ASSOCIATIONS BETWEEN ADULT PERCEPTION OF BODY WEIGHT, DIET, PREPARING MEALS AND DIETARY PATTERNS

Marzena Jezewska-Zychowicz*, Dominika Guzek

Warsaw University of Life Sciences, Faculty of Human Nutrition and Consumer Sciences,
Department of Organization and Consumption Economics, Warsaw, Poland

ABSTRACT

Background. The links between dietary patterns, the perception of one's body weight and diet as well preparing meals are poorly recognised in the literature. In order to develop effective nutritional education and focused interventions, more of such information is thereby required to improve the nation's health.

Objective. To identify dietary patterns based on declared food consumption rates and subject responses on whether dieting, perception of body weight and diet and preparing meals are linked to such dietary patterns.

Material and methods. The survey was conducted in 2016 on 344 consumers chosen for age (20-65 years) and their consent for study participation. Rates of eating the foods selected were measured using a 7-point scale. Cluster analysis was used to identify three dietary patterns of behaviour: 'potentially beneficial to health', 'potentially unfavourable for health; deficient' and 'potentially unfavourable for health; excessive'. The analysis was performed using IBM SPSS Statistics version 23.0.

Results. There were significantly more subjects showing 'potentially beneficial for health' behaviour, normal body weight, those dieting (whether now or in the past) and those who evaluated their diet as being very good or good compared to other groups. They were also more involved in preparing their meals at home. Differences were found between the 'unfavourable for health' dietary patterns concerning subject's involvement in meal preparation. The dietary pattern for 'deficient' behaviour found lower rates of those preparing their meals at home.

Conclusions. The pattern of potentially beneficial dietary habits was linked to weight control through a slimming diet and greater involvement in the preparation of food for consumption. The results show the need to develop food choice skills rather than just transferring knowledge in the nutrition education process.

Key words: *consumer, dietary patterns, perception, cluster analysis*

STRESZCZENIE

Wprowadzenie. Związek między wzorami zachowań żywieniowych a postrzeganiem masy ciała i sposobu żywienia oraz zaangażowaniem w przygotowanie posiłków w domu nie został jeszcze dobrze rozpoznany. Jednocześnie wiedza na ten temat jest użyteczna w przygotowywaniu skutecznej edukacji żywieniowej i interwencji ukierunkowanych na poprawę zdrowia populacji.

Cel. Wyodrębnienie wzorów zachowań żywieniowych na podstawie deklarowanej częstości spożywania wybranych grup żywności oraz odpowiedź na pytanie czy stosowanie diet odchudzających, samoocena masy ciała i sposobu żywienia oraz zaangażowanie w prace związane z przygotowaniem posiłków wykazuje związek z przynależnością do wzorów zachowań żywieniowych.

Materiał i metody. Badanie ankietowe zostało przeprowadzone w 2016 roku wśród 344 konsumentów w wieku 20-65 lat. Dobór próby był celowy. Po spełnieniu kryterium wieku i wyrażeniu zgody na udział w badaniu osoba była włączana do badanej grupy. Częstotliwość spożywania wybranych produktów żywnościowych oceniano na 7-punktowych skalach. Na podstawie analizy skupień uwzględniającej częstość spożywania wybranych grup produktów żywnościowych wyodrębniono 3 wzory zachowań żywieniowych: „potencjalnie korzystne dla zdrowia", „potencjalnie niekorzystne dla zdrowia – niedoborowe"; „potencjalnie niekorzystne dla zdrowia – nadmiarowe". Do charakterystyki wyodrębnionych wzorów wykorzystano cechy socjo-demograficzne, deklaracje respondentów na temat stosowania diety odchudzającej, samoocenę masy ciała i sposobu żywienia oraz zaangażowanie w prace związane z przygotowaniem żywności do spożycia. Analizy wykonano z wykorzystaniem IBM SPSS Statistics, wersja 23.0.

