ENVIRONMENTAL ASPECTS OF V4 HOUSEHOLD CONSUMPTION

Elena Hošková, Iveta Zentková

Slovak University of Agriculture in Nitra, Slovakia

As the standard of living rises, total household consumption increases. However, in addition to satisfying needs, high consumption also has negative consequences, one of which is environmental pollution. The main objective of this paper is to investigate how household consumption in the V4 countries affects the environment, particularly in terms of waste production. Household consumption is understood through expenditures on food and non-alcoholic beverages, alcoholic beverages, clothing and footwear, and household furniture and equipment. Descriptive statistics and regression analysis are employed for the analysis, using data from Eurostat covering the years 2004-2020. The results indicate that in all V4 countries, as expenditure on food and non-alcoholic beverages increases, household waste production also increases. Other monitored expenditures have varying impacts on waste production across different countries.

Keywords: household expenditures, household waste, consumer goods

Introduction

The negative consequences facing the planet – intensifying natural disasters, global warming, declining groundwater levels, deforestation, coral degradation, soil degradation, and changes in species diversity – underscore the necessity of reform in the agri-food complex (Kapsdorferová et al., 2023). In the global context of the bioeconomy, utilizing consumption-based measures is essential for effectively mitigating environmental impacts (Brizga and Räty, 2024). Providing food for a growing population while minimizing various environmental externalities is becoming a key topic in current sustainability debates (Galli et al., 2017; Caro et al., 2023). A more focused approach to individual policies will lead to better environmental outcomes. Different population groups within a country engage in consumption in ways that have varied environmental impacts (Ferreira et al., 2023). There is an urgent need to monitor mismanaged plastic waste resulting from household consumption (Wright et al., 2022).

As household incomes and living standards rise globally, the amount of high-value, small-waste household appliances that generate harmful e-waste increases annually (Liu et al., 2018). Solutions to the negative environmental impacts may include responsible sourcing of agricultural products, shifting from imports to domestic production, implementing environmental taxation, reducing demand by avoiding excessive calorie consumption, and minimizing food waste (Bozatli-Akca, 2023; Mancini et al., 2023; Matej et al., 2024; Song et al., 2015). Ideally, households would only generate unavoidable food waste – waste that is not considered edible – while avoiding the disposal of edible food, thereby mitigating the environmental impacts of food waste and reducing unnecessary consumer spending (Shaw et al., 2018). The results of the Nutrition, Health, and Environmental Sustainability Assessment could provide a basis for awareness campaigns targeting the population (Caro et al., 2023).

Consumers' attitudes towards consumption can be tracked through their expenditure patterns. Several studies have examined the impact of various factors on household spending, revealing significant potential for international expenditure surveys to quantify household plastic waste (Wright et al., 2022).

Numerous studies have investigated the relationship between household consumption and the amount of domestic waste produced. The quantity and composition of household municipal waste vary considerably among different socio-economic groups, with the highest waste generation occurring in higher-income groups, followed by middle and lower-income groups (Suthar-Singh, 2015). Rising living standards and urbanization rates are gradually increasing the consumption levels of urban dwellers. The increase in household municipal waste contributes to environmental degradation due to pollution and greenhouse gas emissions from waste management. Consumption-related waste is an integral part of municipal waste management (Baihui et al., 2024), and there is a strong correlation between household consumption and indirect waste generation (He et al., 2020).

Many studies addressing household expenditure focus on the impact of income or other factors, with few analysing the environmental consequences of consumption expenditures. This paper aims to investigate how household consumption in the V4 countries affects the environment.

Material and Methods

The data for the analysis were drawn from Eurostat for the period 2004–2020. Expenditures with a potential impact on the amount of waste produced by households were selected for analysis. Specifically, these expenditures included food and non-alcoholic beverages, alcoholic beverages, clothing and footwear, furniture, household equipment, and routine household maintenance. The following table provides an overview of the data used.

