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Assessment of Household Liquid Waste Disposal Practice and its Associated Factors in Jimma Town, Southwest Ethiopia: A Cross-Sectional Study

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Abstract

Introduction: Waste management is one of the major public health problems globally. Unsafe household liquid waste disposal practices may cause infectious diseases like cholera, diarrhea, and typhoid fever. The purpose of this study was to assess household liquid disposal practices and associated impacts in Jimma town, Southwest Ethiopia.

Methods: A community-based cross-sectional study was conducted from June 1 to July 30, 2020. The study subjects were 403 households selected using a multistage sampling method. Data are entered into EPI info-data version 3.1 and exported to SPSS version 20. Chi-square and logistic regression tests were employed. A P-value < 0.05 was considered to indicate a statistically significant association. A 95% confidence level was calculated for statistical significance tests.

Results: Nearly half of the respondents, 189 (49.1%), had safe liquid waste disposal practices, while the rest (196, 50.9%) had unsafe liquid waste disposal practices. Primary education level (AOR = 0.266 (95% CI, 0.119 to 0.584), secondary education level (AOR = 0.429 (95% CI, 0.238 to 0.774), home ownership (AOR = 2.432 (95% CI, 1.314 to 4.499), and good knowledge (AOR = 0.431 (95% CI, 0.275 to 0.675) were found to be factors that affect liquid waste disposal practices.

Conclusions: About half of the surveyed households had unsafe liquid waste disposal practices. Education level, knowledge level, and house ownership were found to be associated factors with unsound household liquid waste disposal practices.

Keywords: household liquid waste; disposal practice; associated factors; southwest Ethiopia

Introduction

Liquid waste is referred to as sewage and comprises water that has been used for washing, flushing toilets, or in manufacturing processes (Afriyie, 2010). It includes all contaminated water from human activity and animals that contains microorganisms, oils and grease, biological oxygen demand, and hazardous chemicals (Gisborne, 2010). It is composed of 99% water and 1% suspended, colloidal, and dissolved solids (UN, 2017).

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials (Demirbas, 2011). As a result, one of the aspects of waste management that pose a challenge globally is liquid waste disposal (Akpor, O. B. and Muchie, 2011). Because liquid waste volumes have been increasing with rapidly growing populations, urbanization, improved living conditions, rural-urban migration, and economic development (Sato et al., 2013). This statement is also supported by recent studies, as stated "liquid waste generation have been increasing over the past few years" (Natalia, 2016).

Ethiopia clearly states that the cities and towns ensure a sustainable, resilient, safer, and healthier urban environment through an improved liquid waste management chain devoid of human contact by 2026 and beyond (MoWIE, 2017). Availing a proper liquid waste collection and disposal system and proper or improved latrine construction in all households were prioritized issue set by the Ministry of Health of Ethiopia (MOH-Ethiopia, 2019).

A report on liquid waste by the International Water Association (2017) revealed that approximately 80% of all liquid waste is discharged into water bodies, posing public health risks (IWA, 2018). In most cities, particularly Ethiopian cities, the management of household liquid waste is commonly handled using site-discharge systems. In Debre Markos, Ethiopia, about 50% of the households had unsafe liquid waste

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disposal practices into streets, drainage lines, and nearby open space (Manderso, 2018).

Liquid waste disposal was found to be significantly associated with private house ownership and family size in studies(Mohammed, 2011) (Tafere et al., 2014). In addition, the educational status of the respondents (Tafere et al., 2014) and awareness level also significantly affect household liquid disposal practices (Yoada et al., 2014).

Unsafe household liquid waste disposal practices have both short- and long-term public health consequences (Edokpayi et al., 2017), as they are a source of waste-water borne disease such as gastroenteritis (caused by contaminated water bodies) and mosquito breeding due to pooling, stagnant liquid waste, which results in vector-borne disease (MoWIE, 2017).

According to Adogu et al. (2015), unsafe liquid waste disposal promotes pathogen multiplication, resulting in diseases such as cholera and diarrhea, as well as providing breeding sites for vector-borne diseases such as malaria and dengue fever spread by mosquitoes, flies (diarrhea), and rodents as cited by (Shahzadi et al., 2018). A study conducted in Guinea by Mamady (2016) indicated that improper management of liquid waste causes different diseases such as cholera, typhoid, malaria, dysentery, diarrhea, respiratory infection, and injury (Mamady, 2016).

