PRACE NAUKOWE Akademii im. Jana Długosza w Częstochowie
Kultura Fizyczna 2013, t. XII, nr 2

Ivan UHER[*], Alena BUKOVÁ[*]
Martina HANČOVÁ[**], Kvetoslava RIMÁROVÁ[***]

The Night-Eating Syndrome, Physical Activity and BMI Relationship in University Students

Abstract

There is not a region in the world untouched by the obesity epidemic. Once just a problem of wealthy nations, obesity now impacts countries at all economic levels. The night-eating syndrome (NES) consists of evening hyperphagia or nocturnal eating. However, it is not consistently related to elevated BMI and physical activity (Nolan et al., 2012). We have evidence that the prevalence of NES is higher among overweight-related people, than in a general community. Nevertheless, the exact relationship between this syndrome, physical activity and obesity remains unclear. The reasons for the discrepancies found in the literature include varying diagnostic criteria and a wide range of study population characteristics. The aim of our cross sectional study, that is part of VEGA project "Selected risk factors of obesity and its prevention by physical activity" No.1/1343/12, was to investigate the relationship between the night-eating pattern, physical activity (PA) and BMI on a sample of university freshmen and fresh-women (774 males / 1142 females) with a mean age of 21,46 years (SD=2.33).We found positive association between eating late, physical activity and BMI. However, we recognized some differences between sexes in physical activity and eating habits.

Keywords: Overweight, young adults, university students, night eating, body fat.

Introduction

The night-eating syndrome (NES) was first described as consisting of morning anorexia, and its onset was related to a stressful event (Stunkard et al., 1955). The feature of nocturnal awakening to eat was later added to the description (Birketvedt et al., 1999). The defining symptoms appear to be evening hyper-

[*] Pavol Jozef Šafárik University in Košice, Institute of Physical Education and Sport.
[**] Pavol Jozef Šafárik University in Košice, Faculty of Science.
[***] Pavol Jozef Šafárik University in Košice, Faculty of Medicine.

phagia or nocturnal ingestion (Allison et al., 2009). NES has been linked to elevated body mass index (BMI) (Aronoff et al., 2001, Stunkard et al., 1955). Much more so in clinical populations than in epidemiological studies (Allison et al., 2008). No sex differences have been associated with NES (Striegel – Moore et al., 2009). Only a few studies have been conducted examining the presence of NES among university students, a population in which stress and anxiety levels tend to be high (Brougham et al., 2009). NES appears to be more prevalent in young adults (18–30 years old) than in older adults (Striegel et al., 2006). Thus, studying NES in university students is appropriate and informative.

Worldwide the rate of obesity has nearly doubled since 1980, with just over 200 million adult men and just under 300 million adult women obese. Obesity rates have been steadily rising in children, too. In 2010, 43 million young people were overweight or obese, a 60 percent increase in comparison to 1990. These jumps in obesity rates show no sign of stopping without dedicated efforts to combat the epidemic (DGAC, 2010., Zusková et al., 1999). There is some evidence that skipping breakfast and eating late at night increases the risk of weight gain and obesity, though the evidence is stronger in children, especially teens, than it is in adults (DGAC, 2010). Meal frequency and snacking have increased over the past 30 years in the United States on average 27 percent (Popkin et al., 2010).

We have to understand, that genetic changes are unlikely to explain the rapid spread of obesity around the globe. That is because the "gene pool", the frequency of different genes across a population, remains fairly stable for many generations. It takes long time for new mutations or polymorphisms to spread. So if our genes have stayed largely the same, what has changed over the past 40 years of rising obesity rates? Our environment has changed the most, physical, social, political, and economical surroundings that influence how much we eat and how active we are. Environment changes that make it easier for people to overeat, and harder for people to get enough physical activity, have played the key role in triggering off the recent surge of overweight and obesity (Qi L et al. 2008., WHO, 2012).

However, the role of physical activity in preventing obesity during adolescence remains unknown. Furthermore, the contribution of physical activity level to adolescent adiposity requires clarification, although there is compelling evidence indicating that physical activity is associated with numerous health benefits in children and adolescents (Ruiz et al., 2009, Srdic, 2012).

Objective

In our paper we analyze if there is any connection between the night-eating syndrome, physical activity and BMI in university freshmen. We hypothesize that in both sexes, there is association between increased BMI and dinner pattern, BMI and dinner time, PA and dinner pattern and PA and dinner time.

