



Household Solid Waste Management and Environmental Perception in Urban Areas of Ecuador

Gestión de residuos sólidos domiciliarios y percepción ambiental en zonas urbanas de Ecuador

Daniel Oswaldo Ramírez Guevara¹  

¹ Instituto Sapiens de Investigación Científica Multidisciplinar. Milagro, Ecuador.

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Corresponding Author: Daniel Oswaldo Ramírez Guevara 

ABSTRACT

Solid waste management represents one of the main environmental and urban challenges in Ecuador due to population growth, urban expansion, and increasing household consumption. The aim of this study was to analyze household solid waste generation, waste handling and disposal practices, as well as residents' perceptions and levels of environmental awareness in an urban sector of Ecuador. The research was conducted using a quantitative, descriptive, and cross-sectional approach through the application of structured surveys to randomly selected households. The results showed that organic waste constituted the largest proportion of daily generated waste, followed by plastic, paper, and cardboard. In addition, households with a greater number of members generated larger amounts of solid waste. Although most participants recognized the negative effects of improper waste disposal on the environment and public health, limited practices of waste separation and recycling were identified among households. The study also found that educational level positively influenced environmental attitudes and the adoption of sustainable practices. The findings suggest the need to strengthen environmental education, improve municipal waste collection systems, and promote community recycling programs in order to advance toward integrated and sustainable solid waste management in Ecuador. Effective collaboration between local authorities and citizens is essential to reduce environmental pollution, improve urban living conditions, and encourage long-term sustainability practices within communities.

Keywords: solid waste, recycling, environmental education, sustainability.

RESUMEN

La gestión de residuos sólidos representa uno de los principales desafíos ambientales y urbanos en Ecuador debido al crecimiento poblacional, la expansión de las ciudades y el aumento del consumo doméstico. El presente estudio tuvo como objetivo analizar la generación de residuos sólidos domiciliarios, las prácticas de manejo y disposición final, así como las percepciones y niveles de conciencia ambiental de los habitantes de un sector urbano ecuatoriano. La investigación se desarrolló bajo un enfoque cuantitativo, descriptivo y transversal, mediante la aplicación de encuestas estructuradas a hogares seleccionados aleatoriamente. Los resultados evidenciaron que los residuos orgánicos constituyen la mayor proporción de los desechos generados diariamente, seguidos por plástico, papel y cartón. Además, se identificó que los hogares con mayor número de integrantes producen mayores cantidades de residuos sólidos. Aunque la mayoría de los participantes reconoció los efectos negativos de la mala disposición de basura sobre el ambiente y la salud pública, se observó una limitada práctica de separación y reciclaje en los hogares. También se determinó que el nivel educativo influye positivamente en las actitudes ambientales y en la adopción de prácticas sostenibles. Los resultados permiten concluir que es necesario fortalecer la educación ambiental, mejorar los sistemas municipales de recolección y promover programas de reciclaje comunitario para avanzar hacia una gestión integral y sostenible de los residuos sólidos en Ecuador.

Palabras clave: residuos sólidos, reciclaje, educación ambiental, sostenibilidad.

INTRODUCTION

Solid waste management constitutes one of the main environmental and public health challenges in developing countries, due to rapid urban growth, increased consumption, and the technical and financial limitations of local governments to guarantee adequate waste management (Sharma & Jain, 2020; Abubakar et al., 2022). Globally, municipal solid waste generation continues to increase steadily as a consequence of demographic expansion and changes in production and consumption patterns (Nanda & Berruti, 2021). This problem especially affects Latin American cities, where a large part of the waste is still deposited in open dumps or managed through insufficient collection and final disposal systems, causing soil, water, and air pollution, as well as risks to human health (Zambrano-Monserrate et al., 2021).

In Ecuador, solid waste generation represents a growing concern for environmental and municipal authorities (Solíz Torres, 2015). According to information from the National Institute of Statistics and Censos and the Ministry of the Environment, Water and Ecological Transition, thousands of tons of municipal solid waste are generated daily in the country, of which a significant proportion corresponds to organic waste from households, markets, and commercial activities (Oña-Serrano et al., 2021). The increase in urban population and the expansion of cities have caused greater pressures on waste collection, transport, and final disposal systems, especially in municipalities with budgetary and technological limitations (Villalba Ferreira et al., 2022).

Although in recent years Ecuador has strengthened policies related to integrated solid waste management and the circular economy, difficulties associated with source separation, recycling, and proper waste disposal still persist (Alcocer Quinteros et al., 2020). In numerous urban and peri-urban sectors, it is common to observe waste accumulation in public spaces, informal waste burning, and improper disposal in water bodies or vacant lots. These practices generate negative impacts on the environment and favor the proliferation of disease vectors, bad odors, and visual pollution (Abubakar et al., 2022).

