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Research Article

Investigating the Environmental and Health Problems Associated with Municipal Solid Waste in Bahawalpur City, Pakistan

Muhammad Mohsin[1*], Asad Ali Khan[2], and Tasleem Barkat[2]

[1]Department of Geography, Government Sadiq Egerton Graduate College, Bahawalpur, Pakistan
[2]Department of Geography, The Islamia University of Bahawalpur, Bahawalpur, Pakistan

Abstract: Growing population and various economic activities in the cities has increased the generation of solid waste several times. Therefore, the main objective of the current research was to briefly investigate the impact of municipal solid waste on the environment and human health in Bahawalpur city. For this purpose, primary data about solid waste problems were collected using a structured questionnaire. Three hundred (300) respondents were asked from the residents of four study areas viz. Islami Colony, Model Town C, Model Town B, and Satellite Town (75 from each area) by applying simple random sampling. Necessary secondary data is collected from Bahawalpur Waste Management Company (BWMC). The analysis of the data was carried out in SPSS 17 by applying descriptive statistics, Pearson correlation, and a five-point Likert scale. Findings revealed that the problem is most aggravated in low-income areas (e.g. Islami Colony and Model Town C) where the performance of solid waste was counted average, poor, and very poor. Improper collection and disposal of solid waste also responsible for odour related problems mainly from waste throwing in open spaces like vomiting, land degradation, etc. This situation creates various environmental problems i.e. heaps of rubbish, dirty streets, flies and mosquitoes, and others. The ineffective management of solid waste was also creating severe diseases related to public health i.e. Malaria, respiratory problems, diarrhea, and others. The correlation results also highly significant and indicative that inadequate handling and throwing of solid waste creating severe environmental problems and diseases in the study areas.

Keywords: MSW problems, Open waste throwing, Land degradation, Malaria, Bahawalpur City.

1. INTRODUCTION

With growing demands of population and intensification of various economic activities in the cities generation of solid waste has increased several times. The human actions and activities outcome in the huge quantity of solid waste and its organization has direct impacts on the environment and the public health and thus, its management should be accomplished adequately to save the people and the environment [1]. It is asserted that rapid urbanization in the developing world if ignored could be a great risk to the environment, health, and urban productivity. Municipal solid waste (MSW) imitates the way of production which ultimately affects the environment and people's health. Many governments in most of the major African cities found the organization of municipal solid waste (MSW) one of the most serious environmental and health problems [2, 3]. Similarly, in South Asia, the collection of solid waste is highly ineffective in major urban areas as it is experiencing globally in most of the developing nations [4]. Consequently, the issues and problems regarding waste management arising in urban regions are bigger than in rural regions. In cities of less developed nations, the rate of production of solid waste is complex. In Delhi (India), for instance, during 2007 the solid waste generation rate was 7,000 tons/day that was boosted up to 17,000-25,000 tons/day in 2011. While in Kolkata (India), the generation of solid waste was about 2,920 tons/day [5, 6].

Unfortunately, most cities do not collect the total amount of wastes generated and collected

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*Corresponding Author: Muhammad Mohsin <mohsinshahzad10@yahoo.com>

wastes, only a small part receives proper disposal. The improper collection of waste and lack of appropriate disposal of solid wastes correspond to a basis of land, water, and air pollution, and caused environmental and human health risks [7]. The inefficiency of waste collection and economic constraints along and improper planning and lack of study on varying complexities of municipal waste creating many problems related to solid waste which results in affecting the goal of environment-friendly management of MSW [8]. It is found that dwellings close to the solid waste disposal sites are permanent nourishing areas for pits of dogs, cats, and together with rodents, bear diseases with them to nearby farmhouses [9].

In Pakistan, like most of the less developed countries, management of the MSW is one of the main environmental and public health hazards in urban areas [10]. MSW is not adequately treated and is openly thrown on open places without proper dumping [11]. This collected solid waste is disposed off in unchecked disposal sites, which creates stern environmental impacts [12]. Likewise, in Pakistan, the SWM is highly insufficient apart from a small number of urban centers where the collection rate of solid waste is 51% to 69%. For instance, in Lahore, the second biggest city of Pakistan, the coverage ratio of collection of solid waste is merely about 68% [13]. In Karachi, the biggest city of Pakistan, the production rate of solid waste is at a staggering 12,000 tons per day [14]. While in Lahore, the second biggest city in the country, it was over 5,301 tons in 2016 that is now estimated at over 8,000 tons per day [15].

