

Municipal Solid Waste Management Practice in Yirgalem Town, Sidam Region, Ethiopia

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Abstract

Background: Municipal solid waste is not properly treated and handled in less developed countries such as Ethiopia. Consequently, it pollutes the air, groundwater, and soil, which results in a negative impact on the hygienic conditions of the people, and the environment. This study aimed to assess existing municipal solid waste management practices in Yirgalem Town.

Result: The survey result revealed that 73.2 % of the participants considered their surroundings clean and 83% of the respondents knew more about solid waste management. This result showed that only 38% of the households have access to door -to- door solid waste collection services in the Town. Yirgalem Town does not have a well managed municipal solid waste disposal site, thus every waste generated from the town is discarded into an open dumping area. More than 50.9% of the respondents feel unsatisfied with the current solid waste management services. Most solid waste management practices (knowledge, recycling and reusing, participation, and sorting and disposal practices) are significantly associated with gender, age and monthly income level of socio-demographic characteristics ($p < 0.05$). However, other socio-demographic characteristics such as marital status, educational background, and job status and house ownership were not significantly associated with solid waste management practices. ($p > 0.05$).

Conclusion: In general, poor institutional structure, lack of skilled manpower, finance and equipment and tools are the major challenges faced by the municipality of Yirgalem Town. Thus, an integrated and inclusive solid waste management system is required to strengthen future waste management strategies and policies.

Background

Municipal solid waste includes town or urban wastes disposed of in residential, yard, commercial, street sweeping, markets, and institutional establishment (Okey et al., 2013). The municipal solid waste is not appropriately treated and handled in less developed countries such as Ethiopia. Consequently, it pollutes the air, groundwater, and soil, which results in a negative impact on the hygienic conditions of the people and the environment (Eboh et al., 2016). In developing countries managing municipal solid waste (MSW) plays a significant role in environmental, economic, and social concerns (Kreith and Tchobanoglous, 2002). Limited institutional capacity in municipal waste management, absence of short, medium, or long term planning, inadequate operation and maintenance structure of machinery and equipment, low utilization rate, and use of technology that is technically, economically, or socially inadequate are affecting the existing solid waste management practice in developing countries (Daniel et al., 2015; Shahzad et al., 2017). In Ethiopia the urban center has been facing many challenges related to municipal solid waste management practices (Abrhame, 2018; Birara and Kassahun, 2018; Lema et al., 2019). Little research has indicated that solely 43% of solid waste is collected properly in the country and discarded in open landfills (Turpeinen and Gebre, 2011). The remaining waste is indiscriminately disposed of in drainage lines, open spaces; street sides or is informally burned (Turpeinen and Gebre, 2011). In Ethiopia, an effort to use solid wastes to recycle, reuse or recover is very limited, but waste disposal has been the

major way of waste management practice (Nadeem and Farhan, 2016). Due to lack of awareness of the people, poor waste policy implementation, low-budget allocation and lack of sanitary landfill system, uncollected solid wastes, dumping of waste in open areas are influencing the environments and the health of urban residencies in Ethiopia (Lema et al., 2019). Expansions of industries, Population, and economic growth of the urban center combined with rapid growth rate have led to a rapid increase in the quantity and complexity of solid wastes in Ethiopia, particularly the study area. Solid waste management is the current challenge to municipal managers in terms of organizing, managing, and preventing Yirgalem Town from environmental pollution and social (health) problems.

Therefore, this study is motivated to fill gaps with evidence by producing empirically established data on municipal solid waste, which helps to strengthen existing and future waste management strategies and policies in Yirgalem Town.

Methodology

Study Site Description

The study was conducted in Yirgalem Town, Sidama National Regional State, Ethiopia. It is located at 6°43′ - 6°46′ N latitude and 38°22′ - 38 ° 47′ E longitudes (Fig. 1). It has an elevation of 1600–1960 meters. It is the largest settlement in Dale woreda (Yusuf et al., 2018). It is located 47 km from Hawassa, which is the capital city of the SNNPR and Sidama National Regional state and 311 km south of Addis Ababa, capital of the country. A total population of 64507 of whom 31,737 are male and 32,770 are female (CSA, 2013). Yirgalem Town has a moderate type of climate. The minimum and maximum annual temperature of Yirgalem Town is 14 °C and 30°C respectively. The rainfall is bimodal with peaks in June and August and in April. The Town has 1138–1690 mm annual rainfall (Yusuf et al., 2018).

Sampling Design And Techniques

Yirgalem has two sub-cities, namely Filwuha and Arada. There are six kebeles within all sub-cities and data was gathered from all kebeles. The household samples were distributed by considering the total population size proportionally in the respective kebeles. A systematic random sampling technique was applied for this study recommended as a practical measure for solid waste data collection (NZME, 2002), where every “ith” household was selected, and the number was taken to provide the required total number of samples.

