Handwashing Practices and Its Predictors Among Primary School Children in Damote Woide District, South Ethiopia: An Institution Based Cross-Sectional Study

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ABSTRACT

BACKGROUND: Handwashing in schools with soap could substantially reduce diarrhea and respiratory infections among school-age children; however, in low-and-middle-income countries, handwashing is still being practiced to a very low extent in particular critical moments such as before eating and after using the toilet. Therefore, the main objective of this study was to assess the level of handwashing practice and its predictors among primary school children in South Ethiopia.

METHODS: A school-based cross-sectional study was conducted using a multistage cluster sampling technique from 6 primary schools with 580 students in total. Schools were purposively selected and the students were random. Data were collected using pre-tested questionnaires administered by interviewers and trained data collectors. Data were entered using Epi Data and exported to SPSS software for analysis. Both bivariate and multivariable logistic regression analyzes were used.

RESULT: Proper handwashing practice was reported in 28.10% (95% CI, 24.5, 31.7%) of students. Being eighth grade (AOR = 3.44, 95% CI 1.52, 8.23), urban residence (AOR = 18.84, 95% CI 14.02, 23.29), having parents (AOR = 10.74; 95% CI 8.80-12.36), role model teachers (AOR = 4.45; 95% CI 5.52-8.99), role model health professionals (AOR = 9.62; 95% CI 2.70-14.19), and school handwashing facility (AOR = 3.84; 95% CI 3.60, 4.07) were predictors of proper handwashing practice.

CONCLUSIONS: Proper handwashing practice among schoolchildren was found below. Therefore, promoting and improving handwashing practices and preparing handwashing facilities in schools is mandatory to address the handwashing practice gap among primary school students in the study area.

KEYWORDS: Handwashing practice, primary school, school children, students, school-aged children

Introduction

Handwashing is defined as the vigorous and brief rubbing together of all surfaces of lathered hands, followed by rinsing under a stream of water, with a fundamental principle of removal, not killing of microorganisms.1 Handwashing facilities in schools is one of a mechanism to achieve sustainable development goals 4 and 6 (SDG 4 and 6) in schools, to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all and to ensure availability and sustainable management of water and sanitation for all by the year 2030” respectively.2 Handwashing has been widely recognized and accepted as a low-cost and effective technique in preventing communicable diseases and this practice has been recognized as an important public health measure to prevent and control most infectious diseases.3 The global burden of diarrheal disease can be reduced by 9.1% and 6.3% of all global deaths can be stopped by improving access to water, sanitation, and hygiene (WASH).4,5 WASH interventions have shown significant reductions in school absenteeism and may have a positive influence on educational outcomes.4,6

Handwashing is a basic everyday process and is a skill and behavior that must be learned as a child and should become a habit throughout life to enjoy a better quality of life.7,8 The use of sanitary facilities and handwashing practices is an important life skill for school children.9,10 Handwashing with soap could substantially reduce diarrhea and respiratory infections.11 Proper handwashing practice is a prerequisite for a child’s survival, hence, improper handwashing is responsible for the majority of child deaths globally each year.8,12 However, school-aged children in low-and-middle-income countries usually do not engage in handwashing practice at critical times, such as after using the toilet, before eating, and before cooking the food.13,14

In Nigeria, only 59% of urban and 22% of rural people have access to improved water and sanitation facilities.15 Thus, inadequate sanitary conditions and poor hygiene practices play a...
major role in the increased burden of communicable diseases within these low-and-middle-income countries. School-based handwashing practices have been done in different countries. Some of these studies are in Colombia, where 36.6% of school children reported washing their hands always with soap and very often after using the toilet, however, only 3% always wash their hands for at least 20 seconds; similarly, in Bogota, only 33.6% always or very often wash their hands with soap and clean water before eating and after using the toilet, while about 7% of students reported regular access to soap and clean water at school; in Bangladesh, washing hands specifically using soap after defecation was found to be a common practice; in Vietnam, the common time for handwashing was before eating (60%), but only 23% after defecation and very few did before cooking (only 7%), washed their hands at the recommended duration (30-60 seconds) was 58%, the proportion of handwashing practice was increased by grade levels (34% among grade 1 to 67% among grade 7 students); in South Africa, duration (30-60 seconds) was 58%, the proportion of handwashing practice of handwashing in Angolela District, North Ethiopia, the handwashing practice the day before the interview was 99.7% (99% before meals, 46% after meals, and only 15% after defecation), most of them practiced using with plain water only, 36.2% of them used soap; in Bale town Eastern Ethiopia, 98.3% of the children regularly practiced handwashing before meals; in Arba Minch Town Southern Ethiopia, 79.1% washed their hands with soap after visiting the toilet and before a meal, 22.3% of them properly applied handwashing practice.