The situation of MSW in Bahawalpur, a rapidly growing city in southern Punjab due to the influx of people migrated from the surroundings to the city. The population of the city is about 0.7 million and the rate of generation is about 310.54 tons/day based on the per capita generation rate of 0.457 kg/person/day. Most of the waste (64%) is comprised with organic waste [16, 17]. Although, the management of solid waste under Bahawalpur Waste Management Company (BWMC) is going on smoothly since 2014 yet the residents were also not satisfied with the solid waste management system currently in place. MSW has a great significance from the environmental point of view because many products and services used by homes are the outcomes of a long production string; during life-cycle, start with the extraction of primary manufacturing resources, their utilization, and refusal are among the sources of negative impact on the environment. MSW can be proved a resource if recovered properly, but present ineffective opportunities for management causes loss of valuable resources and around 40% of the solid waste is collected in the town. Chiefly, the huge amount of MSW's foremost disposal option is landfills. Consequently, discarding the municipal solid waste is one of the main reasons to enhance the pressure on the environment and human health. It adversely impacts the environment and creates dangers for the general health of the community [16]. Therefore, the main objective of the current research was to briefly investigate the impact of solid waste on the environment and human health in Bahawalpur city.

2. MATERIALS AND METHODS

2.1 Study Areas Description

Bahawalpur is ranked as the 12th biggest city of Pakistan situated between 29º 22' N Latitude and 71º 41' E Longitude (Figure 1). As per the National Census of Pakistan 2017, the population of the city was 681, 696 (According to the urban unit (Punjab) the estimated population of Bahawalpur in 2020 was about 822, 276) [18]. As the urban population of Bahawalpur is increasing explosively, in return, it creates many environmental problems i.e. solid waste generation, increasing city temperature, deteriorating water quality, and others. Four study zones of the city were selected for conducting the survey. Model Town C is a recently developed area of Bahawalpur City with better socio-economic conditions (some of its areas are still under development); Model Town B is the relatively older larger area, with average socio-economic conditions, while Islami Colony is a less developed area with low socio-economic conditions. Satellite Town is considered to be the high socio-economic area of Bahawalpur City. Figure 1 shows these four sampled areas in Bahawalpur city. Model Town B and Model Town C are neighboring areas in the northwest of the city, satellite Town is on the eastern side and Islami Colony is situated on the southeastern side of the city.

