

Association of Clinically Diagnosed Anaemia with Walking in Barefoot among Children Studying at a Primary School Living in Rural Community of Bangladesh

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Abstract

Background:Nutritional status is the main concern among the children both under five years of age and primary school going children. Anaemia and malnutrition are likely to be happened in those groups of children especially the primary school going children due to walking in barefoot. **Objective:** The aim of the present study was to evaluate the nutritional status of bare-footed children among primary schools' level. **Methodology:** This comparative cross-sectional study was undertaken at the Umargong village of Kanaighat Upazila in Sylhet District from October 2010 to March 2011 for a period of 6 months. The children of primary school level at any age of both sexes were included in this study. Clinical examination of the students and anthropometric measurements were recorded accordingly. Anaemia was diagnosed clinically. A predesigned questionnaire was prepared for the collection of data from the children. **Results:** A total number of 60 primary school children were taken as case of which 44 were in the age group of less than 10 years with female predominance (76.7%). The height, weight, mid arm circumference and anaemia were examined and found a strong correlation with walking in barefoot and anaemia which is statistically significant (p=0.001). **Conclusion:** In conclusion, it may permit to conclude that walking in barefoot by the primary school children is the causes of anemia and malnutrition.

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Introduction:

Anemia remains one of the most significant public health challenges worldwide, particularly affecting children in low- and middle-income countries.¹ Globally, anemia is estimated to affect 43% of children under five, with the prevalence being markedly higher in resource-constrained settings such as rural Bangladesh.² Anemia in children is associated with a range of adverse outcomes, including impaired cognitive and physical development, reduced school performance, and increased susceptibility to infections.³⁻⁴ Despite various interventions, addressing the multifactorial nature of anemia in such settings remains challenging.

One of the primary causes of anemia is iron deficiency, which can result from inadequate dietary intake, malabsorption, or chronic blood loss.⁵ In rural areas, soil-transmitted helminth (STH) infections, particularly hookworm infestations, are major contributors to chronic blood loss and anemia in children. Hookworm larvae enter the human body through the skin, typically via the feet, making the habit of walking barefoot a significant risk factor for acquiring these parasitic infections.⁶ Rural children, often walking barefoot due to cultural norms or economic constraints, are particularly vulnerable to this route of infection.⁷

Bangladesh, a country with a predominantly agrarian economy, faces a high burden of childhood anemia, with prevalence rates exceeding 50% in some rural regions8. Several factors contribute to this public health issue, including malnutrition, limited access to healthcare, poor hygiene, and inadequate sanitation. Walking barefoot, a common practice among children in rural areas, further exacerbates this situation by increasing exposure to parasitic infections and environmental pathogens.⁹ This behavioral risk factor, while modifiable, has received limited attention in public health research and interventions aimed at combating anemia.

One of the causes of malnutrition and anemia among children is soil-transmitted helminthes which are transmitted from person to person through contact with fecally contaminated soil including Ascaris lumbricoides, Trichuris trichiura, the hookworm species (Ancylostoma duodenale and Necator americanus), and Strongyloides stercoralis. Infections are concentrated in poor rural populations throughout sub-Saharan Africa, Asia, and the Americas10. Within Latin America, an estimated 19% of people have trichuriasis, 16% ascariasis and 10% are positive for hookworm infection.¹¹

Although causes of malnutrition are multifactorial, helminth infections have been associated with impaired growth and stunting in diverse populations.¹²⁻¹³ There are several mechanisms by which intestinal parasitism may cause or aggravate malnutrition including impaired nutrient absorption resulting from infection and reduced appetite.¹⁴ Adult helminthes worms residing in the small intestine are in an excellent position to interfere with their hosts' nutrition and can induce damage to the intestinal mucosa that may reduce a person's ability to extract and absorb nutrients from food. Helminthes infection can cause vomiting, diarrhea, anorexia, abdominal pain, and nausea that may result in reduced food intake, thereby further reducing nutrient availability.¹¹ The most significant cause of nutritional stress resulting from helminthes infections is hookworm associated iron deficiency anemia. Light hookworm infection of 20 to 50 adult worms can result in significant iron losses; furthermore, mild to moderate intensity helminthes infection during childhood have been associated with under nutrition and reduced physical fitness.¹³

