Models of human resource nutrition and health: exploring the relationships

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Abstract. The paper examines the relationship between the nutrition models according to the locations (at home and out-of-home) and formats (restaurants, canteens, buffets/cafeterias, etc.), nutrition structure (consumption of basic staples) and health and mortality of the population of Poland and Ukraine. The conducted research allowed determining the importance of these elements in the social and economic development of the countries. The authors identified common and different features in the models of meal arrangements and household eating behaviour. The scholars also analysed the structure and performance of the food business of both countries and clarified its infrastructural and economic features. The research determined that the lack of effective demand in Ukraine does not stimulate food business development of in the catering sector, however, in turn, has long-term consequences for morbidity and mortality of the population. The authors investigated morbidity and mortality from the most common diseases and found that the morbidity rate in Ukraine is higher, and deaths from ischaemic heart disease, also called coronary heart disease (CHD), infectious and parasitic diseases is 6 times higher, whereas mortality from cerebrovascular and circulatory system diseases is 2 times higher than in Poland. The paper found and interpreted dependences between household expenditures on food for different models of meal arrangements, development and health of human resources. The scholars established that household expenditures on eating at home and out-of-home do not have a significant impact on the morbidity of the population in both countries. The performance of public catering companies (their revenue) causes a slight increase in obesity of human resources. Food consumption by human resources and the spread of morbidity in both countries are also poorly linked. However, the study revealed that there are food groups in both countries whose consumption is associated with increased mortality. Such staples as sugar, bread and bakery products were common to both countries. The authors found that food business development via increasing household expenditure on food in the catering sector and increasing the revenue of catering companies contribute to a slight mortality reduction in Ukraine, while in both countries increasing household spending on food prevents increased mortality from malignant neoplasms.

Key words: models, business, nutrition, morbidity, mortality, consumption, health, human resources.

JEL: C 13, D12, I12, L83, O15

Introduction

The health of human resources is one of the indicators of the social and economic development of the state. It is a public good and not only individual. Therefore, its support and provision is built by states taking into account global regulatory and institutional developments, in particular the Agenda for Sustainable Development (2015), recommendations of the World Health Organization and domestic policy of states, in particular the Presidential Decree "On the Sustainable Development Goals of Ukraine until 2030" (2019) and the reference document of the Polish Ministry of Economic Development, Labour and Technology (2018).

The experts of the World Health Organization estimated that 50% of a person's physical health status is determined by his/her lifestyle (primarily by the nature of diet, bad habits, and working conditions), 20% by environmental factors, another 20% by genetic predisposition and only 10% by the medical care.

Modern research on the relationship between nutrition and health covers t he following areas: quality of food, social and economic effects of nutrition and its functional aspect – models of food organization.

The Food and Agriculture Organization of the United Nations (2017) identifies the problem of poor-quality diets, which causes two major issues: either hunger due to lack of food (like in African countries), or overweight and obesity due to micronutrient deficiencies. Here we can highlight the current problem of the study relationship between food consumption and morbidity and mortality of human resources.

The relationship between the food quality, social and economic characteristics of human development is studied in [Afshin, Sur et al.,2019 and Bloom Cafiero, Jane-Llopis et etc., 2011]. Ashkan Afshin, Christopher J. L. Murray, Patrick Sur et al. [Afshin, Sur et al.,2019] found that every fifth death in the world occurs precisely because people do not eat healthy food. In addition to mortality, poor diet affects the DALYs (Disability-Adjusted Life Years), years of life lost due to premature mortality, disability or time lived in states of less than full health. 255 million years of healthy life are lost due to poor diet: this is 16% of DALYs among adults worldwide.

According to the report of the World Economic Forum and Harvard University [Bloom, Cafiero, Jane-Llopis etc., 2011], mortality from major non-communicable diseases leads

to a total loss in output, which is equivalent to about 5% of annual global GDP. In addition, due to the high morbidity of the employed population, especially due to non-adherence to a healthy lifestyle, the total loss of productivity in 2010-2015 amounted to 5.4% in China and 8% of GDP in the United States.

M. Marmot & R. Wilkinson [Marmot, Wilkinson, 2006], Morrison G. [Morrison, 2009], Raphael D [Raphael, 2009], and Shushpanov D [Shushpanov, 2016] position diet as a social and economic determinant of health, while emphasising the link between food (i.e. nutrition) and household income. David E. Bloom proves that this relationship is reciprocal, as "Countries with higher incomes tend to have healthier populations, traditionally seen as the result of the superior nutrition and the better access to safe water, sanitation, and health care that higher income brings" [Bloom, 2014, pp. 6]. However, not has been installed the causation for specific states in these studies.

The functional aspect of nutrition is that it is a primary, physiological need that human resources to satisfy either at home or outside the home through the food business. In fact, business forms models of the organization of food of human resources both on a place, and on channels of coverage of consumers. At the same time, the public organization of food gives the right to human resources to satisfy the needs of the highest level, namely secondary in communication and communications. In this context, it is interesting to find links between the nutrition models and human health.

Gheribi E. [Gheribi , 2016] identifies a number of factors, including lifestyle changes, income growth, employment diversification, and reduced leisure time, that contribute to the breakaway from the traditional model of eating at home and give impetus to the food business, including the catering industry and complementary cooking and delivery services, which may also vary in quality and price. E. Figee & M. Oortwijn [Figee, Oortwijn, 2004], as well as B.Kowrygo & D.Stangierska [Kowrygo, Stangierska, 2012], identify five main channels of consumer coverage in the catering industry: catering entities, restaurants, retail, vending and entertainment companies. However, they have not investigated the relationship between these consumer outreach channels and human health.

Therefore, the overall objective of our research is to find the relationships between the models of nutrition or, in other words, diet (at home and out-of-home (business models)), food quality (consumption of basic staples) and health of the population using the case study of Ukraine and Poland.

Methodology

We conducted a correlation and regression analysis to establish the relationship between the diet models, the structure of nutrition and morbidity of the population, which includes the following stages:

- correlation analysis to establish the significance of relationships between factors,
- regression analysis – to establish causal relationships between the resulting (y) and input (x) factors.

The input indicators include publicly available statistical data regarding consumer expenditure on food and non-alcoholic beverages (eating at home) and out-of-home consumption of food and drinks (expenditure on catering or eating out), consumption of basic staples by the population, the amount of revenue received by 'catering services', i.e. restaurants, cafés, canteens, and the like. The results include the indicators of the incidence of various diseases (prevalence of obesity, diseases and disorders of the musculoskeletal system and connective tissue, diseases of the respiratory system, digestive organs, mental and behavioural disorders, trauma and poisoning, cerebrovascular disease, ischaemic (coronary) heart disease, infectious and parasitic diseases).

The adequacy of the obtained regression equations was checked by Fisher's test, and the significance of the regression coefficients was assessed by Student's test using MS EXCEL software. For economic and mathematical analysis of the obtained regression dependences, the average coefficients of elasticity of the indicators that affect the resulting indicator are calculated by the formula:

$$\mathrm{Ex}_{n = k_n} \frac{\overline{x_n}}{\overline{y}}$$

where Exn –the calculated value of the average coefficient of elasticity of the studied indicator,

kn – the value of the regression coefficient of the studied factor,

$\overline{x_n}$ –the average value of the studied factor,

$\overline{y}$ –the average value of the resulting factor

The information base of the study was the statistical data of the Statistics Poland (formerly known in English as the Central Statistical Office, popularly called GUS) and the State Statistics Service of Ukraine on the number and structure of catering services' network and their revenues, household income and expenditure, consumption of basic staples and data

of the WHO Regional Office for Europe on morbidity and mortality (Appendix A, B). Given that publicly available statistical information on different indicators in Ukraine and Poland is presented for different time periods, the study takes into account the data that is available since 2000. There are also peculiarities in the collection and presentation of statistical data regarding the incidence of diseases among population in both countries, therefore the study selected the data, which are common to both countries. In view of the above, we have further investigated the relationship between the aforementioned indicators and mortality from various diseases.

