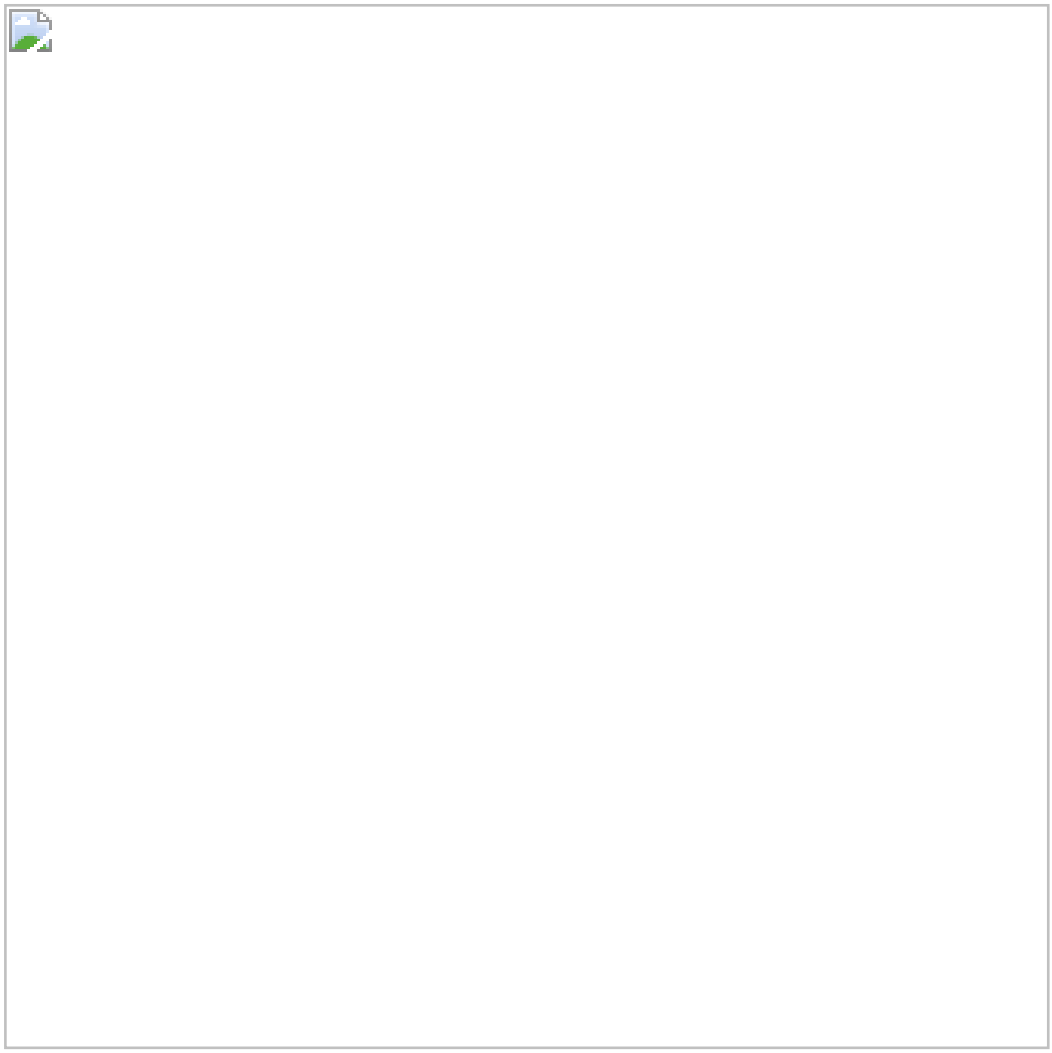

The Influence of Socio-Economic and Psychological Factors on the Composition of Household Solid Waste in Farahzad Neighborhood, Tehran, Iran

Authors: Gharagozloo, Shaghayegh, and Ghazizade, Mahdi Jalili

Source: Environmental Health Insights, 17(1)

Published By: SAGE Publishing

URL: https://doi.org/10.1177/11786302231195794

The Influence of Socio-Economic and Psychological Factors on the Composition of Household Solid Waste in Farahzad Neighborhood, Tehran, Iran

Environmental Health Insights
Volume 17: 1–11

DOI: 10.1177/11786302231195794

Shaghayegh Gharagozloo[1] and Mahdi Jalili Ghazizade[2]

[1]Environmental Science and Engineering, Environmental Sciences Research Institute, Shahid Beheshti University, Tehran, Iran. [2]Environmental Technologies Department, Environmental Sciences Research Institute, Shahid Beheshti University, Tehran, Iran.