Research method

This study was part of VEGA project undertaken by the Pavol Jozef Šafarik University in Košice in the years 2012–2014. Our focus group convenience sample, involved n=1142 fresh-women and n=774 freshmen, mean age 21,46 (SD=2,33). From our all-embracing (quality of life) survey we form brief, research designed questionnaire that was used to compare night eating habits to the physical activity pattern and BMI (weight was measured by Omron BF11, accuracy +/− 3,-5%). Night-eating habits were assessed with two questions "Do you eat dinner every day?" using a 4-point response format (yes, mostly yes, mostly no, no) , and "How many hours before you go to sleep do you eat?" with 5-point response format (1 hour, 2 hours, 3 hours, 4 and more hours, I do not eat dinner).

Participation in physical activity was assessed with one question "What is your overall physical activity" (work in the garden, at home, at school, games, exercise etc.)?" used up a 5-point response format (other, minimal, insufficient, adequate, excessive). For statistical analysis we used Wilcoxon Rank Sum Test and Chi square. For a better overview – we used percentile tables. Differences were considered significant at ($p<0.05$).

Results

When comparing both sexes we found differences in BMI values (χ-squared 101,-36 at $p<0,05$), male BMI average was 23,79 (SD= 3,80), and 21, 77 (SD=3,55) for females, respectively. We found significant relationship between BMI values and the eating pattern of freshmen at night. X-squared=22.49, df=6, $p<0.01$ presented in Contingency Table 1. The same relationship was found when we compared time of eating dinner and BMI. X-squared=29.27, df=8, $p<0.01$ in Tab. 2.

The presented results apply to both genders.

Tab. 1. Dinner pattern and BMI in both genders (%)

BMI	Do you eat dinner every day?			
	1	2	3	4
Overweight	21,2	19,8	26,8	17,7
Optimal weight	66,2	72,8	65,2	72,5
Underweight	12,5	7,4	8,0	9,7

Legend: 1 – yes, 2 – mostly yes, 3 – mostly no, 4 – no

Tab. 2. Dinner time and BMI in both genders (%)

BMI	How many hours before you go to sleep do you eat?				
	1	2	3	4	5
Overweight	20,7	19,3	20,1	20,8	27,4
Optimal weight	69	67,5	68,3	73,7	65
Underweight	10,3	13,1	11,6	5,5	7,6

Legend: 1 – one hour, 2 – two hours, 3 – three hours, 4 – four and more hours, 5 – don't eat supper

Similarly to the previous contingency table we found connection between PA and dinner pattern in both genders (X-squared=31.72, df=9, $p<0.01$ presented in Table 3). We assume that adequate physical activity is relevant to the diverse eating pattern.

Tab. 3. Physical activity and dinner pattern in both genders (%)

Physical activity	Do you eat dinner every day?			
	1	2	3	4
Other	1,2	0,5	0,1	0,7
Minimum	15	5,9	7,3	4,5
Insufficient	21,2	17,3	20	16,9
Adequate	57,5	65,8	65	65
Excessive	5	10,4	7,5	12,9

Legend: 1 – yes, 2 – mostly yes, 3 – mostly no, 4 – no

When we looked at PA and dinner time we found no association (X-squared= 41.77, df=12, $p>0,05$ in Tab. 4). Most of the students of both genders claim adequate participation in PA, but at the same time their eating times does not coincide with participation in PA. In that respect we did not confirm our presumption.

Tab. 4. Physical activity and dinner time in both genders (%)

Physical activity	How many hours before you go to sleep do you eat?				
	1	2	3	4	5
Other	0	0,4	0,5	0,6	0,3
Minimum	19	8,8	6,6	5,1	3,8
Insufficient	13,8	17,5	20,3	19	15,7
Adequate	56,9	58,4	61,2	67,7	71
Excessive	10,3	15	11,4	7,7	9,2

Legend: 1 – one hour, 2 – two hours, 3 – three hours, 4 – four and more hours, 5 – don't eat supper

When comparing BMI, dinner pattern and dinner time, distinctions were not found in between genders . However, when comparing PA, dinner pattern and PA and dinner time, within genders we found differences presented in Tables 5.–8. More specifically in tab. 5. revealing gender differences – PA and dinner time in females, X-squared=25.60, df=12, $p<0.01$. versus the male data presented in Tab. 6. X-squared=14.47, df=9, $p>0.05$. Similarly, between PA and dinner pattern we found differences presented in Tab. 7. Female sample, X-squared=14.77, df=9, $p>0.05$ versus Tab. 8. male sample X-squared=25.34, df=6, $p<0.01$.

