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Energy and nutrient intake versus nutrition status of elderly women

Spożycie energii i składników odżywczych a stan odżywienia kobiet w wieku podeszłym

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S u m m a r y

Introduction. Nutrition as a factor determining good health of elderly people is raising increased interest in all European countries due to the growing share of elderly people in the population.

Aim. The aim of this presentation is to assess the prevalence of improper nutrition and variation from the adequate nutritional status in a group of 71-74 year old women.

Material and methods. 130 women were picked at random from one of Warsaw districts; 68 of them were examined, with the response rate equal 58.1%. Nutrition was examined based on an interview method about the intake during 24 hours, repeated 4 times during the year; tabular data represents the average value across 4 interviews. The following parameters were determined in venal blood samples with the HPLC methods: blood serum concentrations of retinol, α-tocopherol, glucose and triglycerides, total cholesterol and its fractions. Obesity was diagnosed using the BMI index (> 30 kg/m^2).

Results. The study established that prolonged intake of excessive energy compared to the energy spent had resulted in the occurrence of a large percentage of obese women (44%) and a high average value of the BMI. The women's diets were found to contain too much fat (34% energy), with high percentages of the diets being deficient in many mineral components and vitamins. The most frequent deficiencies in the diets (among over 95% women) were found in: vitamin D, calcium, magnesium, potassium and folates. Lipid disorders were significantly more frequent among obese women than among other women.

Conclusions. There is an urgent need to provide dietary advice to elderly people based on the identified errors in nutrition, in order to optimize their health status.

Key words: nutrients, intake, elderly age, obesity, lipid disturbances

S t r e s z c z e n i e

Wstęp. Żywienie, jako czynnik determinujący życie osób starszych w zdrowiu, wzbudza rosnące zainteresowanie, ze względu na wzrost frakcji osób w podeszłym wieku, we wszystkich krajach europejskich.

Cel pracy. Celem artykułu jest oszacowanie nasilenia wad w żywieniu i odchyleń od prawidłowego stanu odżywienia w grupie kobiet w wieku od 71. do 74. roku życia.

Materiał i metody. Wylosowano, z jednej z dzielnic Warszawy, 130 kobiet, zbadano 68, zgłaszalność była równa 58,1%. W badaniu żywienia zastosowano wywiad o spożyciu z 24 godzin, powtórzony cztery razy w ciągu roku, dane tabelaryczne dotyczą wartości średniej z 4 wywiadów. W próbkach krwi żylnej za pomocą metod HPLC oznaczono: koncentrację w surowicy retinolu, α-tokoferolu oraz glukozy i triglicerydów, cholesterolu ogółem i jego frakcji. Otyłość diagnozowano za pomocą wskaźnika BMI (> 30 kg/m^2).

Wyniki. Stwierdzono, że długotrwałe spożywanie nadmiaru energii w stosunku do energii wydatkowanej skutkowało występowaniem dużego odsetka otyłych kobiet (44%) oraz wysoką, średnią wartością wskaźnika BMI. W dietach kobiet stwierdzono za dużo tłuszczu (34% energii) oraz wysokie odsetki diet niedoborowych w wiele składników mineralnych i witamin. Najczęstsze niedobory (u ponad 95% kobiet) w dietach stwierdzono w zakresie zawartości witaminy D, wapnia, magnezu, potasu i folianów. Zaburzenia przemian lipidowych były istotnie częstsze u kobiet otyłych w porównaniu do pozostałych.

Wnioski. Istnieje pilna potrzeba, w oparciu o zidentyfikowane wady w żywieniu, udzielania osobom starszym porad dietetycznych, w celu optymalizacji ich stanu zdrowia.

Słowa kluczowe: składniki odżywcze, spożycie, wiek podeszły, otyłość, zaburzenia lipidowe

INTRODUCTION

Though Europeans live longer and longer, in Poland growth of the average lifespan has slowed down after 2002. In 2007, the lifespan of women was 79.7 years, and was 2 years shorter than the average for the European Union. However, the duration of life does not indicate whether life is spent in good health or not. For this reason, measures indicating the length of life spent in good health have been introduced over the last years. In 2005, calculations based on Eurostat's studies showed that in Poland a woman aged 65 has a chance to live in good health for another 10.1 years, and with limited physical fitness – for further 8.4 years (1, 2).

