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Impact of Socio-economic Profile on Municipal Solid waste Generation: A Study of Baramulla district of Jammu & Kashmir, India

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ABSTRACT

Municipal Solid Waste Management is one of the major environmental challenges in most of the cities of the developing countries like India. Economic development, improved standard of living and urbanization have led to an increase in the quantity and complexity of the waste produced. Environmental sustainability demands proper Municipal Solid waste management system. MSWM is a public service, providing citizens with a system of disposing off their waste in an environmentally sound and economically feasible way. The current study examines the generation of municipal solid waste based on several socioeconomic factors such as education, occupation, family income, and the number of family members. The socioeconomic stratification was based on Kupuswamy's Socioeconomic Status Scale 2020 (SES), which divides a society into five socioeconomic groups: higher socioeconomic group (HSEG), upper middle socioeconomic group (UMSEG), middle socioeconomic group (MSEG), lower middle socioeconomic group (LMSEG), and lower socioeconomic group (LSEG). In Baramulla Town (Study area), a questionnaire survey was done to identify the various socio-economic classes, and ten families from each class were chosen randomly and the solid waste generated by them was quantified. The paper revealed that the Middle socioeconomic category was found to be generating the maximum garbage (581g/c/d). The study also showed that biodegradable waste comprised of the major share (57%), in all the four income groups. The study is the first of its kind in the sample area and provides insights on the role of various socioeconomic parameters on the generation of household waste.

Introduction

The quality and quantity of Municipal Solid Waste (MSW) generated at any particular place varies according to the population characteristics like socio-economic status, cultural habits, population structure, income levels, etc. Economic development, urbanisation and improving living standard in cities of developing countries have led to increase in the quantity of complex composition of MSW. Baramulla, a district from the Kashmir valley as part of the developing country is a very beautiful region of J&K. The rate at which MSW is generated here may destruct the scenic beauty and fragile ecosystems of the region. It is prudent to know the composition and amount of waste generation for effective planning, designing and operation of municipal waste management system.

The main purpose of this study is to identify the different socioeconomic groups in the study area based on some selected socioeconomic parameters and their impact on solid waste generation rate. Recently the generation of MSW has dramatically increased in the urban areas due to the increase in population, urbanization, and improved lifestyle. Globally, MSW generated in urban areas is about 3.5 million tons per day, which is expected to reach around 6.1 million tons per day by 2025 based on the World Bank prediction (The World Bank, 2019). Marcela Taušová , Eva Mihaliková et al , in 2020, highlighted the impact of factors like economy , awareness etc on the MSW generation and its management . Mohamad Noufal et al , 2019, studied factors influencing the waste generation rate and the waste composition and found that according to Pearson's

coefficient values, a positive correlation was found between household waste generation and monthly income (r = 0.626), household size (r = 0.37), and age of the household head (r = 0.517), whereas a negative correlation was found between household waste generation and the education level of the household head (r = −0.649).

This study is aimed to highlight the role of socioeconomic factors on the MSW generation rates in the study area. It is envisaged that the findings of the study will help in identifying a better management strategy for Baramulla town.

Review of literature

Roy and Deb (2013) in their study found that, the more the number of person living in the house, the more waste will be generated and might become difficult to manage. (Bhattarai, 2015). According to Suthar and Singh (2015), there is a substantial link between trash creation and the size of a household's family. The more a family is educated and aware of the negative consequences of improper trash management, the more they value efficient garbage management (Kayode and Omole, 2011)

Nkansah et al., 2015 also felt household size directly impacts the waste generation and positively influences the improved waste collection service among households. Hoornweg and Bhada-Tata (2012) found out that rapid increase of population, lifestyle modifications, income level are the factors of solid waste generation.

Gu et al. (2015) in his study found out that the higher education is not related with high level of awareness on environmental issues. Households participation in awareness campaign, training programs on waste management and recycling activities can help in the improving the waste management crisis.

