

## THE USE OF VITAMIN SUPPLEMENTS AMONG ADULTS IN WARSAW: IS THERE ANY NUTRITIONAL BENEFIT?

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### ABSTRACT

**Background.** The use of dietary supplements is widespread and can contribute substantially to total nutrient intake. However, it also generates some potential risks in the case of unreasonable and excessive use of such products.

**Objective.** To estimate the prevalence of supplementation and the vitamin supplement contribution to total intake among Warsaw population aged 20-74 years.

**Material and methods.** Nutrient intake and supplement use were studied in a representative sample of Warsaw population in years 2011/12 (486 men and 421 women) and in 2001 (658 and 671 respectively). The vitamin levels were analyzed in reference to the Recommended Dietary Allowance (RDA) and the tolerable upper intake level (UL).

**Results.** In the years 2011/12 the use of dietary supplements (vitamins and minerals) was reported by 31% men and 40% women. Vitamin intake from food showed the deficiency of vitamins D, B<sub>1</sub> and folates and adequate intake of vitamins A, C, E, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>. Supplementing with vitamins D and B<sub>1</sub> as well as folic acid contributed to better RDA fulfillment. Supplementing with vitamins A, C, E, B<sub>2</sub>, B<sub>6</sub> and B<sub>12</sub> was not justified because these vitamins were taken in sufficient amounts with food. In 1.3%-14.9% supplement users, the total intake of vitamins A, C, E and B<sub>6</sub> exceeded the UL. The prevalence of supplementation of vitamins A, C and E did not change between 2001 and 2011/12, but the total intake of vitamin A in both sexes and vitamins C, E in women was significantly higher in 2001.

**Conclusions.** The use of dietary supplements in Warsaw population was widespread and in case of some vitamins- unreasonable.

**Key words:** *vitamin supplements, vitamin intake, adult population, recommended dietary allowances, tolerable upper intake level*

### STRESZCZENIE

**Wprowadzenie.** Przyjmowanie suplementów diety jest popularne i może stanowić istotne źródło witamin i składników mineralnych. Jednocześnie niekontrolowane ich pobranie może stwarzać niebezpieczeństwo nadmiernego spożycia.

**Cel badań.** Ustalenie rozpowszechnienia i zasadności stosowania suplementacji wśród mieszkańców Warszawy w wieku 20-74 lat.

**Material i metody.** Sposób żywienia oraz przyjmowanie suplementów oceniono w reprezentatywnej próbie populacji Warszawy w roku 2011/12 (u 486 mężczyzn i 421 kobiet) oraz w roku 2001 (u odpowiednio 658 i 671 osób). Pobranie witamin analizowano w odniesieniu do zalecanego dziennego spożycia (RDA) oraz górnych bezpiecznych poziomów spożycia (UL).

**Wyniki.** W latach 2011/2012 suplementy witaminowo-mineralne przyjmowało 31% mężczyzn i 40% kobiet. Spożycie witamin z żywnością było niedoborowe w przypadku witamin D, B<sub>1</sub> i folianów oraz zgodne z zaleceniami dla witamin A, C, E, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>. Suplementacja witaminami D i B<sub>1</sub> oraz kwasem foliowym przyczyniła się do lepszej realizacji RDA. Natomiast uzupełnianie diety witaminami A, C, E, B<sub>2</sub>, B<sub>6</sub> oraz B<sub>12</sub> nie miało uzasadnienia, ze względu na wystarczające ich spożycie z żywnością. W przypadku 1,3%-14,9% osób stosujących suplementy witamin A, C, E, i B<sub>6</sub> notowano przekroczenie poziomów UL. Częstość przyjmowania suplementów witamin A, C i E była podobna w latach 2001 i 2011/12, ale sumaryczne pobranie witaminy A u obu płci oraz C, E u kobiet było istotnie wyższe w roku 2001.

**Wnioski.** Wzbogacanie diety suplementami przez mieszkańców Warszawy było szeroko rozpowszechnione, a w przypadku niektórych witamin nieuzasadnione.

**Słowa kluczowe:** *suplementy witamin, spożycie witamin, dorosła populacja, zalecane spożycie, górny bezpieczny poziom spożycia*

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## INTRODUCTION

If a human organism is to function correctly, it also needs vitamins, most of which it cannot synthesize on its own. Some of them, particularly antioxidants, i.e. vitamins A, C, E and B group (including folates), play an important role in the prevention of chronic diseases, including cardiovascular diseases [10, 13, 14].