Result

Household Eating Behaviours

Ukraine and Poland are neighbouring countries with different levels of social and economic development, however with common historical and cultural traditions of particular territories. In recent years, there has been a shift in emphasis with regard to nutrition/diet in both countries. Increase in the quality of life and the growth of household incomes are driving the changes in eating habits: traditional home cooking and family consumption have increasingly been replaced by cooking and eating out, in catering establishments. For instance, in Poland, although over 20 years household expenditures on eating at home (statistical indicator: expenditures on food and non-alcoholic beverages) increased by 70% from 184.77 Polish złoty (PLN) in 2000 to PLN 314.35 in 2019, in the structure of total household expenditures the indicator decreased by 5.7 percentage points from 30.8% to 25.1%, respectively, and its share in the income accounted for 30% in 2000 and 17.3% in 2019, respectively. Expenditures on eating out (statistical indicator: expenditures on restaurants and hotels) increased from PLN 8.41 to PLN 61.41 per capita and accounted for 1.4% to 4.9% of household expenditures, respectively, and their shares in the income structure were 1.38% and 3.48%, respectively (see Fig. 1).

In Ukraine, one can easily note the changes in the amount and share of food expenditures at home, as they are even more evident. In absolute terms, expenditures on food and non-alcoholic beverages increased 13 times, however, the percentage of the indicator decreased from 64% in total expenditures (82% in total household income) in 2000 to 46.6% in 2019 (37.2% in total income). Expenditures on eating out (indicator: expenditures

on restaurants and hotels) increased from 5 Ukrainian hryvnias (UAH) to UAH 251 (from 1% of total household expenditures in 2000 to 2.6% in 2019) and relative to income it amounted to 1.2 % and 2.1% respectively (see Fig. 2).

Figure 1. Dynamics of Household Food Expenditure at Home and Away From Home in total Household Expenditures and Incomes (Poland)

Source: own elaboration based on the data of Statistics Poland (GUS)

Figure 2. Dynamics of Household Food Expenditure at Home and Away From Home in total Household Expenditures and Incomes (Ukraine)
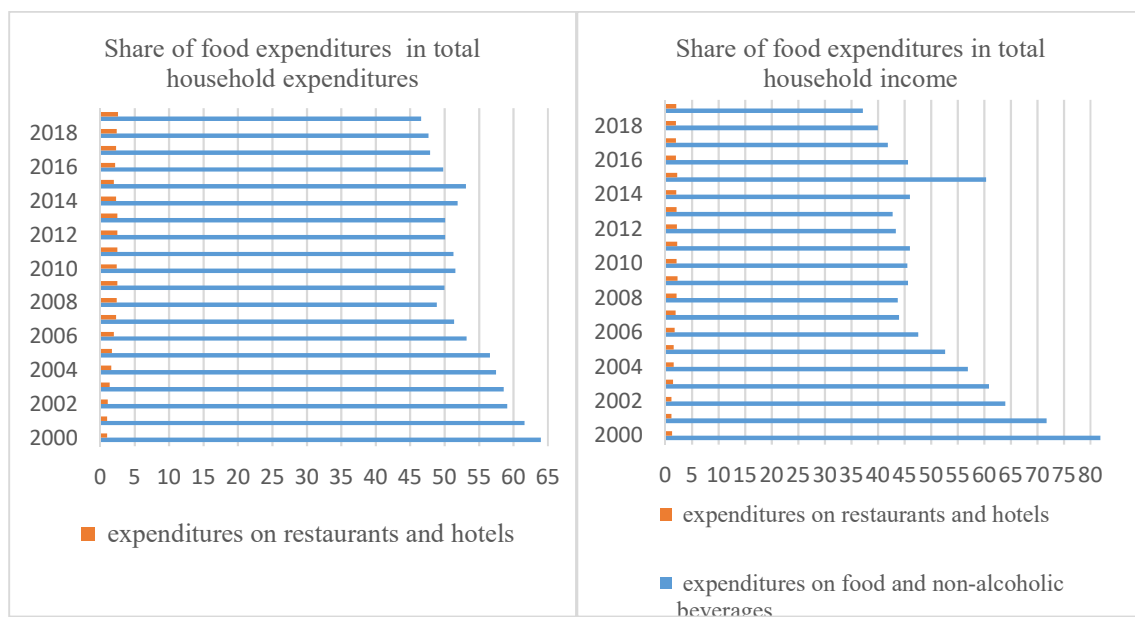
Source: own elaboration based on the data of State Statistics Service of Ukraine

We should also underline that household consumption of food in Ukraine is higher than in Poland. In 2019, compared to 2000, the consumption of meat and meat products (+1.8 kg/month per person), milk and dairy products (+1.9 kg), fruit (+1.5 kg) increased significantly slightly, while for eggs (+2 pcs) and fish (+ 0.2 kg) the consumption slightly increased. Consumption of potatoes (-4.2 kg), bread and bakery products (-2.6 kg), sugar (-0.9 kg) and vegetables (-0.7 kg) decreased. If we look at Poland, in 2019, compared to 2003 (years for which the statistical information is available), the consumption of all food products is declining. The research noted the highest decline for vegetables (-5.06 kg), bread and bakery products (-3.46 kg) and sugar (0.89 kg), and the least decline rates for fish (-0.14 kg) and fruit (-0.2 kg). The consumption of meat and fruit is approximately the same in both countries (about 5 and 4 kg/month per person, respectively), and the consumption of fish in Ukraine is 5 times higher than in Poland, while in case of sugar it is 2.6 times higher. Potato consumption in Poland is calculated as a separate position starting from 2015, so in our study we took into account the consumption of potatoes together with other vegetables. The caloric content of food in both countries is sufficient and the WHO does not calculate the depth of hunger, or food deficit, for them.

The main reasons for the identified disparities are of ethnic and economic nature. Ukrainians like to eat well, and with increasing incomes, the range of gastronomic preferences is also expanding. Besides, although no one has raised the issue of food waste in Ukraine at the state level yet, as well as in Poland, however it is surely present. On the other hand, for a significant part of the population of Ukraine the income level remains quite low, and therefore eating at home is the prevalent choice. Hence, the lack of effective demand does not stimulate the development of the catering industry.

Catering Industry Overview

Compared to Poland and other European countries, in Ukraine, the network of catering establishments is underdeveloped. For instance, according to studies conducted by G. Anisimov, Y. Zhukov & D. Lipovoy [Anisimov, Zhukov, Lipovoy, 2018] in the countries of Western Europe the indicator of the availability of catering establishments is 32 objects, in the low-income countries the number is 16, in the Republic of Belarus the number is 13, in

Poland the number is 18, and in Ukraine the number is 11. In Europe, there is one catering establishment per 477 inhabitants, in Poland one per 554, and in Ukraine one per 845 people.

The major business models in the catering industry, for which one can find available statistical information, include restaurants, cafés and bars, canteens, food courts in Poland, as well as snack bars and buffets in Ukraine. In Poland, food courts have the largest share (32%), while the number of canteens is the least. During 2005-2019, the share of restaurants (29-32%) and bars (28-30%) remained relatively stable, the share of food courts increased (from 19% in 2005 to 31% in 2019) and the share canteens halved (from 22% in 2005 to 10% in 2019) (see Appendix A).

