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NUTRITIONAL PATTERNS OF 40-YEAR-OLD WOMEN FROM WROCŁAW IN THE ASPECT OF THE RISK OF CARDIOVASCULAR DISEASES. PART II. VITAMINS. MINERALS

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The aim of the paper was to assess the intakes of vitamins and minerals in participants of the programme "Prevention in cardiovascular diseases in a selected population from Wrocław". To evaluate dietary intake use was made of the 24-hour dietary recall and history of nutrition.

The intake of calcium (62% of the safe level of intake) was too low (because of inadequate consumption of milk and dietary products), whereas the intake of phosphorus exceeded Polish RDA nearly 2-fold. In this case, the values of the Ca/P ratio (1:2) were improperly high.

The study showed an unsatisfactorily low intake of iron, copper, zinc, manganese, magnesium and vitamins B_1, B_2, and B_6.

INTRODUCTION

In order to function properly, a human body needs to be provided with all indispensable nutrients, including vitamins and minerals, with food.

Vitamins E, C, β-carotene and other substances with antioxidant potential (flavonoids, coenzyme Q) are of key significance in the prevention of civilization diseases [Fairfield & Fletchar, 2002]. Those compounds protect a human body against detrimental activity of free radicals and lipid peroxides. This protective function results from their capability to neutralize free radicals and reactive peroxides of fatty acids evoking, among others, harmful modifications of DNA and proteins, and the formation of atherogenic, oxidatively-modified LDL [Kłosiewicz-Latoszek, 2000; Walczak & Cybulska, 1999].

In addition, some minerals serve an important function as co-factors of enzymatic systems with antioxidant activity, constituting a defense mechanism of the body against changes induced by free radicals. Gluthatione peroxidase and gluthatione catalase activated by selenium, and peroxide dismutase activated by copper, zinc and manganese can serve as examples. Insufficient intake of the above-mentioned macroelements as well as magnesium, calcium and potassium decreases the efficiency of internal antioxidative mechanisms, thus increasing the risk of degenerative diseases [Cappuccio, 2000].

A perfect source of natural antioxidants are fruits and vegetables as well as cereal products and grain legumes. WHO experts [WHO, 2003] recommend their daily intake to exceed 400 g. The supply of those products with a diet at a recommended level has been reported to affect a reduction in the incidence of civilization diseases [Grundy & Becker, 2002].

Investigations carried out in Poland to evaluate dietary patterns and nutritional status have pointed out to insufficient contents of some vitamins and minerals, important in the prevention of degenerative diseases [Hercberg *et al*., 1998], in an average food ration [Rutkowska *et al*., 2000, Szponar *et al*., 2002b; Waśkiewicz *et al*., 2003]. It should be emphasized, however, that in Poland in the years 1991–2001 the death rate of cardiovascular diseases has been observed to decline by *ca*. 30% [Szostak *et al*., 2003b]. That beneficial situation results from changes proceeding in eating habits of the Polish population, including a reduced intake of animal fats and an increased supply of fruits and vegetables with a daily diet [Górnicka & Gronowska-Senger, 2003; Szostak, 2003 a].

The objective of the study was to evaluate correlations between food intake and risk factors of cardiovascular disease in 40-year-old women from Wrocław differing in terms of educational and occupational status.

MATERIAL AND METHODS

A nutritional study covered a group pf 592 women, participants of the programme "Prevention of cardiovascular diseases in a selected population of the 40-year-olds from Wrocław" which was coordinated by the Health Department of the City Office of Wrocław in the years 1999–2001.

The group of women under scrutiny was characterised in Part I of the manuscript [Bronkowska & Żechałko-Czajkowska, 2006].

The assessment of food intake was carried out on data collected using 24-h recall and history of nutrition covering 2–3 months prior the experiment.

In the quantitative evaluation, use was made of the "Photo album of products and dishes" [Album fotografii

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produktów i potraw, 1996] elaborated at the National Food and Nutrition Institute.

