

Nutrition of the population of Ukraine and circulatory system diseases

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Abstract. The work is devoted to the study of the influence of nutrition of the population of Ukraine on the occurrence of circulatory system diseases (CSD). The relevance of this topic is conditioned by the widespread prevalence of these diseases in the country and the low effectiveness of national programs to control them. We determined the statistical relationship between the levels of food consumption and the incidence of CSD that occurred for the first time. The study was performed using nonparametric Kruskal — Wallis analysis of variance. The level of food consumption was an independent variable. The dependent variable (response variable) was the primary incidence of CSD (the number of CSD cases diagnosed for the first time per 100,000 population of the region). The study included 22 regions of Ukraine (all regions, except for the Autonomous Republic of Crimea, Donetsk and Luhansk regions). The study found that the population levels of actual food consumption in different regions of Ukraine met the normative values only for the consumption of milk, eggs and vegetables. Consumption of meat, fish, potatoes, fruits, sugar and oil differed from the norm. The severity of the deficiency in food consumption ranged from 4.9% to 26.2% for meat, from 2% to 43.5% for fish, and from 13% to 48% for fruits. The severity of excess consumption ranged from 71% to 145% for added sugar and from 2% to 5% for oil. The dependence of the incidence of CSD on the consumption of fish and potatoes was established: the incidence of CSD in the group of low fish consumption was significantly higher than the incidence of CSD in the group of optimal fish consumption ($p < 0.05$), the incidence of CSD in the group of high consumption potatoes were significantly higher than in the group of optimal consumption ($p < 0.05$).

Key words: nutrition of the population, cardiovascular diseases, circulatory disorders, consumption of food, prophylaxis.

Relevance

According to the WHO Regional Office for Europe, about 80% of all diseases are somehow related to nutrition, and for 41% of them the nutrition is a leading risk factor. Among these diseases, the circulatory system diseases (CSD) are of paramount importance [1, 2], which have become extremely relevant in Ukraine — they rank first in the structure of disease prevalence (30.67%), mortality (67.3%) and disability. The population of Ukraine suffering from CSD in 2008 was 25.6 million, in 2011 increased to 26.4 million, and in 2015 reached 27.1 million. If now this pathology covers 64% Ukrainians, then, according to scientists, by 2030 the number of patients with CSD will increase to 89%. According to the WHO, the Ukrainian mortality rate from coronary heart disease in 2015 was 7.5 times higher than the world average and led Ukraine to the 2nd place in terms of mortality from this pathology and to the 3rd place — in terms of mortality from all ranking diseases of 226 countries of the world [3].

National measures to control this pathology in the form of national targeted programs, which are based on early detection of diseases, dynamic monitoring and targeted treatment, did not significantly affect this situation, and the prevalence of hypertension during the program even increased 1.8 times [4, 5].

Meanwhile, according to the WHO, from 30% to 40% of CSD cases can be prevented only by changing lifestyle, including diet. Thus, the results of the North Karelia project, successfully implemented in 1972–1997 in Finland, demonstrated the ability to prevent at least 82% of deaths from coronary heart disease by reducing risk factors, primarily through changes in certain eating habits in the population [6].

In the current economic crisis in Ukraine, the problem of diseases caused by nutrition is becoming even more important. This is due to the fact that nutritional diseases cause significant economic damage to the state. Thus, in Ukraine, the annual economic losses due to temporary incapacity for work, disability and premature death from CSD exceed 2 billion UAH [7], which is almost 85% of GDP of the country. In Germany, the value of additional annual economic costs, which are associated only with the diagnosis, treatment and rehabilitation of patients with nutritional disorders, is 30% of total expenditures in the health care system, in the USA this figure reaches 137 billion dollars, in The United Kingdom — 6 million pounds [8].

In these circumstances, the interest in studying the nutrition of the population of Ukraine seems quite natural.

The aim is to study the statistical relationship between food consumption and the incidence of CSD among the population of Ukraine.

