing targeted interventions that can reduce the disease burden in children (Ajayi *et al.*, 2021).

In Jalingo, where access to healthcare services may be limited, many children do not receive adequate treatment for gastroenteritis, leading to recurring infections and a vicious cycle of malnutrition and illness (Bachou *et al.*, 2020). Addressing the relationship between BMI and gastroenteritis in primary school children is, therefore, critical to improving health outcomes and reducing the overall disease burden in this population.

Public health interventions aimed at reducing the incidence of gastroenteritis in Jalingo must prioritize both nutritional support and improvements in sanitation and hygiene practices (Bai *et al.*, 2020). School-based programs that promote healthy eating habits, regular handwashing, and safe water consumption have been shown to significantly reduce the incidence of gastroenteritis among children (Takkar *et al.*, 2020). Additionally, addressing malnutrition through school feeding programs and community health initiatives can improve children's BMI, thereby enhancing their immune response to infections (Sharma *et al.*, 2020). In Jalingo, where malnutrition remains a pressing issue, such interventions could have a profound impact on reducing the incidence and severity of gastroenteritis in primary school children (Takkar *et al.*, 2020).

## 2. Materials and Methods

### 2.1 Study Area

The study is conducted in Jalingo Metropolis, the capital of Taraba State, Nigeria. Jalingo is home to several primary schools, both public and private, serving a diverse population of children from different socioeconomic backgrounds. The area has a tropical climate, with seasonal variations in temperature and rainfall, which may influence the occurrence of gastroenteritis. Environmental factors such as water quality, sanitation, and hygiene practices also vary across different parts of the metropolis, which can affect children's health outcomes.

### 2.2 Study Population

The study population consists of primary school children aged 6-12 years attending selected primary schools in Jalingo metropolis. 300 Children were used in this study.

### 2.3 Sampling Technique and Sample Size

A multistage sampling technique was used to select the study participants: The Random Selection of Schools and Selection of Participants.

### 2.4 Data Collection Methods

The primary data collection tool was a structured questionnaire administered to participants to gather their demographic information. BMI was calculated for each child using anthropometric measurements of height and weight.

### 2.5 Ethical Considerations

Ethical approval was obtained from the Federal Medical Centre, Jalingo, Taraba State with number NHREC/FMCJHREC/17/05/24. All participants were provided with informed consent before enrolment, with assurances of confidentiality and the right to withdraw from the study at any time without any consequences.

### 2.6 Sample Size Determination

The sample size for this study is calculated using Cochran's formula for sample size determination in a population:

$$n = \frac{Z^2 \times P(1-P)}{e^2} \quad (1)$$

Where:

n = required sample size

Z = Z-value (1.96 for a 95% confidence level)

P = prevalence of gastroenteritis in the population (30%)

e = margin of error (5%)

Substituting the values into the formula:

$$n = \frac{(1.96)^2 \times 0.3(1-0.3)}{(0.05)^2} = 323$$

### 2.7 Stool sample collection

Each participant was provided with a clean, dry, wide-mouthed, screw-capped plastic container labeled with a unique identification code, along with instructions on how to collect a fresh stool sample. Participants were advised to avoid contamination of the sample with urine or water. It was retrieved immediately and conveyed to the laboratory for microscopic examination.

### 2.8 Microscopic Examination

#### Direct Wet Mount

A small amount of fresh stool is picked with an applicator stick and emulsified on the clean glass slide containing normal saline solution and mixed thoroughly to create a homogenous smear. The sample is then covered with a coverslip and examined under a light microscope at 10× and 40× magnifications to identify motile trophozoites, cysts, ova, or larvae of parasites (Mahon *et al.*, 2018).

Lugol's iodine was applied to enhance visibility of cysts and ova, and the same steps are followed as in the saline wet mount before examining the sample under the microscope (Mahon *et al.*, 2018).

### 2.9 Data Analysis

Data analysis was conducted using the Statistical Package for Service Solution (SPSS), version 25. Descriptive statistics was employed to summarize the demographic characteristics of the participants, along with BMI categories and the prevalence of gastroenteritis. Measures such as frequencies, means, and percentages were used to depict the data. Further, cross-tabulations were conducted to identify how environmental factors contribute to exacerbating gastroenteritis among children across the different BMI categories. Statistical significance will be considered at a p-value of less than 0.05 to ensure the robustness of the results.

## 3. Results and Discussion

Table 1: Prevalence of Gastrointestinal Parasites in Relation to Demography

School	Number Examined	<i>E. histolytica</i> (%)	<i>Giardia lamblia</i> (%)	<i>A. lumbricoides</i> (%)	Hookworm (%)	$\chi^2$	p-value
Mayo Gwoi Primary School	50	10 (22.0)	1 (2.0)	0 (0.0)	0 (0.0)	29.21	0.0151
Jauro Isa Primary School	50	16 (32.0)	0 (0.0)	1 (2.0)	0 (0.0)		
Kingdom Kids Academy	50	12 (24.0)	4 (8.0)	1 (2.0)	2 (4.0)		
Low-Cost Primary School	50	8 (16.0)	1 (2.0)	1 (2.0)	5 (10.0)		
Annur Academy Jalingo	50	7 (14.0)	3 (6.0)	5 (10.0)	2 (4.0)		
Immaculate Nur/Pri School	50	5 (10.0)	1 (2.0)	2 (4.0)	3 (6.0)		