In rapidly growing Ecuadorian cities, such as Guayaquil, Quito, Cuenca, and other cantonal capitals, the increase in solid waste generation has forced decentralized autonomous governments to implement recycling strategies, awareness campaigns, and differentiated collection programs (Villalba Ferreira et al., 2022). However, the results still show significant challenges related to service coverage, operational efficiency, and household participation in waste separation (Alcocer Quinteros et al., 2020).

Adequate solid waste management not only contributes to environmental protection but also favors sustainable development, public health, and resource recovery through reuse and recycling processes (Asefi et al., 2020). In this context, it is necessary to analyze waste management practices at the household level, as well as the perceptions, knowledge, and attitudes of the population regarding this issue. Understanding these aspects allows for the identification of weaknesses and opportunities to strengthen public policies and environmental education programs aimed at improving integrated solid waste management in Ecuador (Debrah et al., 2021).

METHODS

The present research was developed under a descriptive and cross-sectional quantitative approach, aimed at analyzing household solid waste management and the environmental perceptions of the inhabitants of an urban area in Ecuador. The study allowed for the identification of waste generation characteristics, disposal and separation practices, as well as the level of knowledge and environmental awareness of the population regarding the proper management of solid waste.

The study area corresponded to an urban sector of the selected canton, characterized by rapid population growth and high household waste generation. The selection of the site was made considering the presence of problems related to waste accumulation, collection deficiencies, and limited citizen participation in recycling and source separation activities.

The population consisted of households located within the urban study area. To determine the sample, a simple random probability sampling was applied, using a 95% confidence level and a 5% margin of error. Permanently inhabited dwellings whose residents voluntarily agreed to participate in the research were included.

The main data collection technique was the structured survey, administered to the representatives of each selected household. The instrument consisted of closed-ended and multiple-choice questions related to the quantity and type of waste generated, collection frequency, final disposal methods, recycling practices, knowledge about environmental impacts, and citizen perception regarding municipal solid waste management.

Prior to final administration, the questionnaire underwent content validation through expert review in environmental issues and solid waste management, with the purpose of ensuring the clarity, relevance, and coherence of the questions. In addition, a pilot test was conducted with a small group of participants to identify potential comprehension difficulties and make the necessary adjustments.

Data collection was carried out through home visits conducted during a previously established period. Participants were informed about the research objectives, and the confidentiality of the obtained information was guaranteed. Participation was completely voluntary, and ethical principles related to informed consent and responsible data management were respected.

For data analysis, descriptive statistics were employed, using frequencies, percentages, averages, and comparative tables to interpret the obtained results. The data were organized and processed using spreadsheets and statistical software, allowing the identification of behavioral patterns and relationships between variables such as educational level, household size, environmental practices, and solid waste generation.

Finally, the obtained results were interpreted considering the environmental and urban context of Ecuador, with the purpose of generating useful information to strengthen environmental education, recycling, and comprehensive solid waste management strategies at the local level.

RESULTS

The obtained results evidenced that household solid waste generation constitutes an important environmental problem within the studied urban area. The majority of the surveyed households reported generating waste daily, with organic waste from food scraps predominating, followed by plastics, paper, and cardboard. Likewise, a limited practice of source separation and low participation in recycling activities were observed.

In relation to household size, it was identified that homes with a larger number of members generated greater amounts of solid waste per day. Households consisting of five or more people presented the highest waste production values, especially organic waste.

Table 1. Average solid waste generation according to the number of household members

Number of members	Average waste generated (kg/day)	Predominant waste type
1-2 people	1,2	Organic
3-4 people	2,4	Organic and plastics
5-6 people	3,7	Organic
More than 6 people	4,5	Organic and paper

The results also showed that the municipal collection service has frequent coverage in most urban sectors; however, part of the population expressed dissatisfaction due to delays, temporary accumulation of garbage, and scarce waste sorting during collection.

Regarding waste separation practices in households, it was determined that a considerable proportion of participants do not perform prior sorting before discarding garbage. Only a small group indicated separating recyclable materials such as plastic, cardboard, and glass.

Table 2. Citizen perception of the waste collection service

Service perception	Frequency	Percentage (%)
Excellent	18	12%
Good	64	43%
Fair	49	33%
Poor	19	12%
Total	150	100%

Table 3. Solid waste separation practices in households

Practice performed	Frequency	Percentage (%)
Always separates waste	28	19%
Sometimes separates waste	47	31%
Never separates waste	75	50%
Total	150	100%

Regarding the level of environmental knowledge, the majority of respondents recognized that improper waste disposal generates environmental pollution and affects public health. Participants identified the proliferation of insects, bad odors, river pollution, and the presence of respiratory and gastrointestinal diseases as the main consequences.