It must be stressed that vitamin intake should be supplied by a healthy diet, not by using supplements. Yet it turns out insufficient in numerous situations, such as using low energy diets or such stimulants as tobacco or alcohol, as well as in women in childbearing age. On the one hand, dietary supplements can play a significant role in lowering the risk of the vitamin deficiency; on the other hand, their uncontrolled consumption may result in crossing the thresholds of the tolerable upper intake level [6]. Since the dietary supplements have become popular, they should be considered as a source of vitamins and dietary minerals while evaluating the dietary patterns [22, 23].

It should be emphasised that no current studies regarding the supplementation that would include a representative group of all adult individuals in central Poland have been conducted recently. The results of our project based on standardised methods allowed the evaluation of the discussed issues in the population of Warsaw.

The aim of the study was to estimate the patterns of supplementation and to evaluate the vitamin supplement contribution to the total intake among Warsaw adult population.

## MATERIAL AND METHODS

### *Subjects and study design*

The material for the analysis comprised the data from the European Health Examination Survey–Joint Action (Polish part) - EHES-JA and from the Warsaw Health Survey – WAW-KARD, which was a continuation of the EHES project [7, 16]. The objective of both projects, performed in 2011/12, was to assess the health condition of Warsaw's inhabitants in terms of risks leading to the development of cardiovascular and some other chronic diseases. The study included a representative randomized sample of the whole of Warsaw's population aged 20 years and above – there were 1081 people examined. The operator of randomization was the PESEL system (*PESEL – Universal Electronic System for Registration of the Population*). The sample randomization scheme was a one-step scheme – a simple sample stratified in terms of sex and place of residence (department of Warsaw). In accordance with

the international recommendations on epidemiological studies, a profile of classic risk factors for developing chronic diseases was assessed in all subjects, based on questionnaire, laboratory, anthropometric, blood pressure measurement findings and on subjects' dietary habits.

Dietary patterns and supplement intake were assessed using the 24-hour recall method, in which respondent provides all the products, food and beverages consumed within 24-h before recall. Due to its advantages (low costs, possibility to standardize, a short time of interviewing and no impact on dietary habits) 24-h recall method is commonly used in epidemiological studies. Portion sizes of food consumed was determined based on the album with photographs of more than 200 foodstuffs prepared specifically for this type of research by the National Food and Nutrition Institute (NFNI) (*Instytut Żywności i Żywienia*). Subjects were asked if they had taken any form of dietary supplement on the recall day and the supplement type, name brand, and dose were recorded. The vitamin intake in the diet was calculated based on the amount of food consumed, with the use of "Polish Food Composition Tables", including vitamin losses arising during the technological processes of food preparation [15]. The amount of vitamin derived from supplementation was estimated using the NFNI 4D Diet (*IŻŻ Dieta 4D*) software, that includes a database nutrient pharmaceutical formulations in 1231 supplements, available on the Polish market.

The 2001-year data were obtained from the Pol-MONICA bis study, which covered a representative sample of the right-bank Warsaw's population aged 20-74 years – 679 men and 691 women. Details regarding study were published previously [28]. Their dietary patterns and supplement intake (only vitamins A, C and E, calcium and magnesium) were assessed in the same way as it was done in the EHES and WAW-KARD projects.

The analyses included the data on 486 men and 421 women from the EHES and WAW-KARD studies, and 658 men and 671 women from the Pol-MONICA study; who were aged 20-74 years, and whose dietary data were reliable. The vitamin levels were analyzed in reference to the Recommended Dietary Allowance (RDA) [13] and the tolerable upper intake level (UL) [6].

### *Statistical methods*

The statistical analyses were performed with the Statistical Analysis System (SAS) 9.2 program using an analysis of covariance (GLM-procedure) and chi<sup>2</sup> test (FREQ-procedure) to compare mean values or prevalence of the analyzed factors. The methods of descriptive statistics were employed, the percentage of subjects taking supplements and the mean vitamin intake from food and from supplements were calculated.