Wyniki. Wzór zachowań „potencjalnie korzystnych dla zdrowia", w porównaniu z pozostałymi wzorami, reprezentowało istotnie więcej osób z masą ciała w normie, stosujących obecnie lub w przeszłości dietę odchudzającą, oceniających

* **Corresponding author:** Marzena Jezewska-Zychowicz, Department of Organization and Consumption Economics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences, Nowoursynowska 159 c, 02-776 Warsaw, Poland, tel. +48 22 5937131, fax +4822 5937147, e-mail: marzena_jezewska_zychowicz@sggw.pl

własny sposób żywienia jako bardzo dobry lub dobry oraz często przygotowujących posiłki w domu. W grupie osób z zachowaniami „potencjalnie niekorzystnymi dla zdrowia" stwierdzono zróżnicowanie po uwzględnieniu zaangażowania w prace związane z przygotowaniem posiłków. Wzór zachowań „niedoborowych" charakteryzował mniejszy odsetek osób często przygotowujących posiłki w domu.

Wnioski. Wzór zachowań żywieniowych potencjalnie korzystnych dla zdrowia łączył się z kontrolą masy ciała poprzez stosowanie diety odchudzającej i większym zaangażowaniem w prace związane z przygotowaniem żywności do spożycia. Uzyskane wyniki wskazują na potrzebę rozwijania umiejętności związanych z wyborem żywności, a nie tylko transfer wiedzy w procesie edukacji żywieniowej.

Słowa kluczowe: *konsument, wzory zachowań żywieniowych, percepcja, analiza skupień*

INTRODUCTION

The present-day diets are often characterized by high content of fats, sugar and by substantial energy density. These factors determine individual's nutritional status and health, as well as contribute to weight gain [10,12]. Beyond overweight and obesity, such diets can lead to the development of some diet-related chronic diseases, including diabetes type 2, cardiovascular diseases and some types of cancer [25]. Therefore changes in consumption of both undesirable and desirable foods can be considered as beneficial and health promoting behaviours. Presence of foods high in fat, sugar and salt should be restricted in a diet, while consumption of whole grains, fruit and vegetables should be increased. Moreover, calorie restrictions may provide many benefits for quality of life, especially with respect to loss of weight and fat mass [16, 18]. Recommendations for the desirable changes in the diet are well known, while difficulties in implementing them still exist. Hence the search for more effective solutions to facilitate changes in existing patterns of food consumption is still valid.

The concept that individuals do not consume isolated foods or nutrients but include them in a varied dietary pattern has had a growing acceptance in nutritional epidemiology during the last decade [11, 23]. Clustering of nutritional behaviours is used to identify the dietary patterns. Studies using cluster analysis indicate that dietary patterns are strongly associated with many diseases or biomarkers, including cardiovascular disease, overweight and obesity as well as other ailments [19]. Although studying dietary patterns is recently triggering a lot of interest, to our best knowledge there are still no answers to the questions which individual characteristics are more conducive to healthy dietary patterns. Thus, the purpose of the study was to identify dietary patterns based on declared food consumption rates and subject responses on whether dieting, perception of body weight and diet and preparing meals are linked to such dietary patterns.

MATERIAL AND METHODS

The questionnaire survey was conducted among 344 adults in 2016. Once the age criterion (20-65 years) was met and consent to participate in the study was obtained, the person was included into the sample. The characteristics of study sample is presented in Table 1.

Table 1. Characteristics of the study sample (in %)

Variables		Total	Gender	
			Women	Men
Total		100.0	54.8	45.2
Age (p<0.05)	20 - 35 years old	28.8	29.8	27.6
	36 - 49 years old	41.6	46.3	35.9
	50 - 65 years old	29.7	23.9	36.5
Education (p<0.05)	Lower than secondary	11.8	6.4	18.1
	Secondary	26.8	27.1	25.8
	Higher - bachelor	18.2	18.1	18.7
	Higher - master	43.2	48.4	37.4
BMI (p<0.05)	18.5 - 24.99 kg/m^2	47.5	62.5	30.1
	25 kg/m^2 and higher	52.5	37.5	69.9

The Ethics Committee of the Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences, has approved the protocol of the Lifestyle study on the 27th June 2016, Resolution No. 01/2016. Informed consent was provided by its participants.

