# Common Gastrointestinal Symptoms and Associated Factors Among Under-5 Children in Rural Dembiya, Northwest Ethiopia: A Community-Based Cross-Sectional Study

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# Common Gastrointestinal Symptoms and Associated Factors Among Under-5 Children in Rural Dembiya, Northwest Ethiopia: A Community-Based Cross-Sectional Study

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## ABSTRACT

**BACKGROUND:** Gastrointestinal (GI) symptoms such as abdominal discomfort, abdominal cramp, nausea, vomiting, gas in the GI tract, changes in bowel habits (e.g. diarrhea), or heartburn are common in the community. However, these symptoms may be misinterpreted and their impact and significance misunderstood, especially in the rural communities. This study was, therefore, conducted to assess common GI symptoms among children in rural Dembiya, northwest Ethiopia.

**METHODS:** A community-based cross-sectional study was conducted in May 2017 among 225 randomly selected under-5 children. We primarily used mothers' report to assess GI symptoms. Health professionals also diagnosed for some symptoms. Direct stool examination technique was used to identify parasitic infections. Bacteriological analysis of drinking water was done to determine the quality of drinking water. Food safety, environmental sanitation, and hygiene condition of children were assessed using observation checklists. Multivariable binary logistic regression analysis was employed to identify factors associated with GI symptoms on the basis of adjusted odds ratio (OR) with 95% confidence interval (CI) and $P < .05$.

**RESULTS:** The current study depicted that 139 of 225(61.8%) of the children had GI symptoms. Abdominal discomfort (137 of 139 [98.7%]), abdominal cramp (125 of 139 [89.9%]), and diarrhea (118 of 139 [84.9%]) were the highest GI symptoms reported. GI symptoms were significantly associated with childhood intestinal parasitic infections (OR = 13.69, 95% CI = 3.31-56.59), unclipped and unclean finger nails (OR = 2.28, 95% CI = 1.02-5.10), inadequate living environment sanitation (OR = 2.37, 95% CI = 1.08-5.18), unclean living houses (OR = 9.06, 95% CI = 2.60-31.54), and owning livestock (OR = 4.68, 95% CI = 1.82, 12.03).

**CONCLUSION:** The prevalence of GI symptoms among under-5 children in rural Dembiya, northwest Ethiopia, was found to be high. GI symptoms were significantly associated with childhood intestinal parasitic infections, hand hygiene condition of children, and sanitation condition of the living environment. Therefore, preventing intestinal parasitic infections, improving hand hygiene condition, and promoting environmental sanitation will have overriding contributions to prevent symptoms among children in rural Dembiya.

**KEYWORDS:** Gastrointestinal symptoms, intestinal parasitic infection, environmental sanitation, under-5 children, rural Dembiya

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## Background

Gastrointestinal (GI) symptoms occur as chronic or recurrent complaints attributed to the pharynx, esophagus, stomach, biliary tract, intestines, or anorectum. GI symptoms include abdominal discomfort, abdominal cramp, nausea, vomiting, gas in the GI tract, changes in bowel habits (e.g. diarrhea), or heartburn. GI symptoms are common both in developed and developing worlds. When GI symptoms are experienced as severe, or when they impact on daily life, those afflicted often attribute the symptoms to an illness and seek medical care.[1-3]

Early childhood and parental sociodemographic factors have been implicated as risk factors for the development of functional gastrointestinal disorders (FGIDs). Population-based studies indicated that children from single parent households, households of lower income, and less-educated families more frequently showed symptoms.[4-6] Moreover, GI symptoms are also associated with hand hygiene,[7,8] sanitation,[8-10] and food safety and feeding habits.[7,11,12]

GI symptoms are common in the community. However, these symptoms may be misinterpreted and their impact and significance misunderstood. There is little knowledge of their prevalence, especially in rural communities. This study was, therefore, conducted to assess common GI symptoms among children in rural Dembiya, northwest Ethiopia.