## RESULTS

### *Dietary supplementation prevalence*

Adult Warsaw's inhabitants supplemented their diets with vitamins and minerals quite prevalently. It was more popular among women (40%) than among men (31%). The decision to take such supplementation was most popular among single. The supplementation prevalence was influenced by the subjects' educational and income status – those with higher education supplemented their diet more often than those with primary education (1.6 times men and around 4.8 times women). The highest supplementation intake was noted among people of the highest income (Table 1).

### *Doses of supplemental vitamins (among supplement users of a selected nutrients)*

In supplement users, the mean vitamin intake only from this source (excluding food) exceeded the RDA (except for folates). Depending on the vitamin, the actual intake ranged from 130% to 440% of the RDA. Using vitamin doses higher than UL was reported by 1.3%-4,5% of respondents in the case of vitamins A, E and B<sub>6</sub> (Table 2).

Table 1. Prevalence of vitamin/minerals supplementation use in adult Warsaw population in years 2011/12 (%)

Supplement users	Men	Women
	31.3	40.0
Age		
20-40 years	31.1	40.0
40-60 years	28.5 (ns)*	37.4 (ns)*
60-74 years	31.9	48.2
Education **		
primary	21.6	9.9
secondary	27.2	30.3
university	35.5	47.7
Marital status **		
married	29.3	34.2
single	34.3	45.9
Net income per capita in the family/month**		
<1000 PLN	19.5	23.6
1001-2000 PLN	18.8	33.6
2001-3000 PLN	35.1	41.1
>3000 PLN	38.2	45.1

\* - comparison of prevalence of supplementation use between age groups (test chi<sup>2</sup>)

\*\* - value standardized for age structure in Warsaw population for 30 June 2011

### *Vitamin intake in daily food ration*

The analysis of the vitamin intake from food, both in the group of supplement users and that of nonusers, showed the deficiency of vitamins D, B<sub>1</sub> and folates. The

Table 2. Vitamin intake from supplements (among supplement users of a selected nutrient) in relation to Recommended Dietary Allowance (RDA) and the tolerable upper intake level (UL) in Warsaw population in years 2011/12

Vitamins	Supplement users number (percentage)	RDA	Mean intake % RDA	UL	Subjects with intakes exceeding UL (%)
Men					
Vitamin A (µg)	54 (12.4%)	900	130	3000	3.7
Vitamin C (mg)	73 (16.9%)	90	133	1000	0
Vitamin E (mg)	65 (15.6%)	10	236	300	1.5
Vitamin D (µg)	37 (9.0%)	5-15 (5) <sup>1</sup>	197	50	0
Vitamin B <sub>1</sub> (mg)	50 (12.4%)	1.3	265	-	-
Vitamin B <sub>2</sub> (mg)	50 (12.4%)	1.3	217	-	-
Vitamin B <sub>6</sub> (mg)	80 (18.0%)	1.3-1.7 (1.5) <sup>1</sup>	281	25	1.3
Vitamin B <sub>12</sub> (µg)	30 (7.2%)	2.4	330	-	-
Folate (µg)	31 (7.9%)	400	74	1000 <sup>2</sup>	0
Women					
Vitamin A (µg)	67 (16.0%)	700	137	3000	4.5
Vitamin C (mg)	83 (19.4%)	75	166	1000	0
Vitamin E (mg)	70 (15.8%)	8	348	300	2.9
Vitamin D (µg)	58 (12.7%)	5-15 (5) <sup>1</sup>	151	50	0
Vitamin B <sub>1</sub> (mg)	50 (12.2%)	1.1	137	-	-
Vitamin B <sub>2</sub> (mg)	52 (12.6%)	1.1	153	-	-
Vitamin B <sub>6</sub> (mg)	88 (20.5%)	1.3-1.5 (1.4) <sup>1</sup>	440	25	3.4
Vitamin B <sub>12</sub> (µg)	24 (5.8%)	2.4	193	-	-
Folate (µg)	28 (8.0%)	400	73	1000 <sup>2</sup>	0

<sup>1</sup> - values in brackets assumed as RDA

<sup>2</sup> - UL for folic acid ref. only to folic acid supplements (without folate in food)

Table 3. Vitamin intake from food and from supplements in daily diets among supplement nonusers and users in Warsaw population in years 2011/12