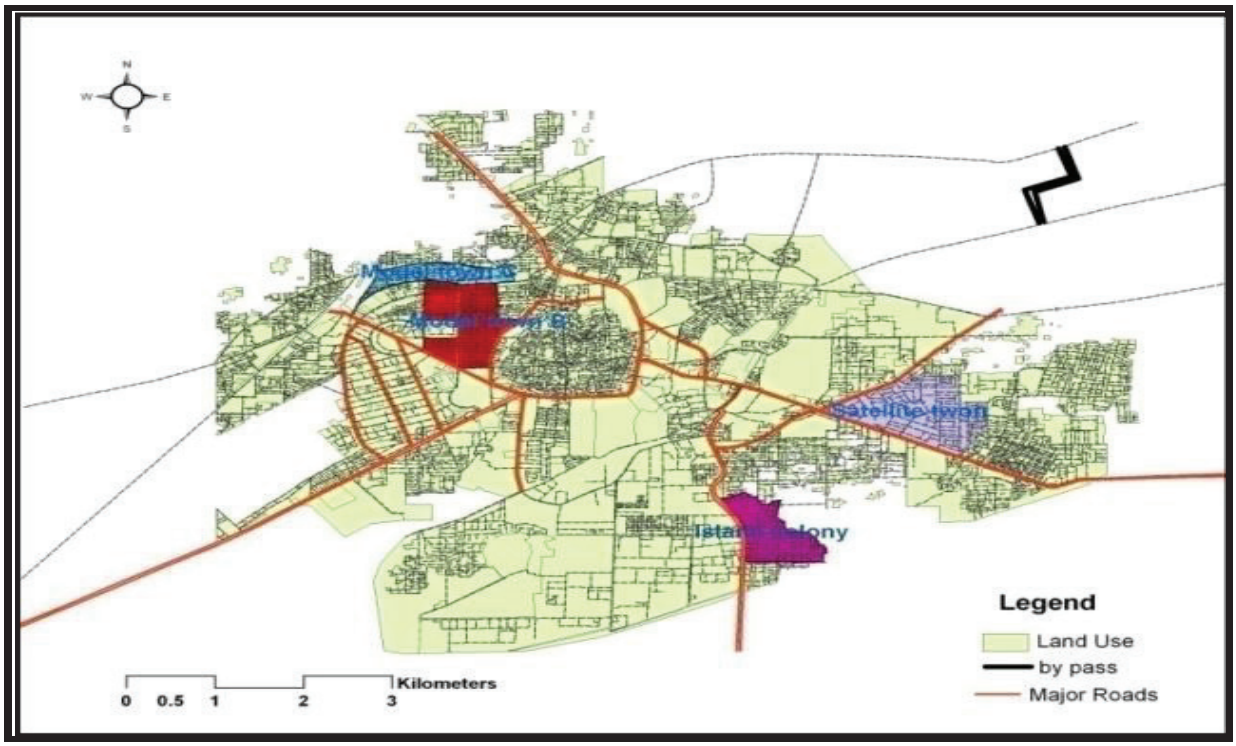

Fig. 1. Sample areas of Bahawalpur City Source: Authors field survey

2.2 Instrumentation and data collection

The instrument used in the field survey for data gathering was a structured questionnaire, consisting of a total of 35 questions some questions were close-ended ranging possible answers options from 2 to 7 and some were open-ended to know the possible answers of the respondents and made categories on the extent of responses. There were four parts of the questionnaire i.e. solid waste management practices, solid waste problems, resident participation, and socioeconomic status of the sample areas.

2.3 Samples and Sampling

A total of 300 respondents were asked from the residents of the respective four sampling zones (Islami Colony, Model Town C, Model Town B, and Satellite Town) with 75 respondents from each area by applying simple random sampling. As researchers couldn't survey the whole population due to financial and time restraints, so for the convenience of researchers, this division was done according to the socio-economic conditions of the residents of the area. This division will helpful for the generalization of the results because in this division responses from all classes and areas would be reflected.

2.4 Data Analysis

The collected data were properly arranged and manipulated according to the study needs. The analysis of the data was performed in SPSS software by applying various statistical techniques. Firstly, a five-point Likert scale and simple descriptive statistics (frequencies and percentages) were applied to evaluate the responses of the respondents and were displayed in the form of tables created in MS Excel. Secondly, Pearson Correlation (two-tailed) was used to find out the relationship between certain variables of solid waste and their associated environmental and health problems. Lastly, the study area and solid waste collection areas maps were created in ArcGIS 10.1.

3. RESULTS AND DISCUSSION

3.1 Monthly Income of the Households

Income is an important indicator to indicate the amount of waste generated in a locality. It is perceived that high-income households generate