If we look at the availability of catering, there is an increase from 9 bars and restaurants per 100 thousand people in 2005 to 15 in 2019, respectively, an increase from 6 to 17 food courts and a decrease from 7 to 5 canteens.

A breakdown into voivodships shows that Masovian (mazowieckie), Lesser Poland (małopolskie), Lower Silesian (dolnośląskie), and Silesian (śląskie) voivodships have the largest number of establishments, while Lubusz (lubuskie), Podlaskie (podlaskie), and Opole (opolskie) voivodships have the smallest number. As a rule, this distribution corresponds to the level of voivodship development in terms of GDP per capita (see Fig. 3).

Figure 3. Distribution of the Regions of Poland and Ukraine by the Number of Catering Establishments and GDP Per Capita
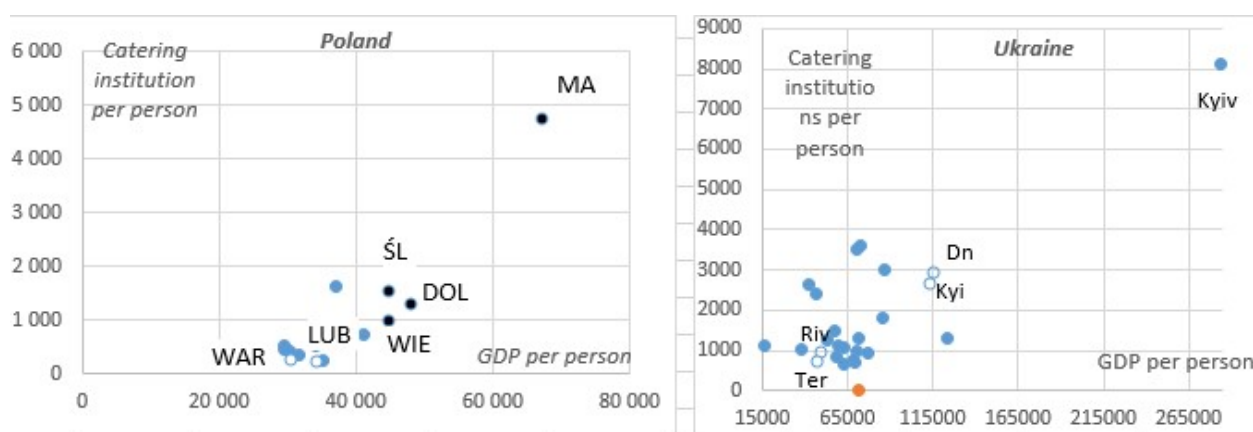
Source: own elaboration based on the data of Statistics Poland (GUS) and State Statistics Service of Ukraine

In Ukraine, cafes, snack bars, buffets, and canteens dominate in the structure of catering establishments, while restaurants are the least numerous ones. During 2010-2017, the share of restaurants increased from 6% to 8.9%, for canteens it increased from 43%

to 50.4%, and the share of cafes, snack bars and buffets it decreased from 40% to 30%, the share of bars remained unchanged, namely 10% (see Appendix A). As in Poland, the regional distribution of caterers generally corresponds to the level of their development in terms of GDP per capita. Most catering establishments are located in the capital (Kyiv), Dnipropetrovsk and Kyiv Oblasts (regions), Ternopil and Rivne Oblasts have the smallest number of caterers (see Fig.3).

The growth of household expenditures on eating out and the growth of revenues of catering establishments occurred at different rates, nonetheless the increase in absolute amounts in 2019 compared to 2005 in Poland is higher according to the expenditures on eating out, whereas in Ukraine – according to the revenues of catering establishments.

Morbidity and Mortality Rate

Statistics from the WHO Regional Office for Europe show that the population of Ukraine is in worse health than people in Poland. In terms of the prevalence of diseases (per 100,000 population), Ukraine is ahead of Poland in all studied indicators. The foremost differences between the countries are in the number of respiratory and cerebrovascular diseases (more than 2 times), the number of injuries and poisonings are almost at the same level (see Fig. 4).

Figure 4: Population Morbidity in Ukraine and Poland, 2009
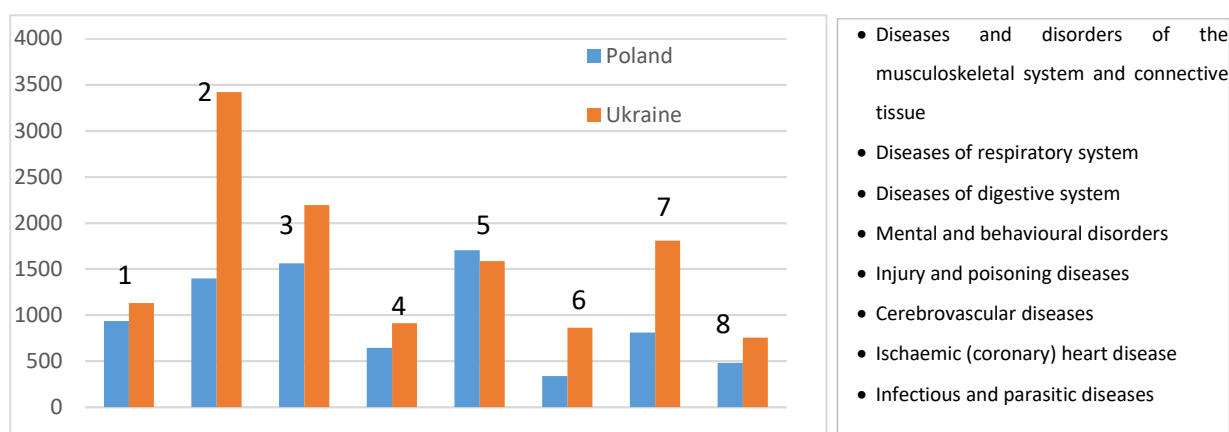
Source: own elaboration based on the data of Statistics Poland (GUS) and State Statistics Service of Ukraine

Poland, deaths from respiratory diseases, diabetes, endocrine, food and metabolic diseases, malignant neoplasms, mental disorders and diseases of the nervous system and sense organs are higher. Nevertheless, in Ukraine mortality from ischaemic (coronary) heart

disease, infectious and parasitic diseases is 6 times higher than in Poland, and death rate from cerebrovascular and circulatory diseases is 2 times higher than in Poland. The countries have approximately the same mortality rate from blood diseases (see Appendix B).

Finding Relationships

The correlation and regression analysis, which we conducted for Poland on the basis of data for seven years (2003 – 2009), showed the presence of strong relationships (correlation coefficient r ≥0.85) in two cases: for all input indicators (forms of nutrition/diet, revenues of catering establishments) and the prevalence of obesity, as well as household expenditures on food and musculoskeletal diseases. The analysis found causal links only between the revenues of catering establishments and the prevalence of obesity (see Appendix C). An increase in the revenue of catering establishments by 1% causes an increase in the prevalence of obesity among persons over 18 years of age by 0.09%, which indicates the average coefficient of elasticity of a statistically significant factor.