Vitamins	Supplement nonusers		Supplement users				
	Average intake from food	% RDA	Average intake			% RDA	>UL
			from food	from supplements	total		
Men							
Vitamin A ( $\mu\text{g}$ )	1063 $\pm$ 1784	118	1335 $\pm$ 1573	1170 $\pm$ 1788	2505 $\pm$ 2263	278	8.3
Vitamin C (mg)	86.4 $\pm$ 78.5	96	105.1 $\pm$ 98.6	119.8 $\pm$ 98.6	224.9 $\pm$ 151.6	250	0
Vitamin E (mg)	11.2 $\pm$ 6.6	112	12.8 $\pm$ 6.3	23.5 $\pm$ 53.6	36.3 $\pm$ 54.1	363	1.5
Vitamin D ( $\mu\text{g}$ )	4.1 $\pm$ 5.4	82	4.0 $\pm$ 5.8	9.8 $\pm$ 6.8	13.8 $\pm$ 8.2	276	0
Vitamin B <sub>1</sub> (mg)	1.27 $\pm$ 0.62	98	1.29 $\pm$ 0.62	3.44 $\pm$ 4.25	4.73 $\pm$ 4.22	363	-
Vitamin B <sub>2</sub> (mg)	1.54 $\pm$ 0.76	118	1.70 $\pm$ 0.80	2.82 $\pm$ 4.20	4.52 $\pm$ 4.15	348	-
Vitamin B <sub>6</sub> (mg)	1.79 $\pm$ 0.78	119	2.02 $\pm$ 0.91	4.21 $\pm$ 3.81	6.23 $\pm$ 3.74	415	1.3
Vitamin B <sub>12</sub> ( $\mu\text{g}$ )	4.08 $\pm$ 6.17	170	4.81 $\pm$ 9.34	7.92 $\pm$ 17.9	12.73 $\pm$ 19.9	530	-
Folate ( $\mu\text{g}$ )	252 $\pm$ 126	63	328 $\pm$ 213	297 $\pm$ 233	625 $\pm$ 311	156	0
Women							
Vitamin A ( $\mu\text{g}$ )	1013 $\pm$ 1634	144	1224 $\pm$ 1918	1234 $\pm$ 2259	2458 $\pm$ 3114	351	14.9
Vitamin C (mg)	90.2 $\pm$ 92.1	150	73.0 $\pm$ 55.8	124.5 $\pm$ 166.0	197.5 $\pm$ 174.0	263	2.4
Vitamin E (mg)	8.4 $\pm$ 5.3	105	8.5 $\pm$ 4.9	34.7 $\pm$ 89.1	43.2 $\pm$ 90.0	540	2.9
Vitamin D ( $\mu\text{g}$ )	3.0 $\pm$ 4.3	60	2.0 $\pm$ 1.6	7.6 $\pm$ 6.9	9.6 $\pm$ 7.4	192	0
Vitamin B <sub>1</sub> (mg)	0.88 $\pm$ 0.41	80	0.80 $\pm$ 0.31	1.78 $\pm$ 1.25	2.58 $\pm$ 1.26	235	-
Vitamin B <sub>2</sub> (mg)	1.30 $\pm$ 0.62	118	1.29 $\pm$ 0.75	1.99 $\pm$ 1.62	3.28 $\pm$ 1.63	300	-
Vitamin B <sub>6</sub> (mg)	1.42 $\pm$ 0.63	101	1.36 $\pm$ 0.47	6.60 $\pm$ 12.86	7.96 $\pm$ 12.88	569	3.4
Vitamin B <sub>12</sub> ( $\mu\text{g}$ )	3.56 $\pm$ 6.31	148	3.87 $\pm$ 2.68	4.64 $\pm$ 5.38	8.51 $\pm$ 6.42	354	-
Folate ( $\mu\text{g}$ )	225 $\pm$ 124	56	197 $\pm$ 64	293 $\pm$ 172	490 $\pm$ 189	122	0

intake of other vitamins was within the RDA (except for vitamin C in a group of men who did not use supplementation) (Table 3).

#### Supplementation effectiveness

Supplementing the diet with vitamins D, B<sub>1</sub> and folic acid was justifiable because it eliminated the deficiency of these nutrients in the diet.