## Methods

### *Study design and description of study settings*

A community-based cross-sectional study was conducted in May 2017 in rural Dembiya. Dembiya is one of the districts in North Gondar Zone, the Amhara National Regional State, Ethiopia. In Dembiya district, hygiene and sanitation-related communicable diseases were highly prevalent. The district health office report indicated that intestinal parasitic infections and diarrheal diseases were the top 4 and 5 prevalent diseases, which accounted 5161 (9.97%) and 4981 (9.62%), respectively, during 2017. The population in the area had also poor access to water, sanitation, and hygiene (WASH). According to the report of the district health department, clean water and latrine coverage in the district was 26.60% and 55%, respectively, in 2017.[13]

### *Sample size determination and sampling procedures*

This study is part of the baseline survey for Dembiya water, sanitation, and hygiene-neglected tropical diseases (Dembiya WASH-NTD) project. The project was implemented to prevent intestinal parasitic infections through improved WASH. Sample size was, therefore, determined based on the prevalence of intestinal parasitic infections using single population proportion formula with the following assumptions: $P = 85.1\%$ (prevalence of intestinal parasitic infections among children aged 6–59 months in Shesha Kebkele, Wondo Genet, Southern Ethiopia during 2010),[14] 95% confidence interval, 5% margin of error (d), and 15% nonresponse rate. A total of 225 children aged 6 to 59 months were selected from 5 rural kebeles (the lowest administrative units in Ethiopia). The study subjects were selected by systematic random sampling technique.

### *Data collection tools*

We used pretested and structured questionnaire to collect sociodemographic, hygiene- and sanitation-related, and common GI symptom data. We also used observation checklists for food safety, environmental sanitation, and hygiene condition of children. Direct stool examination technique was used to identify parasitic infections in children. Children were provided a plastic stool container and asked to bring approximately 15 g of their own stool. A drop or drops of saline were placed on a slide. Approximately 0.05 g of stool specimen was placed using an applicator stick and mixed with a drop of saline and covered by cover slide. Finally, the specimen was examined under the microscope at low power (×10 objective) and high power (×40 objective) magnifications for the identification of intestinal parasites. Stool specimen was analyzed immediately after collection.[15] Water samples were taken from individual households at point of use using sterilized sampling bottles, and the samples were transported to the central laboratory within 4 h with cold chain. *Escherichia coli* was used as a biological indicator for drinking water quality.

### *Measurement of variables*

GI symptoms among children, the primary outcome variable of this study, were defined as the presence of one or more of these symptoms: abdominal discomfort, abdominal cramp, diarrhea, nausea, vomiting, bloating, and perianal itching. We primarily used mothers' report to assess these symptoms. Health professionals also diagnosed for some symptoms. Different predictor variables like presence of intestinal parasitic infections, hand washing practice, drinking water quality, food safety, households' environmental sanitation, and cleanliness of living houses were clearly explained elsewhere.[16]

### *Quality management*

To minimize potential biases, we did the following: adequate or representative sample was calculated and study subjects were selected randomly from a well-defined source or target population; pretested the tools and amended as needed; used well-defined checklists for observation; we trained data collectors and field supervisors in making correct assessments; monitored each stage of research, including close follow-up during data collection; encouraged all the study subjects to participant in the study and to provide complete responses; double checked the data and cleaned it of errors; identify possible confounding factors; analyzed the data with proper statistical methods; and interpreted the results in an objective manner based on evidence.

### *Data analysis*

Statistical Package for Social Sciences (SPSS) version 20 was used to analyze data. Frequencies and percentages were used for most variables. Univariable binary logistic regression analysis was used to choose variables for the multivariable binary logistic regression analysis on the basis of $P$ value less than .2. Multivariable binary logistic regression was employed to identify factors associated with GI symptoms on the basis of odds ratio (OR) with 95% confidence interval (CI) and $P < .05$ and to control the possible effect of confounders. Hosmer and Lemeshow test was used to check model fitness.

## Results

### *Hygiene and sanitation conditions*

A total of 225 mother-child pairs were participated in this study with 100% response rate. One hundred nineteen (52.9%) of the children were female, and 166 (73.8%) of them were aged between 24 and 59 months. The median age of children was 42 months, and the interquartile range was 24 to 48 months. One hundred thirty-four (59.6%) of the mothers were 30 and below years old. Majority, 180 (80.0%), of mothers did not attend formal education and 50 (22.2%) of the households had at least 1 member whose education level is secondary and above.