ABSTRACT: Appropriate solid waste management requires correct identification of its quantitative and qualitative characteristics. Permanent changes in household solid waste composition (especially in developing countries) necessitate identifying factors affecting the composition to avoid frequent, extensive and high-cost sampling. The case study here is Farahzad Neighborhood in Tehran, a region where solid waste is not collected and managed properly, in turn, threatening the health of the residents in that area. The current study aims to identify socio-economic and psychological factors affecting household waste composition in this region. The data collection tool was a questionnaire, completed from July to August 2020, where 66 households were randomly selected as representative of 1950 households. Different parametric statistical tests were undertaken using the SPSS software to characterize factors affecting the waste composition in the research area. The results showed a significant difference ($sig < .05$) in the amount of recyclables in terms number employed people and household members as well education levels. There was also a significant difference ($sig < .05$) between the amount of food waste and education level, yet no ($sig > .05$) between the knowledge of waste management and the amount of generated plastics. Overall, this information may benefit managers and decision-makers to set more effective and socially inclusive policies for storing, collecting, and disposing of solid waste to ensure people from lower socio-economic groups are considered as well.

KEYWORDS: Domestic solid waste, Farahzad, food garbage, recyclables, waste characterization

RECEIVED: April 24, 2023. **ACCEPTED:** August 2, 2023.

TYPE: Original Research

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CORRESPONDING AUTHOR: Mahdi Jalili Ghazizade, Environmental Technologies Department, Environmental Sciences Research Institute, Shahid Beheshti University, Shahid Shahriari Square, Evin, Tehran, 198396941, Iran. Email: ma_jalili@sbu.ac.ir

Introduction

The term "solid waste" means "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material, resulting from industrial, commercial, mining, agricultural operations, and community activities."[1] Solid waste management can be defined as the process of waste characterization, as well as collecting, transporting, recycling, processing, treating, and disposing of solid waste.[2] Poor management of solid waste negatively impacts all members of society, especially those with a lower socioeconomic status, due to a higher vulnerability. As such, appropriate solid waste management is a fundamental requirement for sustainable, healthy, and inclusive cities and communities.[3] Open dumping and uncontrolled burying of solid waste in landfills is a common method of disposal in developing countries, which in turn leads to the generation of leachate causing environmental pollution. Furthermore, the accumulated waste can cause fire and explosion leading to air pollution.[4]

One of the most challenging problems facing contemporary urban communities is an increase in the amount of generated solid waste.[5] As a metropolitan city, Tehran, Iran's capital and largest city, generates almost 7100 tons of municipal solid waste, which is equivalent to 770 g per capita per day. Other factors that make the management of waste complex include Tehran's high population density (almost 12 200/km^2), unbalanced urban growth, insufficient expenditure recovery for waste management services, low source-separation ratio, extensive waste scavenging, and a lack of citizens' knowledge for participating in and support of waste management programs.[6] Furthermore, the topographic and physical limitations of some neighborhoods in Tehran (like Farahzad Neighborhood) as well as the outdated urban fabric make the process of mechanized waste collection and solid waste management very difficult.

Waste characterization should be considered as the first and most important step of municipal solid waste management in different areas of Tehran. The generation rate and composition of household solid waste varies from house to house. The waste composition can be divided into 3 main categories: (1) Food waste, (2) Recyclable materials, and (3) Non-recyclable waste or rejects.[7,8] Identification of various parameters affecting these 3 categories can be used for proper utilization of equipment and methods for collecting domestic waste in Tehran, not least in old neighborhoods.

Literature Review

Some studies have described the relationship between the generation and composition of household solid waste and relevant socioeconomic parameters by using regression analysis.[7,9,10] Income is the main driver of solid waste generation, therefore,

it is an important decision-making variable for identifying different socio-economic groups.[11] Education also affects the composition of solid waste. The high correlation between income and education shows to what extent education is related to income.[12]

Other socioeconomic factors that seemingly influence municipal solid waste generation rate include household number and employment status.[9] Municipal solid waste generation also changes according to average family sizes.[8,11,13]

There is a positive relationship between waste generation and family size; the larger the household, the greater the amount of waste generated per day, while keeping other variables the same.[5,7,10] In saying this, other studies have reported a decrease in per capita waste generation with an increase in household size.[8,9,11,14] The number of employed people in a family is another effective parameter on the quantity and composition of generated domestic waste. Although a positive relationship between the amount of waste generation and the number of employed people has been reported in developing countries by Monavari et al, family employment can reduce the percentage of organic waste in residential waste composition.[7] There is a negative relationship between environmental concerns and the quantity of generated waste. This is mainly because families paying attention to environmental protection are more inclined to waste recycling.[15,16]

The type of building structure (ie, the material) can be considered as an independent parameter. Owing to the fact that this parameter is related to the socio-economic status of residents, it can be useful to incorporate it in the study. This is mainly because the information obtained from the survey may not be reliable or some families may be hesitant to disclose information about their income.[9] The main goal is to identify the type of building structure and determine its different features for various building types.[17] In total, studies have shown that socio-economic parameters affecting waste composition are changeable. In other words, these factors vary in different countries and regions, which has been attributed to variations in personal attitudes and cultural patterns.[9] The research is important because no studies have been undertaken that focus on factors affecting municipal waste composition in Tehran. Farahzad is historically a touristic area in the north of Tehran, which now with the widespread cultural and economic poverty, exhibits different characteristics from the past and other neighborhoods. Waste characterization focusing on the identification of solid waste composition is the first step toward better management. It assists in the proper selection of on-site waste storage facilities, collection equipment, and final disposal methods.[5] Therefore, in this research, factors influencing solid waste composition were recognized for different socio-economic groups in Farahzad Neighborhood. This research answers the questions of whether socio-economic factors affect the amount of recyclable and non-recyclable waste and the presence or absence of food waste. It also answers the question of whether there is a relationship between the knowledge of solid waste management and the presence of plastic in the composition of solid waste.