The questionnaire was developed by authors using 14 questions from the KomPAN questionnaire [13], that concerns the frequency of the food consumption. Food groups included in the study are important from health perspective, i.e. wholemeal bread; buckwheat groats, other coarse grains, oatmeal and wholemeal pasta; fermented milk drinks; cheeses (including melted cheese, blue cheese); cured meats, sausages or Vienna sausages; dishes from so-called red meat; dishes from so-called white meat; fruits; vegetables; fruit juices; vegetable or fruit and vegetable juices; meals or snacks such as burgers, pizza, chicken, fries; sweets and cakes; crisps and other salty snacks [9]. Respondents were asked to specify the habitual frequency of the consumption of 14 selected foods which were consumed on average within the last year. They were provided with 7 categories of the answer: 1 - never; 2 - less than once month, 3 - from 1 to 3 times a month; 4 - once a week, 5 - several times a week; 6 - once a day; 7 - several

times a day. Respondents' answers were converted into daily frequency (times/day): never – 0; less than once a month and 1-3 times a month - 0.06; once a week - 0.14; several times a week - 0.5; once a day – 1; several times a day - 2 [24].

Respondents were also asked about their opinions on: 1/ using a reducing diet nowadays as well as in the past (three categories of answer were provided: 'I have never dieted', 'sometimes I am on a diet', 'I am always on a diet'); 2/ the body weight (five categories of answer were provided: 'I fully accept my body weight', 'My body weight is a little too big', 'My body weight is too big', 'My body weight is a little too low', 'My body weight is too low'); 3/ the diet (four categories of answer were provided: very bad, bad, good, very good); 4/ the statement expressing the individual's involvement in preparing meals: 'I often prepare my meal myself or with my family using purchased ingredients rather than ready-to-eat foods'. They were provided with five categories of answer: 'I strongly disagree' (1), 'I rather disagree' (2), 'I not disagree nor agree' (3), 'I rather agree' (4), and 'I strongly agree' (5). These questions concerning respondents' opinions were not validated prior to the study.

Questions concerning gender, age, education, place of residence and number of adults and children within family were used in questionnaire. Body Mass Index (BMI) was calculated using self-reported weight and height and categorized according to International Obesity Task Force (IOTF) standards [2].

Statistical analysis

In order to identify homogeneous dietary patterns simple segmentation was performed using cluster analysis with the k-means method [1]. Grouping was performed on the basis of differences in the variables related to the frequency of consumption of 14 food groups. Such variables as using a reducing diet, perception of body weight and diet, involvement in meals preparing, gender, age, education, place of residence and number of adults and children within family, and BMI were used to determine differences between the separated dietary patterns. Three clusters were identified, with the convergence achieved in 9 iterations, the minimum distance between the initial centres of clustering was 11.916.

Chi-square test (nominal scales) and one-way analysis of variance – ANOVA (order scales) and *Tukey's* post-hoc test were implemented to determine the significant differences between the variables, with p <0.05. Only data showing statistically significant differences are presented in the tables. All analysis were performed using IBM SPSS Statistics version 23.0.

RESULTS

The dietary pattern described as 'potentially beneficial to health' (51.9% of the population) was characterized by frequent consumption of wholemeal bread; buckwheat groats, other coarse grains, oatmeal and wholemeal pasta; fermented milk drinks; fruits; vegetables and fruit juices in comparison with other clusters (Table 2). 'Potentially unfavourable; deficient' dietary pattern (18.5%) was distinguished by the rare consumption of wholemeal bread, cheese, so-called white meat, fruits, vegetables, fruit and vegetable juices, but also by low frequency of eating sweets. Whereas the cluster called 'potentially unfavourable; excessive' (29.6%) was characterized by the frequent consumption of cheese; cured meats, sausages or Vienna sausages; so-called red meat; sweets and cakes; crisps and other salty snacks (Table 2).

