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Physiological basis of dietary prevention of perimenopausal disorders in the context of dietary habits associated with the consumption of water and beverages by women aged 45-65

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Abstract

Introduction: This study aimed to evaluate the amount of water and type of beverages consumed by women of perimenopausal age against a background of dietary prevention of perimenopausal disorders.

Material and methods: This study was conducted in autumn 2012, in Wielkopolska Province (Poland), on 100 women aged from 45 to 65 years, employed as office workers. Information on the diet, beverages consumption and anthropometric data were collected.

Results: Analysis of the nutritional status of the surveyed women showed that over 50% of them had excess body weight. Analysis of the survey results indicated that the amount of water in the diet of the examined women was appropriate, although the type of drinks consumed was inadequate. The women consumed too much coffee and tea, and simultaneously had a low intake of potable water. More than a half of the surveyed women sweetened coffee and tea. Women with excess body weight did so statistically significantly quite often, and they also used larger amounts of sugar for sweetening. Nearly 60% of the surveyed women added milk, or less frequently cream, to coffee. Milk was statistically significantly more frequently chosen by women with normal body weight, and cream by women with excess body weight. There was a positive correlation between body mass index and the energy value of the consumed fluids.

Conclusions: The dietary irregularities identified in this study may intensify perimenopausal symptoms and contribute to the development of diet-related chronic diseases. Taking into account the observed irregularities, it seems appropriate to provide perimenopausal women with nutrition education and diet correction, including the amount and type of fluids consumed.

Key words: dietary prevention, perimenopausal disorders, beverage consumption.

Introduction

Hormonal changes that occur during perimenopause predispose to metabolic disorders, which in turn promote development of diet-dependent chronic diseases. Menopause is associated, among other things, with an increased risk of obesity, carbohydrate and lipid metabolism disorders, atherosclerosis, cardiovascular complications and osteoporosis [1]. It should be noted, however, that the occurrence and severity of the abovementioned symptoms are conditioned by lifestyle, including physical activity, dietary habits, etc. [2]. Special care should be given to the diet composition, including the amount and type of food, but also the amount and type of fluids, which usually receive much less attention. So far, numerous works have been published on the evaluation of nutritional status and dietary habits of perimenopausal women; however, none of the papers has provided any detailed discussion on the consumption of beverages recently [3, 4]. One of the few studies on a detailed analysis of fluid intake by perimenopausal women is a study by Hernandez-Avila *et al*. [5], who evaluated the influence of different sources of caffeine on bone density of pre- and perimenopausal women aged 50-60 living in Massachusetts.

The type of fluids consumed is of importance, as beverages may provide many health-promoting compounds (including polyphenols, tannins, purine alkaloids, minerals and vitamins), but they can also deliver excessive amounts of energy, phosphates and other food additives.

Appropriate amounts and types of consumed fluids may be of significance in dietary prevention of perimenopausal disorders because of the content of bioactive compounds. They may also support suitable hydration of the body, exerting a positive effect on the skin, as its elasticity, resilience and hydration deteriorate during menopause. Moreover, they maintain the nor-

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mal course of metabolic processes and elimination of metabolites, as well as preventing constipation, which is among the most common disorders of the digestive tract during perimenopause, and are correlated with cardiovascular disease [6].

This study aimed to evaluate the amount of water and type of beverages consumed by women of perimenopausal age, working in an office.

Material and methods

This study was conducted in autumn 2012, in Wielkopolska Province (Poland), on 100 women aged from 45 to 65 years, employed as office workers. 142 questionnaires were distributed, and 111 returned, including 4 incorrectly completed and 7 from women using sweeteners; these surveys were rejected because of their small number for later comparison.

Information on the diet were collected using the method of current noting. The women, having been previously instructed by the researcher, systematically recorded the time, type, amount (in household measures) and way of preparation of consumed products, meals and fluids. The records covered three non-consecutive days (3 × 24 h) of a week, including one day off, and supplementation. The portion size was determined during a personal interview with every women on the basis of a photo album of products and meals [7]. The energetic and nutritional value of whole-day food intake (CRP – *Całodzienna Racja Pokarmowa*) from the diet and supplementation was calculated using the Dieta 5 software. The results obtained were compared to the legal standards on recommended daily allowances (RDA) or adequate intake (AI), for each woman individually, regarding age, body weight and level of physical activity [8]. The obtained menus were also analyzed with regard to the amount and type of consumed beverages and additives, such as sugar, cream and milk added to coffee and tea.