Materials and Methods

Study area

Tehran is divided into 22 municipal districts and 122 regions. The population is 8,737,510, according to the 2016 census. Farahzad is a touristic neighborhood located in the north of Tehran and northwest of Shemiranat, in Region 9 of District 2 of Tehran Municipality. The neighborhood, located east of Farahzad Valley, has an area of about 103 hectares and a population of approximately 19 000.[18] Farahzad has 3 zones: Upper Farahzad (north of Yadegar-e Emam Expressway), Lower Farahzad (south of Yadegar-e Emam Expressway), and Imamzadeh.

The vulnerable and distressed fabric of Farahzad has several features which distinguish it from similar examples in the south of Tehran.[19] The unique features of Farahzad include a recent wave of migrants to the area, particularly Afghans, which has led to significant changes in the locality and has caused several issues such as incoherency in urban management, notably solid waste management. As a result, environmental problems, such as water and soil pollution have arisen, leading to the spread of various diseases in the area. Moreover, the spatial conditions of the neighborhood, including narrow alleys, steep topography, difficulty of access through ramps and long stairs, an insufficient number of mechanized waste bins, and the impossibility of vehicle traffic in most passages, have resulted in challenges for the collection and transfer of solid waste. These issues increase environmental pollution and disease outbreak, which further undermines the area's attractions. On the other hand, there are seasonal jobs in the neighborhood, which contribute to an increase in generated food waste. Therefore, accurate identification of waste composition is necessary to develop an appropriate waste management plan for the area. To this end, the identification of independent and influencing parameters on the composition of the solid waste (dependent variable) is needed.

Figure 1 depicts an analysis of household solid waste composition in Region 9 of District 2 of Tehran Municipality. As shown, food waste was the most common solid waste item (67.1%), followed by plastics (9.32%) and glass (6.8%). Plastics and glass have the highest percentage of recyclables in the solid waste composition in this area. The lowest percentage was associated with non-metal (0.08%), Tetra Pak (0.09%), and metal (0.44%).[6]

Data collection techniques

The study used a questionnaire focusing on the socioeconomic status of households and the commitment of residents to environmental protection.[7,20] As such, the inclusion criteria were households that generate domestic waste through normal residential activities. The questionnaire seeks to

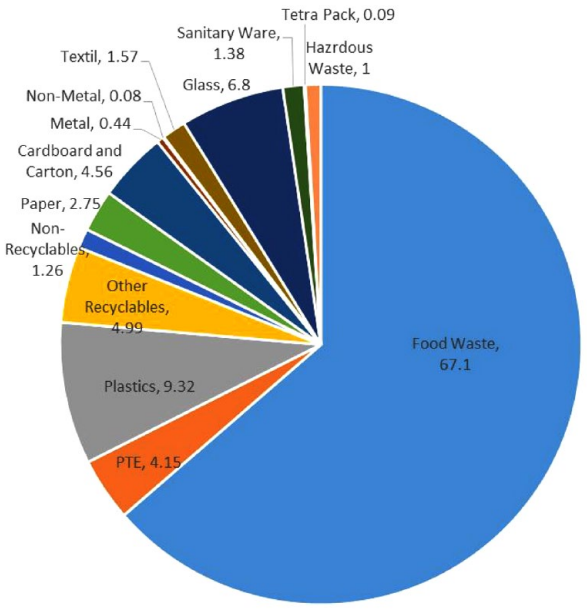

Figure 1. Household solid waste composition in Region 9 District 2 of Tehran municipality.

gather information on age, gender, socioeconomic level, influential factors (such as education and income), accommodation and building type, the combination of generated solid waste, and households' perception of solid waste management and environmental concerns.[5,10,11,13,15,17,20,21] Households with different socioeconomic characteristics, including education, household size, income, mean age, and solid waste generation answered the questionnaire.[7,11,14] Both online and face-to-face questionnaires were used in this study.

Various methods can be used for samplings. This includes stratified random sampling,[7,9,15] door-to-door or face-to-face polls (the most common approach),[10,11,16] random sampling,[5,8] and non-random sampling (ie, only those who agree to participate in the study).[20] Household is the unit of solid waste generation.[10] The number of samples should be proportional to the number of houses and the number of zones within the neighborhood.[7]

Statistical sample and sampling method

Simple random sampling was used in this study. A list of members living in the area was prepared and sampling was done using a lottery. Overall, 1950 residential units were considered as the statistical population. Following this, 66 units (households) were selected using relation (1), which represents Cochran's formula with an error of 10%[22] and a confidence level of 90%,[23] indicating the minimum number of respondents required, due to the COVID-19 restrictions.