Descriptive analysis is employed to describe the data, while the impact of household expenditure on waste production is quantified using regression analysis. The regression function examining the relationship between "municipal waste quantity" and "total household consumption" demonstrates a direct linear dependence (Petrescu et al., 2022). A linear multivariate function is used:

$$y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4$$

where: y – dependent variable; a – local constant; b_{1-4} – regression coefficients; x_{1-4} – independent variables

Table 1   Variables

Variable names	Units of measuring	Source of the data
The share of expenditure on food and non-alcoholic beverages	%	https://doi.org/10.2908/nama_10_co3_p3
The share of expenditure on alcoholic beverages and tobacco	%	https://doi.org/10.2908/nama_10_co3_p3
The share of expenditure on household furniture and furnishings	%	https://doi.org/10.2908/nama_10_co3_p3
The share of expenditure on clothing and footwear	%	https://doi.org/10.2908/nama_10_co3_p3
Household waste	t	https://doi.org/10.2908/env_wasgen
Household waste	kg·capita·year^{-1}	https://doi.org/10.2908/env_wasgen
Expenditure on food and non-alcoholic beverages	mil. €	https://doi.org/10.2908/nama_10_co3_p3
Expenditure on alcoholic beverages and tobacco	mil. €	https://doi.org/10.2908/nama_10_co3_p3
Expenditure on household furniture and furnishings	mil. €	https://doi.org/10.2908/nama_10_co3_p3
Expenditure on clothing and footwear	mil. €	https://doi.org/10.2908/nama_10_co3_p3

The regression function of the dependence of household waste production on household expenditures has the form:

$$Q_i = a + b_1 E_{fn} + b_2 E_a + b_3 E_{cf} + b_4 E_{fhe}$$

where: Q_i – quantity of waste produced by households of the i-th country in tonnes; E_{fn} – expenditure of households of the i-th country on food and non-alcoholic beverages in million €; E_a – expenditure of households of the i-th country on alcoholic beverages in million €; E_{cf} – expenditure of households of the i-th country on clothing and footwear in million €; E_{fhe} – expenditure of households of the i-th country on furniture and household furnishings in million €

Results and Discussion

The needs of the population are met through consumption. Consumption can be expressed in units of quantity or price. Households' consumption is expressed in terms of price and is represented by their expenditure. Household expenditure can be viewed in many ways. We narrow the analysis to household expenditure on goods that could be environmentally relevant because of the potential production of waste. We therefore select expenditure on food and non-alcoholic beverages, expenditure on alcoholic beverages, expenditure on household furniture and furnishings, and expenditure on clothing and footwear.

Household Expenditure

Among the household expenditure items surveyed, expenditures on food and non-alcoholic beverages accounted for the highest share of total household expenditure in all V4 countries. In all countries except Poland, this expenditure showed an increasing trend over the period under review.

Poland had the highest average share at 19.411%, with a standard error of 0.385. The standard deviation was also the highest among the studied countries at 1.227 (see Table 2). The range of values was one of the highest observed. Expenditure on food and non-alcoholic beverages had the lowest share in 2018 and the highest in 2004. The distribution was flatter than normal, skewed to the right. Households in the Czech Republic reported the lowest average expenditure on food and non-alcoholic beverages at 15.389%, with a standard error of 0.312. The minimum share occurred in 2010, while the maximum was recorded in 2020. The distribution in this case was more peaked than normal, skewed to the left.

Expenditure on alcoholic beverages and tobacco was also a significant component of total household expenditure during the period under review. In the Czech Republic, this expenditure followed a slightly increasing trend, while Slovakia and Hungary exhibited a flat trend, and Poland showed a decreasing trend with more pronounced fluctuations in 2010, 2014, and 2018.

Households in the Czech Republic had the highest average share of total expenditure on alcoholic beverages at 7.833%, with a standard error of 0.156 (see Table 3). The distribution was flatter than normal and right-skewed, with a standard deviation of 0.469 and a range of values of 1.3. Deviations between

Table 2   Descriptive analysis – share of expenditure on food and non-alcoholic beverages (%)

Country	Czechia	Hungary	Poland	Slovakia
Mean	15.389	17.367	19.411	16.622
Standard Error	0.312	0.234	0.409	0.385
Median	15.300	17.300	19.400	16.300
Standard Deviation	0.936	0.702	1.227	1.155
Kurtosis	0.125	1.431	-1.390	4.668
Skewness	0.351	0.826	-0.196	2.062
Range	3.100	2.300	3.400	3.800
Minimum	14.000	16.500	17.600	15.600
Maximum	17.100	18.800	21.000	19.400
Confidence (95.0%)	0.719	0.539	0.943	0.888

