

The assessment of knowledge and eating habits of adults in terms of cancer incidence

Ocena wiedzy i nawyków żywieniowych osób dorosłych w aspekcie występowania chorób nowotworowych

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Abstract

Background. The incidence of cancer in Poland is steadily increasing. The development of cancer is influenced by, among others: abnormal eating habits, excessive consumption of alcohol, smoking, and low physical activity. Proper diet along with increased physical activity can significantly reduce the probability of developing cancer.

Objectives. The aim of the study was to assess the knowledge and eating habits of adults in terms of cancer.

Material and methods. The study was conducted in the second half of 2014 among 140 adults. The research tool was a website survey questionnaire with single choice questions on the knowledge and eating habits, and questions about age, weight, height, place of residence, education, and the incidence of cancer in the respondent's family. The data obtained was subjected to statistical analysis using χ^2 test and Spearman's rank correlation.

Results. More than half of the respondents had normal body weight, 23.6% were overweight and 7.1% were obese. Statistically significantly, obesity affected more men than women. The respondents were unaware that frequent consumption of smoked foods could adversely affect their health and did not know which compounds belonged to antioxidants and what was the recommended daily salt intake. Most respondents did not consume adequate quantity of brown bread, coarse groats, milk and milk products, fish, vegetables, and fruit, while sweets, ready-to-eat foods, fast food, and alcoholic beverages were excessively present in their diet.

Conclusions. The respondents showed good nutritional knowledge in terms of cancer incidence, while their eating habits were at a sufficient level, irrespective of occurrence of cancer in the family. There was no statistically significant statistical relationship between eating habits and the level of nutritional knowledge of the respondents. It seems necessary to be continually aware of the effects of abnormal feeding and to motivate the changing of eating habits among all population groups.

Key words: eating habits, cancers, nutritional knowledge

Streszczenie

Wprowadzenie. Częstość zachorowań na nowotwory w Polsce systematycznie się zwiększa. Na powstawanie nowotworów mają wpływ m.in.: nieprawidłowe nawyki żywieniowe, nadmierne spożywanie alkoholu i palenie tytoniu oraz mała aktywność fizyczna. Właściwa dieta wraz ze zwiększoną aktywnością fizyczną mogą znacznie zmniejszyć prawdopodobieństwo rozwinęcia się zmian nowotworowych.

Cel pracy. Ocena wiedzy i nawyków żywieniowych osób dorosłych w aspekcie występowania chorób nowotworowych.

Materiał i metody. Badanie przeprowadzono w 2. połowie 2014 r. wśród 140 osób dorosłych. Wykorzystano w tym celu metodę sondażu diagnostycznego z zastosowaniem techniki ankietowej. Narzędziem badawczym była ankieta internetowa. Kwestionariusz ankiety zawierał pytania jednokrotnego wyboru służące do oceny poziomu wiedzy i nawyków żywieniowych oraz pytania o wiek, masę ciała, wzrost, miejsce zamieszkania, wykształcenie, a także występowanie przypadków zachorowania na choroby nowotworowe w rodzinie respondenta. Uzyskane dane poddano analizie statystycznej, przeprowadzając test niezależności – χ^2 oraz korelację rang Spearmana.

Wyniki. U ponad połowy ankietowanych (55%) stwierdzono prawidłową masę ciała, 23,6% badanych miało nadwagę, a 7,1% – otyłość. Statystycznie istotnie częściej problem otyłości dotyczył mężczyzn niż kobiet (17,2% vs 3,8%). Badane osoby nie były świadome, że częste spożywanie potraw wędzonych może niekorzystnie wpływać na zdrowie oraz nie wiedziały, jakie związki zalicza się do przeciwutleniaczy i ile wynosi zalecane dopuszczalne dzienne spożycie soli. Większość respondentów nie spożywała odpowiednio często ciemnego pieczywa, grubych kasz, mleka i przetworów mlecznych, ryb, warzyw i owoców, natomiast zbyt często spożywała słodkie, potrawy gotowe, dania typu fast food, a także napoje zawierające alkohol.

Wnioski. Respondenci wykazali się dobrym poziomem wiedzy żywieniowej w odniesieniu do występowania chorób nowotworowych. Z kolei ich nawyki żywieniowe były na poziomie dostatecznym. Nie stwierdzono statystycznie istotnej zależności pomiędzy nawykami żywieniowymi a wiedzą żywieniową badanych osób. Konieczne wydaje się stałe uświadamianie skutków nieprawidłowego sposobu żywienia i motywowanie do zmiany nawyków żywieniowych wszystkich ludzi, a szczególnie tych osób, które znajdują się w grupie podwyższonego ryzyka zachorowania na choroby nowotworowe.