Sample Size Determination

Financial, time and resource constraints were considered for determining sample sizes of households in all cases. The total number of household samples were determined using the formula developed by (Yamane, 1967):

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size, and e is the level of precision.

$$n = \frac{64507}{1 + 64507(0.05)^2} = 396$$

At 95% confidence level and 5% precision level, the required sample is **396** HHs which was proportionally divided among six kebele.

Data Source and Methods of Collection

Social survey data was gathered using both primary and secondary data sources. Questionnaire survey, key informant interviews, focus group discussion and field observations were considered as primary data sources. Whereas published and unpublished materials from the administrative office, municipality, finance and economic development office, health office of Yirgalem Town, books, articles, and internet websites are the main sources of secondary data.

This study applied two types of questionnaires (both open and close-ended) which were prepared to look at the municipal solid waste management practices and capacities of the town together with households' solid waste management activities. After preparation, questionnaires were randomly distributed as a pre-test to correct unclear and misleading questions. Then all questionnaires in household samples were collected with the help of eleven data collectors employed from Yirgalem Town, new graduated students and government employees with providing training and under the close supervision of the researcher.

Primary data was also gathered using key informant interviews, which consisted of municipal waste management heads, employers, environmental protection authority office, kebele leaders, and health experts. These key informants were selected from those who have firsthand knowledge about solid waste management, the overall institutional setting, capacity, and constraints of the municipality of the Town.

Besides, focus group discussions were also used to verify the data collected through a household survey and key informant interviews. The checklist was prepared for an initial discussion. Focus group discussions were conducted by considering the size of 6 to 12 members of each group (Ezeah, 2010). Each focus group member was selected purposively by considering the knowledge of subjects and representation of sectors such as local communities, elder and youth groups and small scale enterprises engaged in the solid waste collection of the Town. The discussions were held with each group at different times per a week with the convenience of the participants of the group.

Data Analysis

The collected data were analyzed using Microsoft Excel and SPSS version 20. Socioeconomic characteristics of the respondents and solid waste management practice data were interpreted by using percentages and frequency. The association between socioeconomic characteristics and solid waste management practices was tested by considering Bivariate relationships using Chi-Squared (χ^2) tests.

Results

Socio-demographic Characteristics

All socio-demographic characteristics of the respondents presented in Table 1. A nearly equal proportion of the female (52.4 %) and male (47.6 %) respondents considered for the study. About a quarter of the respondents were within the age group of 31–40 years, followed by ages greater than 50 years (24.3 %) and 41–50 (22.3%). Most of the respondents were married (80.3%) and the remaining 12.2 % were single. The majority of the respondents completed 9–12 (28.4%) and 5–8 grade (21.8%) educational backgrounds. In this study, about 30.4 % of the respondents were government employees and 38 % of the respondents have a monthly income greater than \$50.

Table 1
Socio-demographic characteristics of the study area

Variables	Variable categories	Number of respondents	Percent
Gender	Male	188	47.6
	Female	207	52.4
Age	18–25	51	12.9
	26–30	61	15.4
	31–40	99	25.1
	41–50	88	22.3
	> 50	96	24.3
Marital Status	Married	317	80.3
	Single	48	12.2
	Divorced	13	3.3
	Widowed	17	4.3
Educational background	No formal education	35	8.9
	1–4 grade complete	38	9.6
	5–8 grades complete	86	21.8
	9–12 grades complete	112	28.4
	Certificate diploma and diploma	59	14.9
	BSc	58	14.7
	MSC and above	7	1.8
Household families	1–3	62	15.7
	4–6	222	56.2
	7–9	92	23.3
	10–12	18	4.6
	> 13	1	0.3
Job status	Farmer	14	3.5
	Trader	101	25.6
	Government employee	120	30.4
	Private employee	109	27.6

Variables	Variable categories	Number of respondents	Percent
	Others	51	12.9
House Ownership	Kebelle rental house	93	23.5
	private rental house	118	29.9
	private house	184	46.6
Monthly Income	Less than \$12	141	35.7
	\$13–25	50	12.7
	\$26–38	27	6.8
	\$39–50	27	6.8
	Greater than \$50	150	38.0

Attitudes and knowledge of the residents about municipal solid wastes

A large number of the respondents considered their surroundings clean (73.2 and 71.9% of the respondents participated in solid wastes management campaigns (Table 2). Over 68.4% of the respondents considered solid waste to be usefully and almost 86.3% of the respondents knew more about solid waste management. In addition, 41.3% of the respondents engaged in cleaning their surroundings due to personal hygiene, followed by disease prevention (32.4%) and keeping beatification (16.5%). Open public meeting (46.3%) is the most preferred mechanism to acquire solid waste management knowledge (Table 2).