more solid waste as compared to low-income households [1]. Table 1 depicts the comparison of the monthly income of sampled areas of the city. It identifies that there are just 0.66% households from Islami Colony (underdeveloped area) which are having an average monthly income less than 10,000 PKR monthly income group and rest of the sampled areas does not fall in this category, 3% were having the monthly income ranges from 10,000-15,000 PKR (2.67% from Islami colony), 8% were having the monthly income of 15,000-20,000 PKR (5.33% from Islami colony, 2.67% from Model Town B), 9.67% were having the monthly income of 20,000-25,000 PKR (6% from Islami colony, 2.33% from Model Town B). While 21% was having a monthly income of 25,000-30,000 PKR (3.66% from the Islami colony, 1.67% from Model Town C, 9.67% from Model Town B, and 6% from Satellite Town). While the remaining 57.67% of respondents were earned a monthly income above 30,000 PKR and most of them belonged to Satellite Town (19.67%), Model Town C (18%), Model Town B (15%), and Islami Colony (5%). The socio-economic conditions (e.g. monthly income) greatly influence the service facilities, which are enjoying by the residents of specific areas and generation of solid waste as well. In like manners, less developed areas were facing relatively more problems related to municipal solid waste. It is reported that hasty mushrooming, illegally built low-income housing areas present a specific challenge to MSW management [19]. Low-income people are not willing to participate in MSW collection methods. A study conducted in Ahmedpur East city, a low-income area of Bahawalpur found that residents were not willing to pay for solid waste collection except very few ones those were ready to pay low up to 100 PKR per month [20]. Generally, it is manifested that the residents of Bahawalpur City are not too poor to participate in an improved solid waste collection system (if costs not more than one to two hundred PKR per month).

3.2 Performance of Solid Waste Management (SWM) System

Solid waste management efficiency in the study sites to provide better services is shown in table 2. About 46% of households from all sample areas recorded their responses as an average solid waste management system. About 16.67% of household asserted that solid waste management system is poor in their areas. Similarly, 15.33% of households were disappointed with the SWM system and opined that the system of handling solid waste is very poor. About 16% of households were satisfied with the SWM system and in the like manner remaining 6% of households in Model Town B and Satellite Town said that the solid waste management system is very good. The performance of solid waste collection disposal is not well managed in Bahawalpur city that is producing

Table 1. Average monthly income of respondents from all sources

Sample Area	> 10,000 PKR	10,000-15,000 PKR	15,000-20,000 PKR	20,000-25,000 PKR	25,000-30,000 PKR	Above 30,000 PKR	
Islami Colony	2	8	16	18	11	15	70
Model Town C	0	0	0	1	5	54	60
Model Town B	0	1	8	7	29	45	90
Satellite Town	0	0	0	3	18	59	80
Total	2 (0.66%)	9 (3%)	24 (8%)	29 (9.67%)	63 (21%)	173 (57.67%)	300 (100%)

Table 2. The performance of solid waste management system in study areas

Sample area	**Very good**	**Good**	**Average**	**Poor**	**Very Poor**	**Total**
Islami Colony	0	2	34	8	26	70
Model Town C	0	3	25	26	6	60
Model Town B	6	15	43	13	13	90
Satellite Town	12	28	36	3	1	80
Total	18 (6%)	48 (16%)	138 (46%)	50 (16.67%)	46 (15.33%)	300 (100%)

several kinds of environmental and health issues. A previous study conducted in the Bahawalpur city also certifies that solid waste management is highly unsatisfactory in the city as it is witnessed in most cities of the developing countries, though it is vital to residents' health and environmental safety [16]. A study conducted in rural areas of China found that 83.91% of respondents believed that treatment of domestic waste was highly required due to their high perception of pollution of the environment and want for a good liveable environment [21]. It is found in a study conducted in Asella City, Southeast Ethiopia, that the residents and several works and official trades in the city produced a vast amount of wastes in various forms and regularly polluting the environment i.e. quality of water [22].

3.3 Collection and Removal of Solid Waste

Table 3 reveals the frequency of solid waste removal in the study area. One can easily identify the difference in removal in the study area. The results show that 36.33% of households were agreed with the daily collection and removal of solid waste, 18% were said within two days, 13.33% were asserted within three days, 23% were opined after passing a week and 9.34% expressed that in their areas there is no solid waste collection and removal operation is being processed. The majority of them were belonging to the less developed area of Islami Colony followed by Model Town C and Satellite Town. It is noticed that the collection and removal of waste in Bahawalpur City is practiced daily and weekly basis by the Bahawalpur Waste Management Company (BWMC). A previous study conducted in the Bahawalpur city also indicated that about 22% of respondents each were cleaning their rubbish on a daily and weekly basis [16]. Solid waste when not handled properly and regularly it creates several environmental and health risks [23]. As most of the waste (96%) in Bahawalpur city is organic domestic waste so the volume of waste could be reduced up to 70% and achieved by the use of composting [16]. In the second biggest city of Pakistan, Lahore, more than 30% of the waste is comprised of kitchen waste that can be reduced to enter in SWM system by opting for the composting method in the backyards of the houses [12].