No systemic and scientific work has been done so far to assess the quantity of waste generated and the effects of various socioeconomic factors on the generation of Municipal Solid wastes in the Baramulla town and to fill the gap, this study was conducted. The source of the waste collected were mainly the households of various wards of the town.

Materials and methods

Study area

Baramulla District is one among 22 districts of Jammu & Kashmir state, India. It is located 55 KM east towards state capital Srinagar located at latitude-34°.2", Longitude-74°.3". (Fig. 1). The population of the district is 1015503 (Census 2011) that makes it 04th largest district in the state by population. Baramulla district occupies an area of approximately 4190 square kilometres. It's in the 1589 meters to 1577 meters elevation range. The town was earlier known as *Varahamulla* which is Sanskrit for "boar's molar". The town of Baramulla is located on the banks of the river Jhelum (a tributary of Sindh). The present study was carried out within the Municipal Limits of Baramulla Town, with a which is divided into twenty-six wards which are categorized into five zones (From A-E). (Fig. 2)

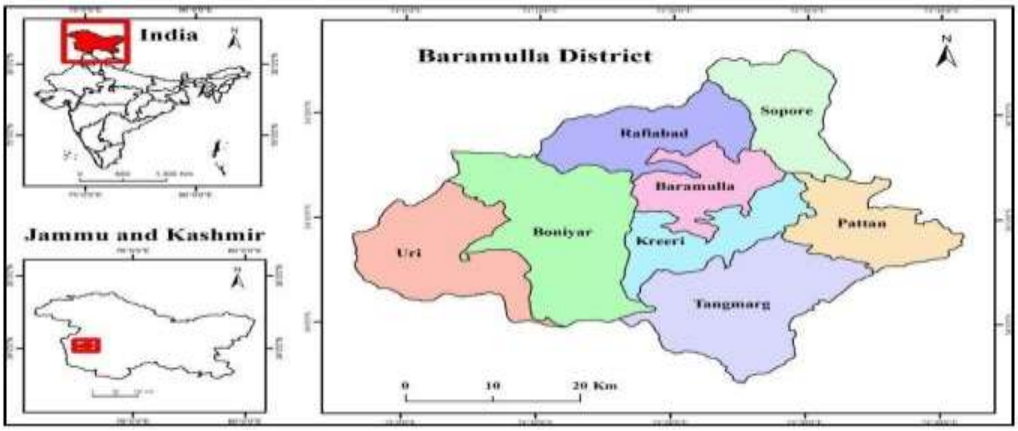

Fig 1: Map of Baramulla

Socioeconomic Scale [SES]

The SES use for the present study is Modified Kuppuswamy socioeconomic scale updated for the year 2020 .The most widely used and popular scale in our country is "Modified Kuppuswamy SES'. The scale was initially developed by Kuppuswamy in the year 1976 including index parameters like education, occupation, and total income which was further modified in later years to include head of families' educational status, occupational status and overall aggregate income of the whole family, collected from all sources. The total score of Kuppuswamy SES ranges from 3-29 and it classifies families into 5 groups, higher socioeconomic group (HSEG), upper middle socioeconomic group (UMSEG), Middle Socioeconomic Group (MSEG), Lower middle socioeconomic group (LMSEG) and Lower Socioeconomic group (LSEG). The parameters selected to assess the socioeconomic status of the study area are family income, education and occupation. These parameters

were given score in descending order from 12 to 1 in the case of per capita income, 7 to 1 in the case of education and 10 to 1 in the case of occupation. The scoring pattern adopted for this study is consistent with the previous researches (Kumar et al., 2012, 2007).The scores assigned to these three variables were pooled in together to a composite index and classified into 5 different classes to denote 5 different socio economic groups

Fig 2: Zones in Baramulla Town

The sample population of 460 persons was taken up for this research, which was estimated on the basis of Cochran's Formula, developed by William Cochran in 1963. The data collected with comprehensive questionaries, interviews and above all from door to door MSW collection, was assorted according to its contents and was analyzed by the Quantitative and Qualitative data analysis approaches.

Table 1: socio-demographic profile of the respondents.