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left(\frac{z^2 pq}{d^2} - 1\right)} \quad (1)$$

Where N is statistical population size, n is sample size, d is error percentage, z is z-score using a 90% confidence level, p is the ratio of having the desired attribute, and q is lacking the desired attribute ($1-p$).

$$p = 0.5;\ q = 1 - 0.5 = 0.5;\ d = 0.1;\ z = 1.645$$

$$n = \frac{\frac{1.645^2 \times 0.5 \times 0.5}{0.1^2}}{1 + \frac{1}{1950}\left(\frac{1.645^2 \times 0.5 \times 0.5}{0.1^2} - 1\right)} = 65.41 \simeq 66$$

Measurement instrument

In this research, the measuring tool is a questionnaire, completed in July and August 2020 by the residents of Farahzad Neighborhood.

The questionnaire has 2 sections:

(1). Summarizing socio-demographic variables such as age and gender as well as socio-economic variables such as household size, average monthly household income, educational background, building type, and residence employment status.
(2). Influencing psychological factors (willingness) on households' sustainable solid waste management.

Solid waste composition is the dependent variable. The outcome variable was measured through a questionnaire. The participants were asked to write their waste composition. The composition was classified into 3 categories of food waste, recyclable waste, and non-recyclable waste (rejects). Categories were determined based on the literature review. Income, number of household members, level of education, number of employees, age, environmental concerns, building type, and gender are the independent variables selected based on their relevancy and continuation in the study area. Regarding concerns around solid waste management, respondents were asked about their willingness to recycle, willingness to participate in cleaning-up programs, knowledge of recycling, the importance of solid waste management, and source separation of solid waste at home or work. These are instances of concerns about solid waste management. The Likert scale was used to quantitatively assess selected questions in the questionnaire regarding concerns and awareness about solid waste management. These questions include the importance of solid waste management, the importance of separating food waste from others, and the willingness to recycle. The respondents selected 1 to indicate "not important at all" and 4 to indicate "very important." For the question on willingness to recycle, 1 indicated "unwillingness," and 4 indicated "willingness." Other questions were designed in the form of multiple-choice, short-answer, paragraph, and multiple-choice network depending on the type of question and the required answer. Waste sampling was not

undertaken, due to the COVID-19 limitations. The number of solid waste types generated by households was obtained through examining and comparing the responses provided in the questionnaire.

CVI was used to calculate the validity of the questionnaire, where the value was 0.85 for 6 questions and 0.80 for 3 questions. Reliability is significantly important in information collection and observations and usually ranges from 0 (irrelevant) to 1 (completely relevant). When Cronbach's alpha is more than .7, the measurement tool has the required reliability and can be considered acceptable. Different methods are used to calculate the reliability of the measurement tool. This study used Cronbach's alpha method.[24] The variance for the scores of each subset of the questionnaire and the total variance should be calculated to obtain Cronbach's alpha coefficient using the relation (2) below.

$$\alpha = \frac{K}{K-1}\left[1 - \frac{\sum S_i^2}{S_T^2}\right] \quad (2)$$

Here, k is the number of questions or items of the questionnaire; S_i^2 is the variance of kth subtest; and S_T^2 is variance of the total test.[25] In this study, the SPSS software was used to calculate the reliability of the respondents' answers to the questions on the knowledge and concerns about solid waste management, where the value was 0.73.

The obtained Cronbach's alpha more than .7, indicates the questionnaire has the required reliability. The electronic questionnaire was designed in Google Forms and the link was sent to various institutions and individuals in Farahzad for completion (43 households answered the questionnaire online). The questionnaire link was also sent to a questioner in the neighborhood to collect data through door-to-door and face-to-face methods. The Farahzad region was divided into 9 imaginary blocks, where blocks 1 to 3 and blocks 4 to 9 were respectively associated with higher-than-average and lower-than-average household income levels. Three questionnaires were completed in each of the blocks 1 and 6. In each of blocks 2, 3, and 9, one questionnaire was completed. Blocks 7 and 8 completed 12 and 2 questionnaires, respectively. Overall, 23 households answered the questionnaire through the face-to-face method, resulting in a total number of 66 completed questionnaires. In terms of skewness and kurtosis, the obtained data followed the normal function.

Tests of hypotheses

Different hypotheses tests (depending on the parameters under study) were used to determine the significance of the relationships between the parameters. The present study examined the results of all statistical tests at a 95% confidence level. The research hypotheses were tested in the SPSS software operating an independent *t*-test and one-way analysis of variance. If the independent variable has only 2 levels, the independent *t*-test is used. However, if the independent variable has more than 2 levels, the one-way analysis of variance is used. The chi-square test was used for variables that could not be averaged.

Consent to participate

Verbal informed consent was obtained prior to the interview.

Results

In this study, the independent variables are monthly household income, gender, age, level of education, number of employed individuals, number of household members, type of building structure, home ownership, and accommodation type. Each of these variables was classified into subgroups.

In total, 66 families participated in this research. The respondents were asked to specify their family members' gender. Among 280 people, 140 were female, 136 were male, and 4 people did not provide any answer. With building type and type of accommodation being steel and villa respectively, most families were tenants living in household sizes of 3 to 4. Regarding age and education, most families consisted of people aged under 19, and elementary to middle school education was the highest level for adults. Regarding income, with only one breadwinner for most families, the highest frequency was related to an income level of fewer than 2 million Tomans per family per month. Descriptive statistics (percentage and frequency) of the participants in the questionnaire for each subgroup are shown in Table 1.