**Table 1.** Personal hygiene of children aged 6 to 59 months in rural Dembiya, northwest Ethiopia, May 2017.

| HYGIENE VARIABLES | FREQUENCY | % |
|---|---|---|
| Children's finger nails kept short | | |
| Yes | 59 | 26.2 |
| No | 166 | 73.8 |
| Children frequently wash their hands after playing, defecation, and before eating | | |
| Yes | 102 | 45.3 |
| No | 123 | 54.7 |
| Mothers' or care givers hand washing practice | | |
| Good | 55 | 24.4 |
| Not good | 170 | 75.6 |
| Drinking water quality | | |
| Good | 67 | 29.8 |
| Not good | 158 | 70.2 |
| Food safety practices | | |
| Good | 118 | 52.4 |
| Poor | 107 | 47.6 |
| Households sanitation performance | | |
| Adequate | 97 | 43.1 |
| Not adequate | 128 | 56.9 |
| Cleanliness of the living quarter or house | | |
| Good | 27 | 12.0 |
| Not good | 198 | 88.0 |
| The household have livestock | | |
| No | 40 | 17.8 |
| Yes | 185 | 82.2 |

This study found that 59 of 225 (26.2%) children kept their finger nails short and clean at the time of the survey. One hundred two (45.3%) of mothers/care givers reported that they frequently washed hands of their child after playing and defecation, and before eating. Nearly a quarter, 55(24.4%), of mothers/care givers had good hand washing practice. The bacteriological test indicated that the quality of drinking water among 158 (70.2%) households was not good. The study revealed that 118 of 225 (52.4%) households practiced good food safety measures at the time of the survey. Less than half, 97 of 225 (43.15), of households had access to adequate sanitation. The vast majority, 198 of 225 (88.0%), of households lived in unclean quarter or house. One hundred eighty-five (82.2%) of the households had livestock at the time of the survey (Table 1).

### *Common intestinal parasitic infections*

In this study, 58 of 225 (25.8%) children were infected with one or more intestinal parasitic infections. Of the infected children, the highest proportion, 45 (77.6%), of them were infected by *Ascaris lumbricoides* (Figure 1).

### *Common GI symptoms*

The current study depicted that 139 of 225 (61.8%) children had GI symptoms. Abdominal discomfort (137 of 139 [98.7%]), abdominal cramp (125 of 139 [89.9%]), and diarrhea (118 of 139[84.9%]) were the highest symptoms reported (Figure 2). Of the children who reported GI symptoms, almost all of them had more than 1 symptom (Table 2).

### *Factors associated with gastrointestinal symptoms*

Table 3 shows factors significantly associated with GI symptoms among under-5 children. Age of children, educational status of mothers/care givers, hand hygiene of children, hand washing practice of mothers/care givers, drinking water quality, food safety, households' sanitation performance, cleanliness of the house, availability of livestock, and intestinal parasitic infections were variables entered into the univariable analysis. All other variables except age of children, educational status of mothers, and hand washing practice of mothers were selected for the multivariable binary logistic regression analysis.

This study found that intestinal parasitic infections were statistically associated with GI symptoms among children. The probability of GI symptoms was 13.69 times to be higher among children who had intestinal parasitic infections (OR = 13.69, 95% CI = 3.31-56.59).

The current study identified that hygiene and sanitation conditions were significantly associated with GI symptoms. The likelihood of having GI symptoms was 2.28 times to be higher among children who did not keep their finger nails short and clean (OR = 2.28, 95% CI = 1.02-5.10). Similarly, children with no access to adequate sanitation had higher odds to have GI symptoms compared with their counterparts (OR = 2.37, 95% CI = 1.08-5.18). The odds of having GI symptoms was 9.06 times to be higher among children who lived in unclean houses (OR = 9.06, 95% CI = 2.60-31.54). The likelihood of GI symptoms among children was higher in households who had livestock (OR = 4.68, 95% CI = 1.82-12.03).

## Discussion

This community-based cross-sectional study found that 139 of 225 (61.8%) children had one or more GI symptoms. Abdominal discomfort (137 of 139 [98.7%]), abdominal cramp (125 of 139[89.9%]), and diarrhea (118 of 139[84.9%]) were the highest GI symptoms reported. The finding of the current study is higher than the findings of studies in Colombia (29%),[17] Panama (28.7%),[18] ElSalvador (20%),[19] Ecuador