Food rations analysed with "Dietetyk 2000" software for Windows 95, containing a data basis created by the authors based on "Tables of nutritive value of food products" [Kunachowicz *et al*., 1998] were determined for the contents of particular vitamins and dietary components. Basic losses occurring during culinary and technological treatment were considered by reducing the concentrations of some vitamins as follows: vitamin C – by 55%, vitamin A – by 25%, vitamin B_1 – by 20%, and vitamin B_2 – by 15%.

In total, 592 recalls were collected over the experimental period, *i.e.* from March 1999 to June 2000.

Tables 1 and 2 compile results of the intakes of vitamins and minerals by the examined group of women as mean values, standard deviation as well as minimal and maximal values. In the evaluation of vitamin intake, use was made of the recommended allowance (a safe level) as a weighted mean, taking into account the appropriate proportion of 26–60-year-old women with small and moderate professional activity [Ziemlański *et al*., 2001]. Recommended dietary allowances for mineral compounds have been demonstrated not to differ depending on the physical activity, hence the results obtained were compared with safe levels [Ziemlański *et al*., 2001]. Since a comparative analysis of the average food ration with recommended levels does not provide a full picture of food intake in the entire group, all food rations were divided according to the per cent of meeting the recommended levels. The following ranges were considered: 0–30%, 30%–50%, 50%–70%, 70%–90%, 90%–110%, 110%–130%, and over 130%; with the 90%–110% range acknowledged as consistent with recommendations. Results were presented in Tables 3 and 4.

RESULTS AND DISCUSSION

In the examined group of the 40-year-old women, the intake of vitamin A (a retinol equivalent) reached 46.1 μg on average, which corresponded to 124.4% of the recommended level (Table 1). In *ca*. 15.5% of the food rations, vitamin A content was within the appropriate range, *i.e*. 90–101% of the recommended level. Still, in as much as *ca*. 40% of the food rations, the intake of vitamin A was insufficient (Table 3).

Przysławski *et al*. [1999] in their study into the evaluation of the nutritive value of reconstituted food rations of people employed in the public and private sectors in the Wielkopolska region demonstrated the intake of vitamin A (a retinol equivalent) to reach 833 μg and 661 μg, respectively. A similar vitamin A intake (834 μg) was reported by Pietruszka *et al*. [1998] who assessed nutritional patterns of inhabitants of three Polish villages. A study by Morawska and Sekuła [1997] demonstrated insufficient vitamin A supply, *i.e.* 638 μg, whereas in the Pol–MONICA BIS assay carried out on 35–44-year-old women from Warsaw and the former Tarnobrzeskie Province the intake of vitamin A (a retinol equivalent) accounted for 1271.7 μg and 1257.7 μg, respectively [Rywik & Broda, 2002a, b]. The assessment of food rations of different age groups of the Polish population, carried out in 2002 by Szponar *et al*. [2002b], indicated that the intake of vitamin A was high compared to the recommended dietary allowances, irrespective of the gender and age of the subjects.

Investigations of eating habits of Italians originated from two regions: Crevalcore and Montegiorgio, showed the intake of vitamin A (a retinol equivalent) at a level of 562.7 μg [Alberti-Finanza *et al*., 1999].

Vitamin A displays a capacity for "trapping" free radicals and their derivatives, disturbing radical reactions and arresting the reaction of lipid oxidation. In addition, it is indispensable for the proper course of growth processes, serves an

TABLE 1. Contents of vitamins in food rations of the women examined (n=592).

Vitamins	Mean ±SD	Min.	Max.	RDA	% of RDA
Vitamin A (retinol equivalent) (μg)	746.1± 614.7	56.8	5981.1	600	124.4
Vitamin E (mg)	9.1± 4.7	0.4	32.1	8	113.6
Vitamin C (mg)	86.3± 88.2	0	724.1	60	143.8
Vitamin B_1 (mg)	1.1± 0.4	0.2	2.6	1.6	67.1
Vitamin B_2 (mg)	1.3± 0.5	0.3	6.3	1.5	87.2
Vitamin B_6 (mg)	1.4± 0.6	0.1	3.9	1.7	85.1
Niacin (mg)	11.9± 5.7	0.9	43.6	17.8	66.8

TABLE 2. Contents of minerals in food rations of the women examined (n=592).