Table 2
Attitude and knowledge of respondents related to solid waste management

Characteristics	Number of respondents	Percent
Cleanness of near environment		
No	106	26.8
Yes	289	73.2
Participation of people in solid wastes campaign		
No	111	28.1
Yes	284	71.9
Considered waste as a resource		
Useless	55	13.9
Somewhat useful	70	17.7
Useful	270	68.4
Knowledge about the solid waste management		
No	54	13.7
Yes	341	86.3
Preferred mechanism to acquire waste management knowledge		
Open public meeting	183	46.3
Brochures distributed to residents	39	9.9
Solid waste management campaign	22	5.6
Door -to-door education	105	26.6
Educational programs newsletter and magazines	13	3.3
Educational programs in radio and television	33	8.4

Storage And Collection Practices Of Municipal Solid Wastes

The result indicated that about 84.3% of the respondents stored solid wastes using sack and only 38 % of the households have access to door -to- door solid waste collection services (Table 3). Among those who have access to door -to- door solid waste collection services given 4–7 days (32%) and 16–30 days (26.7 %) (Table 3). Compostable organic wastes (79.8%) were discarded as the major solid wastes in the Town (Fig. 2). The result of this study showed that 94 % of the respondents didn't have communal waste containers placed in a proper distance of the residences whereas the reminders 6% of the respondents

have the services (Table 3). Similarly, all key informant interviews and focus group discussion members ensured the absence of communal waste containers in their surroundings.

Table 3
Storage and collection practices of municipal solid waste

Characteristics	Number of respondents	Percent
Type of solid waste storage materials		
sack	333	84.3
basket	41	10.4
plastic container(festal)	7	1.8
didn't use	4	1.0
sack, basket and plastic container	1	0.3
others	9	2.3
Access to door- to-door solid waste collection service		
No	245	62
Yes	150	38
Days of an interval to get waste collection services		
Every day	5	3.3
1–3 day	29	19.3
4–7 day	48	32
8–15 day	28	18.7
16–30 day	40	26.7
Communal waste containers		
No	369	94
Yes	24	6

Solid Waste Sorting And Processing Activities

According to the findings of this study, most of the participants understood the idea of practicing solid waste recycling and reusing (91.3%) and 84.3% of the respondents sorted solid wastes before discarding (Table 4). Among those who sorted solid wastes, 43.3% of respondents used solid wastes for reuse purposes (Table 4). However, the purpose of sorted organic wastes was used as fertilizer (47.1%), fuel wood (22.3%), feeding animals (7.6%), and reducing the volume of waste (6.6%) (Table 4).

Table 4
Separation and processing activities of municipal solid wastes

Characteristics	Number of respondents	Percent
Practice of solid waste recycling and reusing		
No	34	8.7
Yes	361	91.3
Sorting of wastes before discarding		
No	62	15.7
Yes	333	84.3
Purpose of Sorting solid wastes		
Salable to “Quraleos”	88	22.8
Exchange with “Liwach”	38	9.1
To reuse	171	43.3
To recycle	9	2.3
To help waste collectors	34	8.6
Segregation of organic solid waste		
No	53	13.4
Yes	342	86.6
Purpose of segregation organic wastes		
Using as fertilizer	186	47.1
Giving to other users	20	5.1
To use as fuel	88	22.3
To use as feeding animals	30	7.6
To recover resources by using my effort	1	.3
For reducing the volume of waste	26	6.6
others	2	.6

Solid Waste Disposal Practices In Yirgalem Town

The finding this study show that 39.5% of the respondent were disposed of solid wastes using small scale enterprises, followed by dumping in nearby roadside (21.8%), town municipality facilities and

services (14.4%), Burning (14.4%) and dumping in a pit (9.6%) (Table 5). According to a focus group discussion, key informant interview, and field observation, Yirgalem Town does not have a well-managed municipal solid waste disposal site, due to this; every waste generated from the Town is discarded into an open dumping area (Plate 1 below). Furthermore, the final solid waste dumping area is located nearly 500 m from residents and the site is not fenced. For these reasons, different scavengers, domestic animals, wild animals, and humans were observed from open dumping areas (Plate 1 below). Also the municipality office is not applying any measurements like coverage of the dumping area with soil, guard, and fence which are important for preventing environmental pollution. It is located at the top of a mountain, near the river, and tap water resources in the bottom; these may lead to water and land pollution leading to health problems.

Plate 1: Open dumping area of Yirgalem Town

Table 5
Solid waste disposal practices in Yirgalem Town

Waste disposal systems	Number of respondents	Percent
The use of town assembly facilities and services	57	14.4
The use of small scale enterprises	156	39.5
dumping in a nearby roadside	86	21.8
Burning	57	14.4
Dumping in a pit	38	9.6
Open dumps	1	.3

Current Status of municipality solid waste management in Yirgalem Town

The study showed that 49.4% of the respondents knew the rules and regulations of solid waste management, whereas 26.8 % partially knew and 23.8% did not know at all. Table 6 showed that more than 50.9% of the respondents feel unsatisfied with the current solid waste management services; whereas 26.8% of respondents were considered the service is fair. Absence of expert supervision and control of illegal solid wastes dumping on open areas was reported by the major respondents (64.1%). The overall efforts of the town municipality were very weak (44%) to handle solid wastes compared to water and road facilities services (Fig. 3).

