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The influence of nutrition on the development of atherosclerosis

Atherosclerosis is one of the most common lifestyle diseases, with serious consequences. The disease affects more or less around 80% of habitants of industrialized countries. In developed countries complications resulting from atherosclerosis remain the main cause of diseases (1). This disease of arteries is a process in which deposits of cholesterol and other lipids build up in the inner lining of an artery, accompanied by a progressive focal conjunctive tissue hyperplasia. The process leads to thickening of artery walls, as a result of which the artery diameter gets narrower.

The pathogenesis of atherosclerosis includes a great many factors which favour the appearance of atherosclerotic changes. The most important are: wrong food habits, high fat diet rich in saturated fatty acids and cholesterol, tobacco smoke, excessive alcohol consumption, a low level of physical activity, elevated blood pressure as well as obesity (2). The risk of atherosclerosis is also caused by: an elevated level of LDL-cholesterol, low concentration of HDL-cholesterol, elevated concentration of triglycerides, hyperglycemia, trombogenic factors, elevated concentration of homocysteine (1, 3, 4).

An elevated concentration of LDL in plasma, and consequently, the one of total cholesterol is a factor responsible for ischaemic heart disease. The risk of developing this disease appears when the concentration of cholesterol in plasma amounts to 200 mg/dl (5.2 mmol/l). As normal as concentrations of total cholesterol may be, a low level of HDL – under 30 mg/dl (<0.9 mmol/l) is a factor of ischaemic heart disease (5). Another well-known factor of atherosclerosis is hypertrigliceridaemia, which induces a higher tendency to develop vessel thrombosis by stimulation of factors 7 and 10. Moreover, it causes the growth of concentration of the inhibitor of tissue plasminogen activator (PAI-1). PAI-1 inhibits the activation of tissue plasminogen and, consequently, the physiological fibrinolytic activity. The activation of blood clotting in partially changed arterial intimae contributes to an intensification of atherosclerotic changes in vessels (6).

Another factor responsible for developing atherosclerosis is an excessive consumption of refined carbohydrates. The most atherogenic carbohydrates are saccharose and fructose. Glucose is not so much atherogenic. High quantity of simple sugars in food rations causes the growth of the level of triglycerides in serum by an increased synthesis of VLDL in the liver. It was noted that fructose coming from the digestion of saccharose was more easily transformed into triglycerides than glucose.

The present work is aimed at showing the influence of wrong food habits in developing atherosclerosis.

MATERIAL AND METHODS

A survey on eating habits was carried out on 60 persons (24 women and 36 men), in order to attain the research target, there was made up a questionnaire containing 30 questions, both open as well as semi-open and closed. The information was statistically analysed. The survey was carried out among people with atherosclerosis, patients of the hospitals SPSK number 4 in Lublin and WSZ in Kielce. The age of the questioned people was between 18 and 80 years.

What was evaluated in the examined group was the physical activity, taking in consideration the kind of work and other activity. A person with low physical activeness was defined as an out-of-work patient, spending his/her time passively at home. A medium-active person was described as a white-collar worker, spending his/her time actively. Physically active persons were qualified essentially as manual workers, spending their free time actively.

Food habits of the examined people were tested by a questionnaire. The questionnaire referred to the period preceding the treatment and contained questions about eating habits, composition of daily food ration as well as the knowledge of right food habits. There were evaluated the following issues: quantitative as well as qualitative values of consumed food, composition of daily food ration, regularity and number of meals per day and snacking between meals.

The obtained results were then statistically analysed. The values of analysed parameters were measured in nominal scale. To test the correlation between the analysed parameters, the independence test χ^2 was used. To compare the frequency in the analysed groups there the homogeneity test χ^2 was used. A 5% conclusion error was assumed as well as the relevance level $p<0.05$ showing the existence of statistically relevant differences or correlations. Statistical analyses were based on STATISTICA V. 6.0. software (StatsSoft, Polska).

RESULTS AND DISCUSSION

One of the causes of atherosclerosis is low physical activity. Hence, the present work is aimed to try to evaluate the physical activity of patients basing on the kind of their work, the way they get to work and the way they spend their free time (Table 1).