We should emphasize that in Ukraine, as in Poland, the links between inputs and morbidity are not very noticeable. The correlation and regression analysis, which we conducted on the basis of statistical data for eleven years (2005 – 2015), showed the presence of strong correlations between all inputs and the prevalence of obesity, as well as household expenditure on food and non-alcoholic beverages and mental and behavioural disorders, injuries and poisonings, infectious and parasitic diseases. Conversely, we found insignificant causal links only between household expenditures on eating out and the revenues of catering establishments and the prevalence of obesity. Therefore, by the values of the average coefficients of elasticity, an increase in household expenditures on eating out by 1% may lead to an increase in the prevalence of obesity by 0.07%, and by 0.02% in revenues of catering establishments.

Food consumption by the population and the estimated morbidity cases in both countries are also poorly linked. The reasons may include the objective lack of a statistically significant relationship, the need in longer study period (7 years for Poland and 11 years for Ukraine may be insufficient) and unaccounted facts of disease when people do not consult a physician.

In case of Poland, we found strong correlations between the consumption of fish, sugar, vegetable oil and fats, vegetables, bread and bakery products and the prevalence of obesity. The study revealed that significant correlations (r ≥0.75) exist between fish and egg consumption and musculoskeletal diseases, milk and dairy consumption and cerebrovascular diseases, fruit consumption and ischaemic (coronary) heart disease. Nonetheless, there are no causal relationships between food consumption and morbidity of the population for studied diseases (see Appendix D).

The situation in Ukraine is somewhat different. The analysis revealed significant (r ≥0.75) and strong correlations (r≥0.85) between the consumption of fish and fish products by the population and the prevalence of obesity, digestive diseases, mental and behavioural disorders, injuries and poisonings; consumption of meat, fruit, berries, nuts, grapes and cerebrovascular diseases and ischaemic (coronary) heart disease; consumption of potatoes, bread and bakery products and the prevalence of obesity, digestive diseases, injuries and poisonings, mental and behavioural disorders. We established a causal relationship between the prevalence of obesity and the consumption of fish and fish products, sugar and potatoes, as well as the consumption of fish and potatoes and the growth of mental and behavioural disorders. Hence, an increase in fish and potato consumption by 1% can lead to a decrease in the prevalence of obesity by 0.1 and 0.56%, respectively, while an increase in sugar consumption may lead to an increase in the prevalence of obesity by 0.38%. If the consumption of other foods remains the same, an increase in the consumption of fish and fish products by 1% can lead to an increase in mental and behavioural disorders by 0.76%, and an increase in the consumption of potatoes can lead to a corresponding increase by 1.8%. The presence of contradictory, from the point of view of nutrition, relationships (including causal ones) between the consumption of fish and fish products in Ukraine and the increase in morbidity may indicate the inadequate quality of these products, associated not only with the quality of raw materials, but also with the subsequent process of its processing, transportation and storage.

If we consider the impact of the same inputs on mortality rates, we can state that it is surely more pronounced (see Appendix E). In Poland, the form of catering and the revenue of catering establishments are not related to mortality from respiratory diseases, diabetes, endocrine diseases, infectious and parasitic diseases, mental disorders and diseases of the nervous system and sense organs. On the other hand, an increase in household expenditures

on food and non-alcoholic beverages by 1% can reduce mortality from cerebrovascular diseases by 0.44%, and mortality from malignant neoplasms by 0.47%. In its turn, a 1% increase of household expenditures on restaurants and hotels may lead to the reduction in mortality from external injuries and poisonings by 0.12%, and a 1% increase of the revenue of catering establishments may lead to the reduction by 0.17%. A similar increase in the revenue of catering establishments can also help reducing mortality from cerebrovascular diseases by 0.29%.

The study found a strong correlation between the consumption of eggs, sugar, vegetables (including potatoes), bread and bakery products and mortality from cervical cancer, cerebrovascular diseases, circulatory diseases, blood diseases, external injuries and poisonings, ischaemic (coronary) heart disease and malignant neoplasms. It is possible that the consumption of potatoes within the whole vegetable group has such an impact, however in the statistics available for the study period, it is not calculated separately. We also noted a significant causal relationship between the consumption of eggs, oil, bread and bakery products and mortality from cerebrovascular diseases. Consequently, an increase in egg consumption by 1% reduces mortality by 1.51%, and a corresponding increase in consumption of oil, bread and bakery products increases mortality by 47.9% and 95.1% respectively. The analysis also showed that fish consumption increases mortality from infectious and parasitic diseases by 1.36% (see Appendix F).

In Ukraine, correlations and causation are even more tangible. The form of catering and the revenue of catering establishments are not related solely to mortality from cervical cancer and digestive diseases. However, further catering development and increase in household expenditures on eating out (by 1%) can reduce mortality from other diseases considered in the study, aside from the mortality from diseases of the circulatory system and infectious and parasitic diseases, within the range of mortality from 0.15% of malignant neoplasms up to 0.77% in case of mental disorders, diseases of the nervous system and sense organs (see Appendix E).

Our research also revealed strong correlations (correlation coefficient r≥0.85) between the consumption of sugar, potatoes, bread and bakery products and mortality from the vast majority of the studied diseases, except for cervical cancer, digestive diseases and malignant neoplasms. Nevertheless, the strength of the impact of consumption of these products on mortality shows that other factors that are not taken into account in this study are more

significant. In particular, we found that an increase in population consumption of potatoes by 1% can lead to an increase in mortality from blood diseases by 2.9%, from endocrine diseases by 1.41%, from infectious and parasitic diseases by 1.7%. The analysis also established the causal relationships between milk consumption and mortality from external injuries and poisonings, as well as from mental and behavioural disorders. Hence, according to the findings an increase in milk consumption by 1% can lead to an increase in mortality from external injuries and poisonings by 1.77% and to an increase in mortality from mental and behavioural disorders by 2.94% (see Appendix F).

Summary, recommendations

Achieving the sustainable development goals requires the creation of safe social living conditions for human resources. Satisfaction of the primary physiological human need for food occurs through the use of different models of nutrition/diet in Ukraine and Poland.

Basing on the analysis of food behaviour of households in both countries, the study found that in Poland the expenditures on eating out are higher than in Ukraine. Nonetheless, both countries share similar trends, namely: reduction of food expenditures in the structure of total expenditures with the simultaneous increase in the share of expenditures on eating out, however the pace of the noted tendencies in these countries varies.

The paper analysed nutrition/diet models and the structure of food establishments in Ukraine and Poland for an extensive period. The research found that in both countries there are structural changes in the catering formats. It also revealed that Ukraine lags behind Poland in the level of the availability of catering establishments for human resources.

The study assessed correlation and causal relationships between morbidity, mortality and the structure of human resources in both countries. The analysis established that in Ukraine they are stronger than in Poland, and the level of morbidity and mortality of human resources is higher.

References

Transforming our world: the 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT. Resolution adopted by the General Assembly on 25 September 2015 No. 70/1

BLOOM, DAVID E. (2014). The Shape of Global Health, Finance & Development, Vol.51, No. 4 (December): 6 – 11.

UN. General Assembly (2017) Resolution adopted by the General Assembly on 6 July 2017 No. 71/313. Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development, Seventy-first session, Agenda items 13 and 117: United Nations.

Pro Tsili staloho rozvytku Ukrainy na period do 2030 roku. [On the Sustainable Development Goals of Ukraine until 2030: PRESIDENTIAL DECREE]. No.722/2019 dated 30.09.2019. [Online]. [Accessed 19 March 2021]. Available from: https://www.president.gov.ua/documents/7222019-29825. [in Ukrainian]

MINISTERSTWO ROZWOJU, Pracy i Technologii [Ministry of Economic Development, Labour and Technology] (2018). Partnerstwo na rzecz realizacji celów zrównoważonego rozwoju w Polsce [Partnership for the Implementation of Sustainable Development Goals in Poland]. Portal Gov.pl [online]. Available at: https://www.gov.pl/web/rozwoj-praca-technologia/partnerstwo-na-rzecz-realizacji-celow-zrownowazonego-rozwoju-w-polsce [Accessed 19 Mar. 2021].