3.4 Types of Environmental Problems Due to Solid Waste

The different environmental problems associated with inappropriate dumping of solid waste are shown in table 4. The results depict that 28.67% of households complaint the heaps of rubbish due to open dumping of solid waste, 14% were said the streets were dirty and smelly from the solid waste throwing, 2.33% were said the solid waste is thrown in open drains that further created the sewage issue, 7% were worried about the smoke problems of rubbish fires, 16% have opined the breeding of flies and mosquitoes, 23% were added that in their neighborhoods all these issues were prevailed and remaining 9% reported no issue of solid waste due to better management in their areas, these areas were Model Town B and Satellite Town.

The environmental problems created by inappropriate collection and disposal of solid waste are numerous. A study conducted in Ahmedpur East, Bahawalpur, revealed that almost 95% of solid waste is improperly and openly thrown in the streets and nearby vacant land which creating severe environmental problems [20]. Another study conducted in Bahawalpur City found that almost 74% of households disposed off their waste in open grounds and plots which poses a high risk to local environmental health as it boosts the breeding of flies, rodents, and vermin, causes of water and soil

Table 3. The frequency of the removal of solid waste in study areas

Sample Areas	Daily	Two days	Three days	After a Week	No Collection	Total
Islami Colony	3	12	12	29	14	70
Model Town C	4	10	12	27	7	60
Model Town B	47	23	8	11	1	90
Satellite Town	55	9	8	2	6	80
Total	109 (36.33%)	54 (18%)	40 (13.33%)	69 (23%)	28 (9.34%)	300 (100%)

Table 4. The types of environmental problems due to solid waste in study areas

Sample Areas	Rubbish heaps	Dirty streets	Open drains	Rubbish fires	Flies & Mosquitoes	All these	None	Total
Islami Colony	17	2	2	6	9	34	0	70
Model Town C	17	18	0	0	8	17	0	60
Model Town B	31	13	2	13	13	15	3	90
Satellite Town	21	9	3	2	18	3	24	80
Total	86 (28.67%)	42 (14%)	7 (2.33%)	21 (7%)	48 (16%)	69 (23%)	27 (9%)	300 (100%)

contamination and obnoxious odour [24]. A study conducted in Karan district, Mogadishu, Somalia found that due to improper disposal of the solid waste majority of the respondents 47 (31.3%) were believed the breeding of vector, while 29 (19.3%) complained of skin disease, about 19 (12.7%) were facing respiratory disease while 55 (36.7%) were in pollution of water air and soil sources [25].

3.5 Solid Waste Dumping Methods and Types of Odour Problems

In the absence of a proper landfill facility in the study area, the odour of openly thrown waste is also teasing for the residents. Table 5 illustrates the solid waste dumping methods and resultant types of odour (smell) problems. Results shown that headache out of 3.7% caused 2% due to dumping of waste in open spaces and 1% due to dustbins/ litter bins. Vomiting 21.75% caused because of solid waste dumping in open spaces, 3.3% due to burning of solid waste, 5% due to openly thrown solid waste in streets, and 17% due to dumping of waste in dustbins. The majority of 9.3% dumping of waste in open spaces has negative impacts on personal mood. All these smell problems 23.7% out of 32.3% caused due to dumping of waste in open spaces, and remaining 3% in streets and 4% in dustbins and litter bins. Only a small share (1.3%) were not reported any problems due to solid waste. It is found in a study that in cities like Bahawalpur, the culture of open throwing of solid waste creates intolerable odour for the residents [24]. It is found in a study that dumpsites emit unpleasant odour and smoke that causes sickness to the nearby living people [26].

Table 6 displays the correlation between dumping methods of solid waste and associated odour problems. The P-value implies a strong positive association and advocates that improper and inadequate dumping methods of solid waste can create an immense unpleasant odour that is highly dangerous and intolerable for the nearby living residents.