Table 6
Existing status of solid waste management practices

Characteristics	Number of respondents	Percent
Knowing the rules and regulations of solid waste management		
none at all	94	23.8
partially know	106	26.8
know at all	195	49.4
The current condition of Yirgalem Town municipal solid waste Practices.		
Very satisfactory	14	3.5
satisfactory	56	14.2
fair	104	26.3
unsatisfactory	201	50.9
very unsatisfactory	20	5.1
Supervision and control on illegal dumping of solid wastes		
No	253	64.1
Yes	142	35.9

Association Between Solid Waste Management And Socio-demographic Factors

Association between solid waste management and socio-demographic factors were presented in Table 7.

The result of the study indicated that there is a relationship between the gender of the respondents and knowledge about solid waste management practices ($p < 0.05$); hence both male and female respondents had similar (50%) knowledge about solid waste management practice. According to the chi-square test, a significant association was observed between the gender of the respondents and participation in solid waste management campaigns ($p < 0.05$). Due to this, both gender categories have comparable participation in solid waste management activities. Similarly, practicing recycling and reusing have significant relationships with the gender of the research participants ($p < 0.05$). An equal proportion of male and female respondents did have a similar understanding of practicing recycling and reusing solid waste for different purposes. Knowledge of rules and regulations and gender of sampled respondents were related to each other at the chi-square test ($p = 0.034$); thus male respondents (53.85%) have more knowledge about rules and regulations of solid waste management than females (46.15%). The analysis of this result showed a significant association between gender and considered wastes as resources ($p < 0.05$); almost equal proportion of males (52.59 %) and females (47.41 %) considered solid waste as a

useful resource. But, sorting of solid wastes at household level and access to door -to- door collections didn't have an association with the gender of respondents ($p > 0.05$).

Table 7
Association between solid waste management and gender of the respondents

Variables	Categories	Gender		χ^2	p-value
		Male	Female		
Knowledge about solid waste	Yes	170	171	5.10	0.024
	No	18	36		
Participation in solid waste management	Yes	145	139	4.86	0.028
	No	43	68		
Segregation of solid wastes at your home	Yes	157	176	0.17	0.684
	No	30	30		
Knowledge of rules and regulation	none	36	58	6.76	0.034
	Partially know	47	59		
	Know at all	105	90		
Access to door to door collections	Yes	78	69	2.81	0.094
	No	110	138		
Practicing recycling and reusing	Yes	179	182	6.03	0.014
	No	9	24		
Consider wastes as resources	Useless	18	37	9.20	0.010
	Somewhat useful	28	42		
	Useful	142	128		

The result of this analysis showed that significant relationships among the age of the respondents, participation campaigns and accesses to door -to- door collections service ($p < 0.05$); hence the age groups of 31–40 (25.81 %) of the respondents were participated more in solid waste management campaigns and have access to door -to- door collections (Table 8). However, segregation of solid wastes at their home, consider wastes as resources, and knowledge of rules and regulation didn't have significant relationships with the age of respondents ($p > 0.05$) (Table 8).

Table 8
Association between solid waste management and age of the respondents

Variables	Categories	Age					χ^2	p-value
		18–25	26–30	31–40	41–50	> 50		
Knowledge about solid waste	Yes	43	54	88	78	78	3.47	0.483
	No	8	7	11	10	18		
Participation in solid waste management	Yes	29	42	80	68	65	11.97	0.018
	No	22	19	19	20	31		
Segregation of solid wastes at your home	Yes	38	56	86	75	78	8.22	0.084
	No	13	5	12	12	18		
Knowledge of rules and regulation	none	10	17	23	24	20	14.12	0.079
	Partially know	23	17	20	23	23		
	Know at all	18	27	56	41	53		
Access to door to door collections	Yes	13	24	48	35	27	12.14	0.016
	No	38	37	51	53	69		
Consider wastes as resources	Useless	5	5	21	10	14	10.80	0.213
	Somewhat useful	11	13	17	18	11		
	Useful	35	43	61	60	71		

The monthly income levels of the respondents were significantly related to participation in solid waste management campaigns and access to door-to-door collections ($p < 0.05$). Hence, majorities of the household were interested in cleaning their own and surrounding compounds (Table 9). However, in this study, monthly income levels were not associated with knowledge of rules and regulations of solid waste management ($p > 0.05$).