The 'potentially unfavourable for health' clusters did not show significant differences in the frequency of consumption of buckwheat groats, other coarse grains, oatmeal and wholemeal pasta; fermented milk beverages, vegetable or fruit and vegetables juices. There were no significant differences between the 'potentially beneficial for health' and the 'potentially unfavourable; deficient' clusters in regard to the frequency of consumption of cured meats, sausages or Vienna sausages, red meat and meals or snacks such as burgers, pizza, chicken, fries. There was no difference in the frequency of consumption between 'potentially beneficial for health' and 'potentially unfavourable; excessive' cluster with regard to white meat (Table 2).

The 'potentially beneficial for health' dietary pattern was represented by significantly more women than men. Moreover, in this cluster were more participants with higher education. The patterns of potentially unfavourable behaviours were represented by more males, especially in the case of unfavourable - deficient pattern. More respondents with secondary and higher education than the others displayed behaviours of potentially unfavourable impact on health. The 'potentially unfavourable; deficient' pattern was represented by more participants living in cities with over 20 thousand inhabitants. In the rural environment nearly twice as many respondents represented the 'potentially unfavourable; deficient' pattern compared to the excessive one (Table 3). The number of individuals and children in the family as well as age did not significantly differentiate the individuals representing the different dietary patterns.

Respondents' perception of body weight did not significantly differentiate belonging to identified dietary patterns, although the majority of those accepting body weight represented a 'potentially unfavourable; deficient' pattern. In the other two dietary patterns, a greater percentage of people reported that they were overweight or obese. Significant differences were demonstrated after taking into account BMI. More people with BMI in the standard interval (BMI 18.5-24.99) represented

the 'potentially beneficial for health' dietary pattern. The potentially unfavourable patterns, both deficient and excessive, were represented by significantly more people with BMI indicating overweight or obesity. More than a half of the respondents representing the 'potentially beneficial for health' pattern declared using a reducing diet now or in the past. On the other hand, such declarations concerned only about 25% of respondents representing 'potentially unfavourable' dietary patterns. More people representing the 'potentially beneficial for health' dietary pattern rated their own diet more positively in comparison to the rest of respondents. This can be a sign of their greater nutritional awareness and ability to evaluate their own diet properly.

Table 2. Cluster characteristics according to the frequency of consumption of particular groups of food products (mean value, standard deviation)

Groups of food products	Total	Dietary patterns - Clusters*		
		1 'potentially beneficial for health' (N=178)	2 'potentially unfavourable; deficient' (N=64)	3 'potentially unfavourable; excessive' (N=102)
Wholemeal bread	0.59±0.65	0.95[a]±0.65	0.05[b]±0.11	0.29[c]±0.40
Buckwheat groats, other coarse grains, oatmeal and wholemeal pasta	0.26±0.29	0.40[a]±0.31	0.12[b]±0.20	0.11[b]±0.14
Fermented milk drinks	0.42±0.42	0.56[a]±0.44	0.30[b]±0.38	0.25[b]±0.32
Cheeses (including melted cheese, blue cheese)	0.47±0.45	0.40[a]±0.35	0.32[b]±0.37	0.69[c]±0.57
Cured meats, sausages or Vienna sausages	0.69±0.57	0.47[a]±0.42	0,59[a]±0.46	1.13[b]±0.63
Dishes from so-called red meat	0.44±0.35	0.26[a]±0.30	0,32[a]±0.31	0.41[b]±0.44
Dishes from so-called white meat	0.39±0.34	0.40[a]±0.33	0.33[b]±0.40	0.41[a]±0.30
Fruits (raw, cooked, from the can)	0.94±0.67	1.17[a]±0.65	0.44[b]±0.48	0.86[c]±0.60
Vegetables (raw, cooked, from the can)	1.11±0.71	1.34[a]±0.70	0.69[b]±0.65	0.98[c]±0.59
Fruit juices	0.36±0.48	0.46[a]±0.52	0.10[b]±0.19	0.33[c]±0.46
Vegetable or fruit and vegetable juices	0.13±0.26	0.20[a]±0.32	0.06[b]±0.12	0.3[b]±0.09
Meals or snacks such as burgers, pizza, chicken, fries	0.06±0.13	0.04[a]±0.08	0.0[a]±0.07	0.12[b]±0.18
Sweets and cakes	0.41±0.46	0.34[a]±0.36	0.18[b]±0.25	0.68[c]±0.56
Crisps and other salty snacks	0.10±0.20	0.05[a]±0.09	0.08[a]±0.16	0.19[b]±0.29