Food and Agriculture Organization of the UNITED NATIONS (2017) The State of Food Security and Nutrition in the World (SOFI) Report, Rome: UN [online]. Available at: https://www.wfp.org/publications/2017-state-food-security-and-nutrition-world-sofi-report [Accessed 19 Mar. 2021].

ASHKAN AFSHIN, PATRICK SUR ET AL. (2019) 'Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017', The Lancet, 393(10184), pp. 1958-1972.

BLOOM, D.E., CAFIERO, E.T., JANÉ-LLOPIS, E., Abrahams-Gessel, S., Bloom, L.R., Fathima, S., Feigl, A.B., Gaziano, T., Mowafi, M., Pandya, A., Prettner, K., Rosenberg, L., Seligman, B., Stein, A.Z., & Weinstein, C. (2011). The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum. [online]. Available at:
http://www3.weforum.org/docs/WEF_Harvard_HE_GlobalEconomicBurdenNonCommunicableDiseases_2011.pdf [Accessed 19 Mar. 2021].

MARMOT, M., WILKINSON, R. (eds.) (2006) Social Determinants of Health, 2nd ed., Oxford: Oxford University Press.

MORRISON, G., HARK, L. (eds.) (2009). Medical Nutrition and Disease: A Case-Based Approach. Oxford: Wiley-Blackwell.

RAPHAEL, D. (ed.) (2009). Social Determinants of Health: Canadian Perspectives, 2nd ed., Toronto: Canadian Scholar's Press.

SHUSHPANOV, D. (2016). Sotsialno-ekonomichni osoblyvosti spozhyvannia produktiv kharchuvannia ta yikh vplyv na stan zdorov'ia naselennia Ukrainy [Socioeconomic features of food consumption and their influence on population health in Ukraine]. Aktualni problemy ekonomiky [Actual Problems of Economy], 334-356 [in Ukrainian].

EDYTA GHERIBI (2016). Perspektywy rozwoju przedsiębiorstw gastronomicznych na polskim rynku [Catering Enterprises Development Prospects for the Polish Market]. Studia Ekonomiczne [Economic Studies]. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach [Scientific Papers of the University of Economics in Katowice], No. 255, pp. 102-112.

FIGEE, E., OORTWIJN, M. (2004). High Pressure Cooking. European foodservice market matures, while value chain dynamics just start. Utrecht: Cap Gemini Ernst & Young.

BARBARA KOWRYGO, DAGMARA STANGIERSKA (2012). Rozwój przedsiębiorczości na przykładzie usług gastronomicznych [Development of Entrepreneurship – Case of Foodservices]. Ekonomiczne Problemy Usług [Economic Problems of Services]. Zeszyty Naukowe Uniwersytetu Szczecińskiego[Scientific Papers of the University of Szczecin], No. 98, pp. 493-506.

ANISIMOV, G., ZHUKOV, Y., LIPOVOY, D. (2018) Analiz stanu merezhi zakladiv restorannoho hospodarstva administratyvnykh rayoniv mista Kharkova [Analysis of the State of the Network of Restaurant Facilities in the Districts of the City of Kharkiv]. Traektoriâ Nauki [Path of Science], Vol. 4, No. 1, pp. 1001-1013 [online]. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=3120729 [Accessed 19 Mar. 2021].

STATISTICS POLAND (2021). Statistical data [online]. Available from: https://stat.gov.pl [Accessed 19 Mar. 2021].

STATE STATISTICS SERVICE OF UKRAINE (2021). Statistical data [online]. Available from: http://www.ukrstat.gov.ua [Accessed 19 Mar. 2021].

WHO Regional Office for Europe (2021). Statistical data [online]. Available from: https://gateway.euro.who.int/en/ [Accessed 19 Mar. 2021].

Appendix A.1

Structure of Catering Establishments and Their Performance Results in Poland

Years	Structure of Catering Establishments				Performance Results of Catering Establishments (Revenue), thou PLN
	restaurants	bars	canteens	food courts	
2005	3,386	3,554	2,640	2,292	7,262,600
2006	3,510	3,793	2,471	2,449	8,156,721
2007	3,673	3,669	2,460	2,506	9,455,252
2008	4,150	3,776	2,077	3,066	10,734,791
2009	4,252	3,817	2,028	3,208	11,961,955
2010	4,625	3,995	2,088	3,700	12,964,888
2011	4,447	3,828	1,898	3,713	13,649,265
2012	4,806	4,266	1,982	4,083	14,719,951
2013	5,264	4,484	1,880	4,179	15,617,247.30
2014	5,615	4,937	1,839	4,934	17,111,889.30
2015	5,587	5,413	1,863	5,748	19,177,590.90
2016	5,917	5,728	1,889	6,089	22,187,755.40
2017	5,600	5,442	1,812	6,271	24,285,734.70
2018	5,034	5,124	1,744	5,798	26,026,718.10
2019	5,837	5,829	2,011	6,583	30,017,103.40

Source: own elaboration based on the data of Statistics Poland (GUS)

Structure of Catering Establishments and Their Performance Results in Ukraine

Years	Structure of Catering Establishments				Performance Results of Catering Establishments (Revenue), million UAH
	restaurants	cafés, snack bars, buffets	bars	canteens	
2010	1,408	9,454	2,453	9,990	10,643,803.8
2011	1,460	9,049	2,448	9,891	11,279,447.2
2012	1,453	8,108	2,266	9,665	16,959,521.8
2013	1,472	7,434	2,146	9,441	22,810,599.1
2014	1,495	6,884	2,063	9,286	17,596,592.6
2015	1,501	6,240	1,931	9,072	22,026,488.6
2016	1,523	5,750	1,842	8,893	27,722,932.6
2017	1,538	5,268	1,748	8,718	36,444,240.5

Source: own elaboration based on the data of Statistics Poland (GUS) and State Statistics Service of Ukraine

Appendix A.2

Household Food Expenditure and Population Morbidity in Poland

Years	Household Food Expenditure, PLN		Population Morbidity, (per 100 000 people)								
	At Home	Away From Home PLN	Revalence of obesity, %	Muscle and connective tissue diseases	Diseases of respiratory system	Diseases of digestive system	Mental and behavioural disorders	Injury and poisoning diseases	Cerebrovascular diseases	Ischaemic (coronary) heart disease	Infectious and parasitic diseases
2003	188	11	18,4	718,56	1417,61	1674,34	623,01	1451,24	370,11	957,89	395,78
2004	195	12	18,8	699,53	1503,67	1711,99	638,7	1562,31	417,37	885,68	424,83
2005	194	13	19,1	598,52	1307,93	1508,41	640,71	1360,76	344,88	773,59	357,71
2006	202	15	19,4	666,88	1333,99	1525,91	635,77	1574,96	355,15	778,39	402,8
2007	216	15	19,8	689	1391,36	1455,69	621,99	1442,74	343,69	742,46	391,25
2008	231	18	20,1	938,12	1516,07	1727,07	673,56	1655,64	387,5	884,2	491,89
2009	240	21	20,5	936,37	1397,41	1560,8	643,69	1701,78	336,42	811,12	477,84