The practice of handwashing in soap-based interventions for primary school children is effective in reducing infectious diseases in the school community. Handwashing is linked to the availability and accessibility of handwashing facilities. A school study in Bogota, Colombia, showed that being urban schools, the availability of water and soap was 3 times more often known. If the level of handwashing were known in the study area, this would be helpful to devise appropriate intervention on school sanitation facilities and awareness creation. Therefore, the main objective of this study was to determine the level of handwashing practice and associated factors among primary school children in Damot Woide District, Wolaita zone, South Ethiopia.

Methods

Study setting and period

The study was carried out in Damot Woide District, Wolaita Zone, Ethiopia. The Damot Woide District is located around 400 km from Addis Ababa, the capital of Ethiopia. The district has a total population of 119,339, there are 31 primary schools (6 in urban and 25 in rural Kebeles) and 2 high schools. The District has 4 health centers, 22 health posts, 12 private clinics, and 1 private drug store. Intestinal parasitoid and diarrheal diseases are the second to third leading causes of morbidity of outpatient diagnosis morbidity in the 10 top disease lists. The study was conducted between January 2018 and February 2018.

Study design and population

A school-based cross-sectional study design was used on randomly selected school-age children (ranges from 10 to 20 years) from selected primary schools of Damot Woide District, south Ethiopia. The survey data was supplemented with school walkthrough observation on sanitation facilities with well-prepared checklists.

Inclusion and exclusion criteria

Randomly selected students from grades 5 to 8 in selected primary schools who are registered and active students during the
study period were included. However, those students with hearing, speaking, disabilities problems, and students attending evening classes were excluded.

**Sample size and sampling procedure**

The sample size was calculated using a single population proportion statistical formula with assumptions of the proportion of improper handwashing practice 77.7%, a 95% confidence level with a 5% error margin, and a design effect of 2 were considered; furthermore, 10% of the calculated sample size (n = 59) was added for possible nonresponse. In the multistage cluster random sampling technique initially, schools (grades 5-8) were stratified into urban and rural schools. Then, a town school and 5 rural schools were purposively selected due to transport access and logistic feasibility. Five hundred and eighty-six (586) students were selected from 6 schools proportionally. The list of students was obtained from the school roster list. Each participating student was selected by the lottery method from the roster list.

**Variables and operational definition**

The dependent variable for the study was handwashing practice, while predictor variables were socio-demographic (age, sex, educational status, occupation, residency), institutional factors (distance from the home, school sanitation facilities, source of water) personal factors, and social factors (important referents, source of information, school wash club, mini-media, and celebration of handwashing day). To assess the level of handwashing practices, respondents were asked 7 questions: washed their hands in the last 12 hours? Usual handwashing time, Items used for handwashing, commonly used type of handwashing materials in the family, duration of washing their hands at a time, how often do you wash hands with soap before a meal? How often do you wash hands with soap after using the toilet? and those who scored more than the mean value were considered as having good practices (ie, correctly responded to at least 4 of 7 practice questions) and those who scored less than the mean value were considered having poor practices (correctly responded to less than 4 of 7 practice questions). Few variables had multiple responses, hence, we had categorized these variables in dichotomous (handwashing practice: Yes or No) based on their relevance to the benefit of handwashing as compared to others.

**Data management and analysis**

Data were checked for completeness, edited manually, coded, and then entered into Epi Data version 3.1 and exported into SPSS version 20 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY) for clearance and analysis. Bivariate and multivariate logistic regression analysis was used. All factors with a P-value less than .25 in the bivariate logistic regression analysis were considered for the multivariate analysis. Both crude and adjusted odds ratios with a 95% confidence interval were reported. Multicollinearity tests were conducted using the Variance Inflation Factor (VIF < 5). Hosmer and Lemeshew’s Goodness of fit test (P < .085) was used to check for the fitness of the model. Variables with a P-value less than .05 in multivariate analysis were considered statistically significant.

**Results**

**Socio-demographic characteristics**

Five hundred eighty (580) students completed survey questions (response rate = 98.9%). About 174 (30.0%) were students in grade 6 and 168 (29.0%) were students in grade 5 (Table 1). About 312 (53.8%) were female students. The mean age of the respondents was 13.3 ± 1.7 years. About 449 (77.5%) lived in a rural area at the time of the survey. Regarding the educational and occupational status of the student’s mother, 174 (30.0%) and 359 (61.9%) were illiterate and housewives, respectively.