Vitamins	Mean ±SD	Min.	Max.	RDA	% of RDA
Calcium (mg)	496.3± 303.2	90.1	2103.3	800	62.0
Phosphorus (mg)	993.5± 379.4	153.6	2621.2	650	152.8
Potassium (mg)	2562.9± 948.5	479.7	6089.7	3500	73.2
Iron (mg)	10.8± 5.5	3.1	58.5	14	77.1
Manganese (mg)	4.9± 2.1	0.6	17.6	3.5	140.3
Zinc (mg)	8.8± 3.3	2.4	25.5	10	88.1
Coper (mg)	0.9± 0.4	0.1	3.0	2.2	41.8
Magnesium (mg)	237.5± 102.2	65.4	779.7	280	84.8

important function in the growth and differentiation of cells as well as participates in biochemical processes proceeding in retina [Kłosiewicz-Latoszek, 2000; Ziemlański, 2001].

Vitamin E plays a role of an antioxidant, reacts with free radicals and transforms them into hydroxides. Thus it protects a human body against, among others, accumulation of lipid peroxides and free radicals, prevents damages to blood vessels, and increases the resistance of erythrocytes to hemolysis. Those properties allow vitamin E to prevent the development of degenerative diseases. Vitamin E is likely to inhibit the development of atherosclerosis also through reducing the adhesion and aggregation of blood cells, which stabilizes atheromatous plaque [Ziemlański, 2001]. The intake of vitamin E by the examined women from Wrocław reached 9.1 mg (113.6% of RDA). It should be emphasized, however, that in *ca*. 27% of the food rations its intake met less than 70% of RDA, and in as little as *ca*. 15% of the food rations analysed the supply of vitamin E was within the 90–110% range of demand. In *ca*. 45.1% of the food rations, the intake of vitamin E exceeded 100% of RDA (Table 3).

The results obtained in this study for vitamin E were higher than those reported by Przysławski *et al*. [1999] who demonstrated vitamin E intake at a level of 5.9 mg in the public sector and 4.5 mg in the private one. On the contrary, in a study by Pietruszka *et al*. [1998] the intake of vitamin E accounted for 11.1 mg, whereas in the women examined in the Pol – MONICA BIS assays – for 9.7 mg (Warsaw) and 8.7 mg (the former Tarnobrzeskie Province) [Rywik & Broda, 2002a, b]. De Carvalho *et al*. [1996] reported on a low intake of vitamin E (*ca*. 5 mg) in as little as 13% of food rations of women originating from Burgundy (France). Research by Ziemlański and Wartanowicz [1999] demonstrated that groups of high and medium risk of vitamin E deficiency were constituted by adults aged 40–50 years who were characterised by a downward tendency of meeting RDA for vitamin E. In food rations of people originating from different socio-economic groups the intake of vitamin E reached 62–74% of RDA in the years 1990–1992 and as low as 45–63% in the years 1997–1998.

It should be emphasized that, due to the function served by vitamin E in the prevention of civilization diseases, its supplementation is introduced in some medical circles. The "Nurses Health Study" carried out on 87245 women showed a 34% reduction in the incidence of cardiovascular diseases in women taking vitamin E supplement (containing at least 67 mg vit. E/day) for at least two years [after Walczak & Cybulska, 1999]. The "Women`s Health Study" demonstrated also an opposite correlation between the risk of death of ischaemic heart disease and vitamin E intake with food [Kushi *et al*., 1996].

In "The Cambridge Heart Antioxidant Study (CHAOS)", covering 2002 patients with coronary atheromatosis administered with vitamin E at daily doses of 268 mg or 537 mg, a decline in the incidence of non-fatal myocardial infarction was observed to reach 77%. In contrast, this study demonstrated also an 18% increase in the risk of cardiovascular deaths [Stephens *et al*., 1996].

Vitamin C (ascorbic acid) is acknowledged as a major antioxidant in human body. It inhibits the formation of carcinogenic nitrosamines from nitrates, stimulates the immune system and is capable of affecting the growth and differentiation of cells [Gałek & Targoński, 2003]. In addition, it participates in the regulation of intracellular redox reactions through, among others, interactions with glutathione. Ascorbic acid regulates the free-radical form of vitamin E by reducing a tocopheroxyl radical back to α-tocopherol. A safe level of its intake accounts for 60 mg/day. It is believed, however, that this intake is insufficient and underestimated [Floriańczyk, 1996].