Tab. 5. Physical activity and dinner time in females only (%)

Physical activity	**How many hours before you go to sleep do you eat?**				
	1	**2**	**3**	**4**	**5**
Other	0	0	25	75	0
Minimum	6	19	27,4	33,3	14,3
Insufficient	2,1	11	30,4	38,8	17,7
Adequate	3,1	8,5	24,1	38,2	26,1
Excessive	4,8	14,3	19	36,5	25,4

Legend: 1 – yes, 2 – mostly yes, 3 – mostly no, 4 – no

Tab. 6. Physical activity and dinner time in males only (%)

Physical activity	**How many hours before you go to sleep do you eat?**				
	1	**2**	**3**	**4**	**5**
Other	0	0,6	0,7	0,5	1
Minimum	27,3	5	5,1	2,3	2
Insufficient	13,6	13,8	15,4	14,6	15,7
Adequate	45,5	60,4	59,6	70,3	63,7
Excessive	13,6	20,1	19,1	12,3	17,6

Legend: 1 – one hour, 2 – two hours, 3 – three hours, 4 – four and more hours, 5 – don't eat supper

Tab. 7. Physical activity and dinner pattern in females only (%)

Physical activity	**Do you eat dinner every day?**			
	1	**2**	**3**	**4**
Other	0	0,7	0,2	0,5
Minimum	10,3	5,3	8,9	5,9
Insufficient	24,1	15,9	21,9	20,7
Adequate	62,1	67,5	64,3	68,1
Excessive	3,4	10,6	4,7	4,9

Legend: 1 – yes, 2 – mostly yes, 3 – mostly no, 4 – no

Tab. 8. Physical activity and dinner pattern in males only (%)

Physical activity	Do you eat dinner every day?			
	1	**2**	**3**	**4**
Other	4,5	0	0	0,9
Minimum	27,3	7,8	4,1	3,3
Insufficient	13,6	21,6	16,1	13,5
Adequate	45,5	60,8	66,5	62,1
Excessive	9,1	9,8	13,2	20,3

Legend: 1 – yes, 2 – mostly yes, 3 – mostly no, 4 – no

Discussion

The presented BMI values were concurrent with some studies done in Slovakia (Hrčka et al., 2011). Higher BMI and lower participation in PA was similar to what has been reported in similar studies (Cepková, 2010, Feč, 2010, PHAC, 2011., Zusková et al., 2012). The beneficial effects of PA on health are well-known and firmly established, however few meet the current PA recommendations. It is now appreciated that individuals face considerable barriers when changing complex behaviours such as PA. In terms of prevention, it is crucial to get involved early (Pullmannová, Švedová, 2010). It is well established that theoretically informed interventions are imperative for successful PA promotion. Nowadays, we are faced with the daunting task of relying upon detailed cross-sectional evidence to develop and test hypothesis in order to enhance further understanding of the determinants of PA. At the present, PA research is at a stage where focus is shifted towards improving our understanding of complex behaviours through application of comprehensive ecological intervention. More specifically, only a few studies have been conducted on the presence of NES in college students. The population in which stress and anxiety levels tend to be high and in which sleep disturbances and late night eating are more prevalent than in the general population (Brougham et al., 2009).

Our findings indicate the possibility that eating habits of female students depend more on the time of having supper than on eating dinner altogether. This argument was supported by the BMI measures that were lower in the female than in the male sample group. It is possible that physical activity plays a significant role in maintaining BMI, an assertion that was demonstrated by female BMI measures. There is some evidence that skipping breakfast and eating late at night increases the risk of weight gain and obesity, though the evidence is stronger in children, especially teens, than it is in adults (DGAC, 2010).

Lastly, the lack of relationship between BMI and the eating pattern in the female sample may be due to the relatively young age of the participants, their

busy schedule at school, etc. All the above mentioned factors can, to a certain extent, exert influence on our behaviour that consequently makes it more difficult to find the exact factors influencing our biological, psychological and social conduct.