In the case of other vitamins, i.e. A, C, E, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>, their supplementation was not necessary because their

mean intake with food was sufficient to meet the RDA. The total intake (from food and from supplements) of vitamins mentioned above exceeded RDA within 250%-570%. With vitamins A, E, B<sub>6</sub> in both sexes and vitamin C in women, UL levels were exceeded (Table 3).

#### Supplementation in 2011/12 in comparison to that in 2001

The prevalence of supplementation with vitamins A, C and E did not change between 2001 and 2011/12. (Figure 1). However, in the years 2011/12 the realization

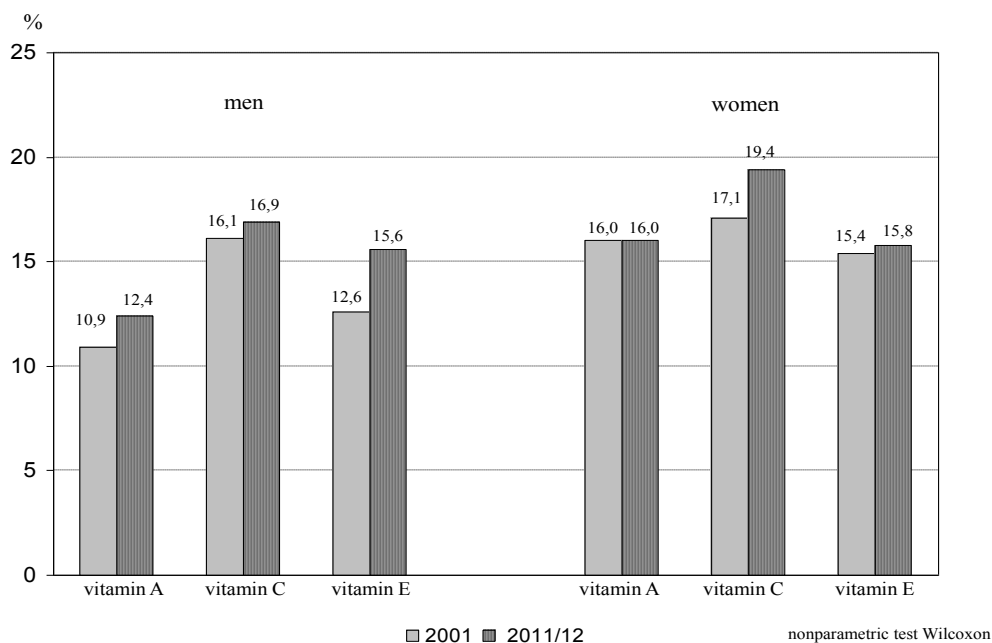


Figure 1. Prevalence of selected vitamin supplements used in 2001 and 2011/12

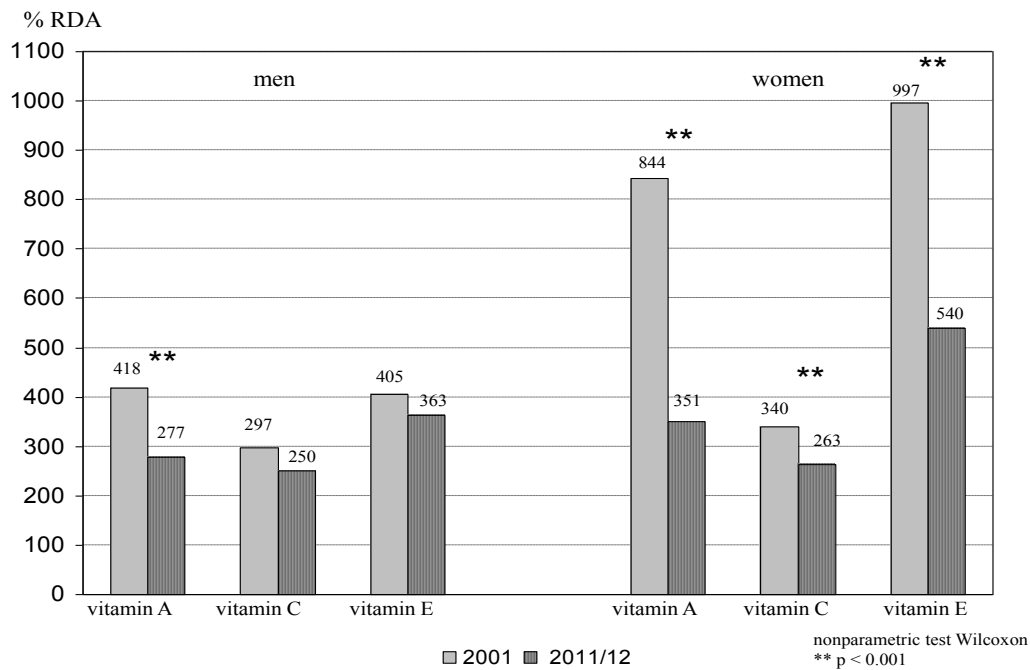


Figure 2. Total vitamin intake in relation to RDAs among supplement users of a selected nutrient in 2001 and 2011/12

of RDA for vitamin A in both sexes and vitamins C, E in women was significantly lower than in 2001 (Figure 2). In 2001, the rate of adherence to recommendation for vitamins A and E in women was very high, and reached 844% and 997%, respectively.

## DISCUSSION

The results of the present study show that enriching a nutritional ration with dietary supplements was more popular among the inhabitants of Warsaw (31% - men and 40% - women) than in the population of the whole of Poland. The findings of the study performed by NFNI in Polish households showed that supplementation was used by 20% of all people [25]; in the WOBASZ study, which included a representative randomized sample of the Polish population, dietary supplements were consumed by 4.6% of men and 11.3% of women [24]. Among the elderly Warsaw dwellers with cardiovascular diseases, vitamin and mineral supplementation was declared by 66.3% [26]. In other countries the frequency of supplementation was very varied, e.g. in the US representative group of adults it was 54% [2] and in the group of German women – 40%, men – 33% [21]. The studies carried out by Flynn et al [8] on minerals and vitamins taken with food and supplements by adults in selected European countries showed that the percentage of people taking supplementation was as follows: Finland 32% men and 58% women, Germany respectively 38% and 48%; Ireland 16%, 31%; the Netherlands 21%, 33%; Spain 8%, 10%; UK 29% and 40%.