The subjects also answered questions on how frequently they consumed sweet carbonated and noncarbonated beverages, as well as energy and isotonic drinks.

Tab. I. Estimation of the nutritional status of examined women according to BMI value

BMI	Nutritional status	Women	
		[*n*]	[%]
< 18.5	Underweight	0	0
18.5-24.9	Correct body weight	45	45
25.0-29.9	Overweight	43	43
30.0-34.9	Obesity class I	10	10
≥ 35	Obesity class II	2	2

In order to estimate nutritional condition of the surveyed women, they were subjected to anthropological measurements, including body weight (using a legalized medical scale, to the nearest 0.1 kg, in the morning, in the fasted state, and in light clothing) and body height (in Frankfurt's horizontal plane, using a stadiometer, to the nearest 0.5 cm). Based on these measurements, body mass index was calculated as follows:

BMI = body weight [kg]/body height [m]^2.

The results obtained enabled us to evaluate nutritional condition of the subjects according to the WHO classification [9].

The resulting data were processed statistically in the Statistica software package, using a two-portion test and Pearson's correlation coefficient.

Results

Analysis of nutritional status of the surveyed women showed that over 50% of them had excess body weight: 43% were overweight, and 12% were obese, including 2% with second-degree obesity (Table I).

The energy value of whole-day food intake (CRP) by the subjects was found insufficient, corresponding on average to 75% of the accepted standard (Table II). The menus had excess protein, mainly of animal origin, and deficient amounts of carbohydrates and lipids (Table II). The consumption of fiber, calcium, iron and vitamin D was just slightly above half of the daily demand. The intake of potassium, zinc, niacin and vitamin C was also inadequate. In contrast, excessive amounts were consumed of sodium, phosphorus, and vitamins A, B_2, B_{12}. The amount of water from beverages and foods in the analyzed menus was appropriate.

The obtained menus enabled us to estimate in detail the intake of water from beverages and the contribution of particular beverages to the structure of consumed liquids (Table III). Coffee was the beverage consumed in the highest quantities by the surveyed women. It constituted nearly 40% of all consumed drinks; the women drank on average 600 ml of coffee a day, but some of them drank as much as over 1 liter daily. Tea constituted a smaller percentage; the women drank it in the amount of about 500 ml a day, usually choosing black tea, less frequently green tea. Pure water accounted for only 20% of consumed drinks; the subjects usually chose noncarbonated water with a low or medium mineral content (Table IV). Sweet fizzy drinks were chosen only occasionally and were drunk in small amounts during the analyzed period. Most women also stated that they never consumed sweet carbonated and noncarbonated beverages, nor energy and isotonic drinks.

More than half of the surveyed women sweetened coffee and tea. Women with excess body weight did so statistically significantly often, and they also used greater amounts of sugar for sweetening (Table V). Usu-

ally, two teaspoonfuls (10 g) of sugar were added to one glassful of infusion; women with excess body weight did so statistically significantly more frequently. Nearly 60% of the surveyed women added milk, or less frequently cream, to coffee. Milk was statistically significantly more frequently chosen by women with normal body weight, and cream by women with excess body weight. There was a positive correlation between body mass index and the energy value of the consumed fluids (Fig. 1).

Discussion

Maintaining a normal body weight is an important prerequisite for good health, which helps to reduce the risk of diet-related chronic diseases. This especially applies to perimenopausal women, who have reduced production of estrogens – hormones that provide protection against disorders in lipid and carbohydrate metabolism. This study revealed that over 50% of women had excess body weight. Similar results were reported by Przybyłowicz *et al*. [10] for perimenopausal women in Warmian-Mazurian Province, by Pertyński and Łukaszek [11] for female residents of Łódź and Dąbrowska *et al*. [12] in Silesia.