3.6 Solid Waste Dumping Methods and Subsequence Impacts on Environment

Table 7 shows the methods of solid waste dumping and types of impacts on the environment. Results make it clear that removal of the vegetal cover was

Table 5. Dumping methods of solid waste and types of odour problems

Types of Smell problems		Dumping of waste					Total
		Open Space (empty plot)	Burning	Street throwing	Dustbin/ Litterbin	None	
Headache	Count	6	0	0	3	2	11
	% of Total	2.0	.0	.0	1.0	.7	3.7
Vomiting	Count	65	10	15	51	5	146
	% of Total	21.7	3.3	5.0	17.0	1.7	48.7
Negative impact on mood	Count	28	1	4	7	2	42
	% of Total	9.3	.3	1.3	2.3	.7	14.0
All of above	Count	71	1	9	12	4	97
	% of Total	23.7	.3	3.0	4.0	1.3	32.3
None	Count	0	0	0	4	0	4
	% of Total	.0	.0	.0	1.3	.0	1.3
Total	Count	170	12	28	77	13	300
	% of Total	56.7%	4.0%	9.3%	25.7%	4.3%	100%

Table 6. Correlation between dumping methods of solid waste and odour problems

		Dumping methods of solid waste	Odour problems
Dumping methods of solid waste	Pearson Correlation	1	.616**
	Sig. (2-tailed)		.002
	N	300	300
Odour problems	Pearson Correlation	.616**	1
	Sig. (2-tailed)	.002	
	N	300	300

about 3.7% due to dumping of waste in open space, the abundance of birds and animals 38% due to dumping of solid waste in nearby open spaces. A majority of 22.3% out of 29.7% land degradation also caused due to dumping of waste in open spaces, 3.3% due to burning of solid waste, 4.7% due to street throwing and 11.3% due to dumping of waste in the dustbin. All impacts on open spaces caused 13.7% due to open space dumping and 2% due to open solid waste street throwing. About 16.3% were reported all of these problems in their areas. Fortunately, 12.3% of households were not expressed any adverse impact of solid waste on the environment.

Table 8 shows the correlation between dumping methods of solid waste and its subsequent bad impacts on the environment and illustrates a strong association between these two variables and thus demonstrated that improper solid waste dumping practices can highly degrade the surrounding environment and proved unhealthy and risky for human life, biodiversity, and natural environment. The unhealthy and inappropriate methods of solid waste dumping are a great threat to the local environment in many developing world's cities including Bahawalpur. Open dumpsites are a great problem to the environment, especially on the air that is inhaled by the people.

3.7 Types of Diseases Due to Uncollected Solid Waste

Table 9 shows the various types of diseases due to uncollected solid waste in the study areas. A wide range of health problems was reported by the households including Malaria (32.66%), Diarrhoea (12.33%), Food Poisoning (6.66%), Skin Allergies (8.33%), Respiratory Problems (17.66%), Fever (8.33%) linked with the deteriorating quality of the environment. Luckily, 14% of households were having no health-related issues due to better management of solid waste in their areas and the majority of them belonged to Satellite Town.

Table 10 shows the correlation between the uncollected solid waste and disease occurrence that shows a high positive association between uncollected solid waste and disease occurrence in the study sites. The uncollected and disposed solid waste can create a great danger of morbidity

Table 7. Dumping methods of solid waste and subsequence impacts on the environment

Types of impacts on the surrounding environment		Method of waste dumping					Total
		Open Space (empty plot)	Burning	Street throwing	Dustbin/ Litterbin	None	
Vegetal cover Removal	Frequency	9	0	0	1	1	11
	% of Total	3.0	.0	.0	.3	.3	3.7
Abundance of birds and animals	Frequency	51	10	14	34	5	114
	% of Total	17.0	3.3	4.7	11.3	1.7	38.0
Land Degradation	Frequency	67	1	8	9	4	89
	% of Total	22.3	.3	2.7	3.0	1.3	29.7
All of above	Frequency	41	0	6	0	2	49
	% of Total	13.7	.0	2.0	.0	.7	16.3
None	Frequency	2	1	0	33	1	37
	% of Total	.7	.3	.0	11.0	.3	12.3
Total	Frequency	170	12	28	77	13	300
	% of Total	56.7%	4.0%	9.3%	25.7%	4.3%	100%