Lengthening of human life, especially life in good health, depends on many factors classified to the lifestyle. Among them, the World Health Organization has recognized nutrition (3, 4) as an essential determinant influencing human lifespan, health status and the risk of developing numerous non-infectious diseases. Modern dietary reference intakes – DRI include elements aimed at prevention of obesity and other non-infectious diseases (5). However, healthy nutrition recommendations developed on their basis are most often addressed to the general adult population, without giving sufficient consideration to changes in the nutrition demands of elderly people which take place with passing years, or to health-related and social determinants influencing the nutrition pattern at an elderly age.

As the body grows older, the requirement for energy decreases, and change for many mineral components and vitamins that help decrease the risk of developing chronic diseases increases. In principle, the domestic publications and the conducted epidemiological studies pay little attention to nutrition of elderly people aged over 65, and few of them are accompanied by assessment of nutrition effects in the form of nutrition status (6, 7, 8, 9, 10). The formulated nutrition recommendations addressed to the elderly are to a large extent based on the results of international programs, like e.g. SENECA (11), EPIC (12) and others.

The aim of this paper is to assess the prevalence of nutrition problems and variations in the nutritional status in a group of elderly women.

MATERIAL

The examined group of women aged 71-74 constituted the Polish part of the international OPTIFORD study conducted within the 5th Frame Programme of the European Commission (13).

The women examined in the study were picked at random from a selected region of Warsaw (the lower Mokotów district) based on data from the PESEL population register office. Out of the 670 women living in the selected region, 130 were picked, 117 were available, 68 were examined; the response rate was 58.1%. The analyses discussed in this paper constituted an independent, additional extension of the OPTIFORD study, executed in Poland only.

The survey for this paper was conducted in 2002/2003, after obtaining consent from the Ethical Commission of the National Food and Nutrition Institute.

METHODS

Examination of the food consumption was carried out with use of 24 hours method, conducted 4 times in the consecutive seasons of the year, according to the methodology in force (14). All examinations of the of nutrition method were undergone by 59 women. The results presented are the average values from four interviews. The sizes of consumed portions were estimated based on a photograph album (15). The energetic and nutritive values of the women's diets were calculated using the DIETA 4 computer program, which contains a new procedure for assessing the statistical probability of occurrence of deficient diets or diets with excessive contents of the individual diet components, recommended by international organizations (16) and polish dietary reference intakes (5).

In venal blood samples collected from fasted women, concentrations of the following vitamins were determined: retinol and α-tocopherol, with the HPLC chromatography and the method described by Kaplan et al. (Methods in Enzymology, 1991) used for that purpose. In addition, the concentrations of glucose and triglycerides, total cholesterol and its fractions were also assessed.

Measurements of body height and mass were carried out in accordance to the accepted methodology, in standard conditions, on fasted women, without footwear, in minimum clothing. Obesity was classified based on the Body Mass Index (BMI), according to the WHO recommendations (17).

RESULTS

The average BMI (29.0 kg/m^2) of the examined women characterizes them as possessing relative body weight classified to the overweight category. Obesity with the BMI value higher than 30 kg/m^2 characterized 44% women (tab. 1).

Table 1. Basic physical characteristics of examined women aged 71-74 y.

Characteristic N = 59	x (SD)
Age (years)	71.6 (1.4)
Height (cm)	156.7 (6.4)
Body mass (kg)	71.1 (12.2)
Body Mass Index (kg/m^2)	29.0 (4.2)
BMI > 30	44%
BMI ≤ 30	56%
BMI < 25	20.3%

Every fifth woman (20%) showed the BMI within limits of the norm (18.5-24.9 kg/m^2), and one of them belonged to the underweight category (BMI < 18.5 kg/m^2).

The average intakes of energy and selected macrocomponents of the diet are presented in table 2.

Table 2. Intakes of energy and macro nutrients in women aged 71-74 y (average intake from four 24 hour recalls).

Intake/day	All x (SD)	Obese BMI > 30	Non obese BMI ≤ 30
Energy (kcal)	1472 (428)	1388	1539
Protein (g)	56.2 (14)	56	56
Total fat (g)	57 (24)	53	59
Carbohydrates (g)	199 (53)	185	210
Saccharose (g)	39 (19)	37	41
Fibre (g)	17 (6)	16	18
Cholesterol (mg)	192 (91)	189	197

The average intake of energy was 1472 Kcal/day in the group of all examined women, and was insignificantly lower (by 150 Kcal) among obese women compared to other women. Obese women declared lower total consumption fat (by 6 g/day), carbohydrates (by 25 g) and sucrose (by 4 g per day). In everyday diets of the women, 34% energy was provided by fats; 50.3% by carbohydrates, and 15.3% by proteins, with a minimum percentage of energy coming from alcohol, equal 0.4% (fig. 1).