Materials and methods

Data on food consumption were obtained from the statistical yearbooks of the State Statistics Committee of Ukraine «Balances and food consumption of the population of Ukraine» for the period 2013–2016. The analysis included the following food groups: meat and meat products, fish, milk and dairy products, eggs, cereals (including bread), potatoes, vegetables, fruits and berries, added sugar, oil. We studied the indicators of primary incidence of CSD among the population in these areas for the same period. Data on the incidence of CSD were obtained from the electronic resource of the Centre for Medical Statistics of the Ministry of Health of Ukraine [9]. All regions of the country were included in the study, except for Donetsk and Luhansk regions. The follow-up period was limited to 2016, due to the fact that, starting in 2017, the state reporting on the incidence of CSD was stopped.

To study the incidence of primary CSD, intensive indicators were calculated — the number of cases of CSD that were first diagnosed, per 100 thousand population of the region).

Data on actual food consumption were compared with the Consumption Standards given in Table 1. These standards are indicators adapted to the objectives of the article, calculated on the basis of the normative and recommendation documents listed in Table 1, by converting units of measurement: g/day per 1 person, pcs/year per 1 person (for eggs) into kg/year per 1 person (for other products).

The patterns of the variable's distribution in variation series were evaluated using the Shapiro — Wilk test. Because the distribution of variants was differing from the normal distribution, a nonparametric Kruskal — Wallis analysis of variance was chosen to determine whether the primary incidence of CSD is changed depending on the amount of food consumption. The level of food consumption was represented as an independent variable. The primary incidence of CSD per 100 thousand population of the region acted as a dependent variable (response variable).

The numerical series of each independent factor were converted into a categorical series. For those food products, the consumption of which did not differ in different administrative regions of Ukraine (or differed less than in 3 regions), quartiles were used as a grouping feature. In other cases, the following categories were chosen as a grouping feature: low consumption (if the actual consumption of the product was less than the lower limit of the recommended value), high consumption (if the actual consumption exceeded the upper limit of the recommended consumption) and optimal consumption (if actual consumption was within permissible limits).

Separately for each of the above groups, the mean values of consumption and its standard deviation were calculated.

Table 1 Norms of daily food consumption

Name of food	Norms of consumption, kg/year			
	Thresholds ¹	Recommended levels		
		2000 ²	2016 ³	8003 ⁴
Cereals (cereals, legumes, flour, bread, bakery products in terms of flour)	101,1	121,6	123,4	219
Potato	124,1	94,9	94,9	
Meat and meat products	80,3	53,3	52,9	109,5
Milk and milk products (in terms of milk)	379,6	148,9	355,2	109,5
Fish	20,1	13,14	13,14	
Eggs ⁷	292	197	212	
Vegetables and melons	161	111,7	109,9	146
Fruits, berries	90,2	64,2	84	
Vegetable oil	13,14	9,13	7,12	
Sugar	36,9	36,5	29,2 ⁵	18,25 ⁶

¹Thresholds are set by the Law of Ukraine «On Food Security of Ukraine», which was adopted by the Verkhovna Rada of Ukraine in late 2011, but on July 5, 2012 was rejected on the initiative of the President of Ukraine. The rejection of the Law is justified by a number of reasons, including uncertainty in full of the composition of the products to be included in the food basket. ²In accordance with the product set defined by the Resolution of the Cabinet of Ministers of Ukraine dated 14.04.2000 № 656. ³In accordance with the product range defined by the Resolution of the Cabinet of Ministers of Ukraine dated 11.10.2016 № 780. ⁴World Health Organization (2000) CINDI Dietary Guide (<http://www.euro.who.int/document/e70041.pdf>). ⁵We also took into account the sugar contained in confectionery. ⁶The indicator calculated by us taking into account the WHO recommendations. ⁷Units of measurement — pcs/year per 1 person.