Analysis of work according to sex showed that most women were white-collar workers whereas most men did physical work. As far as the way they get to work is concerned, most men and most women walk or go by bicycle. Both women and men usually spend their free time on watching TV. The collected data permit to conclude that the physical activity of both groups is low, as most men and women do not work. Among the working group activity is on the middle level, because most men work physically and get to work by foot or by bicycle but after work they watch TV mostly. Women get to work by foot or by bicycle but they have intellectual work and, similarly like men, after work they watch TV most of the time.

It is generally known that body mass reduction in overweight people and maintaining the weight on some constant level help reduce the concentration of triglycerides and cholesterol in blood and increase the HDL level. Moreover, they improve the impaired glucose tolerance and, consequently, lower the risk of atherosclerotic changes. If the body mass is reduced by 10 kg, the total level of cholesterol decreases by 10%, TG level – by 30%, LDL level – by 15% and the HDL increases by 8% (7–13).

All that should be made in order to prevent and treat atherosclerosis is a well balanced diet and frequent meals at regular intervals (14). The sex of the examined people has no significant influence on their eating habits (Table 2).

Table 1. Physical activity of the examined persons

	Atherosclerosis		
	women (%)	men (%)	statistical analysis
Work			
yes	41.67	33.33	$\chi^2= 0.01$ p = 0.94
not	58.33	66.67	
Kind of work			
physical	36.67	66.67	$\chi^2= 0.56$ p = 0.45
intellectual	63.33	33.33	
Getting to work			
on foot	38.87	35.11	$\chi^2= 0.01$ p = 0.91
by car	30.53	40.67	$\chi^2= 0.01$ p = 0.91
by bike	30.53	24.00	$\chi^2= 0.04$ p = 0.84
Spending time			
walking	6.43	21.12	$\chi^2= 0.06$ p = 0.8
social meetings	20.0	15.56	$\chi^2= 1.41$ p = 0.24
watching TV	46.67	37.78	$\chi^2= 0.68$ p = 0.41
reading	20.0	25.67	$\chi^2= 0.83$ p = 0.36
cinema, theatre	8.33	0.00	$\chi^2= 0.2$ p = 0.65

Table 2. Patients' food habits

	Atherosclerosis		
	women (%)	men (%)	statistical analysis
Fat used when preparing meals			
plant fat	75.0	38.89	$\chi^2= 0.48$ p= 0.49
animal fat	25.0	61.11	$\chi^2= 1.25$ p= 0.26
Way of preparing meals			
cooking	52.1	50.00	$\chi^2= 0.01$ p = 0.94
baking	10.77	25.00	$\chi^2= 0.02$ p = 0.88
frying	27.1	25.00	$\chi^2= 0.36$ p = 0.55
cold dishes	2.10	0.00	$\chi^2= 0.25$ p = 0.62
Meals in snack bars			
yes	27.27	16.67	$\chi^2= 0.04$ p= 0.83
no	72.73	83.33	
Having three meals a day			
yes	83.33	66.67	$\chi^2= 0.35$ p = 0.56
no	16.67	33.33	
Regular mealtimes			
yes	58.33	41.18	$\chi^2= 0.83$ p = 0.36
no	41.67	58.82	
Causes of irregular eating			
no time	25.00	22.22	$\chi^2= 0.01$ p = 0.93
forgetting	25.00	22.23	$\chi^2= 0.25$ p = 0.62
not feeling hungry	16.66	27.77	$\chi^2= 0.7$ p = 0.4
stress at work	8.33	5.56	$\chi^2= 0.01$ p = 0.93
too many things to do	25.00	22.22	

Both women and men do not tend to go to snack bars. In their diet there are mainly cooked meals. Most women and men have at least three meals a day, but only women observe regular mealtimes. Moreover, women use plant fat predominantly, whereas men use animal fat. The results confirmed women and men had many wrong food habits, which was directly connected with atherosclerosis (Table 3).