Our study exhibits some limitations. Physical activity estimated from questionnaires and body mass index are the most frequently used measures. Despite the feasibility of using these approaches in epidemiological studies, significant ceiling effect is evident. Questionnaires are subjective and adolescents may not report physical activity level accurately. Furthermore, BMI is not an accurate measure of fatness for adolescents, as it is also associated with the lean mass. Hence, in our study, there may arise a bias from its longitudinal association with physical activity level. However, the main limitations of our study relate to lack of validity in measuring physical activity, night-eating syndrome and BMI. Several cross-sectional studies have addressed this issue. Nevertheless, their results are conflicting (Reichert et al., 2009).

Conclusion

Night eating has been associated with higher BMI, more so in clinical populations than in epidemiological studies. We observed association between dinner time, dinner pattern and BMI. However, we revealed some differences within genders in PA dinner time and PA and dinner pattern. In details between BMI and dinner pattern and BMI and dinner time we confirm our hypothesis in both genders. We did not confirm our hypothesis concerning comparison of PA and dinner time factor in male and female sample groups. Similarly, we confirm our hypothesis between PA and dinner pattern in the male but not in the female sample group. The findings are not conclusive by any means. The study was not designed to analyze the data in depth. The design of our study does not allow for establishing any causal relations. On the grounds of our findings, we can conclude that PA has its substantiation in maintaining healthy weight in young cohorts. Our ambition is to replicate our investigation in a couple of years in order to get some more insight into the complex relationship that PA, night eating and BMI represent. At last, physical activity, and eating habits, represent a complex behaviour that is influenced by personal motivation, general health, genetic factors, and the social and physical environment in which we live. These factors undoubtedly exert an influence on the propensity to engage in certain behaviour. Further studies are needed in order to generate evidence based recommendations to focus our attention to the right direction.

References

Allison, K.C., Latzer, Y., Tzischinsky, O., Vinai, P., *What is night-eating syndrome?* New direction toward a unified definition. International Journal of Child Health and Adolescent Health. 2009; 2. pp. 175–184.

Allison, K.C., Lundgren, J., O'Reardon, J., Martino, N.S., Sarwer, D.B., Wadden, T.A., Crosby, R.D., Engel, S.G., Stunkard, A.J., *The Night Eating Questionnaire*. (NEQ): Psychometric properties of a measure of severity of the nnight-eating syndrome. Eating Behaviors. 2008; 9: pp. 62–72.

Aronoff, N.J., Geliebter, A., Zammit, G., *Gender and body mass index as related to the night-eating syndrome in obese outpatients.* Journal of the American Dietetic Association. 2001; 101: pp. 102–104.

Brougham, R.R., Zail, C.M., Mendoza, C.M., Miller, J.R., *Stress, sex differences and coping strategies among college students*. Current Psychology. 2009; 28: pp. 85–97.

Birketvedt, G.S., Florholmen, J., Sundsfjord, J., Osterud, G., Dinges, D., Bilker, W., *Behavioral and neuroendocrine characteristics of the night-eating syndrome*. Journal of the American Medical Association. 1999; 2: 82. pp. 657–663.

Cepkova, A., *Assess the state of posture, physical fitness and mental health of student of the university.* Integrative power of kinesiology. Proceedings Book. Zagreb; 2011.

Dietary Guidelines for Americans Advisory Committee. *Report of the DGAC on the Dietary Guidelines for Americans*. 2010.

Feč. R., *Vplyv posilňovacieho tréningu na lokálnu redukciu podkožného tuku v oblasti brucha u žien*. Pohyb človeka – základní a sportovní motorika, diagnostika a analýza. Ostrava: 2010. – pp. 48–53.

Hrčka, J., Kovářová, M., Beňačka, J., *Pohybová aktivita edukantov fyzioterapie vo voľnom case a jej reflexia na vybraných zdatnostných a zdravotných charakteristikách.* Prešov; 2011

Popkin, B.M., Duffey, K.J., *Does hunger and satiety drive eating anymore? Increasing eating occasions and decreasing time between eating occasions in the United States.* American Journal of Clinical Nutrition. 2010; 91: 1342–7.

Public Health Agency of Canada. *Obesity in Canada: A Joint Report from the Public Health Agency of Canada and the Canadian Institute for Health Information*; 2011. In; 2011: pp. 12–6.

Pullmannová, Švedová, M., *Kritéria výberu v etape športovej predprípravy pre modernú gymnastiku. Pohybová aktivita v živote človeka, pohyb detí*. Prešov; 2010.

Reichet, F.F., Mnenzes, A.M., Wells, C.K., Dumith, S.C., Hallal, P.C., *Physical Activity as a Predictor of Adolescent Body Fatness.* A Systematic Review. Sport Medicine. 2009; 39.(4): pp. 279–294.