The null hypothesis of the Kruskal — Wallis test was tested — H_0 : the groups have the same distribution of median morbidity values. Quantitative assessment of differences in the distribution of values was performed using the criterion χ -square at the level of significance $\alpha=0.05$. If the calculated significance level p was less than the critical value α , hypothesis H_0 was rejected in favour of the alternative hypothesis H_1 : each group has a different distribution of the median values of the dependent variable, i.e. the incidence rate.

Statistical data processing was performed using the software package Stata (version 14.0).

Results and discussion

According to the Centre for Medical Statistics of the Ministry of Health of Ukraine, in the period from 2013 to 2016, it was registered 25168031 people with CSD, which was 58% of the population. At least 5% of the population was diagnosed with this pathology for the first time annually (on average 2166807 cases of primary CSD per year). Intensive primary incidence of CSD varied in different parts of Ukraine from 3121.03 per 100 thousand of population to 6825.3 per 100 thousand of population, its average value in Ukraine was at the level of 4745.3 per 100 thousand of population. The lowest levels of primary incidence of SD were registered in Zaporizhzhia, Volyn and Kherson regions — 3121.03, 3656.14 and 3745.69 per 100 thousand of population, respectively. The highest rates of primary morbidity at CSD were registered in Dnipropetrovsk, Ivano-Frankivsk, Kyiv and Mykolaiv regions — 6130.84, 6334.56, 6756.77 and 6825.26 per 100 thousand, respectively, which is 1.6–2 times higher, than in areas with the lowest incidence rates.

The average consumption of meat and meat products by Ukrainians was 47.1 ± 4.46 kg/year per person, and was below the recommended consumption rates in all regions of Ukraine, except for only two — Kyiv and Dnipropetrovsk regions. The deficit of meat and meat products consumption varied in different administrative territories of the country from 4.88% (Kirovohrad region) to 26.2% (Ivano-Frankivsk region). On average in Ukraine, this figure was 13.4%.

The average per capita consumption of fish and fish products in Ukraine was 11.1 kg/year. This indicator corresponded to the recommended levels in 5 regions of Ukraine, but in 17 regions it was below the recommended level. The deficit of fish consumption varied from 2.1% (Kherson region) to 43.5% (Ivano-Frankivsk region), the average level in Ukraine was 22.7%.

Milk and dairy products are a traditional national food of Ukrainians. Its actual consumption in Ukraine was 226.8 ± 23.03 kg/year per person and

did not exceed the recommended levels in all regions of Ukraine. Daily consumption of milk and milk products (in terms of milk) in 1990 was 373 kg/year per person, but in the next two decades it decreased almost twice. At the same time, the recommended daily allowance for milk decreased — in 2000 it was only 149 kg/year per person (408 g/day). There were at least two preconditions for this: milk production decreased due to the crisis in the livestock sector and scientific studies appeared that questioned the usefulness of milk consumption, in particular for the circulatory system.

Consumption of vegetables and eggs in all territorial units of Ukraine also met the recommended levels. The average per capita levels of consumption of vegetables and eggs in Ukraine were 150 ± 16.3 kg/year and 269 ± 13.5 units/year, respectively.

Ukrainians traditionally consume a lot of potatoes — an average of 150 ± 28 kg/year per person, which is almost 21% more than the recommended amount. Excessive consumption of potatoes was observed in 16 regions of the country and ranged from 13% to 48% of the recommended value. Only in 6 regions (Zaporizhzhia, Odesa, Mykolaiv, Dnipropetrovsk, Kyiv and Kharkiv) potato consumption was within the recommended limits.

Deficit of fruits and berries consumption was observed in all regions of Ukraine. Per capita consumption of fruits and berries in the country averaged 44.9 ± 7.35 kg/year, which was at least 30% less than the recommended value. In different regions of Ukraine, this deficit varied from 2% (Kyiv region) to 41% (Ivano-Frankivsk region).