S.NO.	Occupation/Educational Qualification/Family income	SCORE
	Occupation	
1	Profession (Doctors, Engineers, Advocates)	10
2	Semi-profession(School Teachers, Group A & B Government Employees, Private Sector Employees)	6
3	Clerical, shop owner, farmer	5
4	Skilled worker	4
5	Semi-skilled worker	3
6	Unskilled worker	2
7	Unemployed	1
	Educational Qualification	
1	Professional degree/PG & above	7
2	Bachelor/graduate	6
3	Intermediate or XII	5
4	High school	4
5	Middle school certificate	3
6	Primary school certificate	2
7	Illiterate	1
	Family income	
1	>/1,99,862	12
2	99,931–199,861	10
3	74,755 –99,930	6
4	49,962–74,755	4
5	29,973– 49,961	3
6	10,002–29,972	2
7	≤ 10,001	1

Table 2 : Total score for measuring SES(Kuppuswamy's socio-economic status scale 2020)

S. No.	Score
1(HSEG)	26-29
2(UMSEG)	26-25
3(MSEG)	11-15
4(LMSEG)	5-10
5(LSEG)	<5

Methodology

At the initial stage of this study, a questionnaire survey was carried out in one hundred (100) households of different administrative wards within the area of municipality to get primary data about their income and other information required for this study such as number of household members, education level, and profession of the head of the family. Based on the survey of 100 households, 50 households were selected which represents the overall socioeconomic status of the study area. In these households , total sampled population was 460 persons. This estimation was done in accordance with the Cochran's formula given by William Cochran in 163, in his book " the sampling techniques "

Cochran's Formula

$$no = \frac{Z^2 \times P\,(1-P)}{e^2}$$

where

no = Sample Size

Z = Confidence level

P = proportion of population

e = margin of Error

$$n = \frac{n_o \times N \text{ [for known popln]}}{n_o + (N-1)}$$

where

n = Sample Size of known population

n_o = proportion of unknown popln.

N = known popln size.

The households were selected were from wards I,III,V,VII and IX of Baramulla Town. Variation in income level, number of family members and occupation were considered for the selection of households for this study. The Municipal solid Waste samples were collected, from ten families from each socioeconomic class of Baramulla Town, the study area, on monthly basis from October 2019 to January 2020. In all, total 50 samples were collected. Each sample house was provided with two oxo- Biodegradable bags of 5kg capacity for the collection of Biodegradable or wet waste and the Dry waste, which included the inert inorganic and plastics, paper and glass (recyclable waste). Before collection, the respondents were explained about the nature of these kinds of wastes and they were made aware by giving examples and practical demonstrations by the author at their households. The sample bags were collected, after the period of 24hrs, labelled on spot, transported and then weighed collectively and individually and manually segregated into different categories, as per the guidelines in Solid Waste Management Rules, 2016. The digital weighing machine was used for measurement of the waste generated.

Results and discussion

The estimation of the Municipal solid waste generated by different socioeconomic groups are summarized in Tables 1,2,3,4 and 5 with the mean values. An essential preliminary step in MSWM is the accurate estimation of the generation rate of Municipal solid waste and its composition. A number of socioeconomic parameters affect the quantity of solid waste generated per day. These include education level, profession and income of head of the family. Figure 3 presents the overall average municipal waste generation in different socio economic group.

Table 1. : Lower socioeconomic group **(LSEG).** *(Average per capita per day MSW generation)*

Sample Number	No. of family members	Waste Generation per day (in gms)				
		OCT-2019	**NOV-2019**	**DEC-2019**	**JAN -2020**	**AVERAGE**
I	07	280	325	310	350	316
II	08	287	309	340	390	332
III	04	278	320	335	360	323
IV	05	276	330	345	325	319
V	07	270	335	330	350	321
VI	06	267	343	345	340	324
VII	10	278	325	350	390	336
VIII	11	268	319	348	410	336
IX	07	275	320	350	380	331
X	07	280	345	370	400	349
Total	**72**					
Average : 329gm/c/d						

