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Rocz Panstw Zakl Hig 2020;71(1):27-31

http://wydawnictwa.pzh.gov.pl/roczniki_pzh/ https://doi.org/10.32394/rpzh.2020.0099

ORIGINAL ARTICLE

FAST CONSUMPTION INCREASES THE RISK OF OVERWEIGHT AND OBESITY

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ABSTRACT

Background. Overweight and obesity are a problem negatively affecting human health. Besides the excess of energy from food, development of overweight can also result from food preferences, the frequency of meals and the speed of eating.

Objective. The aim of this study was to analyse the effect of eating habits and physical activity on the occurrence of overweight and obesity.

Material and method. The questionnaire survey concerning eating habits and physical activity was conducted among adults aged 20-59 (n=420) in Lublin province (Poland). The subjects were divided into two groups – normal (BMI 18.5-25 kg/m^2, n=250) and overweight and obese (BMI≥25 kg/m^2, n=170). One-way analysis of variance (ANOVA) and *post-hoc Tukey's* test as well as chi-square independence test were applied. In addition, the relative risk of overweight for groups divided according to their habits was determined.

Results. The analysis of speed of eating was on the basis of subjective assessment of the subjects and as a relative speed of eating compared to family members and friends. In both methods of assessment, it has been shown that overweight and obesity facilitates fast food intake rate (p=0.0078 and p=0.0010, respectively) The relative risk of obesity and overweight increases almost twice (RR 1.79) when the number of meals consumed daily is between one and two compared to those having five meals a day. In addition, it has been shown that overweight facilitates low physical activity.

Conclusions. Slowly consumed meals, high physical activity and having more than two meals a day promotes maintaining a normal body weight.

Key words: *eating habits, obesity, overweight, frequency of meals, speed of eating*

STRESZCZENIE

Wprowadzenie. Nadwaga i otyłość są problemem wpływającym negatywnie na zdrowie człowieka. Oprócz nadmiaru energii pochodzącej z pożywienia, rozwój nadwagi może wynikać również z preferencji żywieniowych, częstotliwości spożywania posiłków i szybkości jedzenia.

Cel. Celem badań była analiza wpływu nawyków żywieniowych i aktywności fizycznej na występowanie nadwagi i otyłości.

Materiał i metoda. Ankieta dotycząca nawyków żywieniowych i aktywności fizycznej została przeprowadzona wśród osób dorosłych w wieku 20–59 lat (n = 420) w województwie lubelskim. Badanych podzielono na dwie grupy – o prawidłowej masie ciała (BMI 18.5-25 kg/m^2, n = 250) i z nadmierną masą ciała (BMI ≥25 kg/m^2, n = 170). Zastosowano jednoczynnikową analizę wariancji (ANOVA) i test *post-hoc Tukeya*, a także test niezależności chi-kwadrat. Dodatkowo wyznaczono względne ryzyko wystąpienia nadwagi dla poszczególnych grup.

Wyniki. Analiza szybkości jedzenia była oparta na subiektywnej ocenie badanych oraz jako względna szybkość jedzenia w porównaniu z członkami rodziny i przyjaciół. W obu metodach oceny wykazano, że nadmiernej masie ciała sprzyja szybkie tempo spożywania posiłków (odpowiednio p = 0,0078 i p = 0,0010). Względne ryzyko otyłości i nadwagi wzrasta prawie dwukrotnie (RR 1,79), gdy liczba spożywanych posiłków wynosi od jednego do dwóch w porównaniu do tych osób, które spożywają pięć posiłków dziennie. Ponadto wykazano, że nadwadze sprzyja niska aktywność fizyczna.

Wnioski. Wolno spożywane posiłki, duża aktywność fizyczna i spożywanie więcej niż dwóch posiłków dziennie sprzyja utrzymaniu prawidłowej masy ciała.

Słowa kluczowe: *nawyki żywieniowe, otyłość, nadwaga, częstotliwość posiłków, szybkie jedzenie*

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INTRODUCTION

Overweight and obesity are a growing global social problem, affecting the deterioration of human health [9]. Industrial development has influenced changes in human life. Lower physical activity, excessively high energy supply in relation to demand, have become the main factors leading to overweight and obesity. The excess fat tissue plays an important role in the development of metabolic disorders [6, 18]. Even a small weight loss of 5 to 10% in obese people may be conducive to improving the treatment of metabolic disorders [23]. A proper diet combined with regular physical activity helps in maintaining a proper body mass [17]. Overweight, especially obesity, contributes to an increased risk of a number of diseases such as hypertension, atherosclerosis, type 2 diabetes and some cancers (e.g., breast, endometrium, prostate, endometrial, large intestine) [11, 13, 24]. Contrary, weight reduction decreases the risk of hypercholesterolemia, diabetes and cardiovascular disease, including hypertension [4].