**The practice of handwashing**

Among the respondents, 147 (25.8%) and 184 (32.3%) wash their hands before meals and after meals respectively (Figure 1). Respondents who had washed their hands on the morning of interview day were 520 (89.7%) (Table 2). More than half (53.3%) students had used only plain water to wash their hands and were followed by 149 (25.7%) who used soap to wash their hands. The majority of study participants 305 (52.6%) responded that they don’t know for how long to wash their hands at a time. In terms of frequency, 388 (66.9%) of participants reported that they wash their hands often with soap before meals followed by
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those washing very often with soap 76 (13.1%). Of 580 students, 372 (64.1%) reported that they often wash their hands with soap after using the toilet, whereas only 74 (12.8%) of the students wash their hands always after using the toilet. In general, 163 (28.1%) (95% CI, 24.5, 31.7%) of the participants had good handwashing practice.

### Handwashing facilities at the home of students

The most common water source in households was piped water, 337 (58.1%) (Table 2). Most of the students 474 (81.7%) reported having a handwashing facility in the family and of which 394 (82.9%) responded as handwashing is functional (properly working at the time survey, faucets are working and water is available) (Table 3). Two hundred thirty (39.7%) students responded to the presence of only water to wash hands at home, while 396 (68.3%) reported the presence of water and soap for washing hands at home.

### Personal and social factors for handwashing practice

The majority of the 398 students (73.3%) mentioned the benefit of handwashing in the prevention of disease (Table 4). Three hundred twenty (55.2%) respondents reported forgetfulness as the reason for not washing hands, followed by laziness 78 (13.4%). The majority of participants 509 (87.8%) responded that as they know, poor handwashing causes disease. Two hundred sixty (44.8) of the respondents reported that plain water is enough for handwashing. Two hundred ninety-seven (51.2%) participants reported that they need to wash their hands with soap if only they look filthy or smell bad. Most of the participants 175 (30.2%) and 170 (30%) reported having heard about handwashing from the mini-media (school-based mass-media, audio-visual, and information center) and radio, respectively. Referents (role models) of students for handwashing were parents 306 (52.8%) and teachers124 (21.4%), respectively.

### Table 1. Socio-demographic characteristics of students in Damot Woide District Primary Schools, Wolaita zone, Ethiopia, May 2018 (n = 580).

| VARIABLE          | RESPONSE       | URBAN N (%) | RURAL N (%) | TOTAL N (%) |
|-------------------|----------------|-------------|-------------|-------------|
| Grade             | Grade 5       | 42 (25)     | 126 (75)    | 168 (29.0)  |
|                   | Grade 6       | 35 (20.1)   | 139 (79.9)  | 174 (30.0)  |
|                   | Grade 7       | 27 (20.8)   | 103 (79.2)  | 130 (22.4)  |
|                   | Grade 8       | 26 (24.1)   | 82 (75.9)   | 108 (18.6)  |
| Age (y)           | <14           | 97 (29)     | 237 (71)    | 334 (57.6)  |
|                   | ≥14           | 33 (13.4)   | 213 (86.6)  | 246 (42.4)  |
| Sex               | Male          | 54 (20.1)   | 214 (79.9)  | 268 (46.2)  |
|                   | Female        | 76 (24.4)   | 236 (75.6)  | 312 (53.8)  |
| Maternal education| Illiterate    | 22 (12.6)   | 152 (87.4)  | 174 (30)    |
|                   | Grade 1-8     | 31 (13.6)   | 197 (86.4)  | 228 (39.3)  |
|                   | Grade 9-12    | 32 (29.6)   | 76 (70.4)   | 108 (18.6)  |
|                   | Grade ≥12     | 45 (64.3)   | 25 (35.7)   | 70 (12.1)   |
| Maternal occupation| Housewife    | 57 (15.9)   | 302 (84.1)  | 359 (61.9)  |
|                   | Non-housewife | 73 (33.1)   | 148 (66.9)  | 221 (38.1)  |
| Fathers education | Illiterate    | 14 (10.8)   | 116 (89.2)  | 130 (22.4)  |
|                   | Grade 1-8     | 23 (13.2)   | 151 (86.8)  | 174 (30)    |
|                   | Grade 9-12    | 35 (19.7)   | 143 (80.3)  | 178 (30.7)  |
|                   | Grade ≥12     | 58 (59.2)   | 40 (40.8)   | 98 (16.9)   |
| Fathers occupation| Farmer        | 27 (7)      | 357 (93)    | 384 (66.2)  |
|                   | Non-farmers   | 103 (52.5)  | 93 (47.5)   | 196 (33.8)  |
School handwashing facility observation result