Table 2: Lower middle socioeconomic group **(LMSEG).** *(Average per capita per day MSW generation)*

Sample Number	No. of family members	Waste Generation per day (in gms)				
		OCT-2019	**NOV-2019**	**DEC-2019**	**JAN -2020**	**AVERAGE**
I	7	390(gms)	340	360	410	375

II	6	355	380	370	420	381
III	10	390	350	410	430	295
IV	9	380	370	430	480	415
V	11	410	430	450	500	448
VI	12	410	418	440	510	445
VII	11	400	410	390	505	426
VIII	9	390	380	410	520	425
IX	8	380	410	440	490	430
X	10	405	440	450	510	451
Total	**93**					

Average : 409g/c/d

Table 3: Middle socioeconomic group **(MSEG).** *(Average per capita per day MSW generation)*

Sample number	**No. of family members**	**Waste Generation per day (in gms)**				
		OCT 2019	**NOV 2019**	**DEC 2019**	**JAN 2020**	**AVERAGE**
I	11	490	510	530	540	518
II	9	590	610	550	580	583
III	12	570	580	590	610	588
IV	10	610	620	530	590	588
V	8	490	550	590	615	561
VI	10	500	465	635	595	549
VII	13	610	620	650	605	621
VIII	8	590	550	430	610	545
IX	14	650	586	590	660	622
X	9	640	670	586	660	639
Total	**104**					

Table 4: Upper middle socioeconomic group **(UMSEG).** *(Average per capita per day MSW generation)*

Sample number	**No. of family members**	**Waste Generation per day (in gms)**				
		OCT-2019	**NOV-2019**	**DEC-2019**	**JAN -2020**	**AVERAGE**
I	8	520(gms)	530	550	560	540
II	10	530	610	540	595	569
III	11	550	590	610	615	591
IV	13	590	540	515	660	576
V	14	610	630	490	510	560
VI	10	620	590	560	570	585
VII	9	509	570	550	620	562
VIII	11	610	496	570	615	573
IX	12	590	560	610	630	598
X	13	590	495	570	615	568
Total	**111**					

Average : 572gm/c/d

Table 5: Higher socioeconomic group **(HSEG)**

Sample	No. of family members	Waste Generation per day (in gms)				
		OCT-2019	**NOV-2019**	**DEC-2019**	**JAN -2020**	**AVERAGE**
I	9	530	540	560	595	556
II	7	494	580	520	560	539
III	6	515	520	490	600	531
IV	8	540	530	560	505	534
V	10	560	586	525	575	562
VI	5	605	510	610	550	569
VII	8	540	550	615	620	581
VIII	7	496	510	530	550	522
IX	11	494	545	565	580	471
X	9	485	565	570	625	561
Total	**80**					
		Average : 543g/c/d				

Figure 3 shows the overall waste generated by different socioeconomic groups in grams per capita per day. It is evident from the tables and the figure that the highest per capita municipal solid waste generation was that of the Middle socioeconomic group (MSEG) and was estimated to be 581g/c/d, followed by Upper Middle Socioeconomic Group (572g/c/d) and Higher Socioeconomic group (543 g/c/d). The higher rate of MSW generation in Middle socioeconomic Group can be attributed to more number of the individuals in a family and more consumption. Moreover, the lesser generation of MSW from the Higher Socioeconomic Group is due the employment status and the job profile of the said group. Mostly the people in HSEG are either government officials or have their own business setups, so are engaged in outdoor activities during the day time.