Many researchers focus on the analysis of the effect of specific diet [25, 26] or diet components [1, 22, 27], genes [15], physical activity [7] and even the role of microbiota on obesity [3]. However, there are not many studies concerning eating habits, particularly related to the rate of consumption. Recently *Hurst* and *Fukuda* published a study concerning eating speed in patients with type 2 diabetes and its effect on obesity showing that eating slower inhibited the development of obesity [8]. In our opinion it is still a need to study this issue. To the best of our knowledge there are no population-based cohort studies, especially in this part of the world, analysing these habits. For this reason, the main purpose of this study was to determine the effect of eating habits such as intervals between meals, snacks consumption and the speed of eating on the occurrence of overweight and obesity.

MATERIAL AND METHODS

A survey based on PAPI (Paper and Pencil Interview) author's questionnaire [14] was completed by 420 individuals (276 women and 144 men) aged 20-59. The questions concerned the behaviours and eating habits related to the speed of eating, frequency of meals, subjective frequency of snack consumption, intervals between meals and subjective assessment of physical activity. Besides those, there were questions concerning anthropometric parameters (body weight and height). The survey was carried out in Lublin province (Poland) from April to May 2019. The study was approved by the Bioethics Committee at the Medical University in Lublin, Permit No. KE-0254/110/2019.

Statistical analysis was carried out with the use of the Statistica 10 program. To compare the average BMI level in many groups determined by features measured on the ordinal scale, a single-valued ANOVA was used, and when it was justified additional Tukey's simultaneous comparison test. If the use of ANOVA was not possible due to the failure of assumptions about the normality of distribution or homogeneity of variances, the division of people into two groups was introduced due to the BMI value and verified using the chi-square independence test, if there is a relationship between these groups and other results. The relative risk determining the degree of exposure to overweight for individual groups was also determined. Relevance of relative risk values was estimated based on the designated confidence division. In all analyses the significance level $\alpha = 0.05$ was assumed.

RESULTS

In order to analyse the collected results, a simplified model was used to define the overweight from 25 kg/m^2 [9], being aware that some subjects in this category will have a BMI 30 and more, which is referred to as obesity. Because obesity concerns people with excessive (over) weight of the body, it was considered that it does not contradict the meaning of the word "overweight" and for statistical analysis this simplification is acceptable.

When analysing the influence of time between meals on the occurrence of overweight, no statistical trend was demonstrated (Table 1). Establishing the speed of eating by subjects was a challenge because our study was based on a survey. It was decided to ask two questions related to this – the first, related to the subjective speed of eating, the second, concerning the relative speed of consumption in the group in which the surveyed subject eats a meal. In both cases, there was a significant difference but much stronger statistical result was obtained in the second case.

It was shown that a small number of meals during the day is significantly related to overweight (Table 2). In the case of people who eat 3-4 meals a day, their average BMI does not differ significantly from those who consume 5 or more meals, but significantly differs from those consuming only 1-2 meals. Both people with normal BMI and those who are overweight often reach for various snacks (Table 2). In our study the frequency of reaching for snacks does not significantly affect the mean BMI (Table 3).

Analysis of declared physical activity showed significant dependence with BMI (Table 2). The higher the physical activity, the lower the average BMI value, although significantly higher BMI was recorded only in subjects declaring low physical activity.

Table 1. Analysis of the significance of the effect of the intervals between meals and the speed of eating on the overweight (n = 420)

		Overweight		p-value
		no	yes	
Intervals between meals (h)	1-2	8	1	0.3111
	2-3	97	64	
	3-4	114	81	
	5 and more	31	24	
Subjective speed of eating	I chew every bite slowly	29	17	0.0078
	at a moderate speed	158	84	
	fast	52	53	
	very fast	11	16	
Relative speed of eating compared to family members and friends	I finish first	48	60	0.0010
	I finish neither the first nor the last one	66	36	
	I finish last	136	74	

Table 2. Studies on the independence of overweight on the number of meals, snacks consumption and physical activity (n = 420)

		Overweight		p-value in the independence test χ^2	BMI (mean ± SD)
		no	yes		
Number of meals	1-2	9	16	0.0236	27.00 ± 5.74[a]
	3-4	138	98		24.29 ± 3.71[b]
	5 and more	102	57		24.14 ± 3.87[b]
Snacks consumption between the meals	never	37	34	0.2497	25.23 ± 3.99
	sometimes	165	105		24.33 ± 3.82
	often	48	31		23.88 ± 4.32
Physical activity	low	63	73	0.0002	25.35 ± 4.22[a]
	moderate	137	80		24.23 ± 3.90[b]
	high	50	17		23.02 ± 3.09[b]

a, b – the same letter in the same feature means no significant difference according to the *Tukey* test