Table 3 shows the contents of mineral components and vitamins originating either from the consumed food alone (A) or from food together with dietary supplements (B).

The average values „hide" the extreme intake values, that is, the numbers of women whose diets contained decidedly either too little or too much of individual nutrients compared to the norm appropriate for those women. In order to properly assess whether the women's diets contain the appropriate amounts of mineral components and vitamins, updated human nutrition (Dietary Reference Intakes), recommend the method of statistical assessment of the occurrence probability of deficient diets (5).

Table 3. Intakes of minerals and vitamins of women aged 71-74 y.

Nutrient:	A. x (SD)	B. x (SD)
Na (mg)	2753 (837)	2755.2 (840.8)
K (mg)	2647 (798)	2691.0 (803.0)
Ca (mg)	547 (248)	621.0 (288.2)
P (mg)	944.3 (262)	951.4 (262.9)
Mg (mg)	230 (69)	254.7 (87.8)
Fe (mg)	8.5 (3.2)	11.3 (7.2)
Zn (mg)	7.4 (2.0)	8.5 (2.9)
Vit. A (μg)	1015 (1251)	1462 (1959)
Retinol (μg)	547 (1219)	921 (1936)
Beta-caroten (μg)	2809 (1812)	3183 (2046)
Vit. E (mg)	8.5 (3.7)	31.87 (50.05)
Vit. B_1 (mg)	0.824 (0.283)	1.537 (1.474)
Vit. B_2 (mg)	1.36 (0.530)	1.970 (1.238)
Vit. PP (mg)	12.21 (4.54)	17.77 (10.66)
Vit. B_6 (mg)	1.37 (0.46)	3.22 (5.64)
Vit. C (mg)	78 (44)	110.3 (75.4)
Folics (μg)	212 (73)	272.45 (176.08)
Vit. B_{12} (μg)	3.26 (3.9)	4.08 (4.11)
Vit. D (μg)	2.47 (1.75)	4.93 (4.59)

A. – contributed only by foods and B. – from foods and supplements

Application of the above computation method, implemented using the DIETA 4 computer program (16), resulted in assessing the occurrence frequency of de-

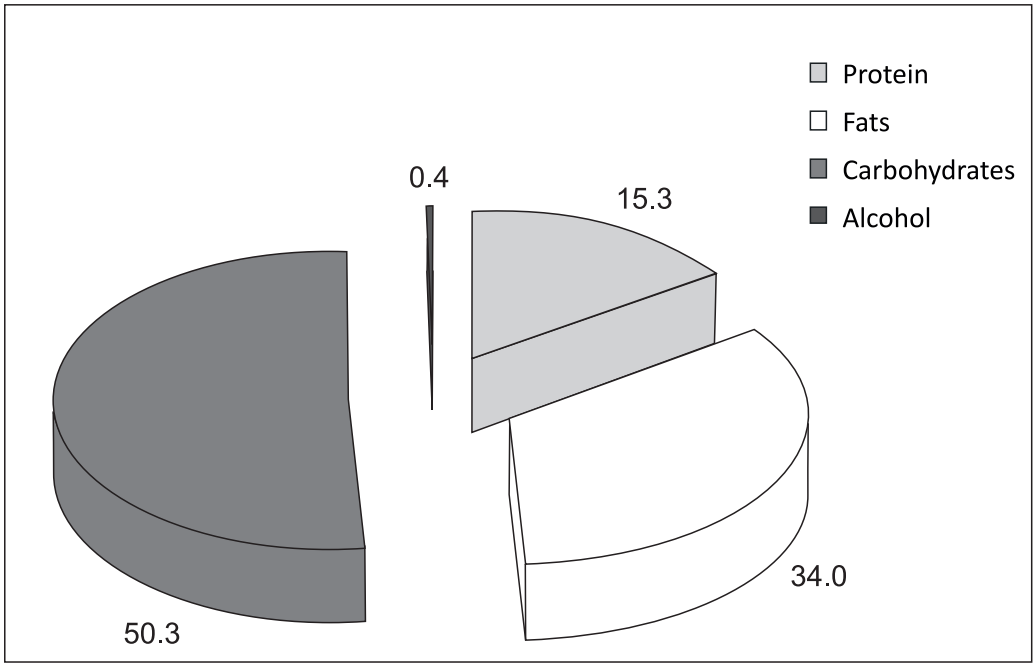

Fig. 1. Contribution of energy by protein, fat, carbohydrates and alcohol in women aged 71-74 y.

ficient diets in the examined group of elderly women. Figure 2 shows the percentages of deficient diets, ordered from the most frequent to the least frequent ones.