Słowa kluczowe: nawyki żywieniowe, choroby nowotworowe, wiedza żywieniowa

Background

The incidence of cancer in Poland is continuously growing. Almost 160,000 cases of malignant neoplasms were reported in 2014, and in 2016 their number exceeded 180,000. The number of cancer deaths has also increased. Malignant neoplasms are the 2nd cause of death in Poland. Approximately 100,000 people die of cancer every year.^{1,2}

Studies show that in Poland the number of deaths is affected by 2 phenomena: high level of exposure to risk factors, especially tobacco smoke, as well as late diagnosis and treatment. Approximately 80% of cancer cases are associated with environmental factors, such as diet, alcohol and smoking.^{3–5}

The development of diet-related cancer results from factors such as high fat consumption, low fiber intake, low fruit and vegetable intake and excessive consumption of cooking salt.³ The correlation between long-term consumption of alcoholic beverages and malignant neoplasms, observed particularly in the case of upper gastrointestinal tract cancer, is also of high significance.⁴ Smoking constitutes another cancer risk factor. Tobacco smoke contains over 50 carcinogenic compounds. The most common cancer caused by smoking is lung cancer.⁵

Excessive body mass may also be the cause of cancer.⁶ Physical activity has a beneficial effect on body weight reduction. It has been found that regular, daily physical ac-

tivity reduces the risk of colorectal, breast, endometrial, and prostate cancer.⁷

Actions aimed at preventing cancer are important in tackling the disease. Diet containing bioactive substances, which are naturally present in certain foods, can be an example of such actions. Those substances can inhibit or slow down the process of carcinogenesis, for example by stabilizing the genetic material (which prevents oxidative damage to the DNA) and showing the following effects: anti-angiogenetic (prevention of the development of cancer and its metastases), antiproliferative in relation to cancer cells, proapoptotic, anti-inflammatory, anti-mutagenic, inducing differentiation in atypical cells, as well as immunomodulating effect. Those compounds include, among other things, plant polyphenols, carotenoids and dietary fiber. Other biologically active components of food, which also have such properties, are vitamins C, E and D, folates, minerals (calcium, selenium), n-3 polyunsaturated fatty acids, as well as pro- and prebiotics.^{8–10}

Based on the gathered data proving the correlation between food, diet, physical activity, overweight and obesity, and the risk of cancer, the World Cancer Research Fund (WCRF) presented several recommendations. It recommends that the median of body mass index for adults (BMI) be within the range of 21–23, depending on the type of population, and that the percentage of overweight or obese people be not higher than at present or favorably lower within 10 years. It also recommends that body mass during childhood and adolescence do not exceed the low-

er BMI range at the age of 21, and that it be maintained at a proper level after the age of 21. The WCRF also warns against weight gain and an increase in the waist circumference in adulthood. It also stresses the importance of physical activity in everyday life, and emphasizes that the physical activity level should be above 1.6. It defined moderate physical activity as fast walking for at least 30 min a day, and, as physical fitness improves, for 60 min or longer at a moderate pace, or for 30 min or longer at a dynamic pace. The organization decisively recommended limiting sedentary lifestyle. As for foods and beverages, it indicated the necessity to limit the consumption of products of high energetic density and exclude sweet beverages from the diet. The organization decided that the average energetic density of the diet should be less than 125 kcal per 100 g. It also recommends consuming mostly the products of plant origin – at least 600 g of fruit and vegetables daily (except for starchy vegetables) and the same amount of unprocessed cereals (grain) and/or legumes and other foods which are a natural source of dietary fiber, in order to provide the body with at least 25 g of non-starch polysaccharide every day. Other recommendations of the WCRF concern the consumption of red meat and avoidance of processed meat. The average consumption of red meat should not exceed 300 g per week, and even less in case of processed meat. The organization also indicated the necessity to limit daily alcohol consumption to 2 alcoholic beverages per day for men (20–30 g of pure ethanol) and 1 alcoholic beverage for women (10–15 g of pure ethanol). It explicitly recommended limiting the consumption of cooking salt by avoiding salty foods and limiting the consumption of processed food with added salt. The average consumption of salt from all sources should not exceed 5 g (2 g of sodium) per day. The organization suggested choosing appropriate methods of food preservation, which do not require using salt, such as: chilling, freezing, drying, preservation, and fermentation. It unambiguously recommended that grains and legumes contaminated with aflatoxins be eliminated from the diet. Another recommendation of the WCRF is that the nutritional needs should be satisfied with food alone, which means that attempts should be made to increase the percentage of people consuming foods of high nutritional value but without dietary supplements. The organization did not recommend consuming dietary supplements in order to prevent cancer.¹¹

The aim of the paper was to assess the knowledge and eating habits of adult individuals in terms of the occurrence of cancer.