N – number of respondents
* Average value based on daily frequency (times/day): never – 0; less than once a month and 1-3 times a month - 0.06; once a week - 0.14; several times a week - 0.5; once a day – 1; several times a day - 2
[a, b, c] – the values in lines with the same letters do not differ significantly (ANOVA, post-hoc Tukey's test, p<0,05)

Table 3. Characteristics of dietary patterns (clusters) according to sociodemographic characteristics of the study sample (%)

Socio-demographic characteristics		Total	Dietary patterns (Clusters)		
			1 'potentially beneficial for health'	2 'potentially unfavourable; deficient'	3 'potentially unfavourable; excessive'
Gender (p<0.05)	Women	54.8	67.8	46.0	37.6
	Men	45.2	32.2	54.0	62.4
Education (p<0.05)	Lower than secondary	11.8	6.3	20.6	15.8
	Secondary	26.8	22.7	31.7	30.7
	Higher - bachelor	18.2	19.3	15.9	17.8
	Higher - master	43.2	51.7	31.7	35.6
Place of residence (p<0.05)	Rural area	18.5	14.7	30.2	17.8
	Town with less than 20 000 habitants	13.2	17.5	9.5	7.9
	Town with 20 000-100 000 habitants	36.4	32.8	44.4	37.7
	City with more than 100 000 habitants	32.0	35.0	15.9	36.6

The distribution of opinions about one's own diet in the group of people representing potentially unfavourable dietary patterns was similar. Approximately one third of them rated their diet as bad or very bad, while those who represented a potentially beneficial dietary pattern expressed such opinions 3 times less frequently (Table 4).

The 'potentially beneficial for health' dietary pattern was represented by more respondents who declared frequent consumption of home-made meals prepared from purchased ingredients without using ready-to-eat foods. The least of such declarations was reported within the potentially unfavourable; deficient dietary pattern (Table 4).

Table 4. Characteristics of dietary patterns (clusters) according to selected opinions and behaviours (%)

Variables		Total	Dietary patterns (Clusters)		
			1 'potentially beneficial for health'	2 'potentially unfavourable; deficient'	3 'potentially unfavourable; excessive'
BMI (p<0.05)	18.5-24.99	47.5	53.4	35.5	44.6
	25 and above	52.5	46.6	64.5	55.4
Using of a reducing diet (p<0.05)	I have never been on a diet	58.0	43.2	74.2	74.0
	I am/was on a diet	42.0	56.8	25.8	26.0
Perception of diet (p<0.05)	Bad or very bad	23.5	13.0	31.7	36.6
	Good or very good	76.5	87.0	68.3	63.4
Individual's involvement in preparing meals * (p<0.05)	no	27.0	20.3	41.3	29.7
	neither no nor yes	22.3	22.6	22.2	21.8
	yes	50.7	57.1	36.5	48.5

*on the base of respondent's opinion the statement 'I often prepare my meal myself or with my family using purchased ingredients rather than ready-to-eat foods': no – 'I strongly disagree' and 'I rather disagree', neither no nor yes – 'I not disagree nor agree', yes – 'I rather agree' and 'I strongly agree'

DISCUSSION

Frequency of eating some foods is indicated by other researchers as important from the perspective of nutritional assessment. Unhealthy behaviours include low frequency of eating whole grains, milk and milk drinks, fruit and vegetables [22] and excessive consumption of salty snacks [20], sweets, meat and meat products [14] or sugar sweetened beverages [7]. The data analysis allowed to identify on the base of food frequency consumption three homogeneous groups of respondents, where the potential health risk is varied.