From the figure we can see that the diets of all women were deficient in vitamin D. Following this, the most frequent (over 94.8%) deficiencies in diets included potassium, calcium, folates and magnesium. Between 40% and 25% diets were deficient in B group vitamins, vitamin E, zinc and iron. The least frequent deficiencies were those of vitamins A, B_2, phosphorus and sodium.

Between 10 and 30% women (tab. 4) applied supplementation of their diets with selected components.

Table 4. Frequency (in %) of women using particular supplements of diet.

Nutrient	% of women
K (mg)	27.1
Ca (mg)	20.3
P (mg)	11.9
Mg (mg)	25.4
Fe (mg)	18.6
Zn (mg)	15.3
Vit. A (μg)	27.1
Retinol (μg)	27.1
Beta-caroten (μg)	10.2
Vit. E (mg)	28.8
Vit. B_1 (mg)	30.5
Vit. B_2 (mg)	28.8
Vit. PP (mg)	30.5
Vit. B_6 (mg)	32.2
Vit. C (mg)	28.8
Folics (μg)	18.6
Vit. B_{12} (μg)	16.9
Vit. D (μg)	27.1

The fact of diet supplementation contributed most (fig. 3) to decreasing the percentage of diets deficient in vitamins E (by 30%), PP (by 26.7%), C (by 23%), B_1 and B_6 (by about 20%), and in magnesium, iron and zinc between roughly 10 to 15%. Supplementation with vitamin D, calcium, potassium and folates was not very effective on the group level, since it practically failed to decrease the deficiencies in those components in the women's diets (fig. 3).

Blood serum concentrations of several biochemical indicators showing the nutrition status of the women's bodies were also determined in the examined group of women (tab. 5).

Table 5. Concentration in serum of women (averages and percentage of deviations from norms) in particular biochemical characteristics.

	X (SD)	"cut offs"	%
Retinol μmol/l	1.37 (0.43)	< 1.5	6.8
α-tocopherol μmol/l	26.6 (9.2)	< 11.9	6.8
Glucose mg/dl	103 (18)	> 100	49.2
Total cholesterol mg/dl	232 (39)	> 200	74.6
LDL cholesterol mg/dl	145 (36)	> 115	72.9
HDL cholesterol mg/dl	62 (15)	< 40 mg/dl	5.1
Triglicerides mg/dl	131 (52)	> 170 mg/dl	16.9
Chol/HDL chol	3.9 (1.2)	> 5.0	10.2
Obesity	29.0 (4.3)	BMI > 30 kg/m^2	44.0

Obese women were characterized by a significantly lower ($p < 0.05$) concentration of the HDL cholesterol, and a higher cholesterol/HDL Chol ratio, as well as a higher concentration of triglycerides than non-obese women (tab. 6).