Source: own calculations

Table 3   Descriptive analysis – share of expenditure on alcoholic beverages and tobacco (%)

Country	Czechia	Hungary	Poland	Slovakia
Mean	7.833	7.300	6.956	5.367
Standard Error	0.156	0.117	0.183	0.090
Median	8.000	7.300	7.000	5.500
Standard Deviation	0.469	0.350	0.550	0.269
Kurtosis	-0.623	-0.391	-1.158	1.635
Skewness	-0.821	-0.382	0.007	-1.273
Range	1.300	1.100	1.600	0.900
Minimum	7.100	6.700	6.200	4.800
Maximum	8.400	7.800	7.800	5.700
Confidence (95.0%)	0.361	0.269	0.423	0.207

Source: own calculations

Table 4   Descriptive analysis – share of expenditure on household furniture and furnishings (%)

Country	Czechia	Hungary	Poland	Slovakia
Mean	5.444	5.067	4.611	5.989
Standard Error	0.071	0.276	0.170	0.143
Median	5.400	4.900	4.300	6.000
Standard Deviation	0.213	0.829	0.509	0.428
Kurtosis	-1.206	0.448	-1.532	1.770
Skewness	0.349	0.995	0.313	-1.005
Range	0.600	2.600	1.400	1.500
Minimum	5.200	4.100	3.900	5.100
Maximum	5.800	6.700	5.300	6.600
Confidence (95.0%)	0.164	0.637	0.391	0.329

Source: own calculations

Table 5   Descriptive analysis – share of expenditure on clothing and footwear (%)

Country	Czechia	Hungary	Poland	Slovakia
Mean	3.578	3.244	4.756	4.244
Standard Error	0.128	0.133	0.169	0.082
Median	3.500	3.200	4.800	4.100
Standard Deviation	0.383	0.400	0.508	0.246
Kurtosis	0.174	-0.530	-0.800	-0.415
Skewness	0.766	-0.420	-0.366	0.835
Range	1.200	1.200	1.500	0.700
Minimum	3.100	2.600	3.900	4.000
Maximum	4.300	3.800	5.400	4.700
Confidence (95.0%)	0.295	0.308	0.390	0.189

Source: own calculations

values were higher only in Poland. The maximum share for alcoholic beverages in the Czech Republic was in 2020, while the lowest was in 2006 and 2008. In Slovakia, the lowest average share of expenditure on alcoholic beverages was 5.367%, with a standard error of 0.090. The distribution in Slovakia was also flatter than normal and skewed to the right. Both the standard deviation and the range of values were the lowest among the V4 countries. The minimum share for alcoholic beverages in Slovakia was 4.8% in 2008, and the maximum was 5.7% in 2016.

Other goods that can potentially generate waste include furniture and household furnishings. The share of expenditure on these items in total household expenditure across the surveyed countries averages between 4.611% and 5.989% (see Table 4). While the share of expenditure on household furniture and furnishings shows a steady trend only in Poland, the time series for the other countries experienced considerable fluctuations.

In Slovakia, the share of expenditure on furniture and furnishings is the highest, with a standard error of 0.143. The standard deviation and range of values indicate slight fluctuations in the trend. The share was highest in 2010 and lowest in 2004, and the distribution is flatter than normal, skewed to the left.

In Poland, the lowest share of expenditure on furniture and furnishings was recorded over the period, with a standard error of 0.170. The standard error and the range are quite similar to those in Slovakia. The lowest value occurred in 2010, while the highest was in 2020. The distribution is also flatter than normal, skewed to the left.

Clothing and footwear represent another important category in household consumption from an environmental perspective. The trend of expenditure on clothing and footwear is slightly decreasing in Slovakia and the Czech Republic, while in Hungary and Poland, the trend shows a significant divergence with an increasing tendency.

The highest average share of household expenditure on clothing and footwear during the review period was in Poland, at 4.756% with a standard error of 0.169 (see Table 5). Both the standard error and the range of values are the highest among the V4 countries. The minimum share for clothing and footwear in Poland was recorded in 2010, while the highest share was in 2014. The distribution is flatter than normal, skewed to the right.