Independent t*-test*

Hypothesis: There is a significant relationship between the independent variables of gender and ownership type (owner or tenant) and the number of solid wastes (recyclables and non-recyclables) in the household's waste composition.

Table 2 shows the results of the significance level between the number of household solid wastes (recyclables and non-recyclables) and the variables of gender and ownership type.

As shown in Table 2, there is no significant relationship between the number of household solid wastes (recyclables and non-recyclables) in the solid waste composition and the independent variables of gender and ownership. In other words, the significance level of the independent *t*-test is $>.05$, the research hypothesis is rejected, and the null hypothesis is accepted.

One-way analysis of variance

Hypothesis: There is a significant difference between the number of household solid wastes (recyclables and non-recyclables) in the solid waste composition among different groups with independent variables of income, age, family size, type of building structure (steel, brick, traditional), accommodation type

Table 1. Frequency, percentage, and valid percentage of variables in Farahzad Neighborhood in 2020.

VARIABLE NAME		FREQUENCY	PERCENT	VALID PERCENT
Income	Under 2 million Toman[a]	47	71.2	71.2
	2-4 million Toman	9	13.6	13.6
	4-6 million Toman	7	10.6	10.6
	Over 6 million Toman	3	4.5	4.5
	Total	66	100.0	100.0
Gender	Male	136	48.6	49.3
	Female	140	50.0	50.7
	Total	276	98.6	100.0
	Missing system	4	1.4	
	Total	280	100.0	
Age	19>	106	37.9	38.8
	19-30	60	21.4	22.0
	31-42	44	15.7	16.1
	43-55	43	15.4	15.8
	55<	20	7.1	7.3
	Total	273	97.5	100.0
	Missing system	7	2.5	
	Total	280	100.0	
Level of education	Postgraduate	7	4.0	4.4
	Bachelor	21	11.9	13.1
	High school	48	27.3	30.0
	Elementary school-middle school	54	30.7	33.8
	Illiterate	30	17.0	18.8
	Total	160	90.9	100.0
	Missing system	16	9.1	
	Total	176	100.0	
The number of employed individuals	0	4	6.1	6.2
	1	31	47.0	47.7
	2	24	36.4	36.9
	3	4	6.1	6.2
	4	2	3.0	3.1
	Total	65	98.5	100.0
	System missing	1	1.5	
	Total	66	100.0	
Number of household members	3>	8	12.1	12.1
	3-4	35	53.0	53.0
	5-6	17	25.8	25.8
	7-8	6	9.1	9.1
	Total	66	100	100

(Continued)

Table 1. (Continued)

VARIABLE NAME		FREQUENCY	PERCENT	VALID PERCENT
Type of building structure	Steel	44	66.7	66.7
	Brick	12	18.2	18.2
	Traditional	10	15.2	15.2
	Total	66	100.0	100.0
Ownership	Owner	20	30.3	30.3
	Tenant	46	69.7	69.7
	Total	66	100.0	100.0
Accommodation type	Apartment	23	34.8	34.8
	Villa	41	62.1	62.1
	Room	2	3.0	3.0
	Total	66	100.0	100.0

[a]1 Million Toman = US$20.

Table 2. The results of the statistical tests between the number of household solid wastes (recyclables and non-recyclables) and the variables of gender and ownership type in Farahzad in 2020.

INDEPENDENT *T*-TEST	*F*	MEAN DIFFERENCE	SIGNIFICANCE LEVEL
Recyclables	0.044	−0.026	.834
Gender			
Non-recyclables	0.120	−0.013	.729
Gender			
Recyclables	0.139	0.110	.711
Ownership type			
Non-recyclables	1.715	0.215	.195
Ownership type			

(apartment, villa, room), employed individuals, and level of education.

Tables 3 and 4 show the results of the significance level between the number of household solid wastes (recyclables and non-recyclables) and the independent variables in this study.

Tables 3 and 4 indicate only 3 independent variables, among others, were identified as effective regarding the amount of recyclable waste in the composition of solid waste. These variables include the number of family members, the number of employed individuals, and the level of education. In fact, according to the significance level of one-way analysis of variance, there is a significant relationship between the number of recyclables in the solid waste composition and the household size, the number of employed individuals, and the level of education (Table 3). Yet, there is no significant relationship between independent parameters in this study and the number of non-recyclables in the composition of solid waste (Table 4).

There is a significant difference in household size and the number of recyclables (0.033). When the number of households exceeded 3, the number of recyclables increased (as shown in Supplemental Table 1 in Online Resource). But when the number of households exceeded 4, the number of recyclable wastes reduced, due to economic considerations to save more by using foods mostly in bulk and open. It can be argued that smaller households consume more processed food, while larger households use less packaged goods. As a result, they (larger households) produce less recyclable waste such as glass, paper, and plastic.