About half of the study sample represented the 'potentially beneficial for health' dietary pattern. Frequent consumption of wholemeal bread, coarse grains, fermented milk drinks, fruits, vegetables and fruit juices provides the opportunity to meet nutritional needs Simultaneously, according to the current studies consumption of these products in many population is not sufficient [6]. Nevertheless, about a half of the respondents did not meet nutritional recommendations, which allowed to include them in the patterns of excessive and deficient diet. Larger in terms of size 'potentially unfavourable; excessive' pattern was characterized by frequent consumption

of energy-rich foods and many nutrients, whose abundant intake creates high healthy risks. Those nutrients included sodium [3], fat and sugar [15]. As in other studies [10,12], this pattern was more often represented by overweight and obese respondents than those with normal body weight.

Less than 1/5 of the population represented 'potentially unfavourable; deficient' pattern, which was characterized by the rare consumption of food beneficial for health, but also sweets. Seldom frequency of eating sweets may suggest that this dietary pattern includes people who control their diet in order to prevent excess of energy from food. However, it turned out that, people with BMI indicating overweight and obesity prevailed in this pattern and at the same time only 1/4 of them used a reducing diet currently or in the past. It can be assumed that frequent consumption of other products, as well as the quantity of food, combined with low physical activity, could have influenced their high BMI. It turned out that twice more people representing 'potentially unfavourable; deficient' pattern, compared with those from potentially beneficial to health pattern, did not engage in preparing meals at home. This may be seen as an evidence of eating outside frequently, but also of low nutritional awareness and no attention paid to nutrition.

Surprisingly, the use of reducing diets concerned roughly the same number of respondents representing both unfavourable for health dietary patterns. The percentage of respondents using a reducing diet was twice lower in the unfavourable dietary patterns in comparison with the potentially beneficial for health pattern. The results of *Galinski* et al. [8] study indicated that the dietary restrictions of sugar, high-fat foods, fats and starch can be considered as predictors of both healthy and unhealthy dietary patterns in the Polish young female population, which is also reflected by the results of this study.

In our study, respondents' perception of body weight did not differentiate belonging to dietary patterns, although such association is reported in the literature [21]. Subjectivity of the perception of body weight, conditioned primarily by personality traits but also by weight management experiences, may be a reason for a lack of direct relation between these variables. In contrast, the BMI significantly differentiated the identified dietary patterns, but the relation between these variables was not obvious. Indeed, more people representing a potentially beneficial pattern than one characterized by unfavourable behaviours had a normal BMI, as evidenced by the literature [5, 19]. On the other hand, in the case of unfavourable dietary patterns, less people representing excessive pattern were characterized by overweight or obesity. However, this may be due to the way we collect weight and height information. Self-reported weight may have led to underestimation of weight in the case of declaring frequent consumption of high-energy products.

The results of the study confirm the importance of socio-demographic characteristics in differentiating the dietary patterns. A more healthy dietary pattern was represented by more women and respondents with higher education, as evidenced by the results of other studies [4, 26]. Unfavourable health-related dietary patterns were represented by more men and people with at least secondary education. A higher presence of men has been reported in 'excessive' rather than 'deficient' dietary pattern.

The limitations of our study relate to the potential biases that may occur when self-reported data is analysed. Moreover, it could be argued that the use of questions on frequency eating leads to overestimation of the level of consumption of some products. People often overestimate the consumption of foods perceived as healthy and misreport on the consumption of unhealthy foods. Nevertheless, using such questions is authorised to research aim that was to screen 'healthy' and 'unhealthy' dietary patterns, rather than the exact intake of certain foods. Finally, cluster analysis require researchers' subjective decisions which means that the results of the study need to be carefully compared with the results of other studies.

Although our findings pertain solely to a rather small group of Polish population and should not be generalized to the wide population, especially to one with different cultural background, our study provides an interesting insight into dietary patterns taking into account respondents' perception of some issues that may determine individuals' behaviours.

CONCLUSIONS

The 'potentially beneficial for health' dietary pattern was represented, compared with the others, by significantly more subjects with normal body weight, respondents using a reducing diet in the past or nowadays, those perceived their diet as very good or good, and often prepared meals at home. Moreover, more women and respondents with higher education represented this dietary pattern. The perception of body weight did not show a significant link with the specificity of the dietary patterns, whereas a more positive perception of one's own diets indicated a more healthy dietary pattern. Dietary pattern potentially beneficial for health was linked with weight control implemented by a reducing diet and with a greater involvement in preparing meals at home. This points to the need for skills development, not just knowledge transfer in the process of nutrition education.