Material and methods

The diagnostic survey method with the use of the questionnaire technique was utilized to conduct the study. A validated online survey posted at www.ankietka.pl con-

stituted the research tool. The survey included 140 adults from the entire country, and was carried out in the second half of 2014.

The participants had to be at least 18 years old. The exclusion criteria included age below 18 and chronic diseases requiring diet therapy, which could affect the eating habits of the respondents.

The questionnaire of the survey contained single choice questions, the aim of which was to assess the level of knowledge and the eating habits, as well as questions concerning age, body mass, height, place of residence, education, and family history of cancer.

In order to conduct the assessment of the level of knowledge and the eating habits, correct answers given to the questions contained in the survey were counted. The respondents scored 1 point for each correct answer, and therefore they could score a maximum of 20 points for their knowledge and 22 points for their eating habits. The interpretation of the scores was conducted on the basis of the following scale: $\geq 75\%$ of correct answers indicated very good eating habits/very good nutritional knowledge; 74.9–50% indicated good eating habits/good nutritional knowledge; 49.9–25% indicated mediocre eating habits/mediocre nutritional knowledge; and $\leq 24.9\%$ indicated bad eating habits/insufficient nutritional knowledge.

The obtained results regarding body mass and height were the basis for calculating the BMI index, which was used to calculate the percentage of adults with normal body weight as well as those who were underweight, overweight or obese. The breakdown of respondents was carried out on the basis of the criteria determined by the World Health Organization (WHO). The values of BMI $< 18.5 \text{ kg/m}^2$ indicated underweight, $18.5\text{--}24.9 \text{ kg/m}^2$ normal body mass, $25.0\text{--}29.9 \text{ kg/m}^2$ overweight, and values $> 30 \text{ kg/m}^2$ indicated obesity.

In order to show the correlation between the level of knowledge and the eating habits in the adults in whose families there were cases of cancer and the individuals without family history of cancer, the χ^2 independence test was conducted. In order to check whether there was a correlation between the knowledge and the eating habits in terms of the occurrence of cancer, Spearman's rank correlation was carried out. The following levels of correlation for r were adopted for result interpretation: $r < 0.20$ lack of linear correlation; $r = 0.20\text{--}0.39$ low correlation; $r = 0.40\text{--}0.69$ moderate correlation; $r = 0.7\text{--}0.90$ relatively strong correlation, and $r > 0.9$ very strong correlation. The level of statistical significance was $p = 0.05$. The statistical analysis was performed with the use of STATISTICA, v. 10.0 software (StatSoft, Inc., Tulsa, USA).

Results

The study involved 105 women (75%) and 35 men (25%). People aged 19–30 constituted the largest group (65.7%),

followed by the group of people aged 31–50 (25%). Most of the respondents were resident in cities (67.1%), and the majority of the participants had secondary (45%) or higher (37.1%) education. The female participants had higher education significantly more often than the male participants (45.7% vs 11.4%); on the other hand, men more often had vocational education (34.3% vs 8.5%). Over a half of the respondents (55%) had normal body mass, 23.6% were overweight and 7.1% were obese. Statistically significantly more often the problem of obesity pertained to men than to women (17.2% vs 3.8%). Underweight was diagnosed in 14.3% of the respondents. Sixty percent of them confirmed that cancer had occurred among their relatives (Table 1).

The respondents showed good nutritional knowledge in terms of cancer occurrence (73.0%). Only 3 out of 20 questions asked posed a problem for over a half of the participants. The respondents did not know that frequent consumption of smoked foods could negatively affect their health, did not know what compounds were classified as antioxidants and what the recommended daily consumption of salt was.

Statistical analysis did not confirm differences in nutritional knowledge depending on the occurrence of cancer among the relatives of the respondents. Both groups presented the same level of knowledge; the percentage of correct answers, however, was slightly higher in the group of participants with family history of cancer than

in the group of people whose relatives did not suffer from it (74.8% vs 70.3%; $p = 0.6140$) – Table 2.

The eating habits of the respondents in terms of cancer occurrence were assessed as mediocre (40.0%). Most respondents did not consume brown bread, coarse-grained groats, milk and dairy, fish, fruit, vegetables, and fish frequently enough, but consumed sweets, instant meals, fast food, and alcoholic beverages too often (Table 3). Only 2.9% of the respondents did not use frying as a cooking technique and for this reason did not provide information regarding the type of grease used for frying food. The daily consumption of salt in the amount not exceeding 1 teaspoon was declared by 47.8% of the respondents. A similar percentage of the participants (41.4%) did not use additional salt in their meals. On the other hand, 25.7% of the respondents did not use pre-made condiment mixes. Fast food was not consumed by 12.9% of the participants and 7.1% of them did not drink alcohol. Only 10% of smokers admitted that they smoked in the presence of non-smokers. Physical activity was practiced at least a couple of times a week by 42.9% of the respondents.