Ruiz, J.R., Ortega, F.B., *Physical activity and cardiovascular disease risk factor in children and adolescents.* Curr Cardiovascular risk report. 2009; 1(3): pp. 281–286.

Srdic, B., Obradovic, B., Dimitric, G., Stokic, E., Babovic, S., *Relationship between body mass index and body fat in children: Age and gender differences.* Obes Res Clin Pract. 2012; 6: pp. 167–73.

Striegel-Moore, R.H., Franko, D.L., Garcia, J., *The International Journal of Eating Disorders*. 2009; 42: pp. 720–738.

Striegel-Moore, R.H., Franko, D.L., Thompson, D., Affenito, S., Kraemer, H.C., *Night eating. Prevalence and demographic correlates. Obesity*. 2006; 14: pp.139–147.

Stunkard, A.J., Grace, W.J., Wolff, H.G., *The night-eating syndrome. A pattern of food intake among certain obese patients. American Journal of Medicine*. 1955; 19: pp. 78–86.

Uher, I., Švedová, M., *Long and prosperous life paradigm*. Physical Activity Review. Vol. 1. p. 213.

Zusková, K., Junger, J., *Miesto pohybovej činnosti v spôsobe života mestských rodín*. Zdravá škola: Zborník z 2. vedeckej konferencie. Prešov: Ministerstvo školstva SR, Metodické centrum v Prešove, 1999, pp. 125–131.

Zusková, Klaudia – Buková, Alena – Horbacz, Agata: *Charakter Práce, Životný Štýl A Nadváha zamestnancov firiem. Rekreačný šport, zdravie, kvalita života*: Košice: 2012. pp. 400–408.

Qi, L., Cho, Y.A., *Gene-environment interaction and obesity. Nutritional Review,* 2008; 66: pp. 684–94.

World Health Organization. *Global strategy on diet, physical activity and health*: *childhood overweight and obesity*. Accessed March 9, 2012.

Acknowledgement

This research is the result of the grant project of Ministry of Education, Science, Research and Sport of the Slovak Republic. VEGA No. 1/1343/12 "SELECTED RISK FACTORS FOR OBESITY AND PHYSICAL PREVENTION" and with the partial support of Project implementation: UNIVERSITY SCIENCE PARK TECHNICOM FOR INNOVATION APPLICATIONS SUPPORTED BY KNOWLEDGE TECHNOLOGY, ITMS: 26220220182, supported by the Research & Development Operational Programme funded by the ERDF.

Streszczenie

Zespół nocnego odżywiania, aktywność fizyczna i BMI studentów wyższej uczelni

Wszystkie regiony świata są dotknięte przez epidemię otyłości. Do niedawna problem ten dotyczył jedynie krajów rozwiniętych gospodarczo, teraz również problem mają kraje mniej rozwinięte i słabo rozwinięte gospodarczo. Zespół nocnego jedzenia (zespół odżywiania nocnego NES – night eating syndrom) obejmuje późne (hyperfagie) i nocne jedzenie. Istnieją różne poglądy na temat związku pomiędzy NES a wzrostem wskaźnika masy ciała i aktywnością fizyczną, a zależności opisywane w literaturze są niejednoznaczne (Nolan i in., 2012). Mamy dowody, aby twierdzić, że występowanie NES jest bardziej widoczne u osób z większą nadwagą niż u pozostałej populacji. Jednak dokładny związek pomiędzy NES i aktywnością fizyczną i otyłością pozostaje nieokreślony. Powodem tej rozbieżności wyników badań są różne kryteria diagnostyczne, jak również różnorodność badanej populacji. Celem naszego przekrojowego badania, które jest częścią projektu VEGA „wybrane czynniki ryzykowych faktorów otyłości i jej profilaktyka aktywnością fizyczną" No.1/1343/12, było zbadanie relacji między NES, aktywnością fizyczną i BMI studentów (774 mężczyzn / 1142 kobiet) ze średnią wieku 21,46 lat (zakres=2,33). Stwierdziliśmy pozytywny związek między NES, aktywnością fizyczną i BMI. Z drugiej strony, zaobserwowaliśmy różnice między płciami, NES i aktywnością fizyczną.

Słowa kluczowe: nadwaga, dorosłość , studenci, jedzenie w nocy, tkanka tłuszczowa.