Overweight and obesity are more frequent in perimenopausal women, compared to women of other age groups, due to hormonal and metabolic changes occurring during perimenopause that are not accompanied by changes in dietary habits [13]. Excess body weight usually results from a lack of physical activity, as well as long-term abnormal eating behaviors and habits, that are not always reflected in excess energy value of CRP, but manifest as abnormal diet composition, including the amount and type of drinks consumed. Beverages can potentially provide excess monosaccharides, contributing to disturbances in carbohydrate and lipid metabolism. Being a source of monosaccharides and disaccharides, they can also increase total daily energy intake. Mattes [14] and DiMeglio and Mattes [15] have shown that consumption of monosaccharides in solid products elicits precise dietary compensation of energy intake, modifying the amount of food consumed. But

Tab. II. Energy value and main nutrition components in daily food rations of examined women in the term of the interview

Component	Intake $\bar{X} \pm SD$	Percentage of norm
Energy [kcal]	1647 ± 631	76.6
Total protein [g][1]	63.9 ± 19.8	121
Animal protein [g][2]	41.7 ± 16.1	260
Assimilable carbohydrates [g]	220 ± 90.2	82.6
Dietary fiber [g][3]	17.7 ± 5.66	53.0
Total fat [g][4]	62.8 ± 27.1	84.6
Cholesterol [mg]	247 ± 122	82.4
Sodium [mg]	3682 ± 536	263
Potassium [mg]	3065 ± 828	65.2
Calcium [mg]	523 ± 234	51.2
Phosphorus [mg]	1041 ± 289	149
Magnesium [mg]	261 ± 74.6	98.5
Iron [mg]	8.05 ± 4.74	57.5
Zinc [mg]	5.69 ± 2.76	71.1
Copper [mg]	1.10 ± 0.372	122
Vitamin A [µg]	1111 ± 2090	159
Vitamin D [µg]	6.20 ± 2.23	49.6
Vitamin E [mg]	7.90 ± 3.87	98.7
Vitamin B_1 [mg]	0.990 ± 0.421	90.0
Vitamin B_2 [mg]	1.45 ± 0.671	132
Vitamin B_6 [mg]	1.48 ± 0.523	106
Vitamin B_{12} [µg]	3.56 ± 5.01	148
Vitamin PP [mg]	11.3 ± 5.7	83.5
Vitamin C [mg]	64.2 ± 37.5	85.0
Water [ml]	1920 ± 134	96.0

[1] – norm level: 0.9 g/kg body weight
[2] – norm level: 1/3 of the recommended amount of total protein
[3] – to 100% accepted median of the norm – 33.5 g/24 h
[4] – to 100% accepted median of the norm – 74.5 g/24 h

Tab. III. Type, amount and structure of the beverages consumed by the examined women

Type of beverages	Intake $\bar{X} \pm SD$ [ml/24 h]	Range [ml/24 h]	Participation in the structure of consumed beverages [%]
Total	1644 ± 1247	375-3122	100
Coffee	645 ± 135	0-1250	39.2
Tea	512 ± 346	0-1000	31.2
Water	342 ± 326	0-2050	20.8
Fruit juice	127 ± 54.2	0-500	7.76
Sweet sodas	16.3 ± 6.3	0-250	0.99

Tab. IV. Types of water consumed by the surveyed women

Type of water	Participation [%]
Boiled tap water	20
Mineral water, including:	80
Low mineralized	36
Medium mineralized	32
High mineralized	12

when monosaccharides were delivered in beverages, this compensation was less precise, and the consumed liquids increased the energy intake and intensified weight gain.

Therefore, properly selected potable water, being calorie-free and rich in minerals, is recommended as the best beverage for water supplementation in the body. The surveyed women seldom drank water, and drank small amounts of the fluids – on average 342 ml. This amount was not sufficient, but it was higher than observed in a previous study [3, 4]. Total water intake from beverages and solid food was normal according to the current standard, although it is worth noting that the standard has been reduced by 700 ml (from 2700 ml to 2000 ml) over the last 4 years [8, 16], and taking into account the balance of fluids in the body it seems to be insufficient.

The surveyed women usually drank water with a medium or low mineral content, which is a rather poor source of minerals. Most bottled drinking water has mineral composition comparable to commonly available tap water. It should be noted, however, that water can supply additional amounts of calcium [17], and this is especially important for women during menopause and older due to accelerated bone loss and frequently observed (also in this study) dietary calcium deficiencies [3, 4]. To serve as a good source of calcium, water must contain the element in the amount corresponding to 10-15% of RDA, which in the case of the surveyed women ranged from 130 to 195 mg/l. Moreover, it must be drunk in the amount of 1 to 1.5 liters daily [18]. In this context, a conclusion can be drawn that the type and amount of consumed water were not optimal. This may contribute to the occurrence of constipation, which increases intestinal passage time and increase the risk of carcinogenic processes.