In Jimma Town (Southwest Ethiopia), the liquid waste disposal system is very poor, resulting in the direct disposal of liquid wastes in streams and open fields. For example, the Aweytu and Kitto rivers and their tributaries drain the town naturally. Many of the households and other establishments found along these streams discharge the liquid waste they generate into the two streams and other channels that ultimately drain into these natural water bodies (ESIA, 2011). Moreover, in Jimma Town, uncontrolled waste was discharged. These would affect the social, environmental, and economic status of the city. Lack of a proper functioning drainage canal, uncontrolled waste disposal, a lack of periodic inspection and maintenance, poor connection of drainage networks, and roads and carelessness led to the failure of the existing drainage system (Dibaba, 2018).

Despite the fact that various strategies and solutions have been implemented in the town by concerned bodies, liquid waste disposal practices in Jimma Town have not been thoroughly investigated. Therefore, there is a need to assess and determine household liquid waste disposal practices and associated factors in Jimma Town, Ethiopia. The information found in this study will help the stakeholders find solutions to the existing and potential problems in the town, and it will serve as a source of data for future research.

Materials And Methods

Study design, period and area

A community-based cross-sectional study was conducted from June 1 to July 30, 2020. It was conducted in Jimma Town, which is situated 352 kilometers away from the capital city, Addis Ababa. The town's geographical coordinates are approximately 7° 41' N latitude and 36° 50' E longitude. Based on the projection from a 2007 census in Ethiopia, the Central Statistical Agency's (CSA) population and housing census report for 2016 is 174,681, of which female and male accounts are 93184 (53.3%) and 81497 (46.7%), respectively (CSA, 2018). It has a city administration and seventeen independent kebeles. Thus, the total number of household units was 31, 060 in the study town (Megersa, 2018). However, according to current information taken from the town health office, Jimma town reached 210,908 people and the total number of households was 43939 in 2020 (source: Jimma town health office, 2020).

Population

The source populations of the study were all households in Jimma Town. The study populations consisted of selected household owners who were over the age of 18 and under the age of 65 and had lived in Jimma Town for at least six months.

Eligibility criteria

The study included households that lived in a registered housing unit in Jimma Town with the owner of the household, lived there for at least six months, were between the ages of 18 and 65, were open during data collection, and volunteered to participate.

Populations excluded from this study were those in involuntary households that were not present during the data collection period, were younger than 18 or older than 65, and did not have adequate information about the study subject or any newcomer to that household. Moreover, an institution, such as an office or hotel, other than a household, and a household that was not registered in the kebeles of the town were excluded.

Sample size determination

Because there is no literature in the study area that describes household liquid waste disposal practices and their effect on public health, the sample size was determined using the single population proportion formula with p = 50% and a 95% confidence interval (CI) of 95%. Therefore, n = 384 is the maximum sample size of housing units for reliable results.

In order to obtain sufficient sample units in the event of an unknown problem during data collection, such as closed houses, involuntary households, or no eligible person in the household, the non-response rate was increased to 5% of the 384 respondents (households). Finally, the total sample household units were 403 households. Therefore, the results of 403 households were analyzed, which was adequate according to the sample size calculated above.

Sampling procedure and technique

A multistage sampling method, including stratified sampling and systematic random sampling, was used to identify or select the study sites and households (Table 1).

Table 1: Number of sampled households from selected kebeles in Jimma town, Ethiopia, 2020

Town	Selected kebeles	Total number of households (N)	Sample size (n)	
			No.	%
Jimma Town	Jiren	1572	33	8
	Ginjo Guduru	2391	49	12
	Mentina	2506	52	13
	Bosa Kito	3239	67	17
	Mendera Koci	3503	72	18
	Bacho Bore	6279	130	32
	Total	19490	403	100

Data collection tools and procedure

For gathering the data, the investigator used questionnaires. The data was collected by four data collectors with bachelor's degrees and experience in data collection.

Data processing and analysis

Data tools were checked for completeness, coded, and cleansed. Then it entered the Epi Info-Data 3.1 version. Afterward, it was exported to the statistical package for social science software (SPSS) version 20 to analyze the results. The investigator used the chi-square test for discrete data in order to test the relationship between variables and regression analysis. A P-value < 0.05 was considered to indicate a statistically significant association. Frequency distributions and percentages with a 95% confidence level were calculated for statistical significance tests.

Study Variables

Study outcome (dependent variable): household liquid waste disposal practice (safe disposal or unsafe disposal).

Independent variables: socio-demographic and economic variables; knowledge and attitude about liquid waste disposal practices.

Operational definition

Safe liquid waste disposal practice: Disposal of liquid waste into either one of seepage pit, closed drainage sewer system, poured or carried to toilet facility or cesspit/septic tank.

Unsafe liquid waste disposal practice: Dispose of liquid waste into either the garden, street, premises yard, or open ditches.