Household Food Expenditure and Population Morbidity in Ukraine

Years	Household Food Expenditure, UAH		Population Morbidity, (per 100 000 people)								
	At Home	Away From Home	Revalence of obesity, %	Muscle and connective tissue diseases	Diseases of respiratory system	Diseases of digestive system	Mental and behavioural disorders	Injury and poisoning diseases	Cerebrovascular diseases	Ischaemic (coronary) heart disease	Infectious and parasitic diseases
2005	695,84	20,90	20,50	1096,02	3149,70	2211,07	937,68	1670,68	770,26	793,96	1645,64
2006	767,57	28,57	20,80	1119,79	3105,34	2210,52	940,89	1698,47	798,47	798,28	1712,21
2007	885,11	39,60	21,10	1139,56	3294,55	2259,77	990,20	1708,51	830,33	785,32	1766,42
2008	1266,71	62,17	21,40	1148,90	3169,65	2250,87	991,64	1681,05	858,87	758,31	1825,24
2009	1377,05	68,85	21,70	1128,37	3419,53	2192,79	910,45	1586,06	862,48	753,28	1808,83
2010	1585,51	73,74	22,00	1145,04	3704,30	2187,41	894,68	1606,76	901,11	756,35	1859,99
2011	1773,95	86,45	22,40	1141,50	3509,60	2139,07	893,57	1563,40	915,81	744,85	1857,64
2012	1799,64	89,80	22,70	1132,74	3238,59	2120,49	840,53	1571,61	916,98	758,28	1866,44
2013	1913,97	95,51	23,00	1132,17	3372,02	2099,16	830,60	1554,25	948,54	746,77	1905,38
2014	2101,38	93,12	23,40	986,64	2840,05	1797,73	662,17	1312,90	817,44	621,97	1621,02
2015	3160,51	119,04	23,70	1050,15	2788,08	1853,77	664,76	1325,57	832,90	630,66	1622,00

Appendix A.3

Household Food consumption in Poland, kilograms

Years	Meat and meat products	Milk and dairy products	Eggs	Fish and fish products	Sugar	Vegetable oil and other vegetable fats	Vegetables (including potatoes) and melon crops	Vruit, berries, nuts and grapes	Bread and bakery products
2003	5,59	6,37	15,16	0,41	1,69	1,61	12,67	3,99	8,82
2004	5,43	0,87	14,89	0,41	1,62	1,57	12,33	3,91	8,68
2005	5,48	6,35	15,16	0,42	1,53	1,53	12,42	3,72	8,44
2006	5,40	6,29	14,02	0,42	1,51	1,46	11,06	3,55	8,05
2007	5,39	6,27	13,49	0,45	1,42	1,42	10,77	3,40	7,70
2008	5,60	6,48	13,05	0,47	1,41	1,39	10,51	3,59	7,42
2009	5,55	6,47	13,00	0,46	1,38	1,37	10,28	3,77	7,17

Household Food consumption in Ukraine, kilograms

Years	Meat and meat products	Milk and dairy products	Eggs	Fish and fish products	Sugar	Vegetable oil and other vegetable fats	Potatoes	Vegetables (including potatoes) and melon crops	Fruit, berries, nuts and grapes	Bread and bakery products
2005	4,4	21,7	21	1,8	3,6	1,9	9,6	9,1	3,1	10,3
2006	4,7	22,3	19	1,9	3,2	1,7	8,7	9,4	3	9,8
2007	5,1	22,1	20	1,9	3,2	1,7	8,3	8,7	3,6	9,6
2008	5,1	22,6	20	2,1	3,4	1,8	8,4	9,3	3,7	9,6
2009	4,8	19,8	20	1,8	3,2	1,9	8	10,1	3,6	9,3
2010	5,1	19,1	20	1,8	3	1,8	7,6	9,5	3,7	9,3
2011	5,1	18,9	20	1,7	3,1	1,8	7,7	10,1	3,7	9,2
2012	5,1	19,6	20	1,7	3,1	1,8	7,6	10,2	3,8	9,1
2013	5,1	20,2	20	1,8	3	1,7	7	9,4	4,2	9
2014	4,9	20,3	20	1,6	3,0	1,7	6,9	9,0	3,7	9,0
2015	4,6	19,8	19	1,2	2,8	1,6	6,6	8,8	3,1	8,5

Appendix B.1

Mortality from Various Diseases in Poland (per 100 000 people)

Years	Diseases of respiratory system	Cancer of the cervix uteri	Cerebrovascular diseases	Diseases of diabetes	Diseases of circulatory system	Diseases of digestive system	Diseases of the blood, blood forming organs and certain immunity disorders	Endocrine, nutritional and metabolic diseases	External causes of injury and poisoning diseases	Infectious and parasitic diseases	Ischaemic (coronary) heart disease	Diseases of malignant neoplasms	Diseases of mental disorders, diseases of nervous system and sense organs
2000	46.42	9.31	104.18	12.97	446.22	37.81	1.41	14.33	66.41	6.47	141.76	217.23	4.06
2001	39.09	8.31	103.6	12.32	433.98	37.67	1.44	13.63	64.09	6.05	134.26	217.84	4.14
2002	37.61	8.41	98.57	12.15	413.88	36.78	1.44	13.47	64.18	6.18	125.78	216.67	3.81
2003	41.46	8.22	95.49	12.24	416.65	36.68	1.31	13.52	62.44	6.09	124.93	214.73	4.34
2004	39.41	8.09	91.54	11.6	397.03	36.42	1.36	13.02	62.14	5.52	117.62	213.98	4.6
2005	42.3	7.81	87.4	12.2	384.24	37.62	1.38	13.45	62.57	5.67	114.43	211.51	4.54
2006	40.67	7.81	83.23	13.12	372.19	39.07	1.06	14.28	61.27	5.66	111.42	210.24	4.9
2007	41.45	8.1	79.79	13.55	365.49	37.73	1.06	14.51	59.77	5.35	104.22	208.72	5.32
2008	40.06	7.31	76.09	13.7	356.9	38.25	0.94	14.74	60.67	6.25	102.32	204.71	5.07
2009	41.91	7.29	72.35	13.69	356.25	38.45	0.92	14.6	57.62	6.31	96.94	201.75	4.27
2010	38.1	7.14	68.46	12.82	335.6	37	0.84	13.64	56.1	6.15	90.29	195.81	3.79
2011	38.48	6.74	66.44	12.95	317.68	34.77	0.66	13.78	55.49	6.66	88.37	191.29	4.29
2012	37.33	6.71	63.01	13.44	323.69	34.73	0.57	14.35	54.26	5.37	83.64	192.32	3.97
2013	41.88	6.5	58.41	13.75	315.02	34.34	0.61	14.6	51.4	4.03	75.07	187.56	3.49
2014	35.85	6.27	53.87	12.18	292.37	33.68	0.44	13.09	48.47	3.86	68.7	187.02	3.38
2015	41.71	5.9	51.53	14.38	302.49	30.88	0.43	15.21	44.34	3.81	68.56	191.53	4.95

Source: own elaboration based on the data of WHO Regional Office for Europe

Appendix B.2

Mortality from Various Diseases in Ukraine (per 100 000 people)