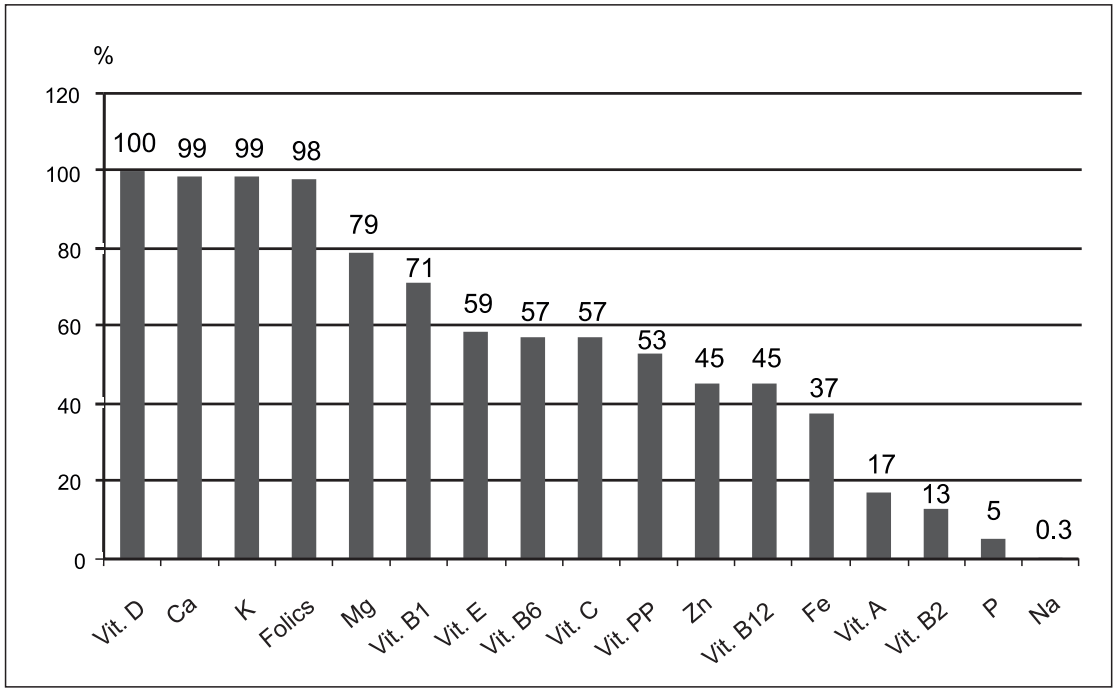

Fig. 2. Percent of women with inadequate intake of nutrients calculated with use probability method (from foods without supplements).

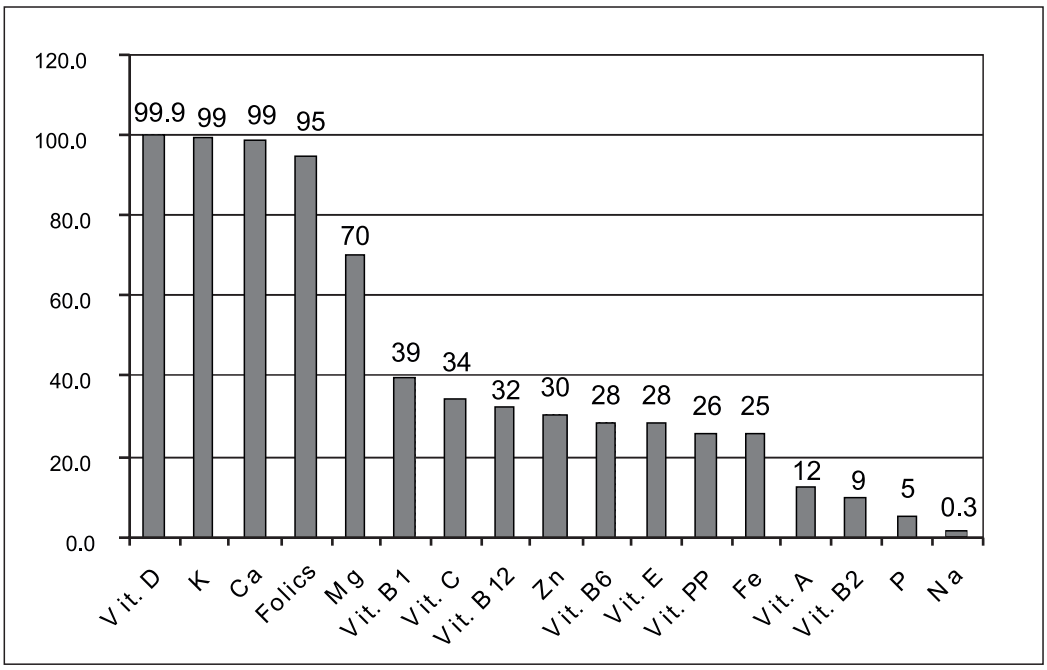

Fig. 3. Percent of women with inadequate intake of nutrients calculated with use probability method (from foods and supplements).

From table 5 we can see that a small percentage of women (6.8%) exhibited deficient concentrations of retinol and α-tocopherol, and the differences between obese and non-obese women were insignificant (tab. 6).

Table 6. Concentration in serum of some nutrients in obese and non obese women.