The surveyed women did not habitually drink water, and instead they often chose tea or coffee. Similar observations were made by Wierzbicka *et al.* [19] in their study on caffeine intake among women in Warsaw; the researchers reported that coffee and black tea infusions were consumed in the highest amounts. A high proportion of tea and coffee in the total fluid intake was also revealed by studies on female populations in Canada [20], the USA [21] and the UK [22].

Tea leaves and coffee beans contain compounds such as polyphenols, purine alkaloids, saponins, amino

Tab. V. Additives for coffee and tea used by the examined women

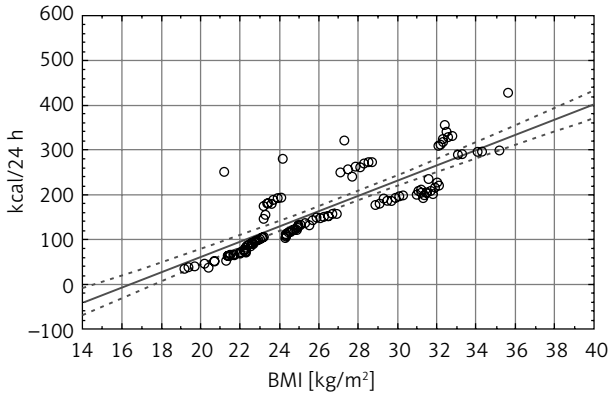
Additive		Body weight	Coffee [%]	Tea [%]
Sugar	Total	Correct (n = 45) Excessive (n = 55)	37.8 61.8* (p = 0.085)	15.6 83.6** (p = 0.000)
		Total (n = 100)	51.0	53.0
	1 teaspoon	Correct (n = 45) Excessive (n = 55)	22.2 16.4	11.1 7.3
		Total (n = 100)	19.0	9.0
	2 teaspoons	Correct (n = 45) Excessive (n = 55)	15.6 40.0* (p = 0.037)	4.4 76.0** (p = 0.000)
		Total (n = 100)	29.0	44.0
	3 teaspoons	Correct (n = 45) Excessive (n = 55)	0.0 5.5	0.0 0.0
		Total (n = 100)	3.0	0.0
Milk		Correct (n = 45) Excessive (n = 55)	66.7 38.2* (p = 0.046)	0.0 0.0
		Total (n = 100)	51.0	0.0
Coffee cream		Correct (n = 45) Excessive (n = 55)	0 14.5* (p = 0.039)	0.0 0.0
		Total (n = 100)	8.0	0.0

*, ** – statistically significant difference. *$p \leq 0.05$; **$p \leq 0.01$ – two portion test

acids, amines, flavoring agents and mineral ingredients [23]. Flavonoids, due to their antioxidant activity, exhibit anticancer, anti-atherosclerotic, anti-inflammatory and antibacterial properties [24, 25]. The presence of tannins makes coffee and tea infusions control diarrhea, exert astringent and anti-inflammatory effects, and prevent tooth decay. Caffeine, one of the purine alkaloids contained in tea leaves and coffee beans, is responsible for the stimulant effect of tea and coffee beverages, as it stimulates the central nervous system and increases the secretion of neurotransmitters such as norepinephrine, GABA, ACTH, and serotonin. Moderate doses of caffeine (200-300 mg/24 h) show beneficial outcomes, but high doses (400 mg – this much is present on average in 700 ml of coffee) cause nervousness, irritability and restlessness [26]. Women who consumed over 500 ml of coffee might observe in themselves adverse effects of caffeine, especially as this alkaloid also occurs in tea and cocoa (including chocolate products). Notwithstanding, caffeine improves the work of cardiac muscle, widens coronary and brain arteries, dilates bronchi and speeds up metabolic processes. Recent studies have revealed that regular drinking of caffeine-containing beverages significantly reduced the risk of Parkinson's disease [27]. Coffee may also cut down the probability of diabetes [28, 29]. On the one hand, caffeine lowers insulin sensitivity of tissues and impairs glucose tolerance, but on the other hand, it stimulates thermogenesis and increases energy expenditure, which may facilitate maintaining or even reducing body weight. Moreover, chlorogenic acids and trigonelline, contained in coffee, reduce glucose and insulin concentrations, and this way improve insulin sensitivity.

