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Original article

Health Impacts of Dye Factory Wastewater: Gastrointestinal, Respiratory, and Skin Symptoms in Children Under 5 in Urban Dhaka

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Abstract:

Background: Gastrointestinal symptoms, particularly diarrhea, and acute respiratory tract infections are among the leading causes of mortality worldwide, including in Bangladesh. Dermatological symptoms also contribute notably to morbidity in both children and adults. Exposure to wastewater from dye factories has been proposed as a potential contributor to these health issues, especially in urban areas where such factories are concentrated. However, there is limited data on the prevalence of these symptoms among children exposed to such environmental pollutants. ***Objectives:*** This study aims to investigate the prevalence of respiratory, gastrointestinal, and dermatological symptoms among children under 5 years of age exposed to dye factory wastewater in the Munda and Polartek communities of Uttarkhan, Dhaka. ***Methods:*** A community-based cross-sectional study was conducted among 200 children aged 6 to 59 months living in wastewater-exposed areas. Data were collected through face-to-face interviews with caregivers using a pre-tested, semi-structured questionnaire. The questionnaire covered socio-demographic information and the presence of specific respiratory, gastrointestinal, and dermatological symptoms in the children. ***Results:*** Among the children, 77.0% experienced nasal discharge, 66.0% had a cough, 20.0% reported shortness of breath, and 26.5% had wheezing. Gastrointestinal symptoms included diarrhea (16.5%), vomiting (22.5%), and abdominal pain (18.0%). Dermatological symptoms were also reported, including itching (17.5%), rash (20.5%), skin ulceration (13.0%), and skin color changes (0.9%).***Conclusion:***This study highlights a considerable prevalence of respiratory, gastrointestinal, and dermatological symptoms among children under 5 exposed to dye factory wastewater. The findings suggest a potential link between industrial pollution and adverse child health outcomes in urban settings. Further research and targeted public health interventions are recommended to mitigate these risks and safeguard vulnerable populations

Keywords: Gastrointestinal symptoms, Cough, Wheeze, respiratory symptoms, dermatological symptoms, dye factory wastewater, under 5 children, urban community, Dhaka, Bangladesh.

Introduction:

Gastrointestinal, respiratory, and dermatological symptoms are major health concerns for children under 5, particularly in developing countries.[1] Diarrheal diseases, including acute diarrhea, are a leading cause of death globally, with significant mortality rates in Asia and Bangladesh, where inadequate sanitation contributes to high rates of

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diarrhea-related deaths.[2] Vomiting and abdominal pain, often associated with gastrointestinal disorders, also pose severe health risks, including dehydration and malnutrition. Respiratory infections, such as pneumonia and bronchitis, are another leading cause of under-5 child mortality worldwide, with the highest prevalence in low-income countries.[3] In Bangladesh, respiratory tract infections are responsible for a significant proportion of child deaths, driven by overcrowded living conditions, poor nutrition, and limited healthcare access.[4] Dermatological disorders, including itching and rashes, are prevalent in children under 5 and are often exacerbated by environmental pollution, such as exposure to industrial wastewater from dye factories.[5] These factories discharge harmful chemicals into nearby water bodies, leading to contamination and environmental degradation.[6] In urban areas like Uttarkhan, Dhaka, children are especially vulnerable to these health issues due to their exposure to dye factory wastewater. Despite growing awareness of the risks, limited data exists on the prevalence of these symptoms in affected communities.[7] This study aims to fill that gap by investigating the health impacts of dye factory wastewater on children under 5 in the Munda and Polartek communities, with a focus on gastrointestinal, respiratory, and dermatological symptoms. The findings will contribute to public health strategies and policy development to mitigate the effects of industrial pollution on vulnerable populations.

Methodology:

A cross-sectional study was conducted from January 1 to December 31, 2018, in Munda and Polartek—two localities in Uttarkhan, under Uttara Thana of the Dhaka North City Corporation, known for exposure to dye factory wastewater. The study population comprised children under five years of age exposed to this wastewater.Using a simple random sampling technique, the first household was selected from a baseline list developed in a previous "Bangladesh Medical University (BMU)" study. Thereafter, every alternate household was visited to identify eligible participants. A total of 200 households with at least one child under five were included.Data were collected through face-to-face interviews with mothers or primary caregivers using a pre-tested semi-structured questionnaire. The questionnaire covered:

- Children's symptoms (gastrointestinal, respiratory, dermatological) in the past month
- Water usage practices
- Socio-demographic characteristics

To ensure reliability, the questionnaire was pilot-tested and refined before data collection. Interviews were monitored for consistency and completeness.Data analysis was performed using SPSS version 21. Continuous variables were summarized as means and standard deviations, and categorical variables were expressed as frequencies and percentages. Results were presented using tables and diagrams for clarity.