Table 9

Association between solid waste management and monthly income level of the respondents

Variables	Categories	Monthly Income level (USD)					χ^2	p-value
		< 12	13– 25	26– 38	39– 50	> 50		
Participation in solid waste management	Yes	121	35	20	21	87	28.47	0.001
	No	20	15	7	6	63		
Knowledge of rules and regulation	none	28	13	9	7	37	12.12	0.146
	Partially know	48	11	10	5	32		
	Know at all	65	26	8	15	81		
Access to door to door collections	Yes	64	13	7	14	49	12.00	0.017
	No	77	37	20	13	101		

Institutional arrangement and capacity of municipal solid waste management of Yirgalem Town

According to key informant interviews from municipality employees, Yirgalem Town does not have an independent waste and beautification office rather than establishing under the municipality office as a department of waste management and beautification case team. The key informant interview indicated that the main responsibility and function of the lower level department and officials of municipal solid waste management are not decentralized. Due to these reasons, the experts and department of sanitation and beautification lack important resources to undertake their responsibilities. The main responsibilities of the sanitation and beautification case team within the municipality are as follows: control and regulate solid waste management services, follow regulations and rules of solid waste management's, support and approve municipal sanitation contractors, initiate urban communities in solid waste management's and undertake public awareness creation. Due to the poor institutional arrangement of the sanitation and beautification case team within the municipality of Yirgalem Town, budget allocation and other required resources were not sufficient to achieve the plan and objectives of the departments. Hence, financial constraints are the major challenges for the sanitation and beautification case team. To provide effective and efficient services to communities as well as the Town, it needs different equipment and tools, skilled manpower, a specific solid waste policy strategy, and a guiding manual. But these facilities depend on well-established institutional arrangements and the good economic performance of a given town. In Yirgalem Town, solid waste management equipment is insufficient to collect, transport, and dispose of waste. Currently, the transportation of waste is undertaken by two tractors which do not efficiently dispose of all solid wastes generated in the Town. The focus group discussion and household interview results showed that Yirgalem Town does not have sufficient vehicles, waste containers, dustbins, gloves,

uniforms, and health and safety measures. These show that equipment is not sufficient to provide the service when compared with the increasing level of waste generation from society.

The sanitation and beautification department within the municipality is not organized with skilled manpower and professionals graduated with particular field specialization of environmental science/engineering, environmental health, and other related programs. According to a key informant interview, only 18 permanent employees are working in Yirgalem Town sanitation and beautification department. These limited and unprofessional numbers of manpower were challenged to implement proper solid waste management practices. But knowledgeable, skilled, and trained solid waste management employees are necessary for effective waste management services.

Discussion

Solid waste management practices cannot be effective without public awareness and participation (Woldetsadik, 2017). Most of the respondents cleaned their homes and surroundings regularly. This study is slightly comparable with Kersa Town (Mengistie and Baraki, 2010) and Mizan-Aman town (Abera, 2017). Most of the respondents were considered solid waste as a useful resource. However, utilized solid waste resources for different purposes were limited by households and municipality offices. This is due to a lack of technology, budget, skilled manpower, and strong institutional arrangement. According to this study result, the majority of the participants understood the idea of practicing solid waste recycling and reusing. But only small proportions of wastes were recycled by informal collectors in unregulated and unsafe ways. Similar reports were done in Northern Kerala and the majority of Ethiopian City (Kaithery and Karunakaran, 2019; Teshome, 2020). Large proportions of the respondents were having the "knowledge" on solid waste management practice, but didn't practice properly. This is due to lack of container bins in the surrounding area, door-to-door collection services, transportation, and disposal facilities given by town municipality offices. A similar study was observed in Ethiopian urban areas done by Fesseha and Bin (2015) and lower than the study done in Dessie Town (Rai Sharma et al., 2013).

In this study, most of the respondents didn't have access to door-to-door solid waste collection services. This study was in line with most African countries having less than 50% of the solid waste generated is collected (Haile et al., 2020; Tyagi et al., 2014; Wako, 2020). But this research result was less than the report made in Addis Ababa City (Mohammed and Elias, 2012). This may be the structure of the institutional arrangement, sources of budget, and equipment. However, these uncollected municipal solid wastes are affecting urban residents' health and the environment. The majority of the respondents stored solid wastes using a sack (84.3%) and a basket (10.4%) at household level. This is due to the low cost of material, easy availability in commercial areas, and storage of large quantities of solid wastes. However, these temporary storage materials at household level are not recommended, due to their susceptibility to moisture, weak strength of the material, the attraction of insects (flies) and rats. A comparable result was observed in the Addis Ababa City study done by Fesseha and Bin (2015) and slightly less than the result reported in Dessie Town (Rai Sharma et al., 2013). According to the respondent's interview of this study, most of the generated solid wastes were organic wastes (fruit wastes, grass, food wastes, and

agricultural wastes). Similar studies were reported in developing countries which generated a larger quantity of organic content than those waste produced in developed nations (Diaz et al., 2005; Oyelola and Babatunde, 2008). This result was in line with the studies made in different Cities (Helelo et al., 2019; Kassaye, 2018; Tyagi et al., 2014) and slightly deviated from the work of Teshome (2020). These large organic wastes are related to the high accumulation of vegetables, fruit, and the utilization of people in unprocessed foods in daily diet in the study area. Most of the respondents did segregation of solid wastes before disposal at the household level, but the absence of such practices at municipal levels. However, this sorting of solid waste aimed to be used as fertilizer, fuel wood, feeding animals, and salable to "Quraleos and liwach". A similar report was done by Kaithery and Karunakaran (2019). This study shows a higher respondent rate compared to the report done in Wolita Sodo Town (Solomon, 2018). Due to inadequate equipment for the gathering of segregated materials, absence of decision-makers' interests in environmental problems, a lack of skilled manpower on available technologies and best practices for waste management is hampered to sort solid wastes at the municipal level of lesser developed and developing nations (Mmerekki et al., 2016).