Another feature of the diet of Ukrainians is the excessive consumption of added sugar — 37 ± 2.9 kg/year per person, which is twice as much as the WHO recommended amount (18.25 kg/year). The excess of added sugar in the diet of Ukrainians living in different regions ranged from 71% in Ternopil region to almost 145% in Cherkasy region.

The average per capita oil consumption met the recommended levels in 19 regions of the country. On average in the country, this indicator was at the optimal level of 12.5 ± 0.9 kg/year. Excessive consumption of vegetable oil was observed only in 3 regions — Odesa, Cherkasy and Mykolaiv, but it was insignificant — did not exceed 2–5% of the recommended value.

To address the question of whether these differences in nutrition affect the incidence of CSD in the population, a Kruskal — Wallis analysis of variance was performed. The results of the analysis are shown in Table 2.

The data obtained indicate that the groups of independent factors corresponding to different levels of consumption of meat and meat products, milk and dairy products, eggs, vegetables (except potatoes), fruits and sugar, have the same distribution of median morbidity values, ie levels CSD incidence does not depend on the level of food consumption.

Significant differences were found in the incidence rates of CSD in the groups of fish and potato consumption (Table 2). The incidence of CSD in the group of low fish consumption was significantly higher than the incidence of CSD in the group of optimal fish consumption ($p < 0.05$). The incidence of CSD in the group of high consumption of potatoes was significantly higher than in the group of optimal consumption ($p < 0.05$).

The number of indicators of food consumption that did not meet the recommended levels varied in different administrative units of Ukraine from 7 to 4 out of 10 studied. We compared the incidence of primary CSD in different regions of the country depending on the number of indicators that did not meet the standards, and did not establish differences between them ($\chi^2=3,602$; $p=0.3077$).

The data we obtained can be useful in developing the main directions of state policy in the field of national nutrition, the purpose of which is to prevent food-related diseases, in particular CSD.

It should be recognized that a limitation of our epidemiological study is that between regions with high and low morbidity, there may be, in addition to differences in food consumption, also differences in a large number of other potential determinants of CSD. These factors may include other dietary features, including salt or margarine intake, environmental and lifestyle factors, such as lack of physical activity, alcohol or smoking abuse, and so on.

Conclusions

1. The average population levels of actual food consumption in regions of Ukraine are corresponded to the recommended values

Table 2 Results of Kruskal — Wallis analysis of variance

Food	Food product group	Number of observations	Rank amount	Test statistics	
				χ^2	p-value
Meat and meat products	1	7	99	3,665	0,2999
	2	4	45		
	3	5	35		
	4	6	74		
Fish	Low consumption	17	170	3,991	0,0457
	Optimal consumption	5	83		
Milk and dairy products	1	6	56	3,416	0,3318
	2	5	80		
	3	5	49		
	4	6	68		
Eggs	1	6	87	2,400	0,4936
	2	5	45		
	3	5	49		
	4	6	72		
Cereal products	High consumption	3	27	2,59	0,2739
	Optimal consumption	18	205		
Potato	High consumption	16	155	4,571	0,0325
	Optimal consumption	6	98		
Other vegetables	1	5	74	2,308	0,5109
	2	6	68		
	3	5	58		
	4	6	53		
Fruits and berries	1	6	68	6,609	0,0855
	2	5	28		
	3	5	64		
	4	6	93		
Sugar	1	6	87	4,534	0,2092
	2	5	70		
	3	5	36		
	4	6	60		
Vegetable oil	High consumption	5	81	4,333	0,1146
	Optimal consumption	16	168		
The number of indicators of food consumption that did not meet the standards	7	2	12	3,602	0,3077
	6	5	47		
	5	10	118		
	4	5	76		

only for milk, eggs and vegetables. Consumption of meat, fish, potatoes, fruits, sugar and vegetable oil didn't meet the norm.