Results:

A total of 200 children under 5 years of age exposed to dye factory wastewater in the Uttarkhan area participated in the study. Respiratory symptoms were common, with 77% of children experiencing nasal discharge, 66% having a cough, 20% suffering from shortness of breath, 26.5% experiencing wheezing or whistling chest, and 8% reporting throat pain. In terms of gastrointestinal symptoms, 16.5% of children had diarrhea, 22.5% suffered from vomiting, and 18% experienced abdominal pain. Dermatological issues were also prevalent, with 17.5% reporting itching, 20.5% having a rash, 13% suffering from skin ulceration, and 9% experiencing changes in skin color. These findings suggest that exposure to dye factory wastewater is associated with a high prevalence of respiratory, gastrointestinal, and dermatological symptoms in children under 5. The results highlight the potential health risks posed by environmental pollution, particularly in urban areas, and emphasize the need for further research and intervention to protect vulnerable populations

Table 1: Prevalence of Respiratory Symptoms among Children Less than Five Years of Age Exposed to Dye Factory Wastewater.

Symptoms in last thirty days	Number (n)	Percentage (%)
Nasal discharge		
Yes (Y)	154	77.0
No (N)	46	23.0
Cough		
Yes (Y)	132	66.0
No (N)	68	34.0
Shortness of breath		
Yes (Y)	40	20.0
No (N)	160	80.0
Wheezing or whistling chest		
Yes (Y)	53	26.5
No (N)	147	73.5
Throat pain		
Yes (Y)	16	8.0
No (N)	184	92.0

● Among the children under 5 years of age, 77% experienced nasal discharge, 66% had a cough, and 26.5% suffered from wheezing or a whistling chest. 20% of the children reported shortness of breath, while 8% had throat pain.