Among the V4 countries, households in the Czech Republic had the lowest share

of expenditure on clothing and footwear, at 3.578% with a standard error of 0.128. The standard deviation is 0.383, and the range of values is 1.200. The minimum share of expenditure on clothing and footwear by households in the Czech Republic was in 2012 (3.100%), while the maximum was in 2004 (4.300%). The distribution is skewed to the left.

Household Waste

In addition to the positive aspects, the consumption of goods also has negative consequences, particularly for the environment. Today, countries are confronted with issues such as high ecological footprints, overconsumption of goods, and the production of excess waste.
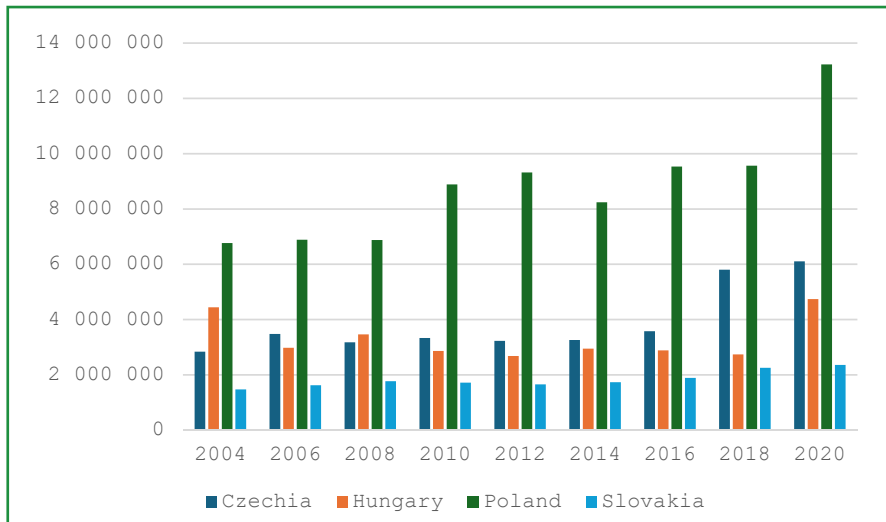
Poland generates the highest total household waste, averaging 8.8 million tonnes over the period under review. In 2020, over 13 million tonnes of waste were produced in Poland (see Figure 1), marking a 95% increase compared to 2004. In contrast, Slovakia produced the lowest total household waste, averaging 1.8 million tonnes during the same years, with a total of 2.4 million tonnes in 2020. This represents a 60% increase since 2004. The average household waste generated in the Czech Republic was 3.9 million tonnes, while in Hungary, it was 3.3 million tonnes.

However, on a per capita basis, average household waste production is the lowest in Poland, at 231.78 kilograms per capita per year (see Figure 2). This is followed by Hungary at 332.90 kilograms per capita per year, and Slovakia at 338.44 kilograms per capita per year. The highest per capita waste generation is found in the Czech Republic, at 368.56 kilograms.

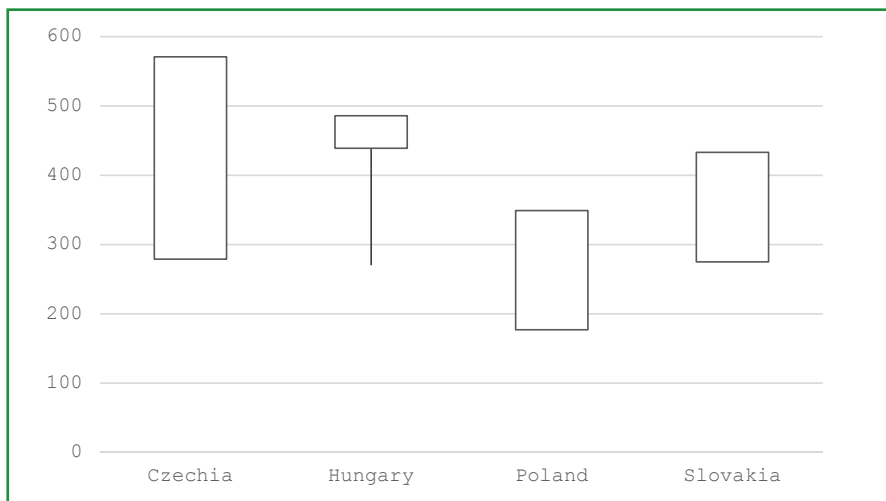**Figure 1**   Household waste (t)
Source: Eurostat

Impact of Consumer Spending on Household Waste

We examined the impact of expenditure on different types of goods on household waste production through regression analysis, with the results presented in Table 5.