Conflicts of interest
The authors declare that they have no competing interests.

REFERENCES

1. *Antonides G., van Raaij W.F.:* Consumer behaviour. Wydawnictwo Naukowe PWN, Warszawa, 2003. (In Polish)

2. *Cole T.J., Lobstein T.:* Extended international (IOTF) body mass index cut-offs for thinness, overweight and obesity. Pediatr Obes 2012;7:284-94. DOI:10.1111/j.2047-6310.2012.00064

3. *Cook N.R., Cutler J.A., Obarzane, E., Buring J.E., Rexrode K.M., Kumanyika S.K.:* Long term effects of dietary sodium reduction on cardiovascular disease outcomes: observational follow-up of the trials of hypertension prevention (TOHP) BMJ, 2007; 334: 885–888 DOI: 10.1136/bmj.39147.604896.55.x

4. *Deshpande S., Basil M.D., Basil D.Z.:* Factors influencing healthy eating habits among college students: an application of the health belief model. *Health Mark Q.* 2009;26(2):145-64. DOI:10.1080/07359680802619834

5. *Féart C., Samieri C., Rondeau V., Amieva H., Portet F., Dartigues J.F., Scarmeas N., Barberger-Gateau P.:* Adherence to a Mediterranean diet, cognitive decline, and risk of dementia. JAMA. Aug 12;302(6):638-48. DOI: 10.1001/jama.2009.1146.

6. *Floro J.D., Newsome R., Fisher W., Barbosa-Cánovas G.V., Chen H., Dunne C.P., German J.B., Hal R.L., Heldman D.R., Karwe M.V., Knabel S.J., Labuza T.P., Lund D.B., Newell-McGloughlin M., Robinson J.L., Sebranek J.G., Shewfelt R.L., Tracy W.F., Weaver C.M., Ziegler G.R.:* Feeding the World Today and Tomorrow: The Importance of Food Science and Technology. Compr Rev Food Sci Food Saf. 2010; 9: 572–599. DOI: 10.1111/j.1541-4337.2010.00127.x

7. *Forshee R.A. Anderson P.A., Storey M.L.:* Sugar-sweetened beverages and body mass index in chilren and adolescents: a meta-analysis. Am J Clin Nutr, 2008; 87:1662–1671.

8. *Galinski G., Lonnie M., Kowalkowska J., Wadolowska L., Czarnocinska J., Jezewska-Zychowicz M., Babicz-Zielinska* E.: Self-reported dietary restrictions and dietary patterns in Polish girls: a short research report (GEbaHealth Study. Nutrients 2016;8(12),796; DOI:10.3390/nu8120796.

9. *Hawrysz I., Krusińska B., Słowińska M.A., Wądołowska L., Czerwińska A., Biernacki M.*: Nutritional knowledge, diet quality and breast or lung cancer risk: a case-control study of adults from Warmia and Mazury region in Poland. Rocz Panstw Zakl Hig 2016;67(1):9-15.

10. *Johnson L., Mander A., Jones L., Emmett P., Jebb S.:* A prospective analysis of dietary energy density at age 5 and 7 years and fatness at 9 years among UK children. Int J Obes 2008;32:586-593. DOI:10.1038/sj.ijo.0803746.

11. *Kant A.K.:* Dietary patterns and health outcomes. J Am Diet Assoc 2004;104:615-635. DOI:10.1016/j.jada.2004.01.010.

12. *Kesse-Guyot E., Bertrais S., Peneau S., Estaquio C., Dauchet L., Vergnaud A., Czernichow S., Galan P., Hercberg S., Bellisle F.*: Dietary patterns and their sociodemographic and behavioural correlates in French middle-aged adults from the SU. VI. MAX cohort. Eur J Clin Nutr 2009;63:521-528. DOI 10.1038/sj.ejcn.1602978.

