Environmental and Behavioral Factors Associated With Handwashing With Soap After Defecation in a Rural Setting of 2 Districts of the Jimma Zone, Ethiopia

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ABSTRACT

BACKGROUND: Handwashing with soap can prevent the spread of fecal oral microbes in the home environment. Despite the lack of water and for a variety of reasons, soap-based handwashing is not practiced in developing countries after defecation.

OBJECTIVE: The objective of the study was to determine the environmental and behavioral factors associated with hand washing with soap after defecation of respondents with children under the age of 5 years in a rural setting.

METHODS: Data used were taken from 756 households with children under the age of 5 that participated in a cross-sectional study conducted from July 22 to August 9, 2018, in 2 selected districts in the Jimma Zone, Southwest Ethiopia. It included post-defecation hand washing with soap and other variables such as sociodemographic information, environmental and behavioral factors. Stata version 16 was used to analyze the data. We use binary logistic regression models. To declare statistical significance, a *P*-value of less than .05 with an adjusted odds ratio and a confidence interval of 95% was used.

RESULTS: The prevalence of soap-based post defecation hand washing practices among respondents was 64.4%. Hand washing practice after defecation with soap has a significant association with having more than 1 child under 5 years of age (AOR = 1.60; 95% CI: 1.05-2.45), households living with cattle (AOR = 2.00; 95% CI: 1.30-3.07), use of unimproved latrine (AOR = 0.55; 95%CI: 0.31-0.98), with the presence of feces in the compound of the households interviewed (AOR = 7.08; 95% CI: 4.07-12.35) and regular cleaning water containers before filling drinking water (AOR = 2.16; 95% CI: 1.13-4.15).

CONCLUSIONS: Most of the study participants washed their hands with soap after defecation. The presence of feces in the compound, having more than 1 child, living with cattle, and cleaning water containers routinely before filling drinking water all enhanced post-defecation handwashing with soap. However, when using unimproved latrines, respondents' post-defecation handwashing behavior with soap may be significantly reduced.

KEYWORDS: Hand washing with soap, post-defecation, environmental and behavioral factors, Ethiopia

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Introduction

Handwashing, also known as hand hygiene, is the act of washing one's hands with soap and water to eliminate viruses, bacteria, and microorganisms, as well as dirt, grease, and other harmful and unwanted substances that have become attached to the hands.[1] Hand washing with soap at a critical time is important for reducing fecal-oral transmission: after using the toilet (for urination, defecation and menstrual hygiene), after cleaning the bottom of a child (changing diapers), before feeding the child, before eating and before/after preparing food or handling raw meat, fish, or poultry.[2,3] It has been shown to be highly effective in preventing the spread of a variety of diseases.[4] Infectious syndromes such as sepsis, acute respiratory infection, neonatal tetanus, and diarrhea are estimated to death over 750 000 newborns worldwide each year,[5] many of which can be avoided by hand washing with soap. It also helps prevent the spread of infectious agents, which can aid in the prevention of skin infections and trachoma.[6]

Handwashing interventions have been shown to significantly reduce the risk of acute respiratory infection in children under the age of 5[7] and have been shown to lower the risk of death from some of the most common causes of death in children.[8] Hand washing with soap before feeding children and after cleaning them can interrupt the transmission of fecal oral microbes in the home setting. According to a review of the literature on hand hygiene, hand washing with soap reduces microorganism levels to near-zero levels.[9] Poor handwashing habits have been associated with the occurrence of childhood diarrhea.[10,11] A systematic review and meta-analysis indicated that the promotion of hand washing reduces the incidence of diarrhea by 30%.[12] Similarly, studies conducted in Bangladesh and Armenia showed that regular hand washing was negatively associated with childhood malnutrition.[13,14] In a study in Vietnam, handwashing activity was found to be significantly associated with educational level, ethnicity of the household head, and household wealth. Those who had access to a better

sanitation facility and improved water supplies were more likely to wash their hands.[15] According to a study conducted in Ghana, hand hygiene skills, and attitudes were independent predictors of hand hygiene practice at a crucial time.[16] According to the findings of studies conducted in urban Bangladesh and rural India, the availability of water and soap is closely related to a higher prevalence of handwashing behavior.[17,18] A study conducted in Ethiopia also found that hand washing practiced at crucial times was significantly associated with a positive attitude, the availability of water for hand washing and a high level of awareness.[19] Another study done in Ethiopia found that handwashing practices were significantly associated with place of residency and attitude.[20]

Despite the fact that several studies in Ethiopia and elsewhere have shown that many mothers/caregivers of children do not wash their hands properly, there are still gaps in our understanding of the factors associated with soap-based post-defecation handwashing practices in rural areas of the Jimma zone. Therefore, this study aims to determine the prevalence and factors associated with post-defecation soap hand washing practices among households in 2 districts of the Jimma zone, Ethiopia. The results of this study could help the government, nongovernmental organizations, and communities promote handwashing practices after defecation to prevent communicable diseases.