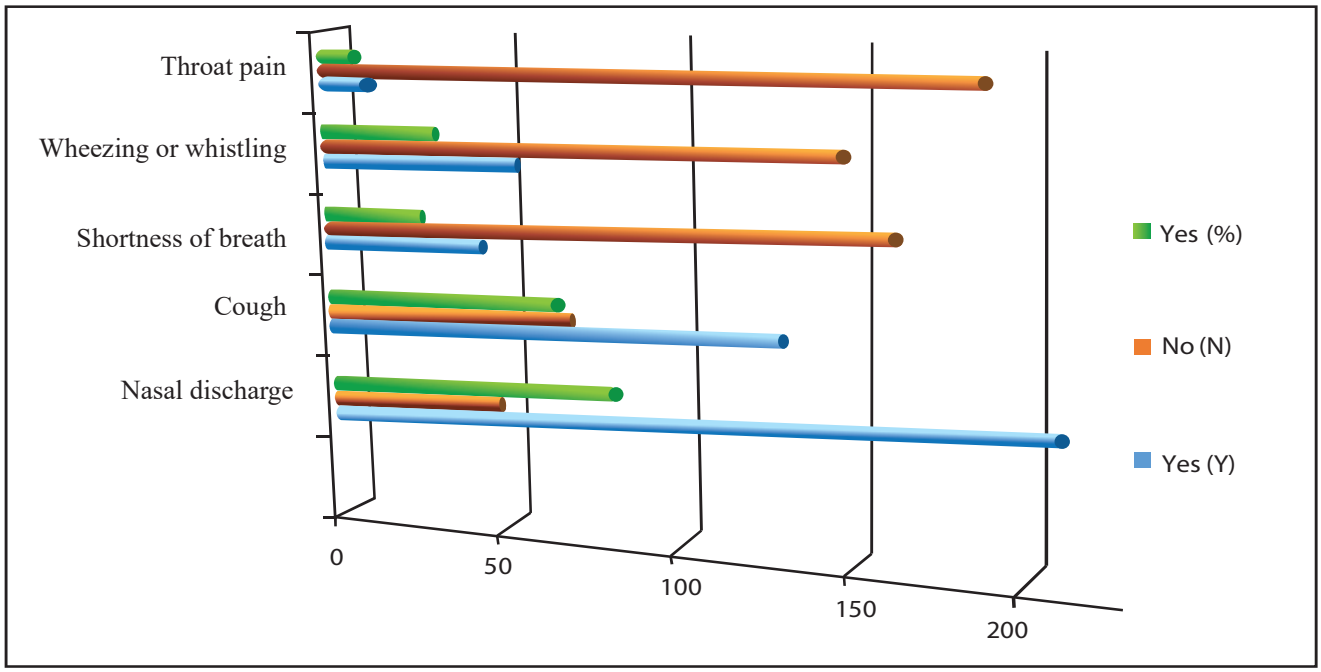

Figure 1: Bar Chart Showing the Prevalence of Symptoms in the Last 30 Days

Table 2: Prevalence of Gastrointestinal Symptoms in Children over the Last Thirty Days.

Symptoms in last thirty days	Number (n)	Percentage (%)
Diarrhea or loose motion		
Yes (Y)	33	16.5
No (N)	167	83.5
Vomiting		
Yes (Y)	45	22.5
No (N)	155	77.5
Abdominal pain		
Yes (Y)	36	18.0
No (N)	164	82.0

● Among the children under 5 years of age, 22.5% experienced vomiting, 18% had abdominal pain, and 16.5% suffered from diarrhea or loose motions..

Table 3: Prevalence of Dermatological Symptoms in Children over the Last Thirty Days

Symptoms in last thirty days	Number (n)	Percentage (%)
Itching		
Yes (Y)	35	17.5
No (N)	165	82.5
Rash		
Yes (Y)	41	20.5
No (N)	159	79.5
Ulceration		
Yes (Y)	26	13.0
No (N)	174	87.0
Color change		
Yes (Y)	18	9.0
No (N)	182	91.0

● Among the children under 5 years of age, 20.5% had a rash, 17.5% experienced itching, 13% had skin ulceration, and 9% reported changes in skin color.

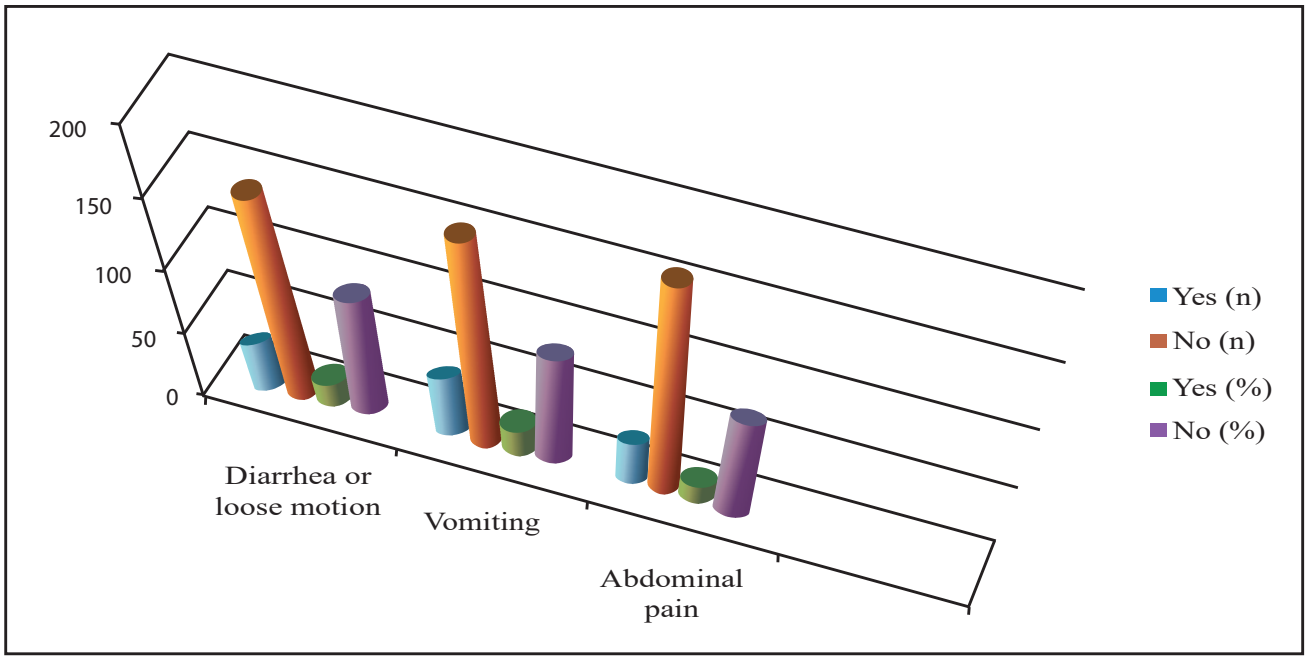

Figure 2 : Bar Chart Showing Prevalence of Gastrointestinal Symptoms in the Last 30 Days