Regarding the significance level (.046) of the number of employed individuals and the number of recyclables, it can be said that when the number of employed individuals increases, the number of recyclable wastes decreases (as shown in Supplemental Table 2 in Online Resource). This is most likely because employed people generate more recyclable trash such

Table 3. The results of the statistical tests between the number of recyclables and the independent variables under study in Farahzad in 2020.

PARAMETER	RECYCLABLES					
		SUM OF SQUARES	DF	MEAN SQUARE	*F*	SIG
Income	Between groups	8.249	3	2.750	2.306	.086
	Within groups	69.170	58	1.193		
	Total	77.419	61			
Age	Between groups	1.262	4	0.315	0.244	.913
	Within groups	332.956	257	1.296		
	Total	334.218	261			
Household size	Between groups	10.774	3	3.591	3.125	.033
	Within groups	66.646	58	1.149		
	Total	77.419	61			
Type of building structure	Between groups	0.894	2	0.447	0.345	.710
	Within groups	76.525	59	1.297		
	Total	77.419	61			
Accommodation type	Between groups	2.147	2	1.073	0.841	.436
	Within groups	75.273	59	1.276		
	Total	77.419	61			
The number of employed individuals	Between groups	11.898	4	2.975	2.588	.046
	Within groups	65.521	57	1.149		
	Total	77.419	61			
Level of education	Between groups	13.248	4	3.312	2.504	.045
	Within groups	197.090	149	1.323		
	Total	210.338	153			

as paper, cartons, and plastic at work. As a result, the number of recyclables is inversely related to the number of employed individuals.

The significant relationship (.045) between the education level and the number of recyclables seems logical as households with more educated individuals generate more recyclable trash like paper, cartons, etc., compared to families with fewer educated members. But when the level of education is greater than a bachelor's degree, the number of recyclables decreases, which is most likely because people with higher education pay more attention to reducing waste (as shown in Supplemental Table 3 in Online Resource).

Chi-square test

H1. There seems to be a significant difference between the knowledge of solid waste management and the presence of plastic in the composition of solid waste.

Table 5 indicates the results of the significance level between the knowledge of solid waste management and the presence of plastic in the composition of solid waste.

In this study, no difference was observed between people with different levels of environmental knowledge and generated plastic. As shown in Table 5, there is no relationship between generated plastic and concerns about solid waste management (sig. = .746). The insignificant relationship between the knowledge of solid waste management and the presence of plastic can be related to the individuals' lack of responsibility for environmental issues.

H2. It seems there is a significant difference between the independent variables of monthly household income, age, household size, building structure, accommodation type, the number of employed individuals, and education level with the presence or absence of food waste. Table 6 shows the results of the significance level between the presence or absence of food waste and the independent variables under study.

Table 4. The results of the statistical tests between the number of non-recyclables and the independent variables under study in Farahzad in 2020.

PARAMETER	NON-RECYCLABLES					
		SUM OF SQUARES	DF	MEAN SQUARE	*F*	SIG
Income	Between groups	0.178	3	0.059	0.160	.923
	Within groups	20.805	56	0.372		
	Total	20.983	59			
Age	Between groups	0.381	4	0.095	0.139	.968
	Within groups	176.260	257	0.686		
	Total	176.461	261			
Household size	Between groups	0.265	3	0.088	0.238	.869
	Within groups	20.719	56	0.370		
	Total	20.983	59			
Type of building structure	Between groups	0.484	2	0.242	0.673	.514
	Within groups	20.499	57	0.360		
	Total	20.983	59			
Accommodation type	Between groups	0.471	2	0.236	0.655	.524
	Within groups	20.512	57	0.360		
	Total	20.983	59			
The number of employed individuals	Between groups	1.240	4	0.310	0.864	.492
	Within groups	19.743	55	0.359		
	Total	20.983	59			
Level of education	Between groups	2.782	4	0.696	1.019	.399
	Within groups	101.660	149	0.682		
	Total	104.442	153			

Table 5. The results of the statistical test between knowledge of solid waste management and the presence of plastic in the solid waste composition in Farahzad in 2020.

PLASTIC WASTE					
VARIABLE	LEVELS	GROUPS		PEARSON CHI-SQUARE	SIG
		X	P		
Knowledge of solid waste management	The person does not have waste management knowledge	2	3	1.229	.746
	The person somewhat has the knowledge of waste management	4	9		
	The person has a rather good knowledge of waste management	6	22		
	The person has complete knowledge of waste management	3	12		

X = Plastic was not present in the household waste composition.
P = Plastic was present in the household waste composition.

Table 6. The results of the statistical tests between the presence or absence of food waste and independent variables under study in Farahzad in 2020.