Years	Diseases of respiratory system	Cancer of the cervix uteri	Cerebrovas-cular diseases	Diseases of diabetes	Diseases of circulatory system	Diseases of digestive system	Diseases of the blood, blood forming organs and certain immunity disorders	Endocrine, nutritional and metabolic diseases	External causes of injury and poisoning diseases	Infectious and parasitic diseases	Ischaemic (coronary) heart disease	Diseases of malignant neoplasms	Diseases of mental disorders, diseases of nervous system and sense organs
2000	67.12	7.66	189.86	5.81	789.4	41.91	0.9	8.41	143.37	25.69	504.53	173.15	5.36
2001	59.08	7.48	184.54	5.54	775.16	42.69	0.89	8.39	146.12	25.82	497.81	169	5.15
2002	56.62	7.57	183.59	5.43	799.57	44.77	0.89	8.98	153.17	24.14	516.93	166.9	5.58
2003	53.65	7.37	176.84	4.98	819.59	48.12	0.85	10.4	145.78	25.11	530.82	164.25	5.43
2004	50.65	7.44	177.36	5.39	807.88	54.58	0.82	11.47	143.77	25.88	522.85	162.67	6.47
2005	50.06	7.41	172.21	5.17	827.06	62.04	0.87	6.4	141.16	35.84	543.7	162.47	6.85
2006	44.03	7.28	167.58	4.95	801.63	59.04	0.75	6.1	130.33	33.91	529.44	159.87	5.78
2007	44.66	7.4	166.03	4.53	791.51	65.95	0.78	5.85	133.44	35.02	522.4	158.85	6.09
2008	41.35	7.38	160.24	4.22	781.29	69.17	0.66	5.34	123.94	35.87	516.49	157.28	5.68
2009	36.77	7.54	159.43	4.31	737.58	58.46	0.68	5.1	98.41	31.47	493.45	156.61	4.01
2010	33.5	7.28	148.13	4.02	732.71	51.36	0.58	5.05	88.43	30.41	491.9	156.39	3.17
2011	30.53	7.17	142.19	3.96	682.79	48.03	0.65	4.77	85.09	29.24	459.46	155.87	2.78
2012	29.03	7.46	139.45	3.65	667.11	52.08	0.63	4.71	83.43	28.82	450.07	161.32	2.95
2014	26.76	7.55	126	3.59	673.67	50.13	0.52	4.33	85.42	23.96	457.15	152.99	3.15
2015	25.25	6.86	123	3.61	634.59	45.17	0.57	4.22	73.62	21.67	433.07	144.59	2.5

Source: own elaboration based on the data of WHO Regional Office for Europe

Appendix C

Results of correlation and regression analysis of the impact of nutrition/diet models (at home (x_1), out-of-home (x_2)) and the performance results of catering establishments (x_3) upon the morbidity of the population (y_i) in Poland and Ukraine

Morbidity of the population (per 100 thousand people) (y_i)	Poland				Ukraine			
	Correlation relationship		Regression dependencies		Correlation relationship		Regression dependencies	
	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient
Prevalence of obesity (y_1)	>0.95	X_1, X_2, X_3	X_3	+0.09	>0.86	X_1, X_2, X_3	X_1 X_2	+0.07 +0.02
*Regression model**	$y_1=15,744+2,11E-07x_3$				$y_1=19,78+0,023x_2+3,65E-08x_3$			
Muscle and connective tissue diseases	>0.75<0.85 ≥0.85	X_2 X_1	Statistically insignificant effect		Statistically insignificant relationship and effect			
Diseases of respiratory system	Statistically insignificant relationship and effect				Statistically insignificant relationship and effect			
Diseases of digestive system	Statistically insignificant relationship and effect				>0.75<0.85	X_1	Statistically insignificant effect	
Mental and behavioural disorders	Statistically insignificant relationship and effect				>0.75<0.85 ≥0.85	X_2, X_3 X_1	Statistically insignificant effect	
Injury and poisoning diseases	>0.75<0.85	X_2	Statistically insignificant effect		>0.75<0.85 ≥0.85	X_2 X_1	Statistically insignificant effect	
Cerebrovascular diseases	Statistically insignificant relationship and effect				Statistically insignificant relationship and effect			

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Ischaemic (coronary) heart disease	Statistically insignificant relationship and effect			Statistically insignificant relationship and effect		
Infectious and parasitic diseases	>0.75<0.85	X_1, X_2	Statistically insignificant effect	>0.75<0.85 ≥0.85	X_2 X_1	Statistically insignificant effect

Source: own elaboration based on the data of WHO Regional Office for Europe, Statistics Poland (GUS) and State Statistics Service of Ukraine

Legend:

X_1 - Household Expenditures on Eating at Home

X_2 - Household Expenditures on Eating Out

X_3 - Performance Results of Catering Establishments

* Here and further, the regression dependences are given in the final version after checking the adequacy of the model (Fisher's test) and regression coefficients (Student's test).

Appendix D

Results of correlation and regression analysis of the impact of consumption of food staples by households of Poland and Ukraine (x_1) upon the

morbidity of the population

Morbidity of the population (per 100 thousand people) (y_i)	Poland				Ukraine			
	Correlation relationship		Regression dependencies		Correlation relationship		Regression dependencies	
	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient
Prevalence of obesity (y_1)	>0.92	X_3, X_4, X_5, X_6, X_7, X_9	Statistically insignificant effect		>0.75<0.85	X_4	X_4	-0.10
							X_5	+0.38
					≥0.85	$X5$, X_9, X_{10}	X_{10}	-0.56
Regression model	x				$y_1=28,24-1,27x_4+2,69x_5-1,58x_{10}$			
Muscle and connective tissue diseases (y_2)	>0.75<0.85	X_3, X_4	Statistically insignificant effect		Statistically insignificant relationship and effect			
Diseases of respiratory system (y_3)	Statistically insignificant relationship and effect				Statistically insignificant relationship and effect			
Diseases of digestive system (y_4)	Statistically insignificant relationship and effect				>0.75<0.85	X_{10}	Statistically insignificant effect	
					≥0.85	X_4		
Mental and behavioural disorders	Statistically insignificant relationship and effect				>0.75<0.85	X_9, X_{10}	X_4	+0.76
					≥0.85	X_4	X_{10}	+1.8
Regression model	x				$y_1=-76,39+300,1x_4+53,31x_{10}$			

Injury and poisoning diseases(y$_6$)	Statistically insignificant relationship and effect			>0.75<0.85 X$_4$, X$_9$, X$_{10}$	X$_4$	+0.45
Regression model	x			*y$_1$=106,8+434,32x$_4$*		
Cerebrovascular diseases (y$_7$)	>0.75<0.85	X$_2$	Statistically insignificant effect	>0.75<0.85	X$_1$, X$_8$	Statistically insignificant effect
Ischaemic (coronary) heart disease (y8)	>0.75<0.85	X$_8$	Statistically insignificant effect	>0.75<0.85	X$_1$, X$_8$	Statistically insignificant effect
Infectious and parasitic diseases (y$_9$)	Statistically insignificant relationship and effect			>0.75<0.85	X$_4$, X$_9$, X$_{10}$	Statistically insignificant effect

Source: own elaboration based on the data of WHO Regional Office for Europe, Statistics Poland (GUS) and State Statistics Service of Ukraine

Legend:

X$_1$ - household consumption of meat and meat products

X$_2$ - household consumption of milk and dairy products

X$_3$ - household consumption of eggs

X$_4$ - household consumption of fish and fish products

X$_5$ - household consumption of sugar

X$_6$ - household consumption of vegetable oil and other vegetable fats

X$_7$ - household consumption of vegetables and melon crops (for Poland, including potatoes)

X$_8$ - household consumption of fruit, berries, nuts and grapes

X$_9$ - household consumption of bread and bakery products

X$_{10}$ - household consumption of potatoes (for Poland it is not calculated separately)

Appendix E

Results of correlation and regression analysis of the impact of nutrition/diet models (at home (x_1), out-of-home (x_2)) and the performance results of catering establishments (x_3) upon the mortality of the population (y_i) in Poland and Ukraine