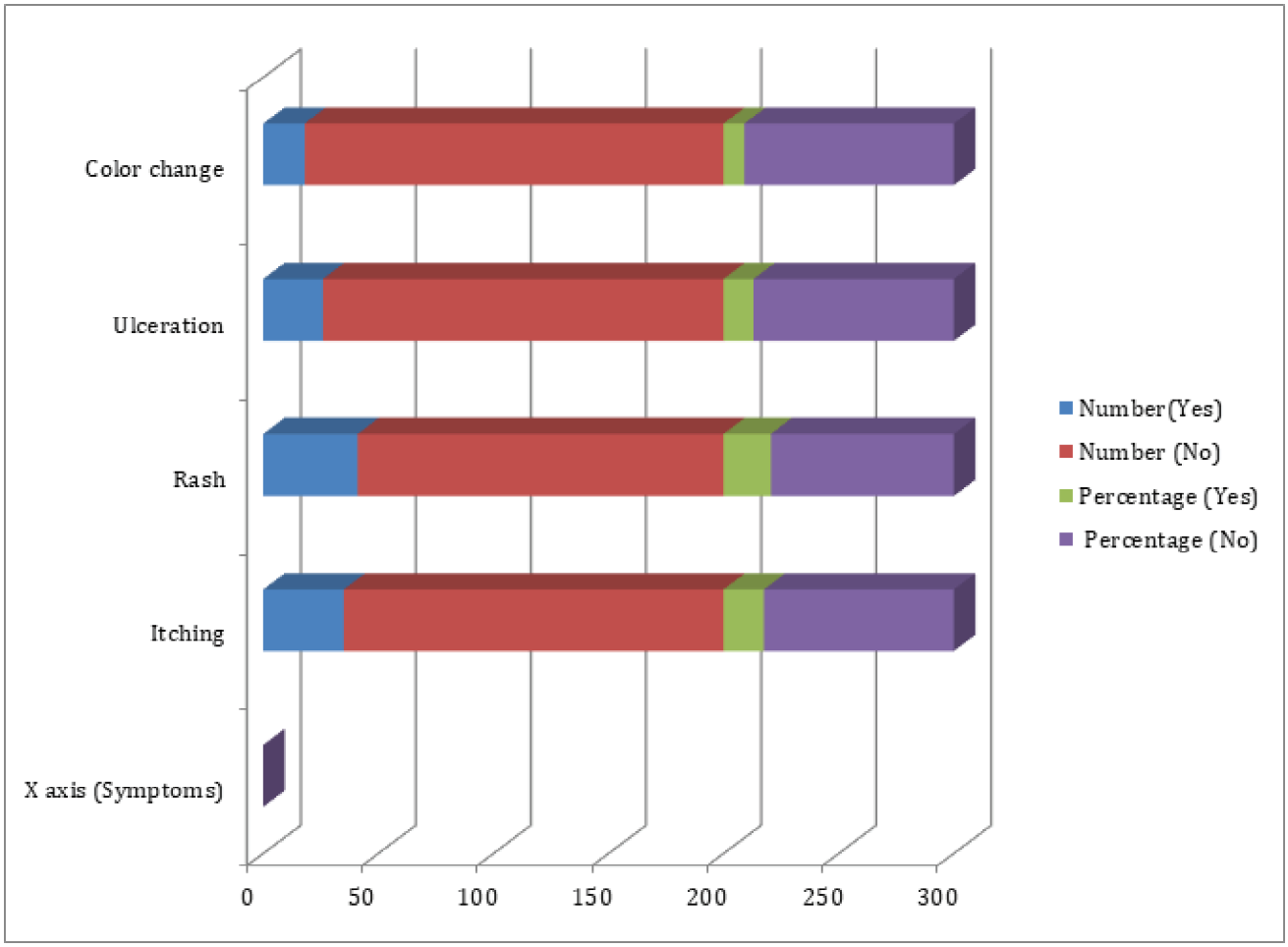

Figure 3: Severity Distribution of Dermatological Symptoms Among Children Exposed to Dye Factory Wastewater in Uttarkhan, Dhaka (3D Horizontal Stacked Bar Chart)