Table 4. Knowledge about environmental impacts caused by solid waste

Identified impact	Frequency	Percentage (%)
Environmental pollution	132	88%
Diseases	119	79%
Unpleasant odors	110	73%
Water pollution	96	64%
Proliferation of insects and rodents	125	83%

In addition, it was observed that participants with a higher educational level presented a more favorable attitude toward recycling and environmental protection. Households with secondary and university education reported greater participation in waste reuse and reduction activities. Finally, the results reflected that there is public interest in receiving training on comprehensive solid waste management and community recycling programs. The majority of respondents considered greater municipal intervention necessary through environmental education campaigns, the installation of differentiated containers, and the strengthening of urban recycling programs.

DISCUSSION

The obtained results evidence that household solid waste management continues to represent a major challenge in urban areas of Ecuador, especially due to the increase in waste generation associated with population growth and changes in consumption patterns. The predominance of organic waste found in households coincides with studies conducted in different cities of developing countries, where biodegradable waste constitutes the largest proportion of municipal solid waste. This situation demonstrates the existence of a high potential to implement recovery strategies such as composting and organic recycling.

The identified relationship between household size and the amount of waste generated reflects that the increase in the number of inhabitants directly influences daily waste production. Households with more members generate larger volumes of waste due to the increase in domestic activities and product consumption. This behavior has been reported in previous research conducted in similar urban contexts, where population density constitutes one of the determining factors in municipal solid waste generation.

Regarding the perception of the collection service, although a considerable part of the participants rated the service as good, there is still a significant percentage of citizens who expressed dissatisfaction due to problems related to delays, garbage accumulation, and operational deficiencies. These results reflect the limitations faced by municipal governments in ensuring efficient and sustainable coverage of the collection service, particularly in cities with rapid urban growth and limited resources.

The results also showed a low rate of household waste separation, which represents a major obstacle to strengthening recycling and circular economy programs. The lack of source separation limits the potential for recovering reusable materials and increases the volume of waste destined for final disposal. This situation may be attributed to insufficient environmental education campaigns, limited recycling infrastructure, and low community participation in environmental initiatives.

Nevertheless, most respondents recognized the negative impacts of improper solid waste disposal, particularly regarding environmental pollution, vector proliferation, and public health effects. This finding indicates a basic level of environmental awareness among the population; however, this knowledge does not always translate into proper waste management practices. This gap between environmental knowledge and behavior has been highlighted in various studies on sustainability and solid waste management.

Furthermore, educational attainment influenced the environmental attitudes and practices of the participants. Households with higher educational levels exhibited a more favorable disposition toward recycling and waste reduction, confirming the importance of environmental education as a fundamental tool for promoting behavioral changes and strengthening citizen participation in sustainable waste management.

These results suggest that implementing permanent environmental awareness programs, alongside adequate source separation and selective collection systems, could significantly improve integrated solid waste management in Ecuadorian cities. Furthermore, strengthening public policies oriented toward recycling, composting, and community participation is essential to reduce the environmental impacts of inadequate waste disposal and transition toward more sustainable urban models.

CONCLUSIONS

Household solid waste management is a significant environmental and social challenge in urban areas of Ecuador, driven by the continuous increase in waste generation and limitations in management and final disposal systems. The study results identified that organic waste represents the largest proportion of household waste, followed by recyclable materials such as plastic, paper, and cardboard, highlighting the need to strengthen recovery and recycling strategies.

Household size directly influences the amount of waste produced, as households with more members generate higher daily waste volumes. Additionally, although a large portion of the population recognizes the importance of the municipal collection service, deficiencies in frequency, efficiency, and proper solid waste management persist.

The research also revealed limited source separation of waste, which hinders the development of efficient recycling and circular economy programs. Although participants demonstrated awareness of the negative impacts of improper waste disposal on the environment and public health, this knowledge is not consistently reflected in responsible waste management behaviors.

Conversely, educational attainment was positively associated with favorable environmental practices, highlighting the importance of environmental education and awareness as fundamental tools for promoting behavioral changes among citizens. Consequently, it is essential to strengthen educational campaigns, community recycling programs, and public policies oriented toward integrated solid waste management.

In conclusion, active public participation, combined with adequate municipal planning and the implementation of sustainable waste management strategies, is essential to reduce environmental pollution, improve urban quality of life, and transition toward a more sustainable development model in Ecuador.

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