The frequency of supplementation is dependent on many factors, including socioeconomic ones. Both in our study and in other projects, supplementing the diet was more prevalent among women, elderly, single and those of higher socioeconomic status [2]. Of note is the fact that the discrepancy of methods applied to evaluate the supplementation, especially the period covered by the study, creates serious difficulties for making direct comparisons. Our study included only the people who took supplements during the day preceding the test; in other studies the questions about supplementation referred to the period ranging from one day to one year. Additionally, some studies qualified only vitamins and minerals as supplements, others also included herbal supplements.

The precondition of effective supplementation is taking such amounts of particular vitamins from pharmaceuticals that their deficiency is leveled, preferably to the values recommended for daily intake in the diet. The safe zone for nutrients intake lies between the recommended value and the tolerable upper intake level (UL). The threat arises when the total vitamin intake, both from food and supplements, exceeds UL.

In Warsaw's population, the amount of vitamins from supplementation (except for folic acid) covered over 100% (130% – 440% range) of their daily recommendation; in the case of vitamins A, E and B<sub>6</sub>, UL was exceeded (in 1.3% - 4.5% of respondents). An analysis of dietary supplements examined by the Polish National Food and Nutrition Institute showed that the daily vitamin doses in particular preparations (except for niacin) did not exceed UL [22]. It means that at least part of



Warsaw's inhabitants took a few preparations at a time or more than one daily dose.

If only the vitamins taken with food were included in the analysis, Warsaw's inhabitants, both those taking supplementation and those who did not, suffered from significant deficiency of vitamin D, folates and, to a lesser extent, vitamin B<sub>1</sub>. Many authors point out the fact of universally present subclinical vitamin D deficiency both in Poland and in other countries [8, 17, 18]. The groups particularly prone to insufficient vitamin D intake are vegans and people who eliminate any dairy from their diet, postmenopausal women, in whom low estrogen concentration is associated with bone mass loss, and also elderly people [13].

A similar problem was observed with folates, which are taken in insufficient amounts both in Poland [12, 27] and in other European countries [5, 8]. Mandatory folic acid fortification can be effective as shown by examples from the US [1] and Northern Ireland [11].