In the investigated group of women, the mean intake of vitamin C was found satisfactory compared to the recommend allowance (86.3 mg) (Table 1). The supply of that vitamin with food rations of women from Wrocław appeared to be highly diversified, which was reflected in its extreme levels, *i.e*. from 0 mg to 724.1 mg. Despite the high mean intake of vitamin C reported in the group under study, it was demonstrated that in *ca*. 26% of the food rations vitamin C intake met the RDA in 0–50%, whereas in *ca*. 23% of the food rations it constituted 50–90% of RDA (Table 3). A very low content of vitamin C was observed by Przysławski *et al*. [1999] in food rations of subjects employed in the public and private sectors, *i.e*. 35.7 mg and 42.1 mg, respectively. A low supply of vitamin C (37.4 mg) was also demonstrated by Pietruszka *et al*. [1998] in a study into nutritional patterns of inhabitants of three Polish villages. In the Pol – MONICA BIS assay of 2001 [Rywik & Broda, 2002a, b], vitamin C intake reached 125.5 mg in the women from Warsaw and as little as 60.3 mg in those from the former Tarnobrzeskie Province. In a nutritional assay of the Dutch population, Löwik *et al*. [1999] observed a high intake of vitamin C, reaching - 81 mg, whereas in two regions of Italy: Crevalcore and Montegiorgio, its levels accounted for 66.6 mg and 84.5 mg [Alberti-

TABLE 3. Division of food rations of the women examined (n=592) according to meeting RDA for vitamins.

Vitamins	Ranges of meeting RDA						
	0–30%	30–50%	50–70%	70–90%	90–110%	110–130%	> 130%
	% of food rations						
Vitamin A (retinol equivalent) (μg)	2.4	7.8	17.1	13.2	15.5	13.3	30.7
Vitamin E (mg)	1.5	6.4	17.1	15.0	14.9	12.5	32.6
Vitamin C (mg)	13.5	12.8	12.7	10.5	6.6	5.9	38.0
Vitamin B_1 (mg)	3.5	26.7	32.9	17.1	11.3	4.7	3.7
Vitamin B_2 (mg)	0.2	9.6	24.8	27.5	19.1	8.9	9.8
Vitamin B_6 (mg)	2.0	12.5	22.3	22.5	22.0	9.5	9.3
Niacin (mg)	8.1	26.9	24.5	20.6	10.8	5.1	4.0

Finanza *et al*., 1999]. In contrast, too low intake of that vitamin was reported by De Carvalho *et al.* [1996] in 3% of food rations of the French women.

In the prevention and treatment of cardiovascular diseases, apart from antioxidant vitamins, great attention is paid to B-group vitamins, mainly B_2, B_6, B_{12} and folic acid, which are nutrients that play a significant role in the metabolism of homocysteine.

The atherogenic mechanisms of homocysteine activity include the activation of blood platelets and enhancement of clotting capacity and proliferation of smooth muscle cells as well as cytotoxicity. Current epidemiological data confirm that homocysteine reveals capacity to modify LDL, thus leading to aggregation of those lipoproteins and, consequently, facilitating the formation of xanthoma cells [Cichocka & Cybulska, 1999; Gariballa, 2000].

A dietary component that affects the level of homocysteine is L-methionine – sulfuric amino acid provided to the organism mainly with animal protein originating most of all from meat and dairy produce. Dietary factors leading to hyperhomocysteinemia are, therefore, linked with either deficiency of homocysteine metabolism co-factors, *i.e.* folic acid, in a diet or deficiency of B_2, B_6 and B_{12} vitamins or a high intake of methionine compared to the intakes of the above-mentioned vitamins [Cichocka & Cybulska, 1999; Gariballa, 2000]. Taking this into account, low intakes of B-group vitamins among the examined women from Wrocław, namely 1.1 mg (67.1% of RDA), 1.3 mg (87.2% of RDA) and 1.4 mg (85.1% of RDA) for vitamins B_1, B_2, and B_6, respectively (Table 1), seem alarming. The intake of vitamin B_1 reported for the women investigated in the Pol – MONICA BIS assay reached *ca*. 0.9 mg [Rywik & Broda, 2002a, b] and was similar to the results obtained in the presented study.