Mortality of the population (per 100 thousand people) (y_i)	Poland				Ukraine			
	Correlation relationship		Regression dependencies		Correlation relationship		Regression dependencies	
	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient
Diseases of respiratory system (y_1)	Statistically insignificant relationship and effect				≥0.85	X_1, X_2	X_2	-0.65
Regression model	x				$y_1=53,45-0,35x_2$			
Cancer of the cervix uteri (y_2)	≥0.85	X_1, X_2, X_3	Statistically insignificant effect		Statistically insignificant relationship and effect			
Cerebrovascular diseases (y_3)	≥0.85	X_1, X_2, X_3	X_1 X_3	-0.44 -0.29	≥0.85	X_1, X_2, X_3	X_2 X_3	-0.16 -0.06
Regression model	$y_1=126,3-0,13x1-1,5E-06x_3$				$y_1=184,24-0,36x_2-9,8E-07x_3$			
Diseases of diabetes (y_4)	Statistically insignificant relationship and effect				≥0.85	X_1, X_2	X_2	-0.45
Regression model					$y_1=5,36-0,03x_2$			
Diseases of circulatory system (y_5)	≥0.85	X_1, X_2, X_3	Statistically insignificant effect		≥0.85	X_1, X_2	X_2	-0.22
Regression model	x				$y_1=866,8-2,31x_2$			

Diseases of digestive system (y6)	≥0.85	X1, X2,	Statistically insignificant effect		Statistically insignificant relationship and effect			
Diseases of the blood, blood forming organs and certain immunity disorders (y7)	≥0.85	X1, X2, X3	Statistically insignificant effect		≥0.85	X2	Statistically insignificant effect	
Endocrine, nutritional and metabolic diseases (y8)	Statistically insignificant relationship and effect				≥0.85	X1, X2	X2	-0.40
Regression model	x				$y_1=6{,}78-0{,}03x_2$			
External causes of injury and poisoning diseases (y9)	≥0.85	X2, X3	X2 X3	-0.12 -0.17	≥0.85	X1, X2,	X2	-0.68
Regression model	$y_1=71{,}67-0{,}26x_2-7{,}5E\text{-}07x_3$				$y_1=156{,}56-1{,}04x_2$			
Infectious and parasitic diseases (y10)	Statistically insignificant relationship and effect				≥0.85	X1, X2, X3	Statistically insignificant effect	
Ischaemic (coronary) heart disease (y11)	≥0.85	X1, X2, X3	Statistically insignificant effect		≥0.85	X1, X2	X2	-0.17
Regression model	x				$y_1=570{,}58-1{,}23x_2$			

Diseases of malignant neoplasms (y_{12})	≥0.85	X_1, X_2, X_3	X_1	-0.47	≥0.85	X_1	X_1	-0.15
Regression model	*$y_1=283{,}63-0{,}39x_1$*				*$y_1=165{,}82-0{,}01x_1$*			
Diseases of mental disorders, diseases of nervous system and sense organs (y_{13})	Statistically insignificant relationship and effect				≥0.85	X_2	X_2	-0.77
Regression model	x				*$y_1=7{,}61-0{,}05x_2$*			

Source: own elaboration based on the data of WHO Regional Office for Europe, Statistics Poland (GUS) and State Statistics Service of Ukraine

Legend:

X_1 - Household Expenditures on Eating at Home

X_2 - Household Expenditures on Eating Out

X_3 - Performance Results of Catering Establishments

Appendix F

Results of correlation and regression analysis of the impact of consumption of food staples by households of Poland and Ukraine (x_i) upon the

mortality of the population (y_i)

Mortality of the population (per 100 thousand people) (y_i)	Poland				Ukraine			
	Correlation relationship		Regression dependencies		Correlation relationship		Regression dependencies	
	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient	Relationship strength	Factors (x_i)	Statistically significant factors (x_i)	Elasticity coefficient
Diseases of respiratory system (y_1)	Statistically insignificant relationship and effect				≥0.85	X_5, X_9, X_{10}	Statistically insignificant effect	
Cancer of the cervix uteri (y_2)	≥0.85	X_3, X_5, X_6, X_7, X_9	Statistically insignificant effect		Statistically insignificant relationship and effect			
Cerebrovascular diseases (y_3)	≥0.85	X_3, X_5, X_6, X_7, X_9	X_3 X_6 X_9	-1.51 +47.89 +95.10	≥0.85	X_5, X_9, X_{10}	Statistically insignificant effect	
Regression model	$y_1=-19,46-8,31x3+47,3x6+17,64x9$				x			
Diseases of diabetes (y_4)	Statistically insignificant relationship and effect				≥0.85	X_5, X_9, X_{10}	Statistically insignificant effect	
Diseases of circulatory system (y_5)	≥0.85	X_3, X_5, X_6, X_7, X_9	Statistically insignificant effect		≥0.85	X_5, X_9, X_{10}	Statistically insignificant effect	
Diseases of digestive system (y_6)	Statistically insignificant relationship and effect				Statistically insignificant relationship and effect			

Diseases of the blood, blood forming organs and certain immunity disorders (y7)	≥0.85	X_3, X_5, X_6, X_7, X_9	Statistically insignificant effect		≥0.85	X_5, X_9, X_{10}	X_{10}	+2.9
Regression model	x				$y_1=0,83+0,24x_{10}$			
Endocrine, nutritional and metabolic diseases (y8)	Statistically insignificant relationship and effect				≥0.85	X_5, X_9, X_{10}	X_{10}	+1.41
Regression model	x				$y_1=-1,97+0,92x_{10}$			
External causes of injury and poisoning diseases (y9)	≥0.85	X_1, X_2, X_3	Statistically insignificant effect		≥0.85	X_2, X_5, X_9, X_{10}	X_2	+1.77
Regression model					$y_1=-278,56+8,99x_2$			
Infectious and parasitic diseases (y10)	≥0.85	X_4	X_4	+1.36	≥0.85	X_4, X_5, X_9, X_{10}	X_4 / X_{10}	+0.67 / +1.70
Regression model	$y_1=-1,98+18,08x4$				$y_1=17,54+11,74x_4+6,59x_{10}$			
Ischaemic (coronary) heart disease (y11)	≥0.85	X_3, X_5, X_6, X_7, X_9	Statistically insignificant effect		≥0.85	X_5, X_9, X_{10}	Statistically insignificant effect	
Diseases of malignant neoplasms (y12)	≥0.85	$X_{3,}, X_5, X_6, X_7, X_9$	Statistically insignificant effect	Statistically insignificant effect		Statistically insignificant relationship and effect		

Diseases of mental disorders, diseases of nervous system and sense organs (y_{13})	Statistically insignificant relationship and effect	≥0.85	X_2, X_5, X_9, X_{10}	X_2	+2.94
Regression model	x	$y_1=-20{,}26+0{,}61x_2$			

Source: own elaboration based on the data of WHO Regional Office for Europe, Statistics Poland (GUS) and State Statistics Service of Ukraine

Legend:

X_1 - household consumption of meat and meat products

X_2 - household consumption of milk and dairy products

X_3 - household consumption of eggs

X_4 - household consumption of fish and fish products

X_5 - household consumption of sugar

X_6 - household consumption of vegetable oil and other vegetable fats

X_7 - household consumption of vegetables (for Poland, including potatoes) and melon crops

X_8 - household consumption of fruit, berries, nuts and grapes

X_9 - household consumption of bread and bakery products

X_{10} - household consumption of potatoes (for Poland it is not calculated separately)