The estimated model for the Czech Republic explained 77.2% of the variations in waste production based on household expenditure. The model is 99% reliable; however, the individual coefficients are not statistically significant. In Hungary, the model explained 75.7% of the changes in waste production with a reliability of 95%. If household expenditure on food and non-alcoholic beverages increases by € 1 million per year, household waste production is projected to increase by 2,343.82 tonnes, with 90% confidence. Conversely, expenditure on alcoholic beverages and tobacco, as well as expenditure on clothing and footwear, correlates negatively with the amount of waste produced. Specifically, if expenditure on alcoholic beverages and tobacco increases by € 1 million per year,

Figure 2   Average household waste in kg per capita and year
Source: own calculations

Table 6   Results of the regression analysis: impact of expenditure in million € on waste production in tonnes

	Czechia	Hungary	Poland	Slovakia
Adjusted R Square	0.772	0.757	0.787	0.797
Significance F	0.001	0.041	0.000	0.000
Food and non-alcoholic beverages	497.323	2,343.820*	788.015*	180.745**
Alcoholic beverages, tobacco	-32.034	-4,624.086*	-1,456.303	91.961
Clothing and footwear	2,218.643	-2,654.898**	-605.629	3,468.917***
Furnishings. household equipment	-1,907.354	968.759	345.743	-2,210.194***

Source: authors calculations, *** α <0.01, ** α <0.05, *α <0.1

household waste production is expected to decrease by 4,624.08 tonnes, with 90% confidence. For the same increase in expenditure on clothing and footwear, waste production is projected to decrease by 2,654.90 tonnes, with 95% confidence.

In Poland, the model explained 78.7% of the relationship between expenditure on individual goods and services and waste production, with 99% confidence. If household expenditures increase by € 1 million per year, household waste production in Poland is expected to increase by 788.02 tonnes, with 90% confidence.

The model applied to Slovakia explained 79.7% of the changes in waste production with 99% confidence. Household expenditures on food and non-alcoholic beverages, clothing and footwear, and household furniture and furnishings influenced waste production, with expenditures on food and non-alcoholic beverages and clothing and footwear positively impacting waste production, while expenditures on household furniture and furnishings had a negative effect.

Discussion

The impact of household final consumption expenditure by purpose on the amount of municipal waste in Romania was ranked as follows: health; housing, water, electricity, gas, and other fuels; clothing and footwear; miscellaneous goods and services; recreation and culture; food and non-alcoholic beverages; restaurants and hotels; household furnishings and equipment; routine household maintenance; alcoholic and tobacco products; communications; and education. The study indicates that services produce the least waste. An increase in any household expenditure is associated with a decrease in municipal waste (Petrescu et al., 2022).

Research in Mexico found that households that participated in the study increased their monetary expenditure on food while simultaneously reducing food waste during the pandemic, leading to food waste becoming a luxury concern (Vargas et al., 2022). Similarly, the significant excess of domestic food waste in China is largely attributed to overconsumption. Excessive food intake results in considerable carbon, water, energy, and ecological footprints, with cereals and meat being the primary contributors. Notably, these impacts vary according to demographic characteristics and levels of urbanization (Shi et al., 2024). A study conducted in the Czech Republic examined bakery waste in households, revealing that actual waste from bakery products is relatively low (less than 5%) due to a high rate of surplus bread and roll utilization. Food is not classified as wasted if it is used for feeding or composting (Ratinger et al., 2016).

Conclusion

This paper aimed to investigate how household consumption in the V4 countries affects the environment. The average share of expenditure on food and non-alcoholic beverages in total household expenditure ranged from 15.4% to 19.4% over the period under review. The average share of expenditure on alcoholic beverages ranged from 5.4% to 7.8%, the average share of expenditure on household furniture and furnishings ranged from 5.4% to 5.9%, and the average share of expenditure on clothing and footwear ranged from 3.2% to 4.8%.