2. The severity of the deficit in food consumption ranged from 4.9% to 26.2% for meat, from 2% to 43.5% for fish, from 13% to 48% for fruits. The excessive consumption was ranged from 71% to 145% for added sugar and from 2% to 5% for vegetable oils.

3. The dependence of the CSD incidence on the level of fish and potato consumption was established: the incidence of CSD in the group of low fish consumption was significantly higher than the incidence of CSD in the group of optimal fish consumption ($\chi^2=3,991$; $p<0,05$), incidence on CSD in the group of high consumption of potatoes were significantly higher than in the group of its optimal consumption ($\chi^2=4,571$; $p<0,05$).

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References:

- Gulich M.P. (2011) Nutrition and a healthy lifestyle are the main factors in maintaining the health of the population. Problems of aging and longevity, 20(2): 128–132. (In Ukr.).
- Fus S.V., Lesnik S.A., Kirilenko E.K. (2006) Analysis of the structure of human nutrition as the basis for the prevention of nutritional diseases. J. General Practitioner, 4: 16–20. (In Rus.).
- WHO (2003) Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation — Geneva: WHO, 149 p.
- Mazhak I.M. (2013) Targeted programs in implementation of public policy in the field of cancer control and prevention (<http://www.dy.nayka.com.ua/?op=1&z=601>). (In Ukr.).
- Gorbas I.M., Smirnova O.O., Kvasha I.P., Dorogoy A.P. (2010) Evaluation of the effectiveness of the «Program for the prevention and treatment of hypertension in Ukraine» according to epidemiological studies. Arterial hypertension, 6(14): 51–67. (In Ukr.).
- Puska P. (2002) Successful prevention of non-communicable diseases: 25 year experiences with North Karelia Project in Finland. Public Health Med, 4: 5–7.
- Linnyk S.O. (2013) Implementation of international strategies for healthy nutrition in Ukraine. University scientific notes, 2(46): 21–26. (In Ukr.).
- Scarborough P., Bhatnagar P., Wickramasinghe K.K. et al. (2011) The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006–07 NHS costs. J. Public Health, 33(4): 527–535.
- <http://medstat.gov.ua>

Харчування населення України та хвороби системи циркуляції крові

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Анотація. Стаття присвячена вивченню впливу харчування населення України на виникнення хвороб системи кровообігу (ХСК). Актуальність теми обумовлена значною поширеністю цих хвороб на території України та низькою ефективністю національних програм боротьби з ними. Визначали статистичний зв'язок між споживанням продуктів харчування та рівнем захворюваності на ХСК, що виникли уперше. Дослідження проводили з використанням непараметричного дисперсійного аналізу Краскела — Уолліса. У якості незалежної змінної виступав рівень споживання продукту харчування. Залежна змінна (змінна відгуку) являла собою первинну захворюваність на ХСК (кількість випадків ХСК, що діагностовані уперше, на 100 тис. населення області). У дослідження включені 22 області України (всі області, за винятком АР Крим, Донецької та Луганської областей). Встановлено, що популяційні рівні фактичного споживання харчових продуктів у різних областях України відповідали нормативним значенням лише за споживанням молока, яєць та овочів. Рівні споживання м'яса, риби, картоплі, фруктів, цукру та олії відрізнялися від нормативних значень. Ступінь вираженості дефіциту у споживанні продуктів харчування варіював в межах 4,9–26,2% для м'яса, 2–43,5% для риби, 13–48% для фруктів. Ступінь вираженості надмірного споживання становив 71–145% для доданого цукру і 2–5% для олії. Встановлена залежність захворюваності на ХСК від кількості споживання риби та картоплі: показники захворюваності на ХСК у групі низького споживання риби були достовірно вищі за показники у групі оптимального споживання риби ($p<0,05$), показники у групі високого споживання картоплі були достовірно вищі, ніж у групі оптимального її споживання ($p<0,05$).

Ключові слова: харчування населення, серцево-судинні хвороби, хвороби системи кровообігу, профілактика.

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