Table 3. The wrong food habits of the examined patients

	Atherosclerosis		
	women (%)	men (%)	statistical analysis
Snacking between meals			
yes	91.67	88.89	$\chi^2 = 0.14$ $p = 0.71$
no	8.33	11.11	
Especially			
sweets	40.0	27.78	$\chi^2 = 1.53$ $p = 0.22$
fruit	10.0	11.13	$\chi^2 = 0.83$ $p = 0.36$
sandwiches	38.33	55.56	$\chi^2 = 0.02$ $p = 0.88$
French bread pizza	11.67	5.56	$\chi^2 = 0.14$ $p = 0.71$
Late night snacking			
yes	50.0	35.29	$\chi^2 = 0.14$ $p = 0.71$
no	50.0	64.71	
Late night food			
sweets	41.30	22.22	$\chi^2 = 2.61$ $p = 0.11$
fruit	24.97	22.22	$\chi^2 = 1.1$ $p = 0.3$
sandwiches	33.63	55.33	$\chi^2 = 0.16$ $p = 0.69$
Mealtime before bed			
a few minutes	25.0	50.0	$\chi^2 = 2.29$ $p = 0.32$
2 hrs	66.67	38.89	
4 hrs	8.33	11.11	
The evening meal is abundant			
yes	75.0	55.56	$\chi^2 = 0.48$ $p = 0.49$
no	25.0	44.44	
Snacking in stressful situations			
yes	80.0	37.50	$\chi^2 = 2.93$ $p = 0.09**$
no	20.0	62.50	
Especially			$\chi^2 = 0.63$ $p = 0.43$
sweets	52.78	44.45	$\chi^2 = 0.2$ $p = 0.65$
fruit	19.44	22.21	$\chi^2 = 0.25$ $p = 0.62$
sandwiches	27.78	33.34	

Other key issues are eating between meals and late night snacking. It was noticed that both men and women snacked between meals, especially sweets and sandwiches. Late night snacking was noted too, especially in women who eat sweets mainly. Man like sandwiches more.

Between-meal-snacking (uncontrolled eating) is a very harmful phenomenon, having a negative influence on the right digestion and functioning of the organism. It may also cause many diseases. In the present work, there was noted a high consumption of simple sugars and saccharose in the form of sweets. These results in elevated energy balance and, consequently, increases the synthesis of triglycerides which are accumulated in liver and fatty issue. All that leads to obesity and developing atherosclerotic changes (3).

The analysis of the influence of stress on extra eating showed that in this respect women were more susceptible, consuming especially sweets. In men, a stressful situation provoked no reaction.

Stress caused by today's lifestyle often leads to an excessive consumption of food, far above the needs of the organism. This concerns essentially the consumption of fat and sugar. Today's lifestyle is also connected with low physical activity. Linked with excessive food consumption, it favours obesity, especially the visceral one (15).

In the present work there were evaluated the kind and frequency of high-calory food consumed in a week, e.g.: fat meat, bacon, fat dairy products, eggs and sweets (Table 4).

Table 4. Frequency of having high-calories products

	Atherosclerosis		
	women (%)	men (%)	statistical analysis
Fat meat			
very often	83.34	76.47	
very rarely	8.33	17.65	$\chi^2 = 0.64$ p = 0.96
not at all	8.33	5.88	
Bacon			
very often	55.56	73.33	
very rarely	22.22	6.67	$\chi^2 = 2.17$ p = 0.7
not at all	22.22	20.0	
Fat dairy products			
very often	70.00	71.43	
very rarely	20.00	7.14	$\chi^2 = 1.93$ p = 0.75
not at all	10.00	0.00	
Eggs			
very often	66.66	94.44	
very rarely	11.11	5.56	$\chi^2 = 0.98$ p = 0.81
not at all	0.00	0.00	
Sweets			
very often	55.55	86.67	
very rarely	33.33	13.33	$\chi^2 = 5.88$ p = 0.21
not at all	11.11	0.00	

It was noted that both women and men preferred a diet rich in cholesterol. All the above-mentioned products were consumed both by the majority of men as well as by women. An excessive consumption of that kind of food increases the plasmatic cholesterol concentration. An elevated level of cholesterol in blood is correlated with a bigger incidence of ischaemic disease (16). If the diet is abundant in meat and fats, especially animal fats, and, moreover, the consumption of fibre gets smaller, it is highly likely that tumours of digestive system may appear (16).