The positive correlation between food expenditures and waste production suggests potential food waste in the countries studied, most notably in Hungary, where household waste production increases at the highest rate alongside food and non-alcoholic beverage expenditure.

The negative correlation between expenditures on alcoholic beverages and clothing and footwear in Hungary and Poland may be attributed to

rational consumer behaviour as expenditure rises. This behaviour contributes positively to the environment by reducing waste production.

In the model applied to Slovakia, more positive correlations between variables were observed than in other countries. This suggests a need for greater educational outreach regarding the consequences of irrational purchases of unnecessary goods.

The results of these analyses can inform waste management strategies in the examined countries. Understanding the links between consumer behaviour and its environmental consequences is valuable not only for the public but also for environmental policymakers.

References

BAIHUI JIN, B. – LI, W. – LI, G. – WANG, Q. 2024. Does upgrading household consumption affect the eco-efficiency of China's solid waste management as measured by emissions? In Utilities Policy, vol. 89, 2024. ISSN 0957-1787. https://doi.org/10.1016/j.jup.2024.101767

BRIZGA, J. – RÄTY, T. 2024. Production, consumption and trade-based forest land and resource footprints in the Nordic and Baltic countries. In Forest Policy and Economics, vol. 161, 2024. https://doi.org/10.1016/j.forpol.2024.103166

BOZATLI, O. – AKCA, H. 2023. The effects of environmental taxes, renewable energy consumption and environmental technology on the ecological footprint: Evidence from advanced panel data analysis. In Journal of Environmental Management, vol. 345, 2023, November. https://doi.org/10.1016/j.jenvman.2023.118857

CARO, D. – SPORCHIA, F. – ANTONELLI, M. – GALLI, A. 2023. Beyond the IPCC for Food: An Overarching Framework for Food Systems Sustainability Assessment. In Sustainability, vol. 15, 2023, no. 19. https://doi.org/10.3390/su151914107

DATASET: Final consumption expenditure of households by consumption purpose (COICOP 3 digit), Online data code: nama_10_co3_p3. https://doi.org/10.2908/nama_10_co3_p3, last update:25/09/2024 23:00

DATASET: Generation of waste by waste category, hazardousness and NACE Rev. 2 activity, Online data code:env_wasgen. https://doi.org/10.2908/env_wasgen, last update:07/08/2024 23:00

FERREIRA, J.P. – MARQUES, J.L. – PIRES, S.M. – IHA, K. – GALLI, A. 2023. Supporting national-level policies for sustainable consumption in Portugal: A socio-economic Ecological Footprint analysis. In Ecological Economics, vol. 205, 2023. https://doi.org/10.1016/j.ecolecon.2022.107687

GALLI, A. – IHA, K. – HALLE, M. – BILALI, H.L. – GRUNEWALD, N. – EATON, D. – CAPONE, R. – DEBS, P. – BOTTALICO, F. 2017. Mediterranean countries' food consumption and sourcing patterns: An Ecological Footprint viewpoint. In Science of The Total Environment, vol. 578, 2017, pp. 383–391. https://doi.org/10.1016/j.scitotenv.2016.10.191

HE, H. – REYNOLDS, CHJ. – HADJIKAKOU, M. – HOLYOAK, N. – BOLAND, J. 2020. Quantification of indirect waste generation and treatment arising from Australian household consumption: A waste input-output analysis. In Journal of Cleaner Production, vol. 258, 2020. ISSN 0959-6526. https://doi.org/10.1016/j.jclepro.2020.120935

KAPSDORFEROVÁ, Z. – ČEREŠ, M. – ZÁBOJNÍKOVÁ, V. – ŠVIKRUHOVÁ, P. – KATANIKOVÁ, R. 2023. Challenges and innovative approaches in the agricultural and food industry and changing consumer behaviour in the milk and milk products market: Case of Slovakia. In Agric. Econ. – Czech, vol. 69, 2023, no. 6, pp. 246–254. https://doi.org/10.17221/119/2023-AGRICECON

LIU, JL. – BAI, HT. – LIANG, HT. – WANG, YT. – XU, H. 2018. How to recycle the small waste household appliances in China? A revenue-expenditure analysis. In Resource Conservation and Recycling, vol. 137, 2018, pp. 292–301. https://doi.org/0.1016/j.resconrec.2018.06.015