FOOD WASTE					
PARAMETER	LEVELS	GROUPS		PEARSON CHI-SQUARE	SIG
		X	P		
Income	Under 2 million Toman	9	34	4.497	.213
	2-4 million Toman	1	8		
	4-6 million Toman	1	6		
	Over 6 million Toman	2	1		
Age	19>	19	82	3.472	.482
	19-30	17	41		
	31-42	10	33		
	43-55	7	35		
	55<	5	13		
Number of household members	3>	2	6	3.078	.380
	3-4	4	27		
	5-6	5	12		
	7-8	2	3		
Gender	Male	27	101	0.185	.667
	Female	31	102		
Ownership	Owner	3	14	0.156	.693
	Tenant	10	35		
Type of building structure	Steel	7	37	3.681	.159
	Brick	2	7		
	Traditional	4	5		
Accommodation type	Apartment	3	19	1.900	.387
	Villa	10	28		
	Room	0	2		
The number of employed individuals	0	2	1	5.350	.253
	1	5	25		
	2	4	19		
	3	1	3		
	4	1	1		
Level of education	Postgraduate	2	5	17.034	.02
	Bachelor	11	9		
	High school	9	36		
	Elementary school-middle school	8	45		
	Illiterate	3	26		

X = Food waste was not present in the household waste composition.
P = Food waste was present in the household waste composition.

This research proved the variable of education level is effective for the presence of food waste. As Table 6 indicates, the only variable with a significant relationship with the presence of food waste was education levels (sig. = .02), which confirms that educated households pay more attention to reducing their food waste.

Discussion

Marquez et al believe there is a significant relationship between gender and solid waste generation.[20] However, in this research, no significant relationship between the independent variables of gender and ownership type and the number of household solid wastes was found. Also, Xiao et al point out that home ownership has no significant relationship with solid waste generation.[8]

When it comes to the number of recyclable wastes in solid waste composition, the number of employed individuals in a household is an influential factor, which can be explained by a higher portion of generated recyclable trash like paper, cartons, and plastic in the workplace. Hence, the number of recyclable wastes is inversely related to the number of employed individuals. However, the results of studies conducted by Monavari et al and Sankoh et al show there is a positive relationship between the number of employed individuals and the generated solid waste.[7,10]

Household size and education level are other influencing factors as, in small families, the amount of generated plastic increases. A study by Xiao et al explains the relationship by stating that small households consume more processed foods, which results in a higher level of recyclable trash like plastic and paper.[8] Big families, due to economic hardship, use less packaged goods and usually consume goods sold in bulk. As such, when households exceed 4 members, recyclable waste is reduced. Qu et al also showed a negative relationship between household size and generated solid waste per capita.[14]

Regarding education level (independent variable), households with higher education levels, generate more recyclable trash (such as paper, cartons, etc.). However, when the level of education is greater than a bachelor's degree, the number of recyclables decreases. This is most likely because the latter group pays more attention to reducing waste. In line with this, Sankoh et al confirm there is a relationship between education level and recyclable trash.[10]

Although in some studies, no relationship has been found between education level and solid waste,[8] in this research, the only variable affecting the presence of food waste in solid waste composition was education, in a way that educated households are likely to pay more attention to the reduction and prevention of solid waste generation, particularly food waste.

Despite Trang et al belief that there is a negative relationship between the knowledge of solid waste management and the generated plastic,[15] in this study, no significant relationship between plastic generation and concerns about solid waste management was shown, which can be related to the individuals' lack of responsibility to the environmental issues.

Conclusion

This research is the first study concerning solid waste composition in Farahzad, a neighborhood which faces several challenges in residential waste collection. Knowledge of factors influencing solid waste composition provides a robust ground for improved management, which help decision-makers better deal with the existing challenges and enhance residents' well-being. Insights toward understanding the physical and chemical composition of solid waste, along with its detailed and comprehensive examination, is necessary for the management system to reduce the volume of generated solid waste. Identification of parameters affecting waste generation is necessary for making better decisions regarding the installation of waste containers in Farahzad. With reference to the answers given to the questionnaires distributed in Farahzad, food wastes, by far, constitute the highest percentage of household solid waste composition, making it one main source of environmental pollution in the area. Education level has been recognized as a critical parameter affecting all waste elements (ie, organic waste and recyclables). Additionally, the amount of recyclable waste is affected by both family size and the number of employed individuals. As such, it can be concluded that educating citizens for better environmental behaviors and increasing their knowledge on the waste-relevant issues is the most important strategy in municipal waste management. Managers and decision-makers may use this insight to determine more effective policies for storing, collecting, and disposing of solid waste while considering different socio-economic groups. Complementary research on waste composition in this area, along with sampling, is suggested for future studies.

According to the findings of this study, the following suggestions are recommended:

- With reference to the high importance of waste management, appropriate policymaking is a fundamental priority. In line with this, it is also suggested to invest in approaches for attracting private sector collaboration, which also helps to empower the informal community.
- The solid waste management strategy in this area should focus on the management of organic and biodegradable solid waste, mainly because of its potential to affect solid waste leachate and gas produced.

Acknowledgements

Not applicable.

Author Contributions

Conceptualization was done by Dr. Mahdi Jalili Ghazizade. Material preparation, data collection, and analysis were performed by Shaghayegh Gharagozloo. The first draft of the

manuscript was written by Shaghayegh Gharagozloo and the other author commented on the previous version of the manuscript. All authors read and approved the final manuscript.

Ethical Approval

Not applicable.