Methods and Materials

Study area, design, and period

A community-based cross-sectional study was conducted in 2 selected districts (Kersa and Omo Nadda) of Jimma Zone, Ethiopia, from July 22 to August 9, 2018. The Zonal capital, Jimma Town, is located 357 km from Addis Ababa in southwest Ethiopia. The zone extends between 7013′-8056′ North latitudes and 35049-38038′ East longitudes. The altitude of these districts ranges from 1740 to 2660 m above sea level. Agriculture is the main source of the economy and includes mainly the cultivation of coffee and the rearing of cattle.

Sources and study population

The source population for this study was all households with children under the age of 5 living in the 2 districts, and study samples were systematically selected households with children under the age of 5. Respondents were those members of households who are responsible for general household responsibilities (mother/caregiver).

Sample size determination and sampling procedure

In this study, we analyzed data from a study conducted by our research team in 2 Jimma zone districts (Kersa and Omo Nadda), Ethiopia.[21] The sample sizes of 756 households with children under the age of 5 for the interviews were estimated and systematically selected. Six rural kebeles from the Kersa and Omo Nadda districts were chosen at random using a lottery method prior to data collection. Then, using a census, all households with children under the age of 5 were identified and the sample size for each kebele was proportionally allocated. Finally, systematically selected households with under-five children were included in the study.

Study variables

The dependent variable, handwashing with soap after defecation, was derived as follows. Respondents were asked a yes or no question about whether they always wash their hands with soap and water after defecation. The study participants' responses were dichotomized as 1 if they responded "yes" to a question and 0 if they answered "no" to a question. Whereas the independent variables were sociodemographic data, they included the age and sex of the respondent, religion of the household, family size, number of under-five children in the house, educational status of the respondent, type of floor material of the living house, family members living with cattle, and household wealth index. Other independent variables were environmental and behavioral variables, such as sources of water for domestic use, water storage practices, and water treatment techniques known and/or used in households, and hygiene and sanitation practices by asking questions like: covering drinking water storage and clean water containers regularly before filling, habits of touching/dipping fingers in water during collection, place of defecation, presence of a functional latrine, type of latrine, and disposal system for children's feces. Information about childhood diarrhea was assessed asking respondents if there had been diarrhea in the past 2 weeks.

Data collection and quality management

Health professionals collected the data through face-to-face interviews with mothers/caregivers. The questionnaire used for this data collection was written in English, then translated into the local language (Afan Oromo), and finally back into English to ensure consistency by experts in public health and linguistics. Subsequently, the instrument was corrected and modified as needed. Data collectors and supervisors received extensive training to preserve data quality. The questionnaire used was adapted from the WHO/UNICEF Joint Monitoring Program for Water Supply, Sanitation, and Hygiene 2017 core questions on water, sanitation and hygiene for household surveys,[22] and other literature was used after the pre-test was performed for validation in our context. Two supervisors followed and checked the data collection processes. The necessary modifications were made on the spot, when necessary. The investigators also followed the general data collection procedures.

Statistical analysis

Data were analyzed using Stata version 16 (StataCorp, College Station, TX, USA). Descriptive statistics for categorical data

Table 1. Sociodemographic characteristics of the study participants of the respondents of 2 selected districts of Jimma Zone, Ethiopia.

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE
Sex of respondent	Female	522	69.0
	Male	234	31.0
Religion	Muslim	706	93.4
	Orthodox	43	5.7
	Protestant	7	0.9
Family Size	<5	221	29.2
	⩾5	535	70.8
Number of under-fives	1	519	68.7
	⩾2	237	31.3
Educational status of the respondent	Had no formal education	288	38.1
	Primary	370	48.9
	Secondary and above	98	13.0
Types of flooring in the living room	Mud/sang/dug	741	98.0
	Cement/wood	15	2.0
Family members live with cattle	Yes	546	72.2
	No	210	27.8
Presence of childhood diarrhea in the past 2 weeks	Yes	150	19.8
	No	606	80.2
Wealth index quintile	Poor	254	33.6
	Medium	251	33.2
	Rich	251	33.2

were computed and presented in frequencies and percentages in the tables. Binary and multivariable logistic regression models were used to identify study variables associated with the practice of post-defecation handwashing with soap. All variables with *P*-value <.25 in binary logistic regression analysis were entered into the multivariable logistic regression model.[23] Those variables with a value of $P<.05$ in the multivariable logistic regression model were considered as associated factors for the practice of post-defecation handwashing with soap. Both crude and adjusted odds ratios with a 95% confidence interval were calculated to assess the level of significance.