Family history of cancer did not differentiate the eating habits of the respondents – they were mediocre in both analyzed groups (40.1% vs 40.0%; $p = 0.9719$) – Table 3.

The conducted analysis of correlation did not confirm that there was a correlation between the level of knowledge and the eating habits of the respondents in terms of cancer occurrence ($r = 0.0851$; $p = 0.7185$).

Table 1. Characteristics of the population studied

Tabela 1. Charakterystyka badanej grupy

Index		Total		Women		Men		<i>p</i> -value
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
		140	100.0	105	75.0	35	25.0	
Age [years]	18	5	3.6	3	2.9	2	5.7	0.7926
	19–30	92	65.7	73	69.5	19	54.3	0.1501
	31–50	35	25.0	22	20.9	13	37.1	0.0910
	>50	8	5.7	7	6.7	1	2.9	0.6742
Place of residence	city	94	67.1	68	64.8	26	74.3	0.4059
	rural area	46	32.9	37	35.2	9	25.7	
Education	higher	52	37.1	48	45.7	4	11.4	0.0006
	secondary	63	45.0	45	42.9	18	51.4	0.4924
	vocational	21	15.0	9	8.5	12	34.3	0.0006
	primary	4	2.9	3	2.9	1	2.9	0.5580
BMI	underweight	20	14.3	18	17.1	2	5.7	0.1632
	normal body weight	77	55.0	54	51.4	23	65.7	0.2023
	overweight	33	23.6	29	27.6	4	11.4	0.0846
	obesity	10	7.1	4	3.8	6	17.2	0.0230
Family history of cancer	yes	84	60.0	62	59.0	22	62.9	0.8421
	no	56	40.0	43	41.0	13	37.1	

n – quantity of the tested feature in the sample; *p* – level of statistical significance (χ^2 test).

Table 2. Level of respondents' nutritional knowledge

Tabela 2. Poziom wiedzy żywieniowej ankietowanych

Survey questions (correct answers)	Total (n = 140)		Family history of cancer				p-value
			yes (n = 84)		yes (n = 56)		
	%	level of nutritional knowledge	%	level of nutritional knowledge	%	level of nutritional knowledge	
Does diet affect the health (e.g., may it increase the risk of cancer)? (yes)	91.4	very good	89.3	very good	94.6	very good	0.4231
Is fiber-rich diet recommended in the prophylaxis of cancer? (yes)	57.1	good	64.3	good	46.4	satisfactory	0.0552
What foods are the best source of protein? (cereal products, vegetables)	86.4	very good	88.1	very good	83.9	very good	0.6503
What are probiotics? (live bacteria cultures which positively affect the intestinal flora)	78.6	very good	79.8	very good	76.8	very good	0.8335
Does the consumption of cholesterol-rich foods increase the risk of cancer? (yes)	75.0	very good	76.2	very good	73.2	good	0.8421
What foods contain most cholesterol? (animal products, for example pork, offal)	77.9	very good	75.0	very good	82.1	very good	0.4299
Does the consumption of fatty marine fish negatively affect the health, and may it increase the risk of cancer? (no, it positively affects the health)	54.3	good	54.8	good	53.6	good	0.9724
Does the consumption of smoked foods negatively affect the health? (yes)	47.9	satisfactory	52.4	good	41.1	satisfactory	0.2544
Which method of food preparation is most beneficial in cancer prophylaxis? (boiling, steaming, baking in baking sleeve)	92.1	very good	94.0	very good	89.3	very good	0.4806
What products are a good source of n-3 fatty acids? (fish)	75.7	very good	78.6	very good	71.4	good	0.4446
Can a diet which is poor in vegetables and fruit increase the risk of cancer? (yes)	62.1	good	64.3	good	58.9	good	0.6438
What compounds are classified as antioxidants? (vitamins A, C and E)	44.3	satisfactory	50.0	good	35.7	satisfactory	0.1353
Can high level of salt consumption increase the risk of cancer? (yes)	64.3	good	66.7	good	60.7	good	0.5892
What is the recommended daily consumption of salt? (1 teaspoon – 5 g)	42.1	satisfactory	41.7	satisfactory	42.9	satisfactory	0.9721
Is the consumption of foods covered in mold after its prior removal harmful? (yes)	80.7	very good	83.3	very good	76.8	very good	0.4573
Can alcohol abuse contribute to the development of cancer? (yes)	80.0	very good	80.9	very good	78.6	very good	0.8971
Can smoking cause not only lung cancer but other types of cancer as well? (yes)	95.0	very good	97.6	very good	91.1	very good	0.1784
Is smoking in the presence of non-smokers harmful for them? (yes)	99.3	very good	98.8	very good	100.0	very good	0.8377
Can regular physical activity reduce the risk of cancer? (yes)	79.3	very good	80.9	very good	76.8	very good	0.7016
Can excess body mass increase the risk of cancer? (yes)	77.9	very good	80.9	very good	73.2	very good	0.3829
The level of nutritional knowledge (average value)	73.0	good	74.8	good	70.3	good	0.6140