	Obese	Non obese
Retinol μmol/l	1.35 (0.41)	1.33 (0.39)
α-tocopherol μmol/l	24.2 (8.3)	27.5 (9.9)
Glucose mg/dl	108 (23)	99 (14)
Total cholesterol mg/dl	221 (30)	237 (47)
LDL cholesterol mg/dl	139 (27)	145 (43)
HDL cholesterol mg/dl	54 (12)*	70 (13)*
Chol/HDL chol	4.4 (1.4)*	3.5 (0.9)*
Triglicerides mg/dl	142 (60)*	110 (37)*
BMI kg/m^2	32.5 (3.1)*	26.2 (2.8)*

*$p < 0.05$

DISCUSSION

Though the average value of the energy intake declared by the examined women was not high, for it did not exceed 1500 Kcal, the average value of the relative body mass index BMI (29.0 kg/m^2) could be rated among the high ones. Together with the fraction of 44% obese women, this showed that the women had been subjected to a long term positive energy balance during their lives. In a study of 2002 on women aged 69-71 (18), so at an age close to those examined in the study, the energy content in diets did not diverge from that established at present. Depending on the women's education, it varied between 1382 and 1507 Kcal, while the average values of BMI were contained between 27.6 and 30.5 kg/m^2 (18). In addition, the energy intake was shown to decrease with age, reaching the lowest values (1424 Kcal) among women aged about 70 (19).

Despite the visible overfeeding, the diets of the women examined in this study were deficient in many nutrients. The highest percentage of women's diets – 99.9% – exhibited deficiencies in vitamin D, which confirms the observation that contemporary nutrition habits (among others, low consumption of sea fish) do not ensure sufficient intake of that vitamin. Only 27% women supplemented their diets in vitamin D, but in the average annual consumption this did not reduce the probability of deficiencies in that vitamin. Absence of a sufficient amount of vitamin D in diets is reflected in the insufficient status of nutrition in that vitamin among elderly Polish women, which was established in an international study conducted using the same methodology (13). Among women from several countries, Polish women were characterized by the lowest concentration of vitamin 25(OH)D in the blood serum, and the highest percentages (92%) of insufficient concentration < 50 nmol/l (13).

Among the women examined in this paper, the average intake of vitamin D from diet (without supplements) was just 2.47 μg, while the updated reference intakes specifies the demand for this age group as 15 μg per day (5). This fully justifies intensified propagation of the recommendations concerning the principles of supplementing diets with vitamin D in all demographic groups, and in particular among elderly people of both sexes who avoid sunlight in summer (20).

Percentages of deficient women's diets as high as for vitamin D were found also in case of calcium, ma-

gnesium and potassium. In this study, the average intake of calcium was just 547 mg, while the norm on the AI level recommends 1300 mg per day for women of that age. All Polish studies (among others, 18, 19) invariantly discover too low intake of calcium, ranging from about 400 mg to maximum 738 mg per day, among persons with university education, who could be expected to possess higher nutritive competences. Against the international background, the intake of calcium among elderly Polish women was also the lowest, amounting to 325 mg compared to, e.g., 975 mg per day among women of the same age in Finland (13).

Every fifth women examined in this paper supplemented their diets with calcium, but the supplementation increased its average intake by about 75 mg per day only. Despite this fact, close to 80% women had too little magnesium in their diets. Supplementation of the diets improved the situation for a small percentage of women.

The inappropriate status of nutrition in the selected analyzed biochemical indexes in case of concentration of retinol and α-tocopherol in the blood serum occurred, when taken jointly, among a small percentage of women (< 7%). This result is comparable with the established small occurrence probability of diets deficient in vitamins A and E discovered based on the nutrition study. In another study conducted among people aged 75-80 from Warsaw and its environs, the risk of α-tocopherol deficiency was higher, for it occurred in about 30% cases (21).

It should be, however, noted that the analyzes conducted in this paper have shown disturbances in lipid metabolism in a large percentage of women, which were significantly more frequently intensified among obese women than among other women.

CONCLUSIONS

The results of the conducted analyzes of nutrition patterns and nutrition statuses of women aged 71-74 have shown:

- Excessive long-term intake of a greater amount of energy than the energy spent by the women, proven by the high average BMI value (29.0 kg/m^2) and high percentages of obese women (44%), as well as
- Too large contribution of energy coming from fat – 34%, compared to the 30% recommended in contemporary nutritional goals. This resulted in the occurrence of frequent disturbances in lipid and carbohydrate metabolisms, significantly more frequent among obese women than among other women.
- High percentages of deficient diets show that diets of elderly women are insufficient with respect to the vitamins and mineral components they contain.
- Elderly women face the highest risk of deficiencies in such nutrients, as: vitamin D, calcium, magnesium, potassium, folates – nutrients which are important from the viewpoint of primary and secondary prevention of such diseases, as cardiovascular diseases or osteoporosis.
- Identification of nutritive needs at an elderly age should translate to drawing the attention of all people who deal professionally with this speedily increasing fraction of the population to give the elderly advice remedying their improper nutrition.

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