Numerous studies have revealed a positive correlation between caffeine intake and lowered bone mineral density, increased risk of fracture, and impaired calcium retention [30]. Caffeine disturbs differentiation of stomal cells into osteoblasts, and shortens the lifetime of already differentiated cells. However, the problem should be considered in the context of calcium intake; the consumption of 2 to 3 cups of coffee per day was found to be associated with bone loss only when dietary calcium deficiency occurred [31]. The surveyed women were at increased risk of developing osteoporosis not only because of their age, but also due to improper composition of their diet, which contained excessive amounts of coffee combined with calcium and vitamin D deficiencies, as well as an excess of animal protein, sodium and phosphorus. And these dietary factors are known to reduce mineral bone density [32].

Tea also contains certain amounts of vitamins, but only niacin occurs in high concentration, due to which tea may produce a protective effect on blood vessels. Coffee may also be a source of niacin, because trigonelline contained in it undergoes transformation to niacin during coffee bean roasting [33].



y = −277.3 + 16.994 • x, r = 0.836*
*– correlation coefficient

Fig. 1. Correlation between body mass index and the energy value of consumed fluids

A favorable change in tea consumption would be to reduce the amount of black tea, which has weaker health-promoting properties, and to increase the intake of green tea, richer in biologically active compounds [34].

Coffee and tea are popular beverages, consumed not only for their taste, but also serving cultural and social functions. Drinking of coffee or tea becomes a pretext for getting away from professional or household duties, and creates some breathing space. The obtained results refer to a select group of women who perform office work, and their dietary habits, including the consumption of fluids, may result from opportunities arising from the specific nature of the work. Therefore, they may not relate to other employee groups. Analysis of individual menus also indicated that coffee was frequently consumed in the morning on an empty stomach, and at work during long gaps between meals. Coffee seems to have been replacing breakfast or lunch, which is undesirable, as coffee weakens the lower esophageal sphincter, increasing the secretion of gastric acid, and through this intensifying dyspepsia and favoring gastritis development [35]. Taking account of the fact that analysis of dietary energy intake revealed deficiency of energy delivered with food, it can be assumed that coffee consumption served not only for taste, stimulation and social functions, but also, or perhaps above all, for hunger inhibition.

It is worth remembering that coffee and tea are diuretic drinks, which intensify elimination of minerals from the body, and therefore they should be consumed in moderate quantities. Moreover, they contain compounds that bind to minerals in the digestive tract and reduce their absorption [36], so they should not be drunk during meals. Menus of the surveyed women demonstrated deficiencies of minerals such as calcium or iron; any additional limitation of absorption or intensification of elimination of the minerals would therefore be highly disadvantageous.

Despite the growing public attention regarding limitation of sugar addition to foods, nearly half of respondents sugared coffee and tea, adding usually 2 teaspoonfuls of sugar to a glassful of infusion. Women with excess body weight sugared coffee or tea definitely more frequently, and they added more sugar compared to women with normal body weight. From among milk-derived coffee additives, cream was chosen mostly by overweight and obese women. This shows that women with excess body weight consumed additional calories from coffee or tea, which might have been one of the reasons for body fat accumulation. It should be also mentioned that a large number of respondents (with both normal and excess body weight) ate sweets while drinking coffee.

The surveyed women also drank fruit juices, which provided vitamin C and β-carotene. It is worth noting, however, that 100 ml of fruit juice (even not sweetened) contains nearly 10 g (2 teaspoonfuls) of monosaccharides. This amount should be taken into account in the daily intake, which in the case of monosaccharides should not exceed 10% of the dietary energy intake. For this reason fruit juices may be replaced by vegetable ones, which provide similar health benefits, and are usually less caloric.

Conclusions

The analysis of the survey results indicated that the amount of water in the diet of the surveyed women was appropriate, although the type of drinks consumed was inadequate. The women consumed too much coffee and tea, and simultaneously had a low intake of potable water. The dietary irregularities identified in this study may intensify perimenopausal symptoms and contribute to the development of diet-related chronic diseases. Taking into account the observed irregularities, it seems appropriate to provide perimenopausal women with nutrition education and diet correction, including the amount and type of fluids consumed.

Disclosure

Authors report no conflicts of interest.

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