Based on the observational checklist, 4 of 6 schools had handwashing facilities (tap water, tippy-tap, buckets, soap, basin, sink, etc.) in their compound at a distance of fewer than 10 m from the latrine facilities. But access to water to handwashing facilities is only available in 3 schools. There is no soap for handwashing facilities in all schools. The handwashing facilities in all schools are not connected to the pipeline, since the school did not have access to water through the pipe. In 5 schools, there are sanitation and hygiene clubs to provide awareness to the school community, but only 4 schools clubs had broadcast handwashing promotions through mini-media. About 5 of the schools celebrate the annual “Handwashing Day.”

Factors affecting handwashing practice in primary school children

On the result of multivariate logistic regression models, being grade 8, living in an urban area, having referents as parents, teachers, and health professionals, and the presence of a handwashing facility in the school was significantly associated with handwashing practice. Grade 8 students were 3.54 times more likely to practice proper handwashing practice compared to grade 5 students (AOR = 3.54, 95% CI: 1.52, 8.23). Students living in an urban area were 18.84 times more likely to practice proper handwashing practice compared to students living in a rural area (AOR = 18.84, 95% CI: 14.02, 23.29). Students whose referents were parents, teachers, and health professionals were more likely (AOR = 10.74; 95% CI 8.80-12.36, AOR = 6.45; 95% CI 5.52-8.99, AOR = 9.62; 95% CI 2.70-14.19 respectively) to practice proper handwashing practice compared to those whose referents were friends. Students attending a school where there is a handwashing facility were 3.84 times more likely to practice proper handwashing practice compared to those who are learning at school where there is no handwashing facility (AOR = 3.84, 95% CI 3.60, 4.07) (Table 5).

Discussion

The proportion of students with good handwashing practice in primary schools in Damot Woide district of Wolaita zone, Ethiopia, was 28.10% (95% CI, 24.5, 31.7%). A slightly higher proportion of the handwashing practice of the students was criticized compared to the study conducted in the town of Arba Minch town, Ethiopia which is (22.3%) and slightly lower proportion than a study conducted in Sebeta, Ethiopia (32%) whereas a study in Colombia, showed 36.6%. The variability in proportion may be due to the difference in access to handwashing facilities in schools and households and, socio-demographic, educational, economic, and cultural differences with the current study area.

This study identified associated factors for proper handwashing practice among students, grade 8 students were 3.54
times more likely to practice proper handwashing compared to grade 5 students, this could be due to teachers focusing on higher grade students, and they could learn as their age increases and are more likely to practice what they learned. This study is comparable to that in Vietnam in that the proportion of handwashing increased with increasing students’ grade level.20

Students living in the urban area were 18.84 times more likely to practice proper handwashing compared to students

| VARIABLE                                      | RESPONSES | FREQUENCY | PERCENT |
|-----------------------------------------------|-----------|-----------|---------|
| **Water sources in**                          |           |           |         |
| Pipe water                                    | 337       | 58.10     |         |
| Spring                                        | 114       | 19.70     |         |
| Hand-dug well                                 | 22        | 3.80      |         |
| Deep well                                     | 20        | 3.40      |         |
| River/Lake                                    | 87        | 15.00     |         |
| **Washed their hands in the last 12h**         |           |           |         |
| Yes                                           | 570       | 98.30     |         |
| No                                            | 10        | 1.70      |         |
| **Usual hand washing time**                   |           |           |         |
| Before meal                                   | 147       | 25.80     |         |
| After meal                                    | 184       | 32.30     |         |
| After work                                    | 89        | 15.60     |         |
| After play                                    | 108       | 18.90     |         |
| After toilet                                  | 42        | 7.40      |         |
| **Items used for hand washing**               |           |           |         |
| Plain water only                              | 309       | 53.30     |         |
| Plain water with Soap                         | 149       | 25.70     |         |
| Plain water with Ash                          | 39        | 6.70      |         |
| Other                                         | 23        | 4.00      |         |
| **More practiced to washing hands in the family**|          |           |         |
| Ash and water                                 | 28        | 4.80      |         |
| Soap and water                                | 203       | 35.00     |         |
| Water only                                    | 349       | 60.20     |         |
| **Duration of washing their hands at a time** |           |           |         |
| <20s                                          | 63        | 10.90     |         |
| 20 s-1 min                                    | 212       | 36.60     |         |
| Do not know                                   | 305       | 52.60     |         |
| **How often do you wash hands with soap before a meal?** | | |         |
| Always                                        | 50        | 8.60      |         |
| Very often                                    | 76        | 13.10     |         |
| Often                                         | 388       | 66.90     |         |
| Some times                                    | 66        | 11.40     |         |
| **How often do you wash hands with soap after using the toilet?** | | |         |
| Always                                        | 74        | 12.80     |         |
| Very often                                    | 48        | 8.30      |         |
| Often                                         | 372       | 64.10     |         |
| Some times                                    | 70        | 12.10     |         |
| Never                                         | 16        | 2.80      |         |
| **Proper handwashing practice**               |           |           |         |
| Yes                                           | 163       | 28.10     |         |
| No                                            | 417       | 71.90     |         |
living in the rural area. A similar study was conducted in Arba Minch\textsuperscript{24} and Bangladesh\textsuperscript{29} revealed that urban students living in urban settings were more likely to practice proper handwashing than those living in rural areas. These differences can be revealed that evaluating school children’s handwashing practice in a rural and urban setting could be worth of different