Szponar *et al*. [2002b] also demonstrated a low vitamin B_1 intake (68% of RDA) in food rations of adult Polish women. For comparison, food rations of adult Austrians appeared to contain vitamin B_1 at a level of 1 mg [Koenig & Elmadfa, 1999], and those of 1644 Spanish women – at a level of 1.3 mg [Mataix *et al*., 2003].

In food rations of selected socio-economic groups reconstituted under laboratory conditions by Nadolna *et al*. [2000], the content of vitamin B_2 ranged from 1.1 mg to 1.5 mg. In the assessment of eating habits of women from Warsaw, Waśkiewicz & Sygnowska [2003] demonstrated their food rations to contain 1.3 mg of vitamin B_2, whereas Mataix *et al*. [2003] showed vitamin B_2 intake at a level of 1.5 mg in food rations of 40-49-year-old women.

The food rations of the examined women from Wrocław were characterised by a low content of niacin, *i.e.* 19.9 mg (66.8% of RDA). In *ca*. 27% of the food rations, the intake of that vitamin met the recommended level in 30–50%, and in *ca*. 45% of the food rations – in 50–90%. Nadolna *et al.* [2000] demonstrated niacin intake to range from 11.8 mg to 18.2 mg, whereas Szponar *et al*. [2002 b] did not observe low contents of niacin in any of the examined groups of adult Poles.

Intakes of individual minerals are shown in Table 2.

Special attention should be paid to an extremely low intake of calcium, *i.e.* 496 mg (62% of RDA on average). Calcium intake meeting the recommended allowances in 30–70% was reported in *ca*. 49% of the women (Table 4). The Pol–MONICA BIS assay carried out in 2001 in a population of women from Warsaw and 35–44-year-old women from the former Tarnobrzeskie Province demonstrated a similarly low intake of calcium, reaching 489.4 mg and 434.7 mg [Rywik & Broda, 2002a, b].

Morawska and Sekuła [1997], in their study into changes in food intakes in families with low-income subsistence, showed the intake of calcium at a level of 416 mg. The authors emphasized that, compared to all other social groups, the investigated group living from social support and child benefit was characterised by the lowest levels of incomes and food expenditures. Calcium content of the food rations of the populations from three villages assessed by Pietruszka *et al*. [1998] was also low and reached 596 mg (75% of RDA). Szponar *et al*. [2002b] observed that in none of the age groups examined in Poland was the intake of calcium at a safe recommended level. Due to unhealthy dietary habits, most of the Poles do not meet the recommended daily allowance for calcium even in 50% [Rogalska-Niedźwiedź *et al*., 2003; Waśkiewicz & Sygnowska, 2003]. This has also been confirmed by cumulative results of studies carried out on different populations from the Wielkopolska region reported by Szajkowski [1996]. This research demonstrated very low intakes of calcium both in children and youth as well as in adults.

It is worth emphasizing that a considerable decline in the consumption of milk and dairy products led to a decrease in calcium intake from 720 mg in 1990 to 512 mg in 2000, which was observed in all socio-occupational groups [Górnicka & Gronowska-Senger, 2003].

TABLE 4. Division of food rations of the women examined (n=592) according to meeting RDA for minerals.