Table 3. Assessment of respondents' eating habits**Tabela 3.** Ocena nawyków żywieniowych ankietowanych

Survey questions (recommendations)	Total (<i>n</i> = 140)		Family history of cancer				<i>p</i> -value
	%	assessment of eating habits	yes (<i>n</i> = 84)		yes (<i>n</i> = 56)		
			%	assessment of eating habits	%	assessment of eating habits	
How many meals do you most often consume every day? (4–5 meals)	53.6	good	57.1	good	48.2	good	0.3872
How often do you consume brown bread or coarse-grained groats? (every day)	23.6	insufficient	19.1	insufficient	30.4	satisfactory	0.1798
How often do you consume milk or dairy? (every day)	27.9	satisfactory	29.8	sufficient	25.0	satisfactory	0.6721
What kind of meat do you consume more often? (turkey, chicken)	64.3	good	63.1	good	66.1	good	0.8571
How often do you eat fish? (several times a week)	7.1	insufficient	7.1	insufficient	7.1	insufficient	0.7377
How often do you consume smoked or grilled products? (rarely, I do not)	79.2	very good	78.6	very good	80.4	very good	0.9660
Most often, how do you prepare your food? (boiling, steaming, baking in baking sleeve)	61.4	good	64.3	good	57.1	good	0.5007
What kind of grease do you most often use for frying food? (I do not fry food)	2.9	insufficient	3.6	insufficient	1.8	insufficient	0.9175
What type of grease do you usually spread on bread? (I do not use grease for my bread, butter or high-quality margarine without <i>trans</i> fats)	97.1	very good	96.4	very good	98.2	very good	0.9175
How often do you consume fruit or vegetables? (several times a day)	39.3	satisfactory	40.5	satisfactory	37.5	satisfactory	0.8598
How often do you consume sweets? (I do not)	2.9	insufficient	3.6	insufficient	1.8	insufficient	0.9175
How much salt approximately do you use every day? (no more than a teaspoon)	47.8	satisfactory	43.8	satisfactory	57.4	good	0.2013
Do you put additional salt in ready dishes? (no)	41.4	satisfactory	41.7	satisfactory	41.1	satisfactory	0.9163
Do you use ready-made spice mixes (Vegeta) or bouillon cubes? (no)	25.7	satisfactory	28.6	satisfactory	21.4	insufficient	0.4533
Do you consume products covered in mold? (no)	90.0	very good	91.7	very good	87.5	very good	0.6048
How often do you consume ready-to-eat meals (e.g., instant meals, instant soups)? (I do not)	13.6	insufficient	14.3	insufficient	12.5	insufficient	0.9598
How often do you consume fast food? (I do not)	12.9	insufficient	11.9	insufficient	14.3	insufficient	0.8771
How often do you drink alcohol? (I do not drink)	7.1	insufficient	8.3	insufficient	5.3	insufficient	0.7377
Do you smoke? (no, I have never smoked)	63.6	good	59.5	good	69.6	good	0.2985
Do you smoke in the presence of non-smokers? (no)	10.0	insufficient	10.5	insufficient	9.1	insufficient	0.6135
How often do you do physical activity? (everyday, several times a week)	42.9	satisfactory	44.1	satisfactory	41.1	satisfactory	0.9327
Do you use dietary supplements to prevent cancer? (no)	65.0	good	64.3	good	66.1	good	0.9711
Assessment of eating habits (average value)	40.0	satisfactory	40.1	satisfactory	40.0	satisfactory	0.9719

^a The question applies only to smokers, that is *n* = 30.