The result of this study showed that almost all respondents didn't have communal waste containers placed at a proper distance from the residences, this due to a lack of budget and complaints from local residents related to unpleasant odors. According to the households' interview, most of the participants disposed of solid waste using small-scale enterprises and dumped it to the roadside. Similar studies were reported in Ethiopian municipal urban areas (Fesseha and Bin, 2015; Umer et al., 2019). The study showed that the majority of the respondents did know the rules and regulations of solid waste management. The national policy of the country reveals that every City's sanitation, beautification, and park development, and waste management authority are accountable for collection, waste disposal, transportation, and overall waste management activity which were released in 2007 as solid waste management proclamation no.513. However, implementation of rules and regulation of solid waste management is limited in Yirgalem Town, due to lack of follow-up, control, and weak coordination of the municipality. The finding of this study indicated that more than half of the respondents were unsatisfied with the current solid waste management services given by the municipality of the town. Similar studies were made in Desie and Robe Town (Erasu et al., 2018; Rai Sharma et al., 2013). The overall effort of the town municipality was very weak and only a few of the respondents said that it was a strong effort to handle solid waste management. This study was in line with the work done in Robe Town (Erasu et al., 2018). Furthermore, a similar study was reported in Wolita Sodo Town (Solomon, 2018). The limited capacity of Yirgalem Town administration to handle municipal solid waste, due to an insufficient institutional arrangement, lack of budget, skilled manpower, and insufficient implementation of solid waste management rules and regulations. This study was in line with a study done in Adama Town (Hailemariam and Ajeme, 2014). Most solid waste management practices (knowledge, recycling and reusing, participation, and sorting and disposal practices) are significantly associated with the gender of socio-demographic characteristics. This means both males and females had a comparable understanding to apply solid waste management practices. Similarly, age and household monthly income were associated with solid waste management practices Comparable work was made in Jima town

related to current practices and socioeconomic factors (Getahun et al., 2012). However, other socio-demographic characteristics such as marital status, educational background, and job status, and house ownership were not significantly associated with solid waste management practices (Almasi et al., 2019). These variations in socioeconomic properties and its solid waste management practice of households can be because of social, economical, political and cultural conditions compared to others (Almasi et al., 2019).

Conclusion

The finding of this study reveals that Yirgalem Town communities have a good level of knowledge, a positive attitude towards cleaning their surroundings, practicing recycling and reusing, participating in solid waste management campaigns, sorting of solid waste, and collection of waste at the household level. However, the overall assessment of municipal solid waste management in Yirgalem Town is poor. Yirgalem Town doesn't have a communal waste container, which is placed in proper sites. Due to the absence of a sanitary landfill, every generated solid waste is dispose of into an open dumping area without any prevention mechanism of environmental pollution. Poor institutional structure, lack of skilled manpower, finance, equipment and tools are the major challenges faced by the municipality of the Town. Therefore, Collaborations of local government, urban residences, nongovernmental organizations, Universities and business communities should be required to implement effective solid waste management practices. In addition Yirgalem Town administration should establish an independent waste management institution while fulfilling equipment and tools. The municipality should scientifically study and propose a sanitary landfill far away from the residences of the households. Furthermore, knowledgeable, skilled, and trained solid waste management employees are necessary for effective waste management services.

Abbreviations

CSA

Central statically agency of Ethiopia

NZME

New Zealand Ministry for the Environment

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

All the authors read and approved this paper.

Availability of data and materials

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interest.

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Authors' contributions

The listed authors participate in data collection, analysis and write up, and editing the article paper.