Results

Sociodemographic characteristics

A total of 756 respondents participated in the study, with a 100% response rate. The mean age of the respondents was 30.8 ± 7.4 years. Of the participants, 69.0% were female; 93.4% were Muslim religious followers; 68.7% had a child under the age of 5; 70.8% had 5 or more family members; 38.1% had no formal education; and 72.2% lived with cattle/animals (Table 1). Information about childhood diarrhea was assessed by asking the respondents whether there had been diarrhea in the past 2 weeks. Based on the information provided, the prevalence of childhood diarrhea in the previous 2 weeks was 19.8%. Of these, 61.4% were less than or equal to the age of 2 years and 38.6% were older than 2 years.

Environmental characteristics

Of the total study participants, 83.5% obtained water primarily from protected sources such as springs, wells, and public taps. The average daily water usage of 4.5% of the study participants was more than 25 L per day. The approximate distance from the water sources from their homes was less than or equal to 1 km for 89.3% of the households. Jerri cans are used by 98% of households to collect drinking water. Most households (93.7%) had a pit latrine with or without a superstructure. Only 27.0% of latrines had handwashing facilities nearby. Almost half of the living compounds of the study participants emitted feces (Table 2).

Table 2. Environmental characteristics of the study participants in 2 selected districts of the Jimma Zone, Ethiopia.

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE
Main source of drinking-water	Improved source	441	58.3
	Unimproved source	315	41.7
Alternative water sources	Harvesting rain water	85	11.2
	Unprotected well	328	43.4
	River	241	31.9
	Others	102	13.5
Average daily water consumption (liters)	<12	357	47.2
	12-24	365	48.3
	⩾25	34	4.5
Approximate distance of water sources from your home (km)	⩽1	675	89.3
	>1	81	10.7
Time taken to fetch water (minutes)	<30	681	90.1
	⩾30	75	9.9
Container used to collect water from sources	Jerri cans	741	98.0
	Clay pots	10	1.3
	Pails	5	0.7
Availability of latrine	Yes	708	93.7
	No	48	6.3
Type of latrine	Pit latrine with super structure	490	69.2
	Pit latrine without super structure	218	30.8
Observation of feces in the compound	Yes	335	44.31
	No	421	55.69
Availability hand washing facilities near the toilet	Yes	191	27.0
	No	517	73.0

Behavioral characteristics

The drinking water storage containers of most households were placed on the floor and properly covered. Most of the respondents (93.3%) said they clean water containers before filling them with drinking water on a regular basis. In our study, 90.7% of the respondents drew water from drinking water containers by pouring, while only 15% treated their drinking water to make it safe to drink. Similarly, 76.6% of the respondents said they used the latrine during the survey and 77.8% said they clean the latrine facility on a regular basis. More than half of the respondents who did not have access to a latrine defecated in open fields. In this study, 64.4% of the respondents wash their hands with soap after defecating (Table 3).

Factors associated with post-defecation handwashing with soap

The results of the multivariable binary logistic regression model showed that having more than 1child under 5 years of age, living with cattle, the use of unimproved latrines, the presence of feces in the compound of the households interviewed and the regular cleaning of the water containers before filling them with drinking water were significantly associated with post-defecation handwashing with soap.

The practice of soap-based post-defecation hand washing was 1.60 times as likely to be higher among households with 2 or more under 5-year-old children compared to households with 1 under 5-year-old child (AOR = 1.60; 95% CI: 1.05-2.45).

Table 3. Behavioral characteristics of the study participants from 2 selected districts of Jimma Zone, Ethiopia.

VARIABLES	CATEGORIES	FREQUENCY	PERCENT
Drinking water containers covered properly	No	63	12.3
	Yes	663	87.7
Drinking water storage containers placed	On the floor	712	94.2
	Elevated above the floor	44	5.8
Cleaning water containers regularly before filling drinking water	Yes	698	92.3
	No	58	7.7
Water taken from the drinking water containers	Pouring	686	90.7
	Dipping glass with fingers	52	6.9
	Container has spigot or tap	18	2.4
Water treatment	Yes	114	15.1
	No	642	84.9
Latrine utilization	Mostly	166	23.4
	Always	542	76.6
Clean latrine facility regularly	Yes	551	77.8
	No	157	22.2
Place of defecation in the absence of latrine	Open field	28	57.1
	Communal latrine	18	36.7
	others	3	6.1
Hand washing before feeding a child	Yes	642	84.9
	No	114	15.1
Hand washing after cleaning a baby's bottom	Yes	631	83.5
	No	125	16.5
Practice of always post-defecation handwashing using soap and water	No	269	35.6
	Yes	487	64.4

Respondents who had no formal education were less likely to practice post-defecation handwashing compared to those who attended secondary school or higher (AOR = 0.71; 95% CI: 0.39-1.30). However, the reduction in post-defecation handwashing with soap by a respondent lacking formal education was not statistically significant. In the same way, the likelihood of washing hands with soap after defecation was lower among respondents who depended on improved water sources as their main source of drinking water (AOR = 0.84; 95% CI: 0.54-1.30) compared to their counterparts.

However, respondents living with children exposed to diarrhea in the past 2 weeks were 1.56 times as likely to practice post-defecation handwashing with soap compared to their counterparts (AOR = 1.56; 95% CI: 0.96-2.53). Although there was no statistical significance in the multivariable analysis, the odds of post-defecation handwashing with soap were increased when the average daily water consumption was decreased. The absence of drinking water treatment at the point of use by households increased post-defecation handwashing with soap, but it was not significant in the final model (AOR = 1.01; 95% CI: 0.58-1.78) (Table 4).

Discussion

The purpose of this study was to determine the environmental and behavioral determinants of handwashing with soap after defecation of respondents with children under the age of 5 in a rural setting in 2 districts of the Jimma Zone, Ethiopia. Hand washing with soap after defecation decreases microorganism concentrations to near zero, potentially interrupting the transmission of communicable disease microbes in the living environment. This study found that 64.4% of study participants wash their hands with soap after defecation. The finding of the

Table 4. Bivariate and multivariate analysis of factors associated with the practice of post-defecation handwashing with soap of the respondent in 2 selected districts of the Jimma Zone, Ethiopia.

VARIABLES	CATEGORIES	POST-DEFECATION HANDWASHING WITH SOAP (%)	TOTAL PARTICIPANT	COR (95%CI)	AOR (95%CI)
Sex of respondent	Female	66.5	522	1.33 (0.97-1.83)	1.35 (0.91-1.99)
	Male	59.8	234	1	1
Number of under-fives	1	58.8	519	1	1
	⩾2	76.8	237	2.32 (1.64-3.29)*	1.60 (1.05-2.45)*
Educational status of the respondent	Lack/Had no formal education	57.3	288	0.71 (0.44-1.15)	0.71 (0.39-1.30)
	Primary school	69.7	370	1.22 (0.76-1.96)	1.39 (0.79-2.50)
	Secondary and above	65.3	98	1	1
Family members live with cattle	Yes	72.7	546	3.55 (2.55-4.95)*	2.00 (1.30-3.07)*
	No	90	210	1	1
Presence of childhood diarrhea in the past 2 weeks	Yes	71.3	150	1.48 (1.01-2.19)*	1.56 (0.96-2.53)
	No	62.7	606	1	1
Wealth index quintile	Poor	74	316	2.30 (1.58-3.34)*	1.30 (0.81-2.10)
	Medium	63.7	268	1.42 (0.99-2.03)	0.94 (0.60-1.46)
	Rich	55.4	172	1	1
Main source of drinking-water	Improved source	66.2	441	1.21 (0.89-1.63)	0.84 (0.54-1.30)
	Unimproved source	61.9	315	1	1
Average daily water consumption (liters)	<12	68.9	357	6.16 (2.78-13.62)*	1.86 (0.76-4.52)
	24-25	63.6	365	4.85 (2.20-10.69)*	2.13 (0.89-5.07)
	⩾25	26.5	34	1	1
Distance of water sources from your home (km)	⩽1	63	675	1	1
	>1	76.5	81	1.92 (1.12-3.28)*	1.04 (0.54-2.00)
Type of latrine used	Improved	88.6	298	1	1
	Unimproved	48.7	458	0.12 (0.08-0.18)*	0.55 (0.31-0.98)*
Observation of feces in the compound	Yes	91.3	335	13.99 (9.13-21.44)*	7.08 (4.07-12.35)*
	No	43	421	1	1
Drinking water containers covered properly	No	51.6	93	1	1
	Yes	66.2	663	1.84 (1.19-2.85)*	0.98 (0.59-1.65)
Cleaning water containers regularly before filling drinking water	Yes	66.6	698	3.27 (1.89-5.68)*	2.16 (1.13-4.15)*
	No	37.9	58	1	1
Water treatment	Yes	74.6	114	1	1
	No	62.6	642	0.57 (0.36-0.90)*	1.01 (0.58-1.78)

*Significant at $P \leqslant .05$.

current study was lower than that of studies conducted in India (73.18%) and Nigeria (79.6%).[24,25] This could be due to the fact that the current study was conducted in an area where Community-Led Total Sanitation (CLTS) had not been fully implemented, or it could be due to the countries' differing commitments to sanitation and hygiene programs.

Having more than 1 child under the age of 5 increases the likelihood of handwashing with soap after feces, according to this study. When moms have more children, they may contact them on a more regular basis for meals, probable fecal contact, and other sanitary reasons. It may be possible to boost the likelihood of handwashing with soap during critical periods.[26,27] A study conducted in urban Bangladesh showed that wealthy households were more likely than poorer households to have soap and water in the house and that having soap and water improves the rate of handwashing.[17] However, in this study, poor respondents were more likely to wash their hands after defecation with soap than wealthier households. One explanation for this may be that, despite their wealth, the families were unable to comprehend the benefits of post defecation handwashing activities, or that the assets and household characteristics used to derive the wealth categories did not accurately reflect the families.

Hand washing with soap after defecation was adversely related to lower educational attainment, according to the findings of the current study, which were comparable to those of previous studies conducted in Kenya and Vietnam.[15,28] In this study, those who did not have a formal education were less likely to perform post defecation hand washing than those who attended secondary school or higher. Similarly, a study conducted in northwest Ethiopia revealed that education had a substantial effect on handwashing activities, implying that hygiene education at the local health extension is also essential to reduce transmissible disease rates.[29] This is a reasonable conclusion because education is the basis for weighing the benefits and drawbacks of hand washing with soap at crucial times and developing behavior against the practice.

According to this study, the odds of post-defecation handwashing with soap were lower in households with unimproved latrines compared to those with improved latrines. The study's results matched those of studies conducted in Eswatini, Vietnam, and Kenya.[15,28,30] In this study, there was a connection between observing feces in the compound and post-defecation handwashing practice. The more feces there were in the compound, the more likely it was that the individuals would wash their hands, increasing the chances. This may be attributed to the fact that due to the presence of feces, families are required to sweep the compound and wash their hands afterwards.

There are some limitations to this study. Due to the individual decisions of the mother about hand washing practices and the inadequate documentation of behavioral factors such as the defecation site and the disposal practices of child urine, recall bias and community desirability bias might have existed. Another limitation of this study is that it was conducted using secondary data, so not all factors that affect post-defecation handwashing practices were considered.

Conclusion

According to the study, the majority of respondents washed their hands after defecation with soap. Only a few of the surveyed households used more than 25 L of drinking water per day on average. Furthermore, at the point of use, the practices of household water treatment were significantly lower. On the other hand, almost all respondents had access to a latrine, but more than half of these latrines were in poor condition. More than a third of the households in the survey used a pit latrine without any supper structure. Most of these latrines also lack hand washing facilities. The post-defecation hand washing practice is linked to having more than 1 child under the age of 5, living with livestock, using unimproved latrines, the presence of feces in the compound of the households interviewed, and regularly cleaning the water containers before filling them with drinking water. As a result, effective administrative measures are recommended, as well as increasing household awareness of the value of hand washing with soap after defecation, the use of improved latrines, and proper hand washing after feces management.

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Author's Contributions

NES participated in the design of the study, performed the statistical analysis and interpretation of the data, and drafted and revised the manuscript. The author read and approved the final manuscript.

Availability of Data and Materials

The data set analyzed during the study is available from the corresponding author on reasonable request.

Ethical Consideration

The Ethiopian Institute of Water Resources Review Committee of Addis Ababa University granted ethical clearance. The Jimma Zone Health Department, Kersa, and the Omo Nadda District Health Office also provided letters of support. Due to the high rate of illiteracy on the consent forms, mothers/caregivers gave their informed verbal consent after being informed about the study's objectives.

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