Discussion

The report of the WCRF states that bad eating habits play a significant role in the development of cancer in humans. It is estimated that 40–60% of cancer cases are related to food and nutrition.^{3,11} The dietary model in

cancer prophylaxis is rich in plant products, which contain a lot of antioxidants and dietary fiber. Increasing the consumption of sea fish should also be considered. The products which should be limited are animal products, particularly the ones containing lots of fat.^{3,8–11}

As a result of rare consumption of wholegrain cere-

als, diets are poor in dietary fiber which performs many health-promoting functions in the organism, first and foremost reducing the risk of colorectal cancer.¹² Dietary fiber shortens the time of intestinal passage and increases the volume of stool, which leads to a decrease in the concentration and the contact time of potentially carcinogenic substances with the mucous membrane of the large intestine. In addition, it binds bile acids and cholesterol, which results in a decrease in lipoprotein synthesis and a decrease in cholesterol concentration in blood.¹³ It is a medium for the microflora inhabiting the human gastrointestinal tract. Fermentation of dietary fiber fractions in the large intestine leads to the production of short-chain fatty acids (butyric, acetic, propionic) and a decrease in stool pH. With respect to the epithelial cells, short-chain fatty acids, mainly butyric acid, protect the DNA from being damaged and affect the process of the expression of genes regulating cell growth; with respect to cancer cells, they have the ability to stimulate the differentiation process, inhibit cell proliferation, induce apoptosis, and inhibit angiogenesis.^{9–11}

In the authors' own studies, only 23.6% of adults declared that they consumed brown bread or coarse-grained groats daily, even though the vast majority of the respondents (86.4%) knew a lot about the sources of fiber, and 57.1% confirmed that a fiber-rich diet was recommended in cancer prophylaxis. In the studies conducted by Głodek et al.,¹⁴ none of the respondents consumed sufficient amounts of fiber, which may prove insufficient consumption of cereals, legumes, fruit, and vegetables. Results similar to the results of the authors' own study were obtained by Kowalczyk et al.¹⁵ Knowledge regarding the products containing fiber and concerning the beneficial effects of fiber in colorectal cancer prophylaxis was declared by 85% and 79% of the respondents, respectively.

The type and amount of consumed fats are important in the course of the neoplastic process. Excessive supply of animal fats, which constitute a source of saturated fatty acids and cholesterol, may promote pathological changes in the organism. A surplus of saturated fatty acids stimulates cancer cell growth and increases the risk of developing, among others, breast, colorectal, endometrial, and prostate cancer. Cholesterol also shows carcinogenic activity. It partakes in estrogen synthesis, thus increasing the risk of breast and cervical cancer. It also stimulates the production of bile acids, which in the large intestine are decomposed by bacteria into harmful metabolites increasing the risk of colorectal cancer development.¹⁶

Only every 7th person declared that they did not use any grease on bread. The others selected butter (52.1%) and margarine (30%). Kiciak et al.¹⁷ obtained opposite results. In the studies conducted by these authors, the respondents' first choice of grease for bread was margarine, then butter. Butter is a fat which is easily digested and contains a large amount of vitamin A as well as smaller amounts of vitamins D and E. However, as an animal fat, rich in

saturated fatty acids and cholesterol, it should be limited. On the other hand, margarine, obtained through hydrogenation of plant oils, is first and foremost a source of the essential unsaturated fatty acids. In natural fresh oils, saturated fatty acids occur in the *cis* configuration, and in hydrogenated plant fats they very often occur in the form of *trans* isomers. Thus, margarines of high nutritional value, free of the *trans* fatty acids, should be selected. Research shows that industrial *trans* isomers increase the risk of cardiovascular disease and some cancers (breast, prostate and colon cancer), and promote the development of the metabolic syndrome.¹⁸

It has also been shown that excessive supply of n-6 polyunsaturated fatty acids (linoleic and arachidonic acid) with food increases the risk of carcinogenesis. Linoleic acid has a stimulating effect on the process of angiogenesis as it is used for the synthesis of prostaglandins inhibiting the formation of the inhibitor of the process, that is interleukin 12, and n-6 tissue hormones, excessively produced from arachidonic acid, have an impact on the increase of cancer cell proliferation and the growth of those which have already formed in the process of carcinogenesis of breast and colon tumors as well as other neoplasms. The surplus of n-6 polyunsaturated fatty acids and the products of their peroxidation also stimulates mutations in the DNA, initiating neoplastic changes.⁹

On the other hand, n-3 polyunsaturated acids – α -linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) – contribute to a decrease in the incidence of, among others, mammary gland, colorectal, pancreatic, prostate, lung, and stomach cancer. Their beneficial effect results from their ability to intervene at each stage of carcinogenesis thanks to inhibiting proliferation, inducing apoptosis, promoting and differentiating cells, and enhancing the immune response and their anti-inflammatory activity.^{9,19}

The main source of n-3 fatty acids are marine fish.^{9,19} The results of authors' own study proved that only 7.1% of the respondents consumed fish every day or several times a week; most participants (75.5%), just like in another study,²⁰ were able to indicate the sources of n-3 fatty acids in diet.