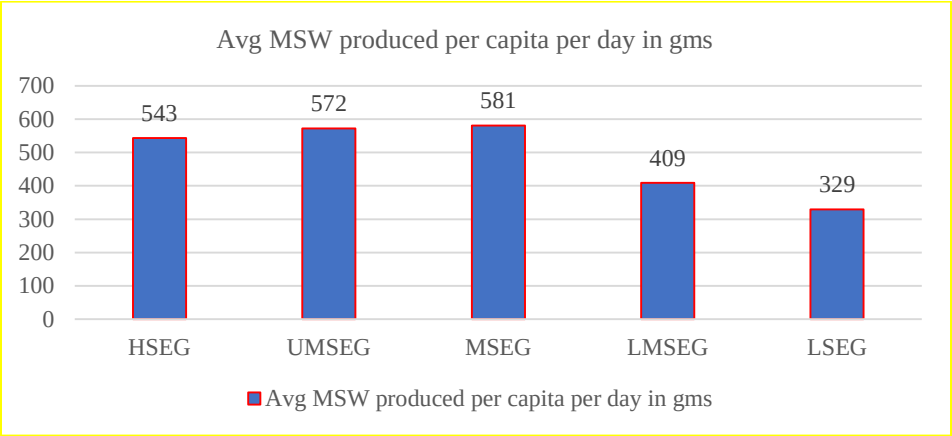

Fig 3: Average MSW production by different socioeconomic groups

Figure 4 indicates the comparative physical composition of MSW (% by weight) in different socioeconomic groups. It is evident that the major content of the waste generated is biodegradable in nature. A pertinent observation is that HSEG generates most of the recyclable waste that includes plastics etc and this is due their lifestyles which includes more use of packed materials. Various researchers (Suthar and Singh, 2015; Monavari et al., 2012) also reported similar findings i.e., food/kitchen waste is the major constituent of the generated household wastes.

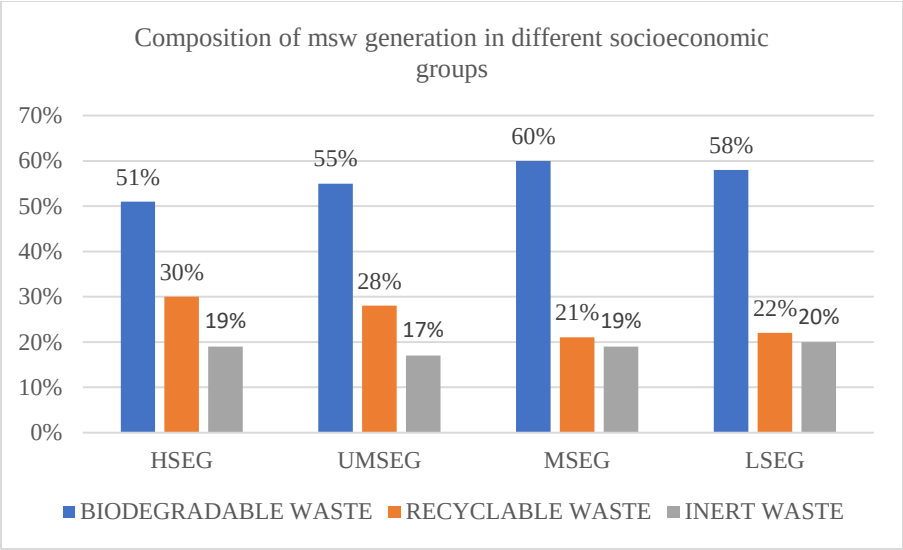

Fig 4: Composition of MSW in different socioeconomic groups

Conclusion

The most crucial step in building a dependable waste management plan is to have a thorough grasp of the types and quantities of garbage that must be managed. It's also vital to assess present solid waste management practices in order to pinpoint the issue and forecast future outcomes. This research made an attempt to advance in that direction. The pace and mix of municipal solid trash generation were shown to be closely related to a number of socioeconomic factors in the community. According to the findings of this study, the MSEG (middle socioeconomic groups) generated the most solid waste. According to the survey, the average amount of garbage generated per capita per day in the municipality of Baramulla was 490 g/capita/day. More detailed analysis of the influence of family members' socio-demographic profiles on waste generation and composition will help to quantify the types of wastes generated more accurately in the future, because family has a profound and long-lasting influence on its members' consumption, waste generation, and disposal behaviours. According to the provisions stated in the proposed MSW (Management and Handling) Rules, 2016, for improved and comprehensive MSW management, monitoring of creation, transportation, and disposal, as well as assessment of physical and chemical characteristics of the
waste, is required.

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