Minerals	Percentage of meeting RDA						
	0–30%	30–50%	50–70%	70–90%	90–110%	110–130%	> 130%
	% of food rations						
Calcium (mg)	17.6	28.7	20.4	16.0	8.3	3.5	5.4
Phosporus (mg)	0.2	0.2	3.5	9.1	11.8	13.3	61.8
Potassium (mg)	2.2	17.7	29.6	27.5	14.4	4.4	4.2
Iron (mg)	1.0	14.7	37.2	24.5	12.0	4.7	5.9
Manganese (mg)	0.7	1.9	5.4	10.5	13.7	18.1	49.8
Zinc (mg)	0.6	9.6	22.3	26.9	17.9	11.6	11.1
Copper (mg)	22.3	54.9	15.7	4.7	1.9	0.6	0.0
Magnesium (mg)	0.5	12.3	24.3	28.7	16.0	9.3	8.8

The intake of calcium by Japanese women was reported to account for 649.4 mg, and by Brazilian women – for 599.4 mg [Freire *et al*., 2003]. In contrast, calcium intake was higher in a few European countries, *e.g.* 779.9 mg in Italy [Alberti-Finanza *et al*., 1999] and 1164 mg in the Netherlands [Löwik *et al*., 1999]. Galan *et al*. [2002] found out that mineral water supplemented with calcium (486 mg/L) and magnesium (84 mg/L) may be an additional source of minerals in a diet of adults who do not accept dairy products.

An irrational diet, unhealthy lifestyle (nicotinism, alcoholism, a lack of physical activity) and abrupt excretion of calcium from the body exert a significant impact on the development of civilization diseases, including osteoporosis [Grajeta, 2003].

Phosphorus together with calcium regulates the process of bone mineralization and is necessary for calcium absorption [Grajeta, 2003]. Phosphorus intake with the average food rations of the women examined reached 993.5 mg and exceeded the recommended level by 52.8%; in 61.8% of the food rations analysed the intake of phosphorus was over 130% of RDA. A high phosphorus intake results, to the greatest extent, from the consumption of processed products containing high doses of technological additives [Rutkowska & Kunachowicz, 1994].

It should be remembered that an inappropriate calcium to phosphorus ratio (1:2) inhibits the absorption of calcium and synthesis of vitamin D, which in turn results in the augmented level of parathormone synthesized in parathyroid glands and, consequently, intensified resorption processes of bones [Ziemlański, 2001]. The opposite calcium to phosphorus ratio is typical of an average Polish food ration [Szajkowski, 1996; Trafalska *et al*., 2003]. This phenomenon is greatly affected by a high contribution of highly-processed products in a diet (meat products, food concentrates, beverages, melted cheeses), containing phosphates and polyphosphates used as agents extending the shelf life and improving organoleptic traits of food products.

The high phosphorus intake (160% of RDA) was also demonstrated in food rations of families from the Podlaskie and Śląskie Provinces [Szponar *et al*., 2002a] as well as in those of physical and intellectual employees from the Wielkopolska region (168–171% RDA) [Szajkowski, 1996].

The mean intake of iron with food rations of the women from Wrocław accounted for 10.8 mg and met the recommended level in 77.1%. In *ca*. 15% of the food rations, iron supply met the recommended levels in 0–50%, whereas in 37% of the food rations – in 50–70% (Table 4). The Pol – MONICA BIS assay carried out in 2001 on the population of women from Warsaw and those from the former Tarnobrzeskie Province demonstrated similarly low intakes of iron, reaching 9.98 mg and 9.36 mg, respectively [Rywik & Broda, 2002a, b]. The low iron intake (*ca*. 11 mg) was also shown by Szajkowski [2000] in food rations of intellectual and physical female workers from the Wielkoposlka region. In food rations of Japenese women [Freire *et al*., 2003] the content of iron was higher (13.5 mg) compared to that reported for the Brazilian population (11.7 mg).

The metabolic processes of iron and copper are closely linked. Copper deficiency may lead to hypochromic anemia developing at iron deficiency [after Szajkowski, 2000]. A long-term deficiency of copper favours the occurrence of some tumors, atherosclerosis and aortic aneurysm as well as induces changes in bones that lead to osteoporosis and subosseous sclerosis [Skalski, 1986].

Hypotheses have also been advanced on the function of copper in the development of atherosclerosis. Investigations carried out on different populations demonstrated an inverse correlation between copper content of liver and serum cholesterol level. At insufficient supply of copper with a diet, the level of cholesterol in blood serum is observed to increase [Ziemlański, 2001].