| VARIABLE                                                      | RESPONSE | FREQUENCY | PERCENT |
|---------------------------------------------------------------|----------|-----------|---------|
| Presence of handwashing facility in the home                  | Yes      | 474       | 81.70   |
|                                                               | No       | 106       | 18.30   |
| Functional handwashing facility in the home                   | Yes      | 394       | 82.90   |
|                                                               | No       | 80        | 17.10   |
| Time taken to fetch water in the home                         | <15 min  | 360       | 62.10   |
|                                                               | 15-30 min| 150       | 25.90   |
|                                                               | >30 min  | 70        | 13      |
| Handwashing facilities in the home easy to Clean              | Yes      | 252       | 43.40   |
|                                                               | No       | 328       | 56.60   |
| Presence of soap and water for handwashing at home            | Yes      | 396       | 68.30   |
|                                                               | No       | 184       | 31.70   |

Table 3. Handwashing facilities at the students’ home in Damot Woide District primary schools in the Wolaita zone, Ethiopia, May 2018.

| VARIABLE                                                      | RESPONSES | FREQUENCY | PERCENT |
|---------------------------------------------------------------|-----------|-----------|---------|
| The benefit of handwashing                                    | To prevent disease | 398 | 73.30 |
|                                                               | To free from bad smell | 48  | 8.80 |
|                                                               | To remove dirt’s    | 42  | 7.70 |
|                                                               | To clean hand      | 49  | 9    |
| What are your reasons for not washing hands                   | Forget fullness  | 320 | 55.2 |
|                                                               | Laziness         | 78  | 13.4 |
|                                                               | Lack of time     | 36  | 6.2  |
|                                                               | Lack of interest | 58  | 10.0 |
|                                                               | Lack of water    | 55  | 9.5  |
|                                                               | Lack of soap     | 33  | 6.0  |
| Source of media information about handwashing                 | Television    | 65  | 11.2 |
|                                                               | Radio          | 174 | 30.0 |
|                                                               | Leaflets       | 61  | 10.5 |
|                                                               | Newspaper      | 11  | 1.9  |
|                                                               | Min-media      | 175 | 30.2 |
|                                                               | Textbooks      | 94  | 16.2 |
| Referents (role model) for handwashing practice               | Parents      | 306 | 52.8 |
|                                                               | Teachers       | 124 | 21.4 |
|                                                               | Health professionals | 50 | 8.6  |
|                                                               | Friends        | 100 | 17.2 |

Table 4. Personal factors for the practice of handwashing by children in primary schools in the Damot Woide district in the Wolaita zone, SNNPR, Ethiopia, May 2018.
This may be due to behavioral differences among rural and urban dwellers and also due to inadequate access to water, handwashing facility, and household level issues.

Students whose parents are used as important referents/role models to wash their hands were 10.74 times more likely to practice handwashing than those who used their friends as a role models. Similarly, students whose referents are teachers for handwashing practice were 6.45 times more likely to practice proper handwashing compared to those students whose important referents/role models were friends. These are in line with a study conducted in Indonesia and Arba-Minch, Ethiopia.24,29,38 This might be due to parents and teachers being more trustworthy sources of information for behavioral changes in students than friends. Though friends are peers, they undermine their friends due to the “we are all in the same boat” effect.