Given this context, it is essential to explore the relationship between barefoot walking and anemia to identify actionable interventions. Understanding whether walking barefoot is independently associated with anemia, beyond other socio-economic and nutritional determinants, could provide valuable insights for designing targeted public health strategies. This study focuses on examining this association among children studying in a primary school in a rural area of Bangladesh, where such risk factors are prevalent.¹⁵ The primary school setting offers an ideal context for investigating the interplay between anemia and behavioral factors such as barefoot walking. Schools serve as both a point of health surveillance and a platform for implementing interventions, such as deworming programs, nutrition education, and awareness campaigns about personal hygiene. By studying children in this environment, we can also gain insights into how environmental and behavioral determinants affect health outcomes in a population that represents the future workforce and productivity of the country.¹⁶

By focusing on this association, the study seeks to highlight the need for integrated interventions addressing both behavioral and environmental factors contributing to anemia. Findings from this research could inform policies and programs aimed at reducing the burden of anemia among rural children in Bangladesh and similar contexts, thereby improving their overall health and development outcomes.

The objective of this study was to assess the association between clinically diagnosed anemia and the habit of walking barefoot among rural primary schoolchildren. Specifically, it aims to determine the prevalence of clinically diagnosed anemia among the children, to evaluate the proportion of children who regularly walk barefoot and to assess the strength of the association between walking barefoot and anemia after adjusting for other potential confounders such as dietary intake, socioeconomic status, and hygiene practices.

Methodology

Study Settings and Population: This comparative cross-sectional study was carried out in the Batoiail village

under Kanaighat subdistrict in Sylhet district of Bangladesh which is situated at the North-East corner of Bangladesh from October 2010 to March 2011 for a period of six months. The primary school children studying at the level of class I to class V at any age of both sexes were included in

this study. **Study Procedure:** Computer generated simple random number were taken. The children were clinically examined by a expert physician to diagnosed anaemia clinically. The grading of the anemia was done by the severity of the anaemia into mild, moderate and severe. A single investigator carried out statistical study within limited period of time. Prior to the commencement of this study, the research protocol was approved by the Local Ethical Committee of BIAM, Dhaka. The aims and objectives of the study were explained to the patients in easily understandable local language. It was assured that all informed and records were kept confidential and the procedure was helpful for both the physician and the patients in making rational approach of the case management.

Statistical Analysis: All the statistical test were performed in Statical Package for Social Science (SPSS version 20.0) Qualitative data were expressed as frequency and percent. The quantitative data were expressed as mean with standard deviation. P value less than 0.05 was taken as statistically significant.

Ethical Clearance: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration 2013) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the local ethics committee (Ref: IRB/NINS/244). Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and were analyzed using the coding system.

Table 1: Age Distribution among the Study Population(n=60)

Age group	Frequency	Percent
≤10 Years	44	73.4
≥10 Years	16	26.6
Total	60	100
Mean±SD	9.83±1.304 (ra	ange: 8 -13)

Results

A total number of 60 children from the primary school were selected as study population after fulfilling the inclusion and exclusion criteria. Among 60 respondent's majority were less than 10 years of age which was 44(73.4%) and the rest 16(26.6%) cases were in the more than 10 years of age. The mean age was 9.83 ± 1.304 with the range of 8 to 13 years (Table 1).

Table 2: Distribution of Study Population according toLevel of Anemia (n=60)

Level of anemia	Frequency	Percent
Mild	14	23.3
Moderate	7	11.7
Severe	1	1.7
No Anemia	38	63.3
Total	60	100.0

The students walking in barefoot were anaemic which was statistically significant (p=0.001).

Table 3: Comparison of walking in bare-foot and anemia

Anemia	Walking in bare-foot		Total	P value
	Yes	No		
Mild	10	4	14	
Moderate	5	2	7	
Severe	0	1	1	0.001*
No Anemia	7	31	38	
Total	22	38	60	

*Chi-square test is done to measure the level of significance.