Table 8. Correlation between dumping methods of solid waste and its impact on the environment

		Dumping methods of solid waste	Impact on environment
Dumping methods of solid waste	Pearson Correlation	1	.635**
	Sig. (2-tailed)		.001
	N	300	300
Impact on environment	Pearson Correlation	.635**	1
	Sig. (2-tailed)	.001	
	N	300	300

**. Correlation is significant at the 0.01 level (2-tailed).

in the study sites. Poor solid waste management practices put negative and harmful impacts on the residents living near those places. Previous studies in Bahawalpur also reported severe health-related problems due to inappropriate dumping of waste in open spaces [10, 16, 25]. A study conducted in Sargodha city, Pakistan also found the occurrence of several diseases near the dumping sites of solid waste are common than the places away from disposal sites. Residents residing near the waste places are more suffered from diseases like fever (malaria, typhoid), diarrhea, cough, eye irritation, skin disease, undernourished infants, stomach and heart problems, and hepatitis C [11]. Perhaps, the possible reason for these health issues are the bad and deteriorating quality of water as well that is becoming poisonous and unfit for drinking due to the leaching of toxins into the underground water from solid waste and wastewater. Similar kinds of threats were reported in Asella city of Southeast Ethiopia where the discharge of solid waste into water bodies making the water highly toxic and increases the risks of several health threats [22]. Similarly, a study undertaken in residential areas in Ikom, cross river state, Nigeria found about 1,272 (76.1%) malaria cases reported in a zone having a distance less than 500 meters from the dumping site, and 398 (23.8%) were found in zone B having distance above 500 meters from the dumping site. These results justify that proximity to solid waste dumping sites is more prone to the creation of health risk zone and proliferate disease vectors highly dangerous for the residents living there [27].

3.8 Waste Generation and Collection Frequency during Survey Period

Table 11 depicts the frequency of daily average solid waste collection and its percentage of collection per day by BWMC from January to June 2018 in Bahawalpur (City). The total collected solid waste was 1,074.13 tons. The average per day solid waste collection was 179.02 tons per day and the mean per day solid waste collection was an average of 65% from January to June 2018. Slight variations were also recorded between different days.

Figure 2 shown the area-wise (Union Council-wise) distribution of collected waste in tons. It can be easily visualized the variation of solid waste distribution system among the Union Councils (UCs) of the Bahawalpur city. The four categories made to shown collected waste in different quantity, it can be observed that Union Council 5 have more waste collection than the other UCs of Bahawalpur and their adjacent areas because (it includes Model Town B, Karbala Gaoshala, Ehsan Colony, People Basti, Dewaan Colony, Khan Colony, and some parts of Model Town C).

Though the rate of waste collection is also high among the area it is perceived that still there is about 30% to 35% of waste remained uncollected [28] which is causing environmental degradation and health-related dangers and many complaints of the residents were registered to the TMA and BWMC concerns. It is revealed in a study conducted on a global scenario that efficient strategies of solid waste management rely on the characteristics and variables of local waste with varying cultural, climatic, and socio-economic, and organizational competence [1].

4. CONCLUSION

The current study found that the improper and poor management of solid waste in Bahawalpur City creating severe environmental and health hazards.