Studies suggest that the consumption of milk fat has a positive impact on human health. It contains components with antioxidative properties, which prevent the effects of oxidative stress. The short-chain unsaturated fatty acids present in it have immunostimulating effect and, like oxidants, show anti-cancer activity. Fatty acids, the prophylactic effect of which in the process of carcinogenesis has been proven, include conjugated linoleic acids (CLA). Their main natural source is milk, dairy and the meat of ruminants.²¹ The probiotic bacteria present in fermented milk beverages are also believed to provide beneficial effects.^{9,22} These bacteria (*Lactobacillus*, *Bifidobacterium*), supported by prebiotics (e.g., inulin, fructooligosaccharides, oligofructose), improve microflora in

the large intestine. Pro- and prebiotics have immunostimulating and anti-inflammatory properties, and they bind carcinogenic compounds and limit the production of bacterial enzymes responsible for the production of mutagenic and carcinogenic compounds in the light of the gastrointestinal tract. Moreover, they partake in the inactivation of procarcinogenes, such as nitrates, nitrosamines and aflatoxins.^{9,23} Milk and dairy were consumed daily by 27.9% of the respondents. Nowak et al.²⁴ obtained somewhat better results in their study, in which 29% of the respondents declared daily consumption of fermented milk beverages. The adults who participated in this study, despite consuming dairy with insufficient frequency, had good knowledge concerning probiotics. More than 78% of the respondents knew that they were live bacteria cultures, which had positive impact on the intestinal flora.

Polycyclic aromatic hydrocarbons (PAHs) show genotoxic activity, which means they react with the DNA, as well as mutagenic and carcinogenic activity. This way, they negatively affect the course of endocrine, developmental and reproductive processes. They show systemic toxicity, causing damage to the suprarenal glands as well as the lymphatic, hematopoietic and respiratory system. The strongest carcinogenic effect is characteristic of benzo[*a*]pyrene,²⁵ which is most often found in thermally processed food. Polycyclic aromatic hydrocarbons are formed during certain types of food processing, such as smoking and heating, frying, baking, and grilling, especially over open fire. Increased temperatures and longer time of thermal processing increase the content of PAHs in food. In order to eliminate PAHs from diet, it is necessary to choose proper techniques of food preparation. Grilling and frying should be replaced by boiling, stewing or baking in foil or special baking sleeves.⁷ Among the respondents, the consumption of smoked or grilled products was rare (20.8%); however, less than a half of them (47.9%) knew about their harmful effect on health. In another study, the respondents also declared occasional consumption of these products.⁵ A study conducted by Merska and Czech²⁶ demonstrated that only 20% of the inhabitants of the Lublin region had knowledge regarding PAHs, and only 21% of the respondents indicated grilling as their potential source. Less than 3% of adults declared that they steamed their food instead of frying it. Most (60%) participants who fried their food used vegetable oil. In the study by Kiciak et al.,¹⁷ oil was also the product used most frequently for frying food.

Fruit and vegetables are a source of many important minerals and vitamins, particularly antioxidative vitamins, which protect the organism from carcinogenesis. The protective activity of these vitamins consists in inhibiting oxidative damage to tissues or the DNA thanks to removing free oxygen radicals, regulating proliferation, inducing differentiation and apoptosis of atypical cells as well as their impact on the activity of the enzymes

responsible for the repair processes of the DNA.^{8–10} Fruit and vegetables should, therefore, be an inseparable part of everyday diet. Only less than 40% of the respondents declared that they consumed fruit and vegetables several times a day. In the study by Zabłocka-Słowińska et al.,²⁷ the respondents also ate fruit and vegetables with low frequency.

More than 44% of the respondents in the authors' own study knew that vitamins A, C and E were classified as antioxidants. Cancer prophylaxis should include a diet rich in antioxidants, the natural source of which are fruit and vegetables, as there is no unambiguous evidence that dietary supplements are beneficial in cancer prevention. The effect of taking certain supplements in higher doses may be opposite and accelerate the development of cancer.¹¹ In the conducted studies, 65% of the respondents opted for not using dietary supplements to prevent cancer.

Salt consumption in Poland exceeds the recommended daily consumption (5 g) by even 2–3 times.²⁸ Excessive amount of salt in the diet constitutes a significant factor of the development of many diseases, among others, cardiovascular disease. High consumption of cooking salt accompanied by low supply of vitamin C also promotes neoplastic changes in the stomach. Sodium chloride damages the gastric mucosa, facilitating its penetration by carcinogens and increases its susceptibility to *Helicobacter pylori*.^{7,28} Unfortunately, less than 50% of the respondents declared daily salt consumption in the amount of no more than a teaspoon.