Good knowledge: Respondents who scored ≥75% of the correct answers (Tafere et al., 2014).

Poor knowledge: Respondents who scored <75% of correct answers (Tafere et al., 2014).

Data quality control

To maintain the quality of data collection, two days of training were given for data collectors and supervisors before data collection began. Five percent of the questionnaires were pretested in another kebele of the study area to assess the suitability of the data collection instrument with regard to duration, language appropriateness, content validity, and question clarity. Data collectors were daily supervised, and daily activities were checked every day, after data collection, for completeness, clarity, and consistency by the supervisors and the principal investigator.

Ethical consideration

Ethical clearance was obtained from the Jimma University Institutional Review Board (IRB). In addition, a formal letter of permission was obtained from Jimma University, the Institute of Health Sciences, the Faculty of Public Health, and the Department of Environmental Health Sciences and

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Technology. Selected kebele administrations provided a letter of cooperation and verbal consent. The purpose of the study was explained to all respondents, and informed verbal consent was obtained prior to the data collection. In addition, all information collected that could identify a participant was protected. The data collectors wore facemasks and kept a distance of 2-3 meters during the interview for the prevention of the current pandemic disease, COVID-19.

Results And Discussion

Socio- demographic and economic characteristics of participants

Out of the four hundred three (N = 403) study participants, three hundred eighty-five (385) took part in the study, yielding a 95.5% response rate. The rest 18 (4.5%) were excluded from analysis for various reasons, such as that housing units were not found, households no longer lived at the original location, and no one was available in the house during data collection.

Among the study participants, the majority, 234 (60.8%), were females, and the rest, 151 (39.2%), were males. Age of the respondent in years: the majority were 28–37 years old (149; 38.7%), followed by 18–27 years old (109; 28.3%); the mean age was 34.2 with SD 10.6. Regarding the religion of the respondents, the majority, (173; 44.9%) were Muslims, followed by 149 (38.7%) Orthodox. Regarding the marital status of the respondents, more than three-quarters (290, or 75.1%) of the subjects were married, and about one-fifth (81 or 21.0%) had never been married. In terms of the respondents' relationship to the household's family, more than three-quarters (300) (77.9%) were household heads, and about one-fifth (19.5%) were the household head's daughter or son. Regarding the type of house ownership, more than three-quarters of the 318 (82.6%) were private, and about 67 were rented from kebele/government and private sources. Regarding the educational status of the household head, over one-third, 148 (37.2%), were educated above secondary education, followed by 97 (25.2%) who were educated up to the level of secondary education. Regarding the occupational status of the household heads, over one-third, 174 (43.1%), were employees of the government and private sectors, and about one-third, 122 (33.9%), were merchants. Regarding the monthly income of the households, more than one-half (245, 63.6%) had above 2000 birr, about one-fifth (22.3%) had between 1000 and 2000 birr, and the lowest monthly 54, (14.0%) had less than 1000 birr, and the mean family income was 4183.0 with a SD of 3410.4 (Table 2).

Table 2: Socio- demographic and economic characteristics of the respondents, Jimma town, Ethiopia, 2020 (n=385)

Variables		Frequency (n=385)	Percentage
Sex	Male	151	39.2
	Female	234	60.8
Age	18-27 years	109	28.3
	28-37 years	149	38.7
	38-47 years	85	22.1
	48-57 years	26	6.8
	≥ 58 years	16	4.2
Marital status	Never married	81	21
Married		290	75.3
Divorced/widowed		14	3.6
Relation to the family			
Household head		300	77.9
Household head daughter or son		75	19.5
Dependent		10	2.6
Educational status	No education	45	11.7
Primary education		95	24.7
Secondary education		97	25.2
Above secondary education		148	38.2
Monthly income of family	≤ 1000 birr	54	14
	1000-2000 birr	86	22.3
	≥ 2000 birr	245	63.6

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Occupation	Merchants	122	33
Employed (private and government)		174	43.1
Housewife		52	13.5
Retiree		13	3.4
Student		5	1.3
Farmer		17	4.4
Other		10	2.6
Type of house ownership	Private	318	82.6
	Rented	67	17.4
Family size	1-3	50	51.4
	04-Jun	226	48.6
	Above 7	109	28.3
Number of rooms in households	< 5	257	66.8
	≥ 5	128	33.2

Knowledge of the respondents about household liquid waste disposal practices

Almost 99.2% of respondents said yes to the question, "Do you know what waste means?" 56.6% of respondents said waste is disposable materials produced, whether by humans or other animals, and 40.3% of respondents replied with unwanted or unusable materials, while 3.1% of respondents replied with the correct answer, i.e., wanted or usable materials. Approximately 97.1 percent of respondents are aware that improper liquid waste disposal causes diseases and illnesses (Table 3).