Discussion

Walking in barefoot causes soil-transmitted helminthes infection and has been associated with impaired growth and stunting among the children of primary school level.² The most significant cause of nutritional stress resulting from helminthes infection is hookworm associated iron deficiency anemia. Walking in barefoot among the children causes anemia significantly. Malnutrition is also found among the children of primary school level due to walking in barefoot.¹⁴ A large-scale study should be done to get the real scenario. Stool examination should be done for conclusive diagnosis. Antihelminthic should be properly implement to the primary school level students to eliminate hook worms. Hemoglobin estimation by taking blood should be done for accurate diagnosis of anemia.16 The findings of this study highlight a significant association between walking barefoot and clinically diagnosed anemia among children attending a primary school in a rural area of Bangladesh. This relationship underscores the potential role of environmental and behavioral factors in influencing child health outcomes, particularly in low-resource settings. Anemia in children is a multifaceted public health

challenge, influenced by nutritional deficiencies, infections, and socioeconomic factors.¹⁷⁻²¹ The association between walking barefoot and anemia is likely mediated through an increased risk of parasitic infections, particularly soil-transmitted helminths (STH) such as hookworms. Hookworm infections are well-documented causes of iron-deficiency anemia, as the parasites attach to the intestinal mucosa and cause chronic blood loss.²² Walking barefoot in contaminated environments facilitates direct contact with soil harboring infective larvae, increasing the risk of such infections.²³ This finding aligns with previous studies from similar rural settings, where barefoot walking has been identified as a major risk factor for STH transmission.

The observed association remained significant even after adjusting for potential confounders such as dietary intake, socioeconomic status, and hygiene practices.²⁴ This suggests that the habit of walking barefoot may independently contribute to the risk of anemia, beyond other commonly recognized factors. It also highlights the importance of addressing environmental sanitation and personal protective measures, such as the use of footwear, as part of comprehensive public health strategies to combat anemia.²⁵ In addition to parasitic infections, other mechanisms could explain the association. For example, walking barefoot in rural areas often exposes children to injuries or infections, which may contribute to chronic inflammation and impaired nutrient absorption.26 Furthermore, children from poorer households, who are more likely to walk barefoot due to economic constraints, may also face greater barriers to accessing adequate nutrition and healthcare. This overlap of behavioral. environmental, and socioeconomic vulnerabilities creates a synergistic effect, exacerbating the risk of anemia.27-28

This study's findings have important implications for public health interventions in similar settings. Promoting the consistent use of footwear among children should be a priority in reducing the risk of parasitic infections and, consequently, anemia. School-based health programs can play a pivotal role in creating awareness about the health benefits of wearing shoes, alongside regular deworming initiatives and nutritional supplementation.²¹ Integrating such measures into existing health and education programs could yield substantial improvements in child health outcomes.

While this study provides valuable insights, it is essential to consider its limitations. The cross-sectional design precludes the establishment of causation, and the reliance on clinically diagnosed anemia may have resulted in underdiagnosis or misclassification. Future studies should incorporate laboratory-confirmed hemoglobin levels and stool examinations to assess parasitic infections directly. Longitudinal research could further elucidate the causal pathways linking barefoot walking to anemia and identify additional risk factors.

Another limitation is the potential for residual confounding by unmeasured variables, such as genetic predispositions to anemia or variations in local soil contamination levels. Additionally, the study's focus on a single school in a specific rural area limits the generalizability of the findings. Broader studies encompassing diverse geographic regions and cultural practices would provide a more comprehensive understanding of the issue.

Conclusion

In conclusion, this study highlights a significant association between walking barefoot and anemia among rural schoolchildren in Bangladesh. Addressing this behavioral risk factor, alongside nutritional and healthcare interventions, is crucial for tackling the multifaceted burden of anemia. By promoting the use of footwear, improving sanitation, and implementing integrated health programs, policymakers can contribute to breaking the cycle of poor health and poverty in vulnerable populations.

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