Forty-one percent of the respondents had knowledge regarding the recommended salt consumption. Among the students of Lublin universities, 80% of the participants did not know the recommended salt consumption.²⁹ Studies conducted by Schlegel-Zawadzka and Kowalczyk³⁰ show that participants' knowledge regarding salt consumption did not translate into their eating habits. People who had knowledge regarding the subject ate more salt than it was recommended.

The studies conducted by the authors indicated that most respondents consumed alcohol regularly. It probably resulted from the fact that people aged 19–30 constituted a significant part of the studied group. Meanwhile, alcohol consumption is a factor increasing the incidence of oral, pharyngeal and laryngeal cancer.⁴ It is not the ethanol contained in alcoholic beverages that is directly harmful to the organism, but its metabolite, acetaldehyde. This compound may damage the genetic material of the cell and interfere with its repair mechanisms. Ethanol also affects the concentration of estrogens and their metabolites, which may cause breast cancer.^{4,7} On the basis of the screening test AUDIT, associated with alcohol consumption, Kurpas et al.³¹ demonstrated that in a high percentage of students, alcohol consumption was hazardous, which means that they consume 6 or more units of alcohol per day. Moreover, students had insufficient

knowledge regarding the consequences of alcohol abuse. On the other hand, in the authors' own study as much as 80% of the respondents associated alcohol-rich diet with the risk of cancer.

The harmful effects of alcohol consumption may be aggravated by smoking, which, as studies show, is the cause of many diseases, including cancer.⁵ The most important carcinogenic factor, which is well known, is tobacco. It is believed that it is associated with 90% of the cases of lung cancer, 80–90% of the cases of oral, pharyngeal and laryngeal cancer and 30% of bladder and pancreatic cancer. Lung cancer is 10 times less common among non-smokers than in people addicted to smoking. The risk of lung cancer depends primarily on the duration of the addiction and the number of cigarettes smoked daily.³² In the studied group, 63.6% of the respondents declared that they had never smoked tobacco. In the light of the European Health Interview Survey (EHIS) from 2014, smoking is becoming less and less popular in Poland. Twenty-nine percent of adult men and 17% of adult women smoke tobacco in various forms daily. Smoking addiction occurs particularly often in 50-year-olds.³³ Passive smoking is as harmful as active smoking⁵ as it also entails the risk of tobacco-dependent diseases. It is estimated that the risk of lung cancer is approx. 20% higher in the people who spend time with smokers.³² A high percentage of the studied respondents (99.3%) were aware of the fact that smoking in the presence of non-smokers is harmful to them. It did not, however, translate into the practiced behavior. Only 10% of smokers declared that they did not smoke in the presence of non-smokers.

Overweight and obesity constitute a serious social and health problem of the 21st century, particularly due to the fact that a decrease in the age of the people with excess body mass is being observed. According to the results of EHIS, obtained in 2014, respectively 36.6% and 16.7% of Polish people aged >15 were overweight and obese, which altogether amounts to 53.3%.³³ Slightly better results were obtained in the group of adults. Excess body weight was found in 30.7% of the respondents – 23.6% were overweight and 7.1% obese. Excess body weight may lead to an increase in the incidence of chronic non-infectious diseases and increase the risk of cancer. The mechanisms of the impact of overweight and obesity on the development of cancer are very complex. They involve estrogen production, elevated level of insulin-like growth factor (IGF), an increase in the production of adipokines regulating cell growth, inflammatory processes, as well as changed immune response and oxidative stress. High level of estrogen increases the incidence of hormone-dependent cancer, that is breast and endometrial cancer, and higher level of IGF contributes to an increase in the incidence of liver cancer and non-Hodgkin's lymphoma as well as colon and bladder cancer in women.⁶

The conducted studies showed that the adult respondents had good nutritional knowledge in terms of cancer

incidence. Their knowledge, however, did not translate into their eating habits, which were assessed as mediocre. Statistical analysis confirmed the lack of correlation between the eating habits and the respondents' knowledge. Such bad lifestyle may lead to the development of cancer in the future. Moreover, as studies show, family history of cancer does not encourage and lead to the implementation of preventive measures, such as the improvement of eating habits.

Conclusions

The adults surveyed showed good nutritional knowledge in terms of the occurrence of cancer. On the other hand, their eating habits were mediocre, regardless of whether there was history of cancer in their families.

No statistically significant correlation was found between the eating habits and nutritional knowledge of the respondents.

It seems necessary to continuously raise the awareness regarding the consequences of bad diet and motivate all groups of people to change their eating habits, particularly the individuals who are at higher risk of developing cancer.

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