Table 9. The types of diseases due to solid waste in the study areas

Sample Area	Malaria	Diarrhoea	Food Poisoning	Skin Allergies	Respiratory Problems	Fever	None	Total
Islami Colony	24	9	6	12	10	8	1	70
Model Town C	21	11	7	4	11	6	0	60
Model Town B	29	9	5	6	21	7	13	90
Satellite Town	24	8	2	3	11	4	28	80
Total	98 (32.66%)	37 (12.33%)	20 (6.66%)	25 (8.33%)	53 (17.66%)	25 (8.33%)	42 (14%)	300 (100%)

Table 10. Correlation between uncollected solid waste and disease occurrence

		Uncollected solid waste	Disease occurrence
Uncollected solid waste	Pearson Correlation	1	.546*
	Sig. (2-tailed)		.003
	N	300	300
Disease occurrence	Pearson Correlation	.546*	1
	Sig. (2-tailed)	.003	
	N	300	300

**. Correlation is significant at the 0.05 level (2-tailed).

Table 11. Waste generation and collection in Bahawalpur City during the survey period

Time Period	Solid waste generation avg. tons/day	Solid waste collection avg. tons/day	Percent of collected solid waste/ day
January, 2018	323.69	227.66	70%
February, 2018	323.69	211.21	65%
March, 2018	323.69	197.75	61%
April, 2018	323.69	197.94	61%
May, 2018	323.69	208.01	64%
June, 2018	323.69	230.56	71%

Source: BWMC, TMA Bahawalpur City, 2018

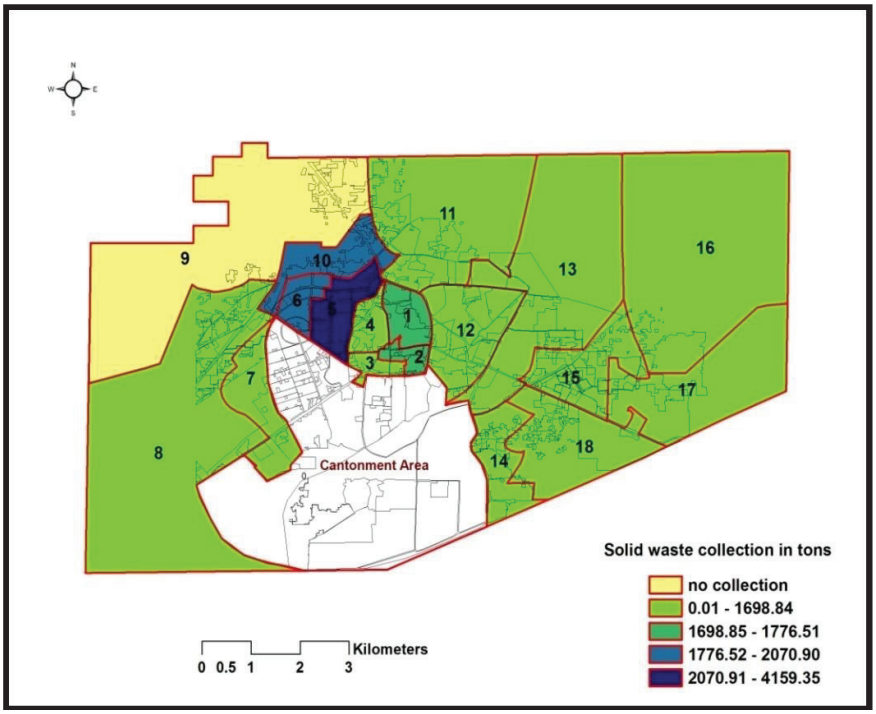

Fig. 2. Union Councils wise collection of municipal solid waste in Bahawalpur city
Source: Adapted from [28]

The problem is most aggravated in low-income areas (e.g. Islami Colony and Model Town C) where the performance of solid waste was counted poor and very poor. Due to this, the collection of solid waste is also irregular and inefficient. This situation creates various environmental problems i.e. heaps of rubbish, dirty streets, flies, and mosquitoes, etc. Improper solid waste dumping also responsible for odour problems in study areas due to waste throwing in open spaces Consequently, these were lead to creating severe health problems like Malaria, respiratory problems, diarrhea, skin allergies, fever, and food poisoning. Statistical analysis also verifies the problems associated with improper disposal of solid waste. The frequency of solid waste generation per day was about 323.69 tons and the average collection during the survey period by BWMC was 65%. It is concluded that due to poor management, irregular collection, and improper disposal of MSW the situation is troublesome. The amalgamation of social, technical, organizational, and financial strings might bring sufficient improvement in SWM in the study area.

Conflict of Interest: The authors declare no conflict of interest.

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