Students attending a school where there is a handwashing facility were 3.84 times more likely to practice proper handwashing than those attending a school where there is no handwashing facility. According to a study conducted in Ghana, accessibility, and availability of handwashing facilities in schools26,39 and Indonesia, availability of clean water and soap at handwashing stands25,40 were found to be significant predictors of proper handwashing practice. This may be because handwashing facilities motivate the students to wash their hands properly.

### Table 5. Predictor variable analysis of children’s handwashing practice in the primary school of the Damot Woide District primary schools in the Wolaita zone, Ethiopia, May 2018.

| VARIABLE                        | RESPONSE | HAND WASHING PRACTICE | OR 95% CI |
|---------------------------------|----------|-----------------------|-----------|
|                                 |          | PROPER | IMPROPER | COR | AOR |
| Grade of students               | Grade 5  | 42     | 126      | 1.00 |     |
|                                 | Grade 6  | 37     | 137      | 0.80 (0.50, 1.34) | 0.87 (0.45, 1.69) |
|                                 | Grade 7  | 45     | 85       | 1.58 (0.96, 2.60) | 1.54 (0.75, 3.16) |
|                                 | Grade 8  | 39     | 69       | 1.70 (1.00, 2.80) | 3.54 (1.52, 8.23) |
| Age                             | <14 y    | 103    | 231      | 1.00 | 1.00 |
|                                 | ≥14 y    | 60     | 186      | 0.72 (0.49, 1.05) | 0.38 (0.21, 1.70) |
| Sex                             | Male     | 84     | 184      | 1.34 (0.94, 1.93) | 1.15 (0.70, 1.90) |
|                                 | Female   | 79     | 233      | 1.00 | 1.00 |
| Residence                       | Urban    | 72     | 59       | 4.70 (3.17, 7.26) | 18.84 (14.02, 23.29) |
|                                 | Rural    | 91     | 358      | 1.00 | 1.00 |
| Maternal education              | Non-educated | 27 | 147 | 1.00 | 1.00 |
|                                 | Grade 1-8 | 69 | 159 | 2.36 (1.40, 3.88) | 1.57 (0.78, 3.14) |
|                                 | Grade 9-12 | 38 | 70 | 2.95 (1.67, 5.20) | 1.86 (0.83, 4.17) |
|                                 | Grade ≥12 | 29 | 41 | 3.80 (2.05, 7.20) | 2.79 (0.89, 8.70) |
| Paternal education              | Non-educated | 21 | 109 | 1.00 | 1.00 |
|                                 | Grade 1-8 | 47 | 127 | 1.92 (1.08, 3.41) | 1.16 (0.54, 2.48) |
|                                 | Grade 9-12 | 56 | 122 | 2.38 (1.38, 4.18) | 1.56 (0.72, 3.36) |
|                                 | Grade ≥12 | 39 | 59 | 3.43 (1.85, 6.36) | 1.25 (0.45, 3.51) |
| Referents for handwashing practice | Parents | 99 | 207 | 7.50 (3.17, 17.69) | 10.74 (8.80, 12.36) |
|                                 | Teachers | 47 | 77    | 9.50 (3.80, 23.50) | 6.45 (5.52, 8.99) |
|                                 | Health personnel | 11 | 39 | 4.40 (1.50, 12.70) | 9.62 (2.70, 14.19) |
|                                 | Friends | 6 | 94 | 1.00 | 1.00 |
| Handwashing facility in the school | Yes | 158 | 257 | 3.44 (2.15, 5.50) | 3.84 (3.60, 4.07) |
|                                 | No | 25 | 140 | 1.00 | 1.00 |
The strength of this study was conducted in a school-based environment in which handwashing matters most in maintaining the health of pupils in representing both rural and urban school settings. However, parents and teachers have not been involved in responding to students' handwashing practice-related questions which was a missing opportunity. Schools were selected purposively due to lack of transport access and logistic inconveniences that may introduce some level of bias in terms of representativeness and generalizability. Data collection would have been best if handwashing practices were observed anonymously than depending on the self-reported practice. Being cross-sectional study design and the majority of the finding is based on the self-reported response of study participants. Data analysis lacks some level of weighing for clustering effect between urban and rural school settings.

Conclusion
The proportion of students who practiced proper handwashing in the school was low. Grade 8 students; urban students; students whose important referents for handwashing were parents, teachers, and health professionals; and students who had access to handwashing facilities in schools were significant factors for proper practice of handwashing. Therefore, all primary schools should advocate and involve students in handwashing practice activities at school and outside the school in age-specific WASH intervention in both rural and urban setting schools. The rural health extension program should focus on hygiene education on handwashing practice at the family level (children and their parents) and in schools (teachers). Local government and non-governmental offices in the area should support school clubs to teach/demonstrate proper handwashing practices by providing well-designed, well-functioning, and conveniently-located handwashing facilities and infrastructures. Finally, we strongly recommended a more robust research design for future studies, involving parents and more in the observational and qualitative study design.