Sex							
• Male	93	6 (6.5)	3 (3.2)	6 (6.5)	6 (6.5)	18.004	0.0004
• Female	207	52(25.1)	7 (3.4)	4 (1.9)	6 (2.9)		
Age							
• 6–9 years	146	1(0.7)	3 (2.1)	4 (2.7)	5 (3.4)	22.402	0.0001
• 10–12 years	154	58 (37.7)	7 (4.5)	6 (3.9)	7 (4.5)		
Total	<b>300</b>					<b>90 (30)</b>	

Table 2: Prevalence of Gastrointestinal Parasites by Body Mass Index

BMI Category	Number Examined	<i>E. histolytica</i> (%)	<i>Giardia lamblia</i> (%)	<i>A. lumbricoides</i> (%)	Hookworm (%)
Underweight	44	14 (31.8%)	2 (4.5%)	0 (0.0%)	2 (4.5%)
Normal Weight	161	30 (18.6%)	2 (1.2%)	1 (0.6%)	2 (1.2%)
Overweight	71	13 (18.3%)	3 (4.2%)	1 (1.4%)	3 (4.2%)
Obese	24	2 (8.3%)	0 (0.0%)	2 (8.3%)	0 (0.0%)

(Chi-square ( $\chi^2$ ) = 23.865; p-value=0.021)

Table 3: Prevalence of Gastrointestinal Parasites by Risk Factors

Variables	Number Examined	<i>E. histolytica</i> (%)	<i>Giardia lamblia</i> (%)	<i>A. lumbricoides</i> (%)	Hookworm (%)	$\chi^2$	p-value
<b>Hand Washing</b>							
<b>Before Eating</b>							
• Yes	275	50 (18.2)	7 (2.5)	4 (1.5)	7 (2.5)	5.728	0.220
• No	25	9 (36.0)	0 (0.0)	0 (0.0%)	0 (0.0)		
<b>Untreated Water Consumption</b>							
• Yes	108	28 (25.9)	1 (0.9)	1 (0.9)	0 (0.0)	9.043	0.060
• No	192	31 (16.1)	6 (3.1)	3 (1.6)	7 (3.6)		
<b>Physical Activity</b>							
• Yes	160	43 (26.9)	5 (3.1%)	2 (1.2)	3 (1.9)	12.872	0.012
• No	140	16 (11.4)	2 (1.4)	2 (1.4)	4 (2.9)		

## Discussion

This study investigated the prevalence and associated factors of gastrointestinal parasites among primary school children. The findings revealed significant variations across schools, sex, age, and several behavioral and health-related factors with a total prevalence of 30%.

The highest prevalence of *E. histolytica* was found in Jauro Isa Primary School (32.0%), followed by Kingdom Kids Academy (24.0%), while Immaculate Nur/Pri School had the lowest at 10.0%. These findings suggest a possible link between school location or environmental sanitation and the occurrence of parasitic infections. This pattern is in line with the work of Adeyemi *et al.* (2021), who reported higher parasite burdens in schools located in less developed settings due to inadequate hygiene infrastructure. However, the lower prevalence at Immaculate Nur/Pri School may reflect better sanitation or health education interventions, contrasting with findings by Nettles *et al.* (2020), who observed uniformly high parasite rates across different schools in urban areas.

Females had a notably higher prevalence of *E. histolytica* (25.1%) compared to males (6.5%), and also showed higher infection rates for other parasites. This result contradicts the general assumption that males are more prone to helminth infections due to outdoor activities (Aubert *et al.*, 2019), but aligns with findings by Baker, *et al.* (2020) who observed that gender differences can be context-dependent, influenced by hygiene practices and roles in household chores such as water fetching and caregiving.

There was a significantly higher infection among children aged 10–12 years (37.7% *E. histolytica*) compared to those aged 6–9 years (0.7%). This trend corresponds with the study by Freeman, *et al.* (2020), who noted that older children often engage in unsupervised eating and are more exposed to contaminated environments, thereby increasing their risk. This finding reinforces the need for age-specific health education interventions.

Underweight children recorded the highest rate of *E. histolytica* (31.8%) and other parasitic infections, whereas obese children had the lowest. This supports the study by Stovitz *et al.*, (2020), which established a strong link between intestinal parasitism and poor nutritional status in children. Gastrointestinal infections can lead to malabsorption, contributing to undernutrition, as also discussed by Pickering *et al.*, (2020).

Children who washed their hands had a lower prevalence of *E. histolytica* (18.2%) compared to those who did not (36.0%), highlighting the protective role of good hygiene. However, the difference was not statistically significant, which could be due to reporting bias or the limited sample size in the "No" group. This partially aligns with the findings by Ezeh *et al.*, (2021), who established strong links between handwashing and reduced parasitic infections. A higher prevalence of *E. histolytica* (25.9%) was recorded among children who drank untreated water, compared to 16.1% among those who consumed treated sources. This finding reinforces conclusions from studies by WHO WHO. (2021), which emphasized that untreated water remains a major source of intestinal parasites in developing countries. Children who engaged in physical activities had higher parasite prevalence, particularly *E. histolytica* (26.9%). This might be due to increased exposure to contaminated environments during outdoor play, as supported by the work of Uneke (2008), who highlighted that playing in contaminated soil increases contact with infective parasite stages.

#### 4. Conclusion

Gastrointestinal parasitic infections remain a public health concern among school-aged children in Jalingo Metropolis. The high prevalence among older children, females, and underweight individuals suggests a need for more targeted public health interventions. Behavioral factors such as poor hand hygiene and the consumption of untreated water continue to contribute to the spread of these infections. The findings highlight the importance of integrating health education with school programs and improving environmental sanitation to reduce infection rates.

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