Table 3: Respondents response towards knowledge question related to household liquid waste disposal practice (n=385)

Knowledge		Frequency	Percent
Do you know what waste mean	Yes	382	99.2
	No	3	0.8
Answer for waste definition			
Disposable materials produced by human or other		218	56.6
Unwanted/unusable materials		155	40.3
Wanted/usable materials		12	3.1
Unsafe disposal of LW	causes disease/illness	374	97.1
	Don't cause for disease	11	2.9

Household liquid waste disposal practice

The result of this study showed that half (50.9%) of the respondents had unsafe liquid waste disposal practice. On the other hand, 49.1% of the respondents had safe liquid waste disposal practices (Table 4).

Table 4: Disposal methods of household liquid waste in Jimma, Ethiopia (n=385)

Methods of household liquid waste disposal	Frequency	Percentage
Safe disposal		
Seepage pit	97	25.2
Cesspit/septic tank	63	16.4
Drain closed sewer system	21	5.5
Poured/carried to toilet	8	2.1
Total	189	49.1
Unsafe disposal		
Open ditch	148	38.4
Discharge to premises yard	14	3.6
drain to directly to garden	22	5.7
Discharge to street surface	12	3.1
Total	196	50.9

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The finding was in line with a study conducted in Pakistan, in which 52 percent of the respondents had unsafe household waste disposal practices (Shahzadi et al., 2018). The similarity of the finding might be due to their similar socioeconomic settings and the study design used.

However, the findings of our study was lower than a study conducted in Ghana , 78.7% of the households disposed their liquid waste anywhere (Afriyie, 2010) and in Bahir Dar City (Ethiopia), 64.3% households had unsound liquid waste disposal practices (Fenta, 2017). In contrast, a study conducted in Debre Tabor, only 34.8 % of the household have unsafe liquid waste disposal (Tafere et al., 2014). A similar study done in Dukem town, Ethiopia, showed that 75.1 % of the respondents have unsafe liquid waste disposal practice which is larger percentage than our study findings (Mohammed, 2011). The findings revealed the existence of the problem which is in line with a study conducted in Nigeria indicated that the problem with the drainage system, either constructed without a gradient or not well maintained as they are clogged or blocked with sand or other materials thus preventing sewage drainage (Adogu et al., 2015).

Factors associated with household liquid waste disposal practices

Chi- square test was done to assess the association of the various factors related with liquid waste disposal practices (safe versus unsafe liquid waste disposal practices). Education, occupation, type of house ownership, and knowledge were statistically significant factors (x^2 = 16.2; p <0.05, x^2 = 14.8; p < 0.05, x^2 =10.2; p < 0.05 and x^2=14.5, p< 0.05 respectively) associated liquid waste disposal practices (Table 5).

Table 5: Factors associated with liquid waste disposal practices, Jimma town, 2020 (n=385)

Characteristics Types				X2 (p-value)
	Unsafe disposal n (%)	Safe disposal n (%)	Total n (%)	
Educational status				
No education	33(8.6)	15(3.9)	48(12.5)	
Primary education	57(14.8)	38(9.9)	95(24.7)	16.2
Secondary education	48(12.5)	49(12.7)	97(25.2)	(p=0.001)
Above secondary education	58(15.1)	87(22.6)	145(37.7)	
Total	196(50.9)	189(49.1)	385(100.0)	
Occupation				
Merchants	70(18.2)	52(13.5)	122(31.7)	
Employed	73(19.0)	93(24.2)	166(43.1)	
Housewife	27(7.0)	25(6.5)	52(13.5)	
Retiree	8(2.1)	5(1.3)	13(3.4)	14.8
Student	0(0.0)	5(1.3)	5(1.3)	(p=0.022)
Farmer	10(2.6)	7(1.8)	17(4.4)	
Others	8(2.1)	2(0.5)	10(2.6)	
Total	196(50.9)	189(49.1)	385(100.0)	
House ownership				
Private	150(39.0)	168(52.8)	318(82.6)	10.2
Rented	46(11.9)	21(5.5)	67(17.4)	(p=0.002)
Total	196(50.9)	189(49.1)	385(100.0)	
Knowledge Poor knowledge				
Good knowledge	130(33.8)	89(23.1)	219(56.9)	14.5
Total	66(17.1)	100(26.0)	166(43.1	(p=0.000)
	196(50.9)	189(49.1)	385(100.0)	

X^2= chi square value; P-value at 5%; N=385

Logistic regression was done to assess the effect of a number of factors on the likelihood of liquid waste disposal practices. This study findings showed that odds of being educated of primary and secondary education level have safe liquid disposal practice at the household's level was 0.266 (95% CI, 0.119 to 0.584) and 0.429((95% CI, 0.238 to 0.774) times that of not educated. While those who had their own houses, had odds of 2.432 (95% CI, 1.314 to 4.499) times that of those rented the houses from

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government/kebele or private. Respondents who have good knowledge level also had odds 0.431(95% CI, 0.275 to 0.675) to those who had poor knowledge (Table 6).