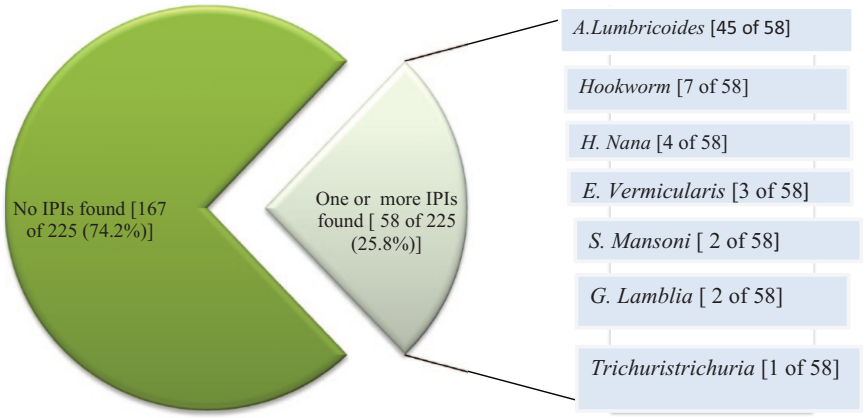


**Figure 1.** Prevalence and commonly identified intestinal parasitic infections (IPIs) among under-5 children in rural Dembiya, northwest Ethiopia, May 2017.

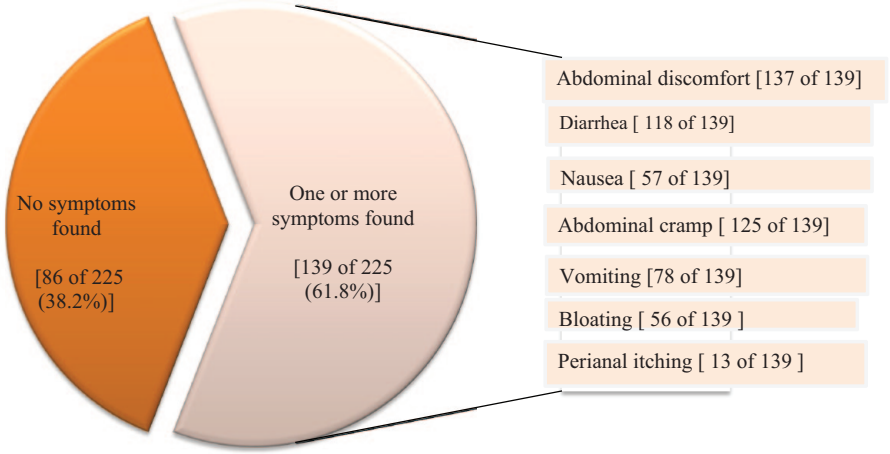


**Figure 2.** Prevalence and commonly identified GI symptoms among under-5 children in rural Dembiya, northwest Ethiopia, May 2017.

**Table 2.** Number of gastrointestinal symptoms found in under-5 children in rural Dembiya, northwest Ethiopia, May 2017.

| NUMBER OF GASTROINTESTINAL SYMPTOMS FOUND | FREQUENCY | % |
|---|---|---|
| No | 86 | 38.2 |
| 1 | 2 | 0.9 |
| 2 | 12 | 5.3 |
| 3 | 25 | 11.1 |
| 4 | 40 | 17.8 |
| 5 | 40 | 17.8 |
| 6 | 17 | 7.6 |
| 10 | 3 | 1.3 |

(22.8%),[20] and Italy (54.9%).[2] The possible explanation for this difference might be due to sociodemographic, hygiene, and sanitation differences.

This study showed that GI symptoms were significantly associated with intestinal parasitic infections. GI symptoms were common among children who had one or more intestinal parasitic infections. This finding is in line with the findings of other studies.[21-24] It might be due to the fact that intestinal parasitic infections could trigger changes in immune function, metabolic processes, and intestinal microflora and result in abnormal intestinal or extraintestinal physiology that could be associated with symptoms persisting well after the infection.[25-27]

The current study also identified that hand hygiene was significantly associated with GI symptoms. The likelihood of having GI symptoms was higher among children who did not keep their finger nails short and clean. Other studies also reported the association of hand hygiene and GI symptoms among children.[7,28,29] This might be due to the fact that a number of infectious diseases like GI infections can be spread from one person to another by contaminated hands. Washing hands properly can help prevent the spread of the germs (like bacteria and viruses) that cause GI infections.[29-31]

This study depicted that GI symptoms among children were statistically associated with sanitation condition of the living environment. Children with no access to adequate sanitation had higher odds to have GI symptoms. The effect