Discussion

Gastrointestinal Symptoms

The findings from this study reveal a considerable burden of gastrointestinal symptoms—diarrhea (16.5%), vomiting (22.5%), and abdominal pain (18%)—among children under five exposed to dye factory wastewater in Uttarkhan, Dhaka. These rates are higher than those reported in prior studies in Bangladesh, 8where diarrhea prevalence ranged from 1.6% to 6.1%. The elevated rates in our study may be attributed to direct exposure to dye factory wastewater, which often contains harmful substances like azo dyes and heavy metals.[9] These toxins are known to irritate the gastrointestinal tract, potentially causing inflammation or altering gut microbes, thereby increasing vulnerability to gastrointestinal disorders.[10] The average age of children in our study was 28.6 months, and research shows that children aged 1–2 years are particularly susceptible to gastrointestinal infections due to immature immune systems and frequent hand-to-mouth activity.[11] In line with this, we observed higher rates of diarrhea among children in this age group. Furthermore, socioeconomic factors such as inadequate sanitation, poor access to clean drinking water, and limited healthcare services likely compound the risk of gastrointestinal infections in these communities.[12]

Respiratory Symptoms

Respiratory symptoms were also highly prevalent, with 77.0% of children experiencing nasal discharge, 66.0% reporting cough, 26.5% having wheezing, and 20.0% suffering from shortness of breath. These figures are notably higher than those found in previous studies in India and Bangladesh, where the prevalence of respiratory symptoms typically ranged from 20% to 28%.[13] This disparity suggests a possible association between dye factory wastewater exposure and respiratory irritation caused by airborne pollutants and toxic fumes.[14] Environmental conditions at the time of the study may have exacerbated these symptoms. Data were collected during the dry winter season—a period linked to increased airborne particulate matter and industrial emissions.[15] This seasonal effect, combined with the children's developing respiratory systems and the additional burden of indoor pollution (e.g., from biomass fuel or poor ventilation), could further explain the high rates of respiratory symptoms observed.[16] The presence of wheezing and shortness of breath raises concern for more severe respiratory illnesses, such as asthma, bronchitis, or pneumonia, potentially linked to chronic exposure to environmental toxins.[17]

Dermatological Symptoms

Although dermatological symptoms were less prevalent than gastrointestinal and respiratory ones, they remain a noteworthy health concern. Rash (20.5%), itching (17.5%), skin ulceration (13%), and skin color changes (9%) were reported among exposed children. These findings align with existing literature suggesting that contact with polluted water can result in skin irritation or more chronic conditions.[18] However, the absence of scabies and other contagious skin diseases in our study may be due to the cross-sectional nature of the research and its limited duration, which may not have captured the full effects of long-term exposure.[19] Compared to previous studies reporting higher rates of skin diseases, our findings may seem modest; however, it's important to consider that those studies often involved different age groups or hospital-based populations.[20] Moreover, the onset of chronic dermatological symptoms often requires prolonged exposure. Nonetheless, poor hygiene, overcrowding, and limited access to clean water—common in urban slums—are contributing environmental factors that may exacerbate dermatological issues.[21] These conditions, in combination with exposure to dye wastewater, could increase the risk of skin problems in this vulnerable population.[22]

Conclusion

In conclusion, this study highlights the serious health risks posed by exposure to dye factory wastewater among children under five years of age in the Uttarkhan area of Dhaka, Bangladesh. The higher prevalence of gastrointestinal, respiratory, and dermatological symptoms in our study population compared to other studies suggests that industrial pollution plays a critical role in exacerbating health issues in vulnerable populations. The findings underline the urgent need for environmental interventions to mitigate the harmful effects of dye factory wastewater, particularly in urban slum areas. Policy-makers and public health authorities must prioritize the reduction of industrial pollution, improve water and sanitation infrastructure, and ensure better healthcare access for children living in these highly affected areas. Further research, including longitudinal studies, is needed to fully understand the long-term health consequences of prolonged exposure to dye wastewater and to develop effective interventions.

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- The research work is self-funded
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