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FREQUENCY OF DAILY MEAL CONSUMPTION AND THEIR QUANTITY AS RISK FACTORS FOR THE DEVELOPMENT OF OBESITY IN WORKERS

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Abstract. *Obesity, as a chronic noncommunicable disease with an increasing prevalence, and as a risk factor for the development of many other diseases, represents a serious health problem. Therefore, study of risk factors for development of obesity among workers is necessary for timely prevention this serious public health problem. The purpose of this study was: to establish relationship between the eating frequency and weight gain; to investigate the portion sizes as a possible causative factor for weight gain and to determine the most optimal population education strategies for preventive activities in workers.The research included 144 males, between 20 and 58 years, randomly chosen among workers of the Electronic Industry, Niš. The data concerning the number of meals has been obtained by nutrition survey. Body mass (kg) and height (m) were assessed by standard methods and the degree of nutrition has been determined by body mass index calculation (kg/m^2). The existence of statistically significant difference between average number of daily meals, weight of daily meals and body mass index was examined by means of T-test. The average number of daily meals was statistically significantly greater in workers with body mass index less than 25 kg/m^2, compared to subjects with obesity and persons who were overweight ($T=2.55$; $P<0.05$). Between average differences of daily meals weights, in subjects with obesity and overweight subjects compared to other subjects with normal body mass, no statistically significant difference had been found ($T=0.63$; $p>0.05$). We concluded that increased eating frequency is important for decreasing risk for development of obesity among workers. Portion sizes had smaller importance for development obesity in this population.*

Key Words: *Workers, frequency of meal consumption, meal weight, obesity*

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INTRODUCTION

Obesity is a contemporary important public problem and the prevalence of overweight and obesity continues to increase worldwide, in our country as well [1]. Proper dietary behavior and finding well-established strategies are needed to stem the burden of obesity and associated diseases, especially chronic noncommunicable diseases [2,3]. Obesity is not easy for treatment, regardless of a multi-disciplinary therapeutic program, which encompasses a change in dietary habits, a restriction of energy intake, an increase of physical activity, use of pharmacological agents, psychotherapy and surgical treatment. This is the reason why prevention is receiving increasingly greater attention, with a special accent on population education strategies [4,5,6]. Taking into account factors that might promote or protect against weight gain and obesity, it is necessary to propose proper dietary behavior on an individual and public level for the improvement of nutritional status [7,8].

The purpose of this study has been: to establish a relationship between eating frequency and weight gain; to investigate the portion sizes as a possible causative factor for weight gain and to determine the most optimal population education strategies for preventive activities in workers.

PATIENTS AND METHODS

The study was performed in 2003, and involved a group of 144 healthy males, randomly chosen among workers of the Electronic Industry in Niš. The subjects were excluded from the study if they had any chronic or digestive conditions, cardiovascular, malignant, hormonal or any disorder that was potentially related to the consummation of alcohol or smoking.

Subjects were interviewed with a structured questionnaire to obtain information on general characteristics. The data about frequency of eating and portion sizes of the workers had been obtained by a nutrition survey. We used a 24-hour record of a three-day diet, during the week of the research (two business days and one day of the weekend).

Body weight (kg) and body height (m) were measured by standard anthropometrical methods, using portable scales and height body meter and the body mass index - BMI (kg/m^2) was calculated. All the participants were divided into two groups: the first group consisted of participants with a BMI<25 kg/m^2 (normal weight) and the second group consisted of participants with a BMI>25 kg/m^2 (overweight and obese persons).

Based on the data obtained by the nutrition survey, the average frequency of meals, as well as the average weight of daily meals (g) was determined, and these two groups were compared.

By means of the T-test, we determined the statistical significance of the difference between the average number of daily meals, in the case of participants with different degrees of BMI. In the same way we examined whether there is a statistically significant difference in the average weight of the daily meals.

By means of the Student t-test we examined the statistical significance of the difference of mean values of the BMI and the portion sizes, in the case of participants who had less than five meals in comparison to the participants who had five or more daily meals.

THE RESULTS

Table 1 shows the baseline date of the investigated individuals.

Table 1. The baseline data of participants

	Body mass index < 25 kg/m^2	Body mass index >25 kg/m^2
Number of participants	68	75
Age (years)	39.7± 9.2	41.7±8.1
Duration of education (years)	%	%
<8	61.1	61.0
8-12	28.4	23.9
> 12	10.5	15.1
Cigarette smoking	%	%
never smoked	36.9	44.3
currently smoking	63.1	55.7
Place of residence	%	%
City	76.3	79.1
Country	23.7	20.9

Table 2 shows the statistical significance of the difference in the average number of daily meals of subjects with different BMIs.

Table 2. Body mass index and average number of the daily meals of workers

Body mass index < 25 kg/m^2		Body mass index >25 kg/m^2		T	p
N	$\overline{X}$ ± SD	N	$\overline{X}$ ± SD	2.55	p< 0.05*
68	5.51 ± 1.82	76	4.75 ± 1.72		

*Stands for the statistical significance of the difference

The mean value of the number of daily meals in the first group of individuals, with a BMI less than 25 kg/m^2, was (X=5.51±1.82), and in the second group of workers (consisting of participants with a BMI>25 kg/m^2), it was (X=4.75±1.72). By means of the T-test we determined that the average number of daily meals is statistically significantly higher for persons with a BMI<25 compared to the overweight and obese participants (T=2.55; p<0.05).

Table 3 shows that the average weight of daily meals for persons with normal body mass was (X=2002 ± 620 g), and for overweight and obese persons (X=1941 ± 520 g). The statistical significance of the difference between the average values of the portion sizes for both groups was not established. (T= 0.63; p>0.05).