Consent to Publish

We hereby declare our consent for the publication of identifiable details, which may include the photograph(s) and/or details within the text ("Materials"), in the Environmental Health Insights journal.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author, upon reasonable request.

Supplemental Material

Supplemental material for this article is available online.

REFERENCES

1. EPA. *Code of Federal Regulations, Title 40 (Protection of Environment), Parts 260 to 265*. U.S. Government Publishing Office; 2018.
2. Teferi SC. The status of household solid waste management and its associated factors in Fiche Town, North Shewa Zone, Ethiopia. *Environ Health Insights*. 2022;16:1-7.
3. Kaza S, Yao L, Bhada-Tata P, Van Woerden F. *What a Waste 2.0*. World Bank; 2018.
4. UN-HABITAT. *Solid Waste Management in Cities*. United Nations Human Settlements Program; 2010.
5. Jadoon A, Batool SA, Chaudhry MN. Assessment of factors affecting household solid waste generation and its composition in Gulberg Town, Lahore, Pakistan. *J Mater Cycles Waste Manag*. 2014;16:73-81.
6. Jamialahmadi N, Hashemi M, Jalili Ghazizade M. Assessment of the current municipal solid waste management system in Tehran, Iran: challenges and opportunities for sustainable development. *J Mater Cycles Waste Manag*. 2022;24:2054-2067.
7. Monavari SM, Omrani GA, Karbassi A, Raof FF. The effects of socioeconomic parameters on household solid-waste generation and composition in developing countries (a case study: Ahvaz, Iran). *Environ Monit Assess*. 2012;184:1841-1846.
8. Xiao L, Lin T, Chen S, Zhang G, Ye Z, Yu Z. Characterizing urban household waste generation and metabolism considering community stratification in a rapid urbanizing area of China. *Househ Waste Gener Metab*. 2015;10: e0145405.
9. Bandara NJGJ, Hettiaratchi JPA, Wirasinghe SC, Pilapiiya S. Relation of waste generation and composition to socio-economic factors: a case study. *Environ Monit Assess*. 2007;135:31-39.
10. Sankoh FP, Yan X, Conteh AMH. A situational assessment of socioeconomic factors affecting solid waste generation and composition in Freetown, Sierra Leon. *JEP*. 2012;3:563-568.
11. Khan D, Kumar A, Samadder SR. Impact of socioeconomic status on municipal solid waste generation rate. *Waste Manag*. 2016;49:15-25.
12. Vieira VHADM, Matheus DR. The impact of socioeconomic factors on municipal solid waste generation in São Paulo, Brazil. *Waste Manag Res*. 2018;36: 79-85.
13. Suthar S, Singh P. Household solid waste generation and composition in different family size and socio-economic groups: a case study. *Sustain Cities Soc*. 2015;14:56-63.
14. Qu XY, Li ZS, Xie XY, Sui YM, Yang L, Chen Y. Survey of composition and generation rate of household wastes in Beijing, China. *Waste Manag*. 2009;29:2618-2624.
15. Trang PTT, Dong HQ, Toan DQ, Hanh NTX, Thu NT. The effects of socio-economic factors on household solid waste generation and composition: a case study in Thu Dau Mot, Vietnam. *Energy Proc*. 2017;107:253-258.
16. Afroz R, Hanaki K, Tudin R. Factors affecting waste generation: a study in a waste management program in Dhaka city, Bangladesh. *Environ Monit Assess*. 2011;179:509-519.
17. Vetter-Gindele J, Braun A, Warth G, Bui TTQ, Bachofer F, Eltrop L. Assessment of household solid waste generation and composition by building type in Da Nang, Vietnam. *Resources*. 2019;8:171.
18. Kheiroddin R, Salahimoghadam A. The empowerment of informal settlement by Moving from the need-based to asset-based approach; (case study of Farahzad, one of the Tehran's neighborhood). *Qtly J Urban Reg Dev Plan*. 2021;6:29-58.
19. Farnahad Consulting Engineers. Report on identification and analysis of demographic and ethnic studies in the Farahzad neighborhood. Office of Farahzad Renovation Services. Accessed summer 2015; (in Persian).
20. Márquez MY, Ojeda S, Hidalgo H. Identification of behavior patterns in household solid waste generation in Mexicali`s city: study case. *Resour Conserv Recycl*. 2008;52:1299-1306.
21. Ojeda-Benítez S, Vega CAD, Marquez-Montenegro MY. Household solid waste characterization by family socioeconomic profile as unit of analysis. *Resour Conserv Recycl*. 2008;52:992-999.
22. Musa E, Ho GE. Optimum sample size in refuse analysis. *J Environ Eng Div*. 1981;107:1247-1259.
23. Ugwu CO, Ozoegwu CG, Ozor PA. Solid waste quantification and characterization in university of Nigeria, Nsukka campus, and recommendations for sustainable management. *Heliyon*. 2020;6:e04255.
24. Liu C, Wu X. Factors influencing solid waste generation in China: a multiple statistical analysis study. *Waste Manag Res*. 2010;29:371-378.
25. Bazargan A, Sarmad Z, Hejazi A. *Methods of research in behavioral sciences*. Agah Publishing; 1997 (in Persian).