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Figures

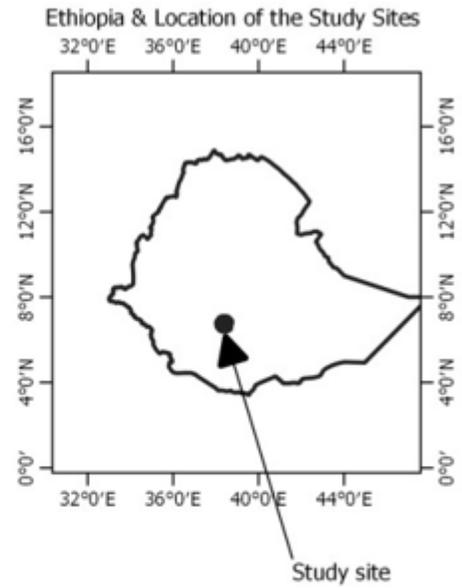
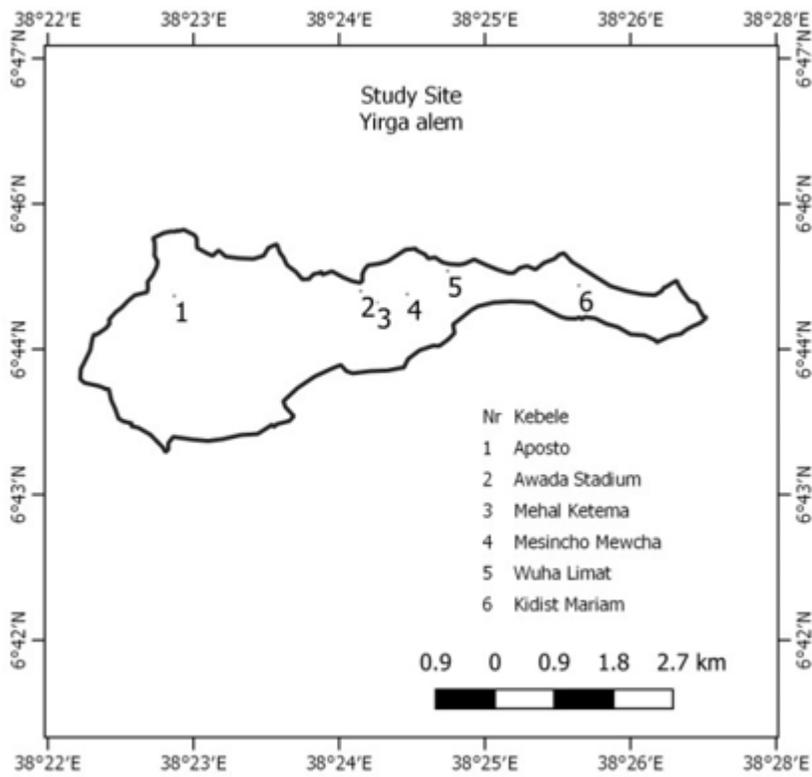