Table 3. The body mass index according to the weight of the daily meals of the workers

Body mass index < 25 kg/m^2		Body mass index >25 kg/m^2		T	p
N	$\overline{X}$ ± SD	N	$\overline{X}$ ± SD	0.63	p>0.05
68	2002 ± 620	76	1941 ± 520		

The results revealed that there is a statistically significantly higher mean value of the BMI for participants who had less than five daily meals, compared to the BMI of those who had more than five meals (T=2.02; p<0.05), and that all the participants (who had

five or more meals during the day) had statistically significantly higher food quantity (T=5.14; p<0.01). This evidence in shown in table 4.

Table 4. Average body mass index and number of daily meals

Number of meals daily	Body mass index (kg/m^2) $\overline{X}$ ± SD	Weight of meals (g) $\overline{X}$ ± SD
< 5 meals	25.66 ± 2.42	1714 ± 486
5 and more	24.76 ± 2.90	2163 ± 551
T	2.02	5.14
p	P< 0.05*	p<0.001*

*Stands for the statistical significance of the difference

DISCUSSION

This investigation has shown that a high frequency of eating has a negative relationship with energy intake and weight gain among workers.

These results have been confirmed by experimental research from earlier periods [9,10,11]. This phenomenon was first described as early as 1943. Animals eating continuously, transform glucides into lipids, and in that way deposit less fat, compared to animals which have the same food intake, but in the course of one meal (for example by means of gastric probe). It was established in 1964 that this phenomenon is valid for human beings as well [12].

According to the World Health Organization [13], there is convincing evidence that a high frequency of meal consumption is a risk factor for developing obesity. In this investigation, workers who had less than five meals per day had greater body mass and a greater BMI than the people who had five or more meals per day.

The previous scientific evidence shows that most people get hungry in 3-4 hours. When a person skips a meal, his organism slows down the metabolism in order to conserve energy, so skipping meals is not recommended for reduction of body mass [14,15,16].

These findings dispel two of the most common illusions about nutrition associated with the number of daily meals - that it is harmful to eat between main meals and that skipping meals relates to loss of body weight [17,18].

The aforementioned investigation has also proven that large portion sizes are possible causative factors of weight gain [19,20]. The intake of a voluminous meal can produce enzyme changes in the body, which favor the development of obesity. When these change become regular, one has to maintain a greater intake of food in order to maintain homeostasis, which leads to obesity [21]. The marketing of the super-size portion, particularly in fast food outlets, is also a common practice in our country. There is evidence that people poorly estimate portion size and that the subsequent energy compensation for a large meal is incomplete and therefore is likely to lead to over-consumption [22].

According to these findings, we could notice that portion size is not of great significance for the development of obesity in our male working population, but it should be taken into account that we haven't done the chemical analysis of the energetic and biochemical values of the meals. These results suggested that a higher intake of energy-dense foods also might promote weight gain.

CONCLUSION

On the basis of the available literature and the results obtained by this study, the following conclusions are obvious:

1. Increased eating frequency is important for decreasing the risk for development of obesity.
2. There is insufficient evidence that large portion sizes and greater weights of the meals increase risk for obesity, because a higher consumption of energy dense foods and drinks can also contribute to an increase in the total energy intake in our working population.
3. Because the prevention of obesity in workers by promoting healthier lifestyles should be one of our highest priorities in the new health care system, greater attention should be paid to the health education of patients, in regards to proper nutrition habits. Taking various foods, in 5-6 small amount meals and avoiding skipping meals are necessary for the prevention of obesity.

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UČESTALOST KONZUMIRANJA HRANE I KOLIČINA OBROKA KAO FAKTOR RIZIKA ZA RAZVOJ GOJAZNOSTI KOD RADNIKA

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Gojaznost kao hronična nezarazna bolest sa rastućom prevalencom, i kao faktor rizika za nastanak mnogih drugih bolesti, predstavlja ozbiljan javno zdravstveni problem. Zato je neophodno ispitati faktore rizika koji mogu delovati promotivno i povećati rizik za nastanak gojaznosti kod različitih populacionih grupa.

Cilj ovoga rada je bio ispitivanje međuzavisnosti između broja dnevnih obroka, težine prosečnog celodnevnog obroka, i stepena ishranjenosti radnika.

Ispitivanjem je bilo obuhvaćeno 144 osoba muškog pola, starosti od 20 do 58 godina, odabranih metodom slučajnog uzorka medju radnicima Elektronske industrije u Nišu. Podaci o broju dnevnih obroka i težini celodnevnog obroka dobijeni su anketom 24h-ne dijete po sećanju. Telesna masa (kg) i telesna visina (m) merene su standardnim metodama, a stanje ishranjenosti procenjivano je određivanjem indeksa telesne mase (kg/m^2). Pomoću T- testa za velike nezavisne uzorke je ispitano postojanje statistički značajne razlike između prosečnog broja dnevnih obroka, težine celodnevnog obroka i indeksa telesne mase.

Prosečan broj dnevnih obroka statistički je bio značajno veći, kod ispitanika čiji je indeks telesne mase bio manji od 25 kg/m^2, u odnosu na gojazne ispitanike i osobe koje su imale prekomernu telesnu masu (preko 25 kg/m^2) ($T=2,55$; $p<0,05$). Između prosečnih težina celodnevnih obroka, kod gojaznih i ispitanika sa prekomernom telesnom masom u odnosu na osobe sa normalnom telesnom masom, nije nađena statistički značajna razlika ($T=0,63$; $p>0,05$).

Može se reći da povećan broj obroka predstavlja faktor rizika za nastanak gojaznosti kod radnika, dok veličina porcije obroka ima manji značaj.

Ključne reči: *radnici, broj dnevnih obroka, težina obroka, gojaznost*