**Table 3.** Factors with GI symptoms among under-5 children in rural Dembiya, northwest Ethiopia, May 2017.

| VARIABLES | ONE OR MORE GI SYMPTOMS FOUND | | CRUDE OR WITH 95% CI | ADJUSTED OR WITH 95% CI |
|---|---|---|---|---|
| | YES | NO | | |
| Intestinal parasitic infections | | | | |
| No | 84 | 83 | 1 | |
| Yes | 55 | 3 | 18.12 (5.45-60.20) | 13.69 (3.31-56.59)** |
| Children kept their finger nail short | | | | |
| Yes | 31 | 28 | 1 | |
| No | 108 | 58 | 1.68 (0.92-3.07) | 2.28 (1.02-5.10)* |
| Children wash hands after playing/defecation/ before eating | | | | |
| Yes | 51 | 51 | 1 | |
| No | 88 | 35 | 2.51 (1.45-4.36) | 0.93 (0.46-1.89) |
| Drinking water quality | | | | |
| Good | 36 | 31 | 1 | |
| Not good | 103 | 55 | 1.61 (0.90-2.88) | 1.54 (0.74-3.19) |
| Food safety practices | | | | |
| Good | 59 | 59 | 1 | |
| Poor | 80 | 27 | 2.96 (1.68-5.22) | 1.76 (0.74-4.17) |
| Households sanitation performance | | | | |
| Adequate | 41 | 56 | 1 | |
| Not adequate | 98 | 30 | 4.46, (2.51-7.92) | 2.37 (1.08-5.18)* |
| Cleanliness of the house | | | | |
| Good | 5 | 22 | 1 | |
| Not good | 134 | 64 | 9.21 (3.34-25.44) | 9.06 (2.60-31.54)** |
| Households have livestock | | | | |
| No | 16 | 24 | 1 | |
| Yes | 123 | 62 | 2.98 (1.47-6.01) | 4.68 (1.82-12.03)** |

Abbreviations: CI, confidence interval; GI, gastrointestinal; OR, odds ratio.
Hosmer and Lemeshow test = 0.335.
*Statistically significant at $P < .05$. **Statistically significant at $P < .001$.

of poor sanitation on GI symptoms can be justified that poor sanitation (indiscriminate dumping of wastes and open urination and defecation) spreads enteric pathogens. As discussed above, enteric pathogens are associated with GI symptoms.[32-34]

This study revealed that GI symptoms were significantly associated with presence of livestock. The likelihood of GI symptoms among children was higher in households who own livestock. This finding is supported by the finding of another study.[35] This can be justified that owning animals increases the risk of zoonotic intestinal parasitic infections and in turn associates with GI symptoms.[36,37]

### *Implications of findings*

The findings of this study may indicate high prevalence of enteric infections as the reported GI symptoms are hallmarks or common manifestations of different enteric infections, and provide initial evidence to the local health authorities or health practitioners about the burden of enteric infections in the area and warrants further researches on enteric infections.

### *Limitation of the study*

We primarily used mothers' report to assess GI symptoms. Health professionals also diagnosed for some symptoms. Due

to this phenomenon, the current study might be affected by social desirability bias. Moreover, the 95% CI for some predictor variables, for instance "intestinal parasitic infections," is wide due to small number of cases in one of the cells in a 2-by-2 table.

## Conclusion

The prevalence of GI symptoms among under-5 children in rural Dembiya, northwest Ethiopia, was found to be high. GI symptoms were significantly associated with childhood intestinal parasitic infections, hand hygiene condition of children, and sanitation condition of the living environment. Therefore, preventing intestinal parasitic infections, improving hand hygiene condition, and promoting environmental sanitation will have overriding contributions to prevent GI symptoms among children in Rural Dembiya.

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## Author Contributions

All the authors actively participated during conception of the research issue, data collection, analysis, and interpretation of results. Z.G. had designed the protocol and wrote the manuscript. A.A. and D.G. supervised the overall research process. All the authors read and approved the final manuscript.

## Availability of Data and Material

Data will be made available upon requesting the primary author.

## Consent for Publication

This article does not contain any individual person's data.

## Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Institutional Review Board of the University of Gondar. Authors obtained verbal informed consent from the mothers as the study did not use risky procedure and there were no risks due to participation in this research project. The collected data were used only for this research purpose and kept with complete confidentiality. Privacy was assured during data collection. Appropriate anthelmintic drugs were given for infected children.

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