MANCINI, L. – VALENTEM, A. – VIGNOLA, GB. – MENGUAL, ES. – SALA, S. 2023. Social footprint of European food production and consumption. In Sustainable Production and Consumption, vol. 35, 2023, pp. 287–299. https://doi.org/10.1016/j.spc.2022.11.005

MATEJ, S. – KAUFMANN, L. – SEMENCHUK, P. – DULLINGER, S. – ESSL, F. – HABERL, H. – KALT, G. – KASTNER, T. – LAUK, CH. – KRAUSMANN, F. – ERB, KH. 2024. Options for reducing a city's global biodiversity footprint – The case of food consumption in Vienna. In Journal of Cleaner Production, vol. 437, 2024, January. https://doi.org/10.1016/j.jclepro.2024.140712

PETRESCU, IE. – LOMBARDI, M. – LADARU, GR. – MUNTEANU, RA. – ISTUDOR, M. – TARASILA, GA. 2022. Influence of the Total Consumption of Households on

Municipal Waste Quantity in Romania. In Sustainability, vol. 14, 2022, no. 14. https://doi.org10.3390/su14148828

RATINGER, T. – TOMKA, A. – BOSKOVA, I. 2016. Sustainable consumption of bakery products a challenge for Czech consumers and producers. In Agricultural Economics, vol. 62, 2016, no. 10, pp. 447–458. https://doi.org/10.17221/244/2015-Agricecon

SHAW, P. – SMITH, MM. – WILLIAMS, ID. 2018. On the Prevention of Avoidable Food Waste from Domestic Households. In Recycling, vol. 3, 2018, no. 2. https://doi.org/10.3390/recycling3020024

SHI, Z. – ZHANG, L. – XIONG, X. – HAO, Y. – ZHANG, P. – PANG, M. – YANG, Y. 2024. Environmental burden of excessive food intake: Exploring new opportunities to enhance food and environmental sustainability in China. In Resources, Conservation and Recycling, vol. 209, 2024. ISSN 09213449. https://doi.org/10.1016/j.resconrec.2024.107820

SONG, G. – LI, M. – SEMAKULA, HM. – ZHANG, S. 2015. Food consumption and waste and the embedded carbon, water and ecological footprints of households in China, In Science of The Total Environment, vol. 529, 2015, pp. 191–197. https://doi.org/10.1016/j.scitotenv.2015.05.068

SUTHAR, S. – SINGH, P. 2015. Household solid waste generation and composition in different family size and socio-economic groups: A case study. In Sustainable Cities and Society, vol. 14, 2015, pp. 56–63. ISSN 2210-6707. https://doi.org/10.1016/j.scs.2014.07.004

VARGAS-LOPEZ, A. – CICATIELLO, C. – PRINCIPATO, L. – SECONDI, L. 2022. Consumer expenditure, elasticity and value of food waste: A Quadratic Almost Ideal Demand System for evaluating changes in Mexico during COVID-19. In Socio-economic planning science, vol. 82, 2022, Part A. https://doi.org/10.1016/j.seps.2021.101065

WRIGHT, J. – DAMKJAER, S. – VAISANEN, H. – ADAMA-TETTEY, Q. – DZODZOMENYO, M. – HILL, A.G. – OKOTTO, L.G. – OKOTTO-OKOTTO, J. – SHAW, P. 2022. On the use of household expenditure surveys to monitor mismanaged plastic waste from food packaging in low- and middle-income countries. In Environmental Research Letters, vol. 17, 2022, no. 12. https://doi.org10.1088/1748-9326/aca623

Contact address

Elena Hošková
Slovak University of Agriculture in Nitra
Faculty of Economics and Management
⚲ Trieda Andreja Hlinku 2, 949 76 Nitra, Slovakia
☎ +421 37/641 45 75
✉ elena.hoskova@uniag.sk

Iveta Zentková
Slovak University of Agriculture in Nitra
Faculty of Economics and Management
⚲ Trieda Andreja Hlinku 2, 949 76 Nitra, Slovakia
☎ +421 37/641 45 76
✉ iveta.zentkova@uniag.sk