Figure 1

Map of the study area

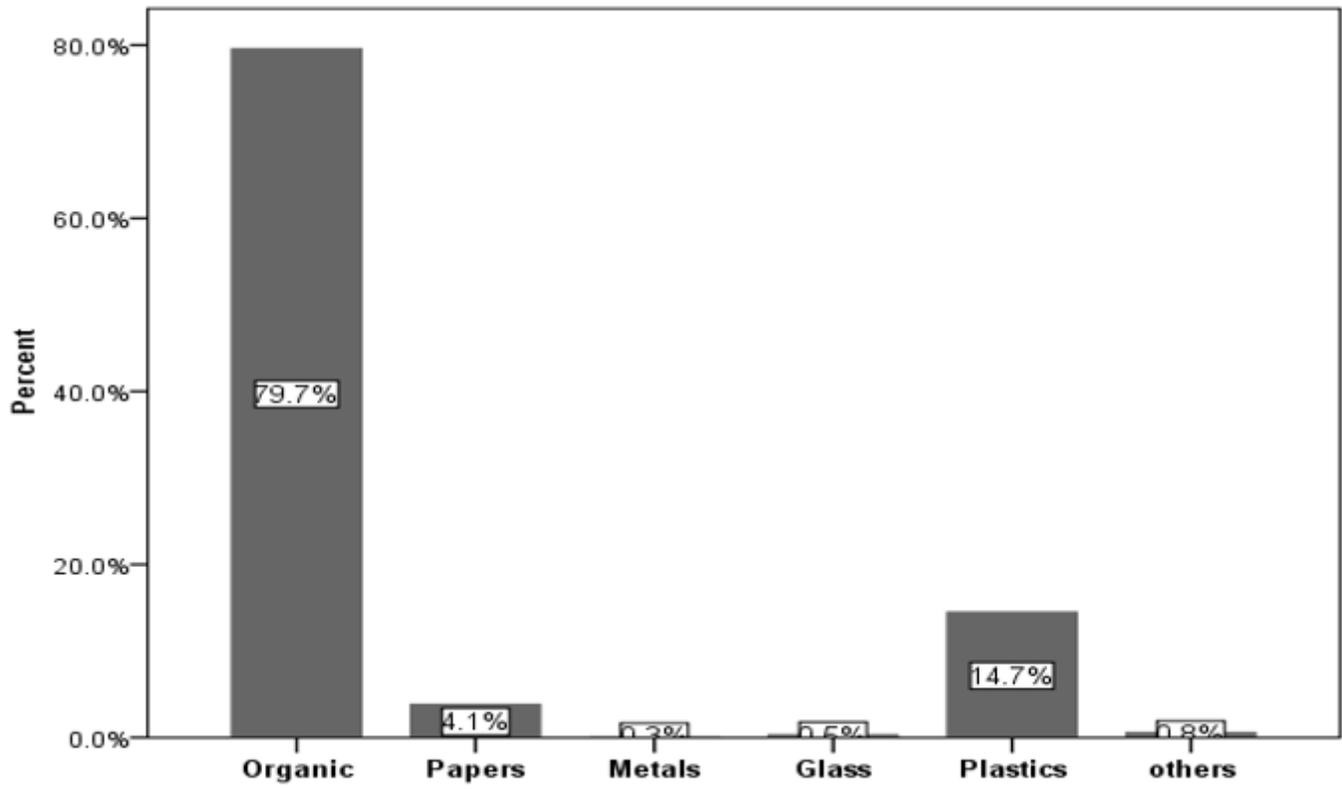


Figure 2

Type of solid wastes generated in households

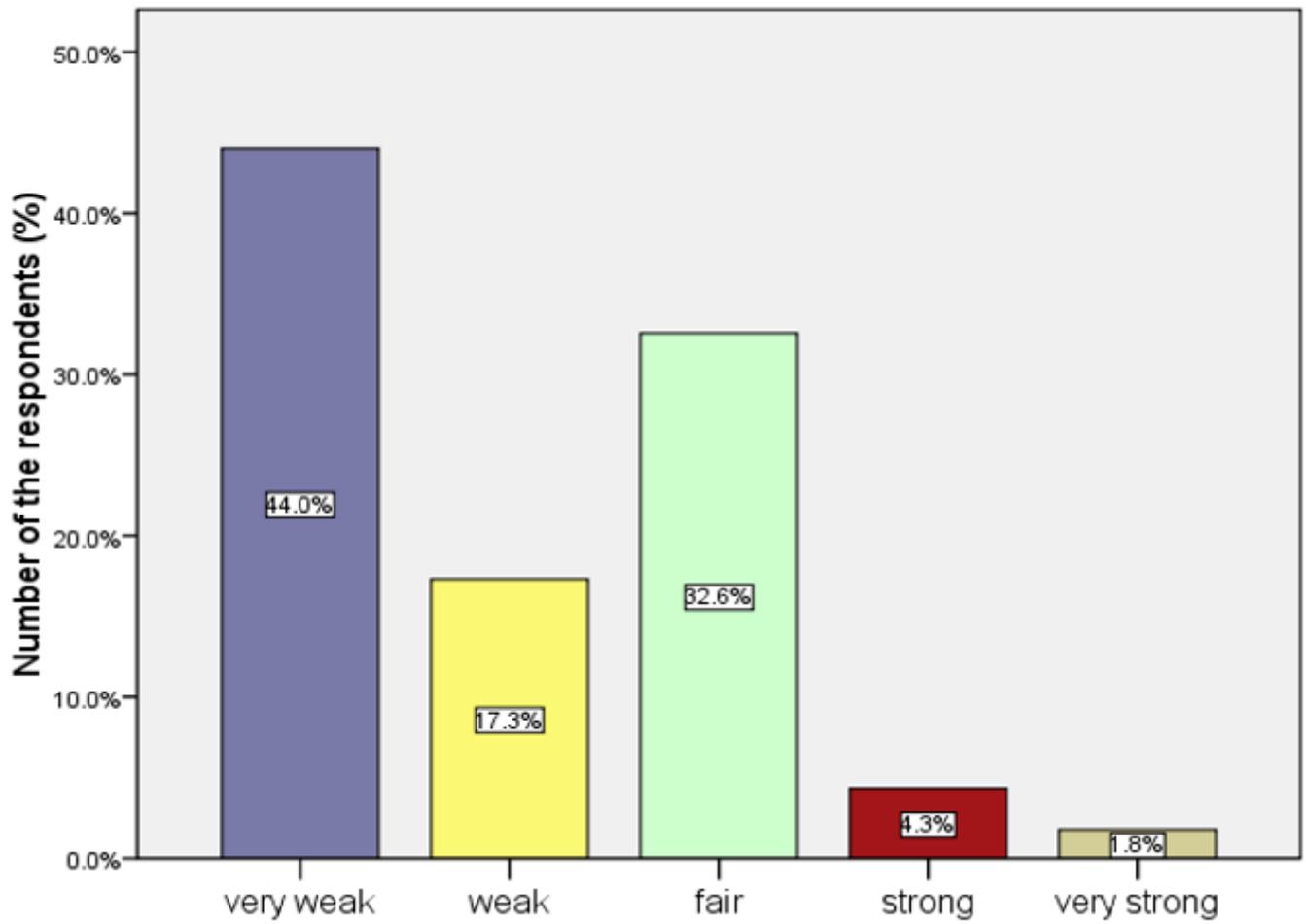


Figure 3

Efforts made by municipality compared to water and road facilities



Figure 4

Plate 1: Open dumping area of Yirgalem Town