Table 3. Relative risk (RR) of overweight depending on the number of meals, snacks consumption and physical activity (n = 420)

	Overweight		RR	95% CI
	no	yes		
	n_1	n_2		
Number of meals:				
1-2	9	16	1.79	1.25-2.56
3-4	138	98	1.14	0.89-1.48
>=5	102	57	1 (reference)	
Snack consumption:				
never	37	34	1.23	0.93-1.64
sometimes	165	105	1 (reference)	
often	48	31	1.01	0.74-1.38
Physical activity:				
low	63	73	2.12	1.36-3.28
moderate	137	80	1.45	0.93-2.27
high	50	17	1 (reference)	

Further statistical analysis of results summarized in Table 2 made it possible to estimate the relative risk (RR, 95% CI) of overweight depending on the number of meals, frequency of snacks consumption and physical activity (Table 3). Assuming that the reference value for the number of meals is at least five per day, it

has been calculated that the relative risk of obesity and overweight increases almost twice (RR 1.79) when the number of meals consumed daily is from one to two. In the case of snack consumption frequency, the reference value was the answer "sometimes" and the results were intriguing. With this assumption, frequent snacks consumption does not increase the risk of overweight (RR = 1.01), while the lack of snacks eating increases the risk by 23%. It is possible that overweight people are aware of this and try to avoid snacks eating, or at least declare this. However, differences in obtained RR are not statistically significant (no value 1 in the range of 95% CI). In the case of physical activity, high activity was assumed as the reference value. With this assumption, the relative risk of overweight with low activity increased more than twofold (RR = 2.12).

DISCUSSION

The numbers shown in Table 1 allow to conclude that fast food intake correlates with a higher BMI. Of course, the question arises as to what is a cause and what is the result – whether higher BMI affects the faster rate of eating, or people are overweight due to the fact that they quickly consume meals. Fast consumption allows people to eat more than they need, due to the inertia of biochemical signals directed to the centre of satiety. Eating at a lower rate allows the body to stop further consumption due to satiety at the right time, which in the long run results in maintaining the normal body mass [2, 16].

Due to fundamental nutritional recommendations for most people the number of meals during a day ranges from three to five [9]. The obtained results confirmed the validity of these recommendations (Table 2). In a review of 10 papers on the role of meal frequencies in weight management by healthy adults aged 20-70 *Palmer* et al. did not show any significant dependence on weight loss or maintenance [21]. On the other hand, *Kahleova* et al. analysing data from 50,660 adult members aged ≥30 y Seventh-day Adventist churches in the United States and Canada reports relative increase in BMI during a year in subjects who ate 3 meals/d compared with those who ate 1 or 2 meals/d [12]. It is worth to mention that such strategy worked for those who ate breakfast and lunch 5-6 h apart, consumed no snacks and made the overnight fast last 18-19 h. In studies performed by *O'Connor* et al. in a group of 1,092 adults with a normal body weight, eating snacks between meals did not result in weight gain as well [20]. *Nijke* et al. argue that eating the wholesome snacks affects the feeling of fullness and helps control appetite, which can contribute to reduce the obesity [19].

Many studies have shown that people with excessive body mass characterise low level of physical activity [5, 28, 29] and our results are not an exception (Table 2). However, as for physical activity and dependence with BMI, the question may again arise what is the cause and what is the result. The answer to this question can be found in the work of *Li* et al., who showed a dependence between the occurrence of overweight and the presence of genes determining the obesity [15]. The work involved analysis of physical activity of 20,430 people and it was shown that despite the same number of alleles determining the obesity, physically active people had significantly lower BMI.

The present study had some limitations. Since lifestyle habits as well as anthropometric data were self-assessed they may be vulnerable to reporting bias. However, bias may rather result from providing false information received negatively as high body mass or low physical activity. In this case, even if there was an underestimation related to the aforementioned data, the results obtained seem to be reliable, which we believe confirm the value of the material presented.

CONCLUSIONS

Development of overweight and obesity is facilitated by a fast food intake rate, consumption of less than three meals a day and low physical activity. In the studied group, no significant influence of snacks consumption on the development of overweight and obesity was demonstrated. The results of this study can help dietitians and nutritionists to help patients lose weight more effectively in the future.

Conflict of interest

The authors declare no conflict of interest.

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Received: 29.10.2019
Accepted: 17.01.2020

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