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Author Contributions
AA: conceived and designed the study, performed analysis, interpreted the data. All authors were involved in the analysis, interpretation of the data. AA: prepared the original manuscript draft. FWF: revised the manuscript. All authors critically reviewed and approved the final manuscript.

Availability of Data and Materials
The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Considerations
Ethics clearance was obtained from the Ethics Review Board of Wolaita Sodo University. After approval, an official letter of cooperation was sent to the Damot Woide District Education Office. The permission letter was obtained from the district education office before data collection. The nature of the study was fully explained to the study participants and informed written consent was obtained from each school director before data collection to maintain privacy and confidentiality. Participants were told that documents will be kept in a secure place to avoid access to others, and they were informed that they have the right to refuse and withdraw from the interview at any time if they are not comfortable.

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REFERENCES
1. Dean E. Hand washing, Nurs Child Young People. 2017;29:11.
2. UNESCO. SDG 4 Education 2030 High-Level Steering Committee Secretariat. Sustainable Development Goal 4. 2021. Accessed December 27, 2021. Educa
3. Eijkemans G. Meeting Report: WHO-ILO Joint Effort on Occupational Health and Safety in Africa. World Health Organization With input of WHO/ILO Joint Effort Taskforce; 2001.
4. Biran A, Schmidt WP, Varadharajan KS, et al. Effect of a behavior-change intervention on handwashing with soap in India (SuperAmma): a cluster-randomized trial. Lancet Glob Health. 2014;2:e145-e154.
5. Ministry of Education. National School Water, Sanitation and Hygiene (SWASH) Implementation Guideline. FDRE Ministry of Education; 2017:45.
6. White C, Kolble R, Carbon R, et al. The effect of hand hygiene on illness rate among students in University Residence Halls. Am J Infect Control. 2003;31: 364-370.
7. Adams PF, Ma M. Lether up for good health. Class Room Guide. 2010.
8. Mane AB, Reddy NS, Reddy P, Chetana KV, Srijith SN, Srinivas T. Differences in hand hygiene and its correlates among school-going children in rural and urban area of Karnataka, India. Arch Med 2016;8:1-5.
9. FMOH. School WASH Manual. FMOH, 2005.
10. Almoome M, Alshehri TA, Alhumbairi AA, Aljassim MT, Hassan ME, Berekaa MM. Handwashing knowledge, attitudes, and practices among students in Eastern Province schools, Saudi Arabia. J Environ Public Health 2021:6638443.
11. Yallew WW, Terefe MW, Herchline TE, et al. Assessment of water, sanitation, and hygiene practice and associated factors among people living with HIV/AIDS home-based care services in Gondar city, Ethiopia. BAC Public Health. 2012;12:1057.
12. Rubanprem KS, Aruna S, Saiikala M. Effectiveness of hand hygiene teaching on knowledge and compliance of handwashing among the students at a selected school in Mugalivakkam village, Kancheepuram District. IOSR J Nurs Health Sci 2014;3:56-60.
13. Esbuchi R. Promoting Handwashing With Soap Behaviour in Kenyan Schools: Learning From Puppetry Trials Among Primary School Children in Kenya, in Faculties and Divisions > Creative Industries Faculty Past > Schools > School of Media, Entertainment & Creative Arts. Queensland University of Technology, 2013.
14. Biswas D, Sahoo S, Daugpta A, Preeti PS, Amitavakumar Das S. Quantification of perception status of hand washing practice among school children in a rural area of West Bengal. Appl Med Sci. 2015;3:1683-1687.
15. Azuogu VC, Ilo CI, Nwimo IO, Azuogu BN, Omwunaka C. Extent of hand washing practice among secondary school students in Ebonyi State, Nigeria. Int J Educ Learn Dev. 2016;4:11-22.
16. Steiner-Ayinde M, Van-Ees SE, Papo M, Setorglo J, Asiedu DK, Anderson AK. Hand washing practices among school children in Ghana. Scie 2011;3:393-300.