Especially women in childbearing age should have their diet supplemented with appropriate amounts of folic acid in order to diminish the likelihood of neural tube developmental defects and other neurological malformations in the child. Unfortunately, most recent studies have confirmed low intake of this nutrient even in this age group and by pregnant women [4, 9]. Among Warsaw's inhabitants, the supplementation with the vitamins mentioned was effective because it prevents their deficiency.

In the case of other vitamins analyzed, i.e. A, E, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub> and C, in women regardless of supplementing, their mean intake with food was sufficient to meet the RDA. Supplementing the diet with these vitamins was not justified. There are reports that excessive vitamin taking is not beneficial, and UL is not a recommended level which should be reached when nutrition is correct. In Warsaw's adult population, UL was exceeded mainly in the case of vitamin A (in 8.3% of men and 14.9% of women taking vitamin A supplementation) and to a smaller extent vitamins E and B<sub>6</sub> in both sexes and vitamin C in women. High doses of fat-soluble vitamins are particularly worrying – they tend to cumulate in tissue. Vitamin A and β-carotene are mentioned in the EU as those whose excessive intake is risky and which tend to exceed UL [6]. Also in the US, the percentage of people who exceed UL for vitamin A is estimated at 10% – 15% [19]. There are reports in literature warning against excessive vitamin E intake as it is associated with the risk for peroxidative process stimulation [20]. Furthermore, there is no unequivocal scientific evidence that dietary supplementation is justified in cardiovascular prevention, except possibly fish oil and niacin [10, 14]. A meta-analysis of 68 randomized studies did not show any beneficial effect of supplements containing antioxidants (A, E, C, β-carotene and selenium) on

mortality rates; in the case of β-carotene and vitamins A and E, the effect may be quite opposite [3].

Although there are no established UL values for vitamins B<sub>1</sub>, B<sub>2</sub> and B<sub>12</sub>, their intake in the Warsaw population using supplementation was high (235% – 530% of RDA). Yet according to the latest knowledge based on data on the consumption in the EU countries, the risk resulting from the excessive intake of the group B vitamins mentioned above is believed to be nonexistent [6]. It must be also added that the methodology applied in this study did not allow us to differentiate whether excessive intake of some vitamins by Warsaw's inhabitants was short- or long-term, which might prove significant in assessing how much their health was affected.

In summary, it seems that the analysis of benefits and risks arising from the use of dietary supplements by the inhabitants of Warsaw is an important issue. On the one hand, as in the case of vitamins D, B<sub>1</sub> and folates, it can contribute to lowering the risk of the deficiency of these nutrients in the diet. On the other, as in the case of vitamins A, C, E, B<sub>2</sub> and B<sub>12</sub>, their sufficient intake with food along with high doses from supplements may not be beneficial for the consumers' health.

Referring to the range of dietary supplementation by Warsaw's inhabitants in the years 2011/12 vs 2001, it should be noted that the share of people taking vitamins A, C and E was similar even though range of dietary supplements in Poland greatly expanded (in 2003 there were available 557 of them, in 2004 – 1187, and in 2005 as many as 1285) [23]. A positive phenomenon was a significant, over two-fold, drop in the intake of vitamins A and E in the group of women who used supplementation of these vitamins. In the case of vitamin A, the realization of RDA dropped from 844% to 351%; with vitamin E from 997% to 540%. Such a high intake of these vitamins in 2001 might have resulted from their aggressive advertising pointing to their role both in the prevention of chronic diseases and beneficial function in dermatology and cosmetology.

## CONCLUSIONS

1. Dietary supplementation with vitamins and minerals is very prevalent among Warsaw's inhabitants, more so among women, unmarried, and of higher socioeconomic status.
2. Supplementing the diet with vitamins D and B<sub>1</sub> as well as folic acid contributed to better fulfilling nutritional targets. Supplementing with vitamins A, C, E, B<sub>2</sub>, B<sub>6</sub> and B<sub>12</sub> was not justified because these vitamins were taken in sufficient amounts with food.
3. The prevalence of supplementation of vitamins A, C and E did not change between 2001 and 2011/12, but the total intake of vitamin A in both sexes and

vitamins C, E in women was significantly higher in 2001.

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### Conflict of interest

The authors declare no conflict of interest.

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