13. Kwestionariusz do badania poglądów i zwyczajów żywieniowych osób w wieku 16-65 lat [Questionnaire to study beliefs and dietary habits of people aged 16-65 years]. Available ttps://www.knozc.pan.pl (Accessed 2.01.2016) (in Polish).

14. *Luszczynska A., Scholz U., Sutton, S.:* Planning to change diet: a controlled trial of an implementation intentions training intervention to reduce saturated fat intake among patients after myocardial infarction. J Psychosom Res. 2007;63(5):491-7. DOI:10.1016/j.jpsychores.2007.06.014.

15. *Meier T., Senftleben, K., Deumelandt, P., Christen, O., Riedel, K., Lange,r M.:* Healthcare Costs Associated with an Adequate Intake of Sugars, Salt and Saturated Fat in Germany: A Health Econometrical Analysis. PLoS One. 2015;10(9), DOI:.org/10.1371/journal.pone.0135990.

16. *Messier S.P., Mihalko S.L., Legault C., Miller G.D., Nicklas B.J., DeVita P., Loeser R.F.:* Effects of intensive diet and exercise on knee joint loads, inflammation, and clinical outcomes among overweight and obese adults with knee osteoarthritis: the IDEA randomized clinical trial. JAMA 2013;310(12):1263-1273. DOI: 10.1001/jama.2013.277669.

17. *Nakai, Y., Noma, S., Nin, K., Teramukai, S., Wonderlich, S.A.*: Eating disorder behaviors and attitudes in Japanese adolescent girls and boys in high schools. *Psychiatry Res* 2015;*230:*722-7244, DOI: 248 10.1016/j.psychres.2015.09.045.

18. *Napoli N., Shah K., Waters D.L., Sinacore D.R., Qualls C., Villareal D.T.:* Effect of weight loss, exercise, or both on cognition and quality of life in obese older adults. Am. J Clin Nutr 2014;100(1):189-198. DOI: 10.3945/ajcn.113.082883.

19. *Newby P.K., Muller D., Hallfrisch J., Qiao N., Andres R., Tucker K.L.:* Dietary patterns and changes in body mass index and waist circumference in adults. Am J Clin Nutr. 2003;77(6):1417-25.

20. *Phillips S.M., Bandini L.G., Naumova E.N., Cyr, H., Colclough S., Dietz W.H., Must A.:* Energy-dense snack food intake in adolescence: longitudinal relationship to weight and fatness. Obes Res, 2004:12:461-472. DOI:10.1038/oby.2004.52.

21. *Piotrowska E., Broniecka A., Bronkowska M., Wyka J., Biernat J.*: Impact of self-assessment of body mass on the supply of energy and macronutrients in 17-18-year-old adolescents in the aspect of metabolic syndrome risk Probl Hig Epidemiol 2014, 95(2):366-375 (In Polish)

22. *Rodrigues P.R.M., Luiz R.R., Monteiro L.S., Ferreira M.G., Gonçalves-Silva, R.M.V., Pereira, R.A.:* Adolescents' unhealthy eating habits are associated with meals skipping. Nutrition 2017: DOI: 10.1016/j.nut.2017.03.01.

23. *Ruano C., Henriquez P., Martínez-González MÁ., Bes-Rastrollo M., Ruiz-Canela M., Sánchez-Villegas A.* Empirically derived dietary patterns and health-related quality of life in the SUN project. PLoS One 2013;8(5) DOI.org/10.1371/journal.pone.0061490.

24. *Wądołowska L., Krusińska B.:* Procedure for the development of nutritional data from the questionnaire QEB (in Polish). Available from: http://www.uwm.edu.pl/edu/ lidiawadolowska/ (accessed 27.10.2017). (In Polish)

25. WHO/FAO. Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation. Geneva: World Health Organization. 2003.

26. *Zaborowicz K., Czarnocińska J., Galiński G., Kaźmierczak P., Górska K, Durczewski P.:* Evaluation of selected dietary behaviours of students according to gender and nutritional knowledge. Rocz Panstw Zakl Hig 2016;67(1):45-50.