In preventing of atherosclerosis, fat consumption should be generally limited. That means a smaller consumption of saturated fatty acids. It is a basic element of every diet when preventing or treating hypercholesterolaemia which helps reach and maintain the right body mass. It is recommended, that consumption of plant fats, which are a source of polyunsaturated fatty acids, be increased (7, 8, 10–12).

Having evaluated the level of knowledge of the right food habits among the examined people (Table 5) it was shown that both women and men do not know much about it. That is why they find it hard to change their lifestyle.

Table 5. Knowledge of the optimal feeding model

	Atherosclerosis		
	women (%)	men (%)	statistical analysis
Knowledge of the rules of the healthy nutrition yes no	41.67 58.33	27.78 72.22	$\chi^2 = 0.63$ $p = 0.43$
Knowledge of products raising the level of cholesterol yes no	100 0.00	87.50 12.50	$\chi^2 = 0.17$ $p = 0.68$

It is therefore important to get people to change the habits they have had so far.

CONCLUSIONS

1. Wrong food habits in patients were linked with a lack of knowledge about right nutrition. That may encourage them to break their wrong food irregular feeding, snacking between meals, consumption of fat meat and baked meals.

2. High-calory and high-fat diet were the major causes of atherosclerosis.

3. The examined groups had unsatisfactory knowledge of good nutrition rules – more should be done about education in this domain.

4. The examined groups had no knowledge of rational nutrition, which resulted in developing atherosclerosis.

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SUMMARY

The proper diet is one of the basic factors assuring health and functioning of an organism. Incorrectly balanced diet, which means feeding inadequate to the physiological needs of the organism was recognized as a risk factor of many diseases. Diet has a significant influence on the prevalence of atherosclerosis. Those are the diseases that originate from improper nutrition and they are a significant problem in our country. They lead to serious complications, disabilities and even death. The observations of populations of many countries and the epidemiological studies conducted on many people prove the influence of incorrectly balanced diet on morbidity and mortality due to the above mentioned diseases. The aim of this study was to analyse the influence of diet on the prevalence of metabolic diseases. Nutrition manners, most frequent diet mistakes and the kind of food preferred by people suffering from atherosclerosis were evaluated. The study was conducted among the hospital patients in Lublin and Kielce using a questionnaire. The questionnaire included questions about physical activity of the respondents, their nutrition manners and their knowledge about the rational nutrition. It was concluded that the examined people had low physical activity, used to make several diet mistakes and their knowledge about proper nutrition was limited. All those factors contributed to atherosclerosis in those patients.

Wpływ sposobu żywienia na występowanie miażdżycy

Jednym z podstawowych warunków dobrego stanu zdrowia i funkcjonowania organizmu jest odpowiednia dieta. Nieprawidłowe żywienie, czyli niezgodne z fizjologicznymi potrzebami organizmu, uznano za czynnik ryzyka wielu schorzeń. Sposób żywienia ma istotny wpływ na występowanie miażdżycy. Jest to schorzenie zaliczane do chorób powstających na tle nieprawidłowego żywienia. Stanowi poważny problem epidemiologiczny w naszym kraju. Prowadzi do poważnych powikłań, które są przyczyną niepełnosprawności, a nawet zgonów. Dowodów wpływu nieprawidłowo zbilansowanej diety człowieka na zapadalność i umieralność z powodu miażdżycy dostarczają obserwacje populacji wielu krajów, jak i badania epidemiologiczne prowadzone na dużych liczbach osób. Celem pracy było ukazanie wpływu żywienia na występowanie miażdżycy. Oceniano zachowania związane z przyjmowaniem pokarmu oraz rodzaj najczęściej popełnianych błędów żywieniowych, jak również rodzaj preferowanej żywności przez osoby z miażdżycą. Badania przeprowadzono metodą kwestionariusza ankiety wśród pacjentów szpitali w Lublinie i w Kielcach. Kwestionariusz zawierał pytania dotyczące aktywności fizycznej respondentów, ich zwyczajów żywieniowych oraz wiedzy na temat zasad racjonalnego żywienia. Stwierdzono, iż badane osoby cechowały się niską aktywnością fizyczną, popełniały liczne błędy żywieniowe, a ich stan wiedzy dotyczącej żywienia był niewystarczający. Zachowania te przyczyniły się w dużej mierze do wystąpienia u nich miażdżycy.