17. Chittleborough CR, Nicholson AL, Basker E, Bell S, Campbell R. Factors influencing hand washing behaviour in primary schools: process evaluation within a randomized controlled trial. Health Educ Res. 2012;27:1055-1068.
18. Lopez-Quintero C, Freeman P, Neumark Y. Hand washing among school children in Bogota, Colombia. Am J Public Health. 2009;99:94-101.
19. Akter T, Ali AM. Factors influencing knowledge and practice of hygiene in water, sanitation and hygiene (WASH) programme areas of Bangladesh Rural Advancement Committee. Rural Remote Health. 2014;14:2628-2710.
20. Thanh Xuan LT, Hoat LN. Handwashing among schoolchildren in an ethnically diverse population in northern rural Vietnam. Glob Health Action. 2013;6:1-8.
21. Sibiya J, Gumbo J. Knowledge, attitude and practices (KAP) survey on water, sanitation, and hygiene in selected schools in Vhembe District, Limpopo, South Africa. Int J Environ Res Public Health. 2013;10:2282-2295.
22. Vivas AP, Gelaye B, Aboset N, Kumie A, Berhane Y, Williams MA. Knowledge, attitudes, and practices (KAP) of hygiene among school children in Angolela, Ethiopia. J Prev Med Hyg. 2010;51:73-79.
23. Tadesse G. The prevalence of intestinal helminthic infections and associated risk factors among school children in Babile town, eastern Ethiopia. Ethiop J Health Dev. 2005;19:140-147.
24. Besha B, Guche H. Assessment of handwashing practice and its associated factors among first cycle primary school children in Arba Minch Town, Ethiopia, 2015. Epidemiol Open Access. 2016;6:2161-1165.
25. Setyautami T, Sermri S, Chompikul J. Proper hand washing practices among elementary school students in Selat sub-district, Indonesia. J Public Health Dev. 2012;10:3-20.
26. Monney I. Assessing hand hygiene practices in schools benefiting from the Ghana School Feeding Programme. Sci J Public Health. 2014;2:7-14.
27. Durton P, Nguyen NK, Peschiera PF. The Power of Primary Schools to Change and Sustain Handwashing With Soap Among Children: The Cases of Vietnam and Peru (English), in Water and Sanitation Program Technical Paper; WSP World Bank; 2011.
28. UNICEF. WASH for School Children South Asia Report. UNICEF; 2012.
29. Rabbi SE, Dey NC. Exploring the gap between handwashing knowledge and practice in Bangladesh: a cross-sectional comparative study. BMC Public Health. 2013;13:1-7.
30. Education Office. Damot Woide Woreda Education Office Mid Term Report. Damot Woide Woreda Education Office; 2010.
31. Health Office. Damot Woide Woreda Health Office Annual Report. D.W.W.H. Office, Editor. Damot Woide Woreda Health Office; 2009.
32. Cherraghi Z, Okhovat B, Doosti Irani A, et al. Knowledge, Attitude, and Practice Regarding Food, and Waterborne Outbreak After Massive Diarrhoea Outbreak in Yazd Province, Iran, Summer 2013. Vol. 2014. International Scholarly Research Notices; 2013:7.
33. Asekun-Olarinmoye E. Handwashing: knowledge, attitude, and practice amongst mothers of under-five children in Oshogbo, Osun State, Nigeria. J Biol Agric Healthc. 2014;4:40-49.
34. Central Statistical Agency. Ethiopia Demographic and Health Survey 2016. CSA and ICF; 2016.
35. Lauritsen JM. EpiData (Version 3.1). A Comprehensive Tool for Validated Entry and Documentation of Data. The EpiData Association; 2004.
36. Assefa M, Kumie A. Assessment of factors influencing hygiene behavior among school children in Merer-Leke District, Northern Ethiopia: a cross-sectional study. BMC Public Health. 2014;14:1471-2458.
37. Rutter S, Macduff C, Stones C, Gomez-Escalada M. Evaluating children’s handwashing in schools: an integrative review of indicative measures and measurement tools. Int J Environ Health Res. 2021;31:1-19.
38. Lewis HE, Greenland K, Curtis V, Schmidt WP. Effect of a school-based Hygiene Behavior Change campaign on handwashing with soap in Bihar, India: Cluster-Randomized Trial. Am J Trop Med Hyg. 2018;99:924-933.
39. Appiah-Brempong E, Harris MJ, Newton S, Galis G. Examining school-based hygiene facilities: a quantitative assessment in a Ghanaian municipality. BMC Public Health. 2018;18:581.
40. Ramos MM, Blea M, Trujillo R, Greenberg C. Inspections of handwashing supplies and hand sanitizer in public schools. J Sch Nurs. 2010;26:393-397.