

QUANTIFICATION AND DETERMINATION OF MUNICIPAL WASTE AND ITS RELATION TO HOUSEHOLD SIZE IN THE CZECH REPUBLIC

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Abstract

Municipal waste with more than 14 % share on total waste production in the Czech Republic plays important role. Understanding household waste sorting behaviour allows more effective design of municipal waste system in accordance with the waste hierarchy. This article focuses on determination and quantification of municipal waste generated at household in the Czech Republic and studies its relation to the family size. Waste generation and separation at source was measured on a 14day basis in households. Results of this study proved a significant relation between waste production and household size. One-member family produce more waste (plastics, mixed and biodegradable waste) than families with more members. This knowledge in combination with population structure will help municipality to better set up its waste collection system and develop a system that is suitable for the inhabitants based on the demographic segmentation.

Key words: waste composition; waste generation; family size; source-separation.

INTRODUCTION

Municipal solid waste is a long-term challenge for municipal authorities to face, especially due to the increasing pressure of the European Union on diversion of waste from landfill. In the Czech Republic, just 39 % of municipal solid waste (MSW) was reused or recycled in 2020, 13 % was recovered for energy consumption and 48 percent ended up in landfills. However, the priority of the Czech Republic are in the reverse order: waste prevention comes first, followed by reuse and recycling. Then follows energy recovery, and finally the landfill itself. The described situation was supported by the fact that the landfill ban was postponed from 2024 to 2030 and that the landfill fee remained unchanged for 12 years at CZK 500 per tonne of waste (*NKU*, 2022). Municipal waste with more than 14 % share on total waste production in the Czech Republic plays important role and households themselves can also make a significant contribution to waste reduction (*Suthar & Singh*, 2015). Understanding household waste separating behaviour is increasingly essential in waste collection planning and treatment strategies, and establishing policies toward a sustainable waste management system (*Abbasi et al.*, 2013; *Chen & Chang*, 2000). The aim of this study was to describe the household wastes (HW) generated by families of different sizes in order to identify the potential of the wastes for recycling.

MATERIALS AND METHOD

Data of household waste production were collected during 2021. Over 100 families were included in this experiment to measure their waste production at home. The experiment was designed on assessing of household waste production including recyclable waste based on 14-day period with repetition. Families in this experiment sorted municipal waste into 7 groups: paper, plastics, glass, TetraPak, metal, organic waste (BIO), municipal solid waste (MSW).

Produced waste was weighted using kitchen scale by each family and recorded by the end of day. After all repetitions, data were collected from households and entered in Excel form. Raw data were converted to unit 'kilogram per capita per year (kg/pc/yr)' in order to analyse the difference in waste production among different family size. Selected families were divided into 4 groups according to their size: one-member, two-member, three-member and four-member family. Data from these families were converted and compared based on production in kilograms per capita per year.



During the statistical analysis, the data were tested with the normal distribution by Shapiros *test (Shapiro & Wilk, 1965)*. The result has shown that variables of interest did not have normal distribution, therefore the non-parametric Kruskal-Wallis test for differences between those families was applied in our experiment (*Kruskal & Wallis, 1952*).

RESULTS AND DISCUSSION

The total of 115 families were involved in this experiment to measure their 2-week period waste production at home. Data from these families were converted and compared based on production in kilograms per capita per year to study the differences between them. Table 1 demonstrates the composition of household solid waste generated by different groups. One-member family produced in average 157 kg of municipal waste (MS) in total per capita per year according to this study. As compared with it, other sized families produced less MS in total. The same trend can be observed at level of particular waste types. All monitored waste types (plastics, glass, organic waste and MSW) except paper waste demonstrated a declining tendency in production with increasing number in family (**Chyba! Nenalezen zdroj odkazů**.). It suggests that multi-person family may generate less waste per person than family with single member (Fig. 3). This suggestion did not apply on paper waste, which's average production did not indicate a clear trend among families. The statistical results of Kruskal-Wallis test have shown similar signs. Waste types i.e. plastics, glass, organic waste and MSW demonstrated that multi-person families (2-4 members) had different waste production than one-person families (p<0.05). Again, paper waste did not prove significant difference between variously sized families (p=0.5062).

This connection between the waste generation and family size as one of the socioeconomic parameters is supported by other studies. For example, *Rawat & Daverey (2018)* have showed in their study that the amount of household waste produced per person declines as family size rises. *Monavari et al. (2012)* have proved that family size as one of the socioeconomic parameters beside income and education level has direct effect on household waste generation.

Due to their insufficient quantity and extreme values, Tetrapak and metals have been excluded from the overall statistical analysis and are depicted in a special chart (**Chyba! Nenalezen zdroj odkazů**.). The data so far demonstrate a similar trend as MSW in total or others, but Tetrapak and metals will need more data collection and evaluation to prove the significance.

Household	PAPER	PLASTICS	GLASS	BIO	MSW	TOTAL
 Members	_					(kg/capita/yr)
 One	9.54	11.97	28.02	47.67	60.10	157.29
Two	11.18	13.22	32.04	40.80	35.71	132.95
Three	13.30	10.92	18.01	37.16	39.37	118.76
Four	8.53	8.44	16.01	22.33	26.71	82.02

Tab. 1 Average waste production of municipal waste in families of different sizes





Fig. 1 Various type of municipal waste produced within differently sized families





Fig. 3 Total waste production compared within families with different number of members.



CONCLUSIONS

Results of this study proved relation between waste production and household size. It is a fundamental indicator for decision-making process to set up the waste system in the municipalities of the Czech Republic. Knowledge of population structure will help the municipality to better set up its waste system including logistics and the financial aspects. The authorities will have a better understanding of the waste situation and may implement a suitable system for the citizens according to the population structure. For the future studies, it is highly recommended to design a longer measuring time and include social – economic aspects into study.

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