Health literacy relating to everyday eating habits having impact on body composition in students of pedagogical disciplines of the Palacký University in Olomouc

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Abstract

Appropriate eating habits create a prerequisite for the prevention of many chronic non-infectious diseases. Formation of health literacy, which includes edification in lifestyle and particularly education in the optimal eating habits, is part of general and profiling disciplines of students of pedagogical disciplines. This strengthens the likelihood of higher health literacy and thus putting into practice good eating habits by the students themselves and above all, by the next generation they will be educating and training in their teaching profession.

The aim of our research was to evaluate selected parameters of body composition based on eating habits in 324 female students of pedagogical disciplines of the Pedagogical Faculty of the Palacký University in Olomouc. Based on a questionnaire investigation of eating habits, the monitored students were divided into two groups: Group I (5 meals per day or more), Group II (4 meals per day or less). Multi-frequency bioimpedance analysis was carried out using the InBody 720 device to determine the body composition parameters. Received energy divided into five portions per day

(Group I) has optimal impact on the body composition. We can state that a statistically significant lower relative risk of health damage assessed using the amount of body fat (BFM, BFP, BFMI) was demonstrated in Group I women. The relative body fat (BFP) for Group II women exceeded 28 % and falls into the overweight category. From the point of view of Fat-free Mass Index (FFMI), both groups of women were placed among individuals with higher muscle development. Positive results of somatic diagnostics based on good eating habits thus may become a tangible basis for motivation of using preventive nutritional measures by future teachers. Secondly, the results are used within the framework of academic educational reality in disciplines related to the health literacy and health education.

Key words: health education, health promotion, young adulthood, bioelectrical impedance.

Zdravotní gramotnost na úrovni uplatňovaných stravovacích zvyklostí v kontextu tělesného složení u studentů pedagogických oborů Univerzity Palackého v Olomouci

Abstrakt

Vhodné stravovací návyky vytvářejí předpoklad pro prevenci mnoha chronických neinfekčních onemocnění. Vytvoření zdravotní gramotnosti, která zahrnuje úpravu životního stylu a zvláště vzdělávání v optimálních stravovacích návycích, je součástí obecných a profilových disciplín studentů pedagogických oborů. To posiluje pravděpodobnost vyšší zdravotní gramotnosti, a tím zavedení dobrých stravovacích návyků samotnými studenty a především tak budou vzdělávat budoucí generace ve své profesi.

Cílem našeho výzkumu bylo zhodnotit vybrané parametry tělesného složení založené na stravovacích návycích u 324 studentek pedagogických oborů Pedagogické fakulty Univerzity Palackého v Olomouci. Na základě dotazníku zaměřeného na stravovací návyky byli sledovaní studenti rozděleni do dvou skupin: skupina I (5 jídel denně nebo více), skupina II (4 jídla denně nebo méně). Byla provedena frekvenční bio-impedanční analýza s použitím přístroje InBody 720 pro stanovení parametrů tělesné kompozice. Výsledná energie rozdělená na pět porcí denně (skupina I) má optimální dopad na složení těla. Můžeme konstatovat, že u žen skupiny I bylo prokázáno statisticky významné nižší relativní riziko poškození zdraví, které bylo hodnoceno pomocí množství tělesného tuku (BFM, BFP, BFMI). Relativní tělesný tuk (BFP) u žen skupiny II přesáhl 28 % a spadá do kategorie nadváhy. Z pohledu Indexu bez tuku (FFMI) byly obě skupiny žen zařazeny mezi jedinci s vyšším vývojem svalů. Pozitivní výsledky somatické diagnostiky založené

na dobrých stravovacích návycích se tak mohou stát hmatatelným základem pro motivaci využití preventivních nutričních opatření budoucími učiteli. Dále jsou výsledky využívány v rámci akademické vzdělávací reality v disciplínách týkajících se zdravotní gramotnosti a zdravotní výchovy.

Klíčová slova: zdravotní výchova, podpora zdraví, mládež, bioelektrická impedance.

Introduction

Health is determined by many endogenous and exogenous factors. However, the most dominant factor is the everyday lifestyle that can enhance natural determinants of health and delay the onset or manifestation of many health and lifestyle complications. Lifestyle is the result of interaction between man and environment. Good eating habits and healthy nutrition take part in weight management and are one of the key prerequisites for a healthy lifestyle. Established positive principles in this area provide prerequisites for prevention in the fight against chronic non-infectious diseases (Hainer et al., 2011; Holčík, Káňová, & Prudil, 2015; Katzmarzyk, Baur, & Blair, 2008; Machová & Kubátová, 2010).

Atherosclerotic cardiovascular diseases, which are a very common accompanying complication of obesity, are the most frequent cause of death (approximately 50 %) in developed countries, including the Czech Republic (Report on the Health of the Population of the Czech Republic, 2014). To remedy this situation, programs aimed at improving the health condition of the population have been developed (Health 21, Health 2020, Zdraví 21, Zdraví 2020, etc.) at international and national level. One of the tools of the Health 2020 program is the Action Plan to Improve Health Literacy (2015), which ranks among the key intervention areas, among other things, education and training (MZ ČR, 2015; MZ ČR, 2014a; MZČR, 2014b; MZČR, 2003; WHO, 20013; WHO, 1999).

Scope for the formation of health literacy, health promotion and health education is thus created at the various levels of the educational system, where, within the curriculum documents, this issue is implemented into objectives and educational content. For this reason, it is essential to prepare knowledgeable educators at the level of specialists in health education and to train future teachers of various approbation combinations for acquiring medical proficiency (Hřivnová, 2017; Marádová, 2016).

Health literacy in the Czech Republic is assessed as problematic to low in the adult population. The justification of health education and thus the development of health literacy is based on a number of research studies confirming relationship between the health literacy and educational attainment levels and, consequently, the socio-economic status (Kučera, Pelikan & Šteflová, 2016; Heide, Wang, Droomers, Spreeuwenberg, Rademakers, & Uiters, 2013).

Because the primary prevention is always the most effective, the focus of our study is on future teachers and their health literacy relating to everyday eating habits having impact on the body composition. We consider the body composition as appropriate indicator of the functional status of the body and its fitness. Suitable indicators of the somatic condition are the different body components, particularly body fat, visceral fat and fat free mass (Baumgartner, 2000; Hainer et al., 2011; Sofková & Přidalová, 2016).

Through teaching at the Pedagogical Faculty of the Palacký University in Olomouc, we can learn a healthy approach to nutritional stereotypes. Future teachers and parents are involved in shaping the level of pupil's health literacy. How teachers will be equipped to deal with the primary prevention process at elementary or secondary school with all cognitive-affective-psychomotor issues is based on their undergraduate and lifelong learning.

Consequently, the primary objective of our research was to evaluate the selected body fractions, particularly body fat and fat free mass, based on the eating habits of female students of pedagogical disciplines at the Pedagogical Faculty of the Palacký University in Olomouc (PdF UP).

1