The results of the reported assay showed an extremely low intake of copper, reaching 0.9 mg (41.8% of RDA). A similarly low supply of that element was observed by Szajkowski [2000] in daily food rations of women from the Wielkopolska region (0.72 mg). A higher copper intake, accounting for 1.2 mg, was demonstrated in food rations of Italians [Lombardi-Boccia *et al*., 2003].

The intake of potassium, zinc and magnesium met the recommended level in 75–90% on average, yet it appeared to be substantially lower in a number of food rations. Calcium and potassium intakes inconsistent with the recommended allowances may contribute to elevated arterial blood pressure. Deficiencies of those minerals are of great significance to the etiology of cardiovascular diseases [McCarron & Reusser, 2001]. In food rations of villagers, Pietruszka *et al*. [1998] observed a low supply of magnesium at a level of 299 mg (76% of RDA). An investigation of Rutkowska *et al*. [1994] into food rations of physical and non-physical workers demonstrated magnesium intake to reach 185 mg and 175 mg, respectively. The low magnesium content of food rations is a relatively common phenomenon that affects *ca*. 30–60% of the Polish population. It is likely to result in a number of systemic disorders, especially those functional in character. Inappropriate supply of magnesium may affect higher incidence of atherosclerotic lesions of blood vessels [Zdrójkowska *et al*., 1996; Ziemlański, 2001].

Low concentrations of vitamins and minerals observed in numerous food rations of the examined women stem from a low intake of cereal products, milk and dairy products, potatoes as well as vegetables and fruit, which was demonstrated in Part I of this study [Bronkowska & Żechałko-Czajkowska, 2005].

A high intake of food products of plant origin is one of key recommendations in the prevention of civilization diseases [Fairfield & Fletchar, 2002; Leterme, 2002].

Due to insufficient intakes of both vitamins and minerals, the supplementation of food rations with nutrients in the form of pharmaceutical preparations is widely propagated. It should be born in mind, however, that improperly applied supplementation poses a risk of side effects in the body, especially in the case of exceeding the recommended dietary allowances [after Waśkiewicz *et al*., 2003].

CONCLUSIONS

1. The mean intake of antioxidant vitamins by the women under study basically covered the demand, yet a more detailed analysis demonstrated that in *ca*. 8% of the food rations the concentrations of vitamin A, E and C met the recommended levels in as little as 30–50%, whereas in 17% of the food rations – in 50–70%.

2. The mean intake of B-group vitamins was found insufficient, *i.e*. vitamin B_1 – 67.1% of RDA, vitamin B_2 – 87.2% of

RDA, vitamin B_6 – 85.1% of RDA, and niacin – 66.8% of RDA. In 50–60% of the food rations, the recommended allowances for those vitamins were met in as little as 30–70%.

3. The mean food ration of women from Wrocław was demonstrated to provide insufficient contents of copper (42% of RDA), calcium (62% of RDA), iron (77% of RDA), magnesium (84% of RDA), and zinc (88% of RDA).

4. In *ca*. 20–25% of the food rations, the concentrations of vitamins and minerals ranged from 0% to 50% of RDA. This was due to the insufficient intakes of cereal products, milk and dairy products as well as fruits and vegetables being a valuable source of those dietary components.

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SPOSÓB ŻYWIENIA 40-LETNICH KOBIET Z WROCŁAWIA W ASPEKCIE ZAGROŻENIA CHOROBAMI UKŁADU KRĄŻENIA. CZ. II. WITAMINY. SKŁADNIKI MINERALNE

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Oceniono spożycie witamin oraz składników mineralnych w racjach pokarmowych 40-letnich kobiet (n=592) uczestniczek programu „Profilaktyka chorób sercowo-naczyniowych dla wybranej populacji 40-letnich mieszkańców Wrocławia". W badaniu zastosowano wywiad o spożyciu w ciągu 24 godzin oraz historię żywienia.

Stwierdzono niedostateczne spożycie wapnia (62% normy), związane m.in. z niską konsumpcją mleka i jego przetworów (66,5% zaleceń). Wykazano wysoką podaż fosforu (153% normy) oraz nieprawidłowy stosunek Ca:P (1:2). Stwierdzono niskie spożycie żelaza, miedzi, cynku, manganu, magnezu oraz witamin z grupy B.