Table 6: Binary logistic regressions predicting likelihood of reporting for liquid waste disposal practices, Jimma Town, Southwest Ethiopia, 2020.

Variables	B	S.E.	Wald	DF.	Sig.	Exp(B)	CI (95%)
Education level							
Education category			13.851	3	0.003		
No education	(Ref)						
10-education	-1.324	0.41	10.45	1	0.001	0.266	0.119,0.594
20 educations	-0.845	0.301	7.911	1	0.005	0.429	0.238,0.774
Above 20 –education	-0.429	0.283	2.299	1	0.129	0.651	0.374,1.134,
Relation							
Relation types			3.786	2	0.151		
Dependent	(Ref)						
Household head	-1.826	0.942	3.758	1	0.053	0.161	0.25,1.020
Daughter or son	-1.264	0.851	2.204	1	0.138	0.283	0.053,1.499
Knowledge							
Poor knowledge	(Ref)						
Good knowledge	-0.842	0.229	13.516	1	0	0.431	0.275,0.675
House ownership							
Rented	(Ref)						
Private	0.889	0.314	8.012	1	0.005	2.432	1.314,4.499
Marriage							
Marriage category			0.971	2	0.615		
Never married	-0.054	0.839	0.004	1	0.949	0.948	0.183,4.903
Married	0.38	0.648	0.343	1	0.558	1.462	0.410,5.209
Divorced/widowed	(Ref)						
Income							
Income category			3.35	2	0.187		
< 1000	(Ref)						
1000-2000	-0.619	0.353	3.073	1	0.8	0.539	0.270,1.076
>2000	0.022	0.022	0.006	1	0.937	1.022	0.594,1.758
Room number							
< 5	(Ref)						
≥ 5	0.131	0.252	0.269	1	0.604	1.14	0.695,1.868
Age							
Age category							
18-27	0.557	0.702	5.438	4	0.245	1.745	0.441,6.912
28-37	0.318	0.647	0.629	1	0.428	1.374	0.387,4.882
38-47	0.869	0.658	0.241	1	0.623	2.384	0.656,8.662
48-57	1.025	0.74	1.742	1	0.187	2.787	0.653,11.899
≥ 58	(Ref)		1.917	1	0.166		
Constant	1.027	1.383	0.552	1	0.457	2.794	

In this study, level of education was significantly affecting household liquid waste disposal practices with AOR (95% CI) = 0.266 (0.119-0.594) for primary education level; and AOR (95%CI) =0.429(0.238 - 0.744) for secondary education compared to not educated. The study finding is consistent with the study findings done in Debre tabor (Tafere et al., 2014). This is due that education has an influence on the liquid waste disposal practices (Manzo et al., 2015). This study also found that those respondents who had their own houses, had odds of 2.432 (95% CI, 1.314 to 4.499) times that of those rented the houses from government/kebele or private. This result was similar with the study conducted in Debretabor (Tafere et al., 2014).

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Furthermore, among respondents who have good knowledge about household liquid waste disposal practice also had odds 0.431(95% CI, 0.275 to 0.675) compared to those who had poor knowledge. Because knowledge about household liquid waste disposal practice is important in improving the management of waste (Demirbas, 2011). Overall, the study was limited to the problems related to liquid waste disposal practices and its associated factors; it did not include institutions like hospitals, health centers, hotels, prisons, and other liquid waste productive facilities. Some respondents were unwilling to provide the correct response, particularly to socio-demographic and economic questions, which influenced the study's findings. The sources of liquid waste generated by households were not quantified separately.

Conclusion

Half of the respondents dispose of liquid waste generated from household activities improperly in an open ditch, street, garden, or premises yard, which is unsound. Educational status, type of house ownership, and knowledge level were statistically significant associated factors with household liquid waste disposal practices. In general, it would be useful if the concerned bodies worked towards improving liquid waste disposal practices. More so, future research that spans multiple disciplines and involves multiple institutions is required.

Declarations

Disclosure of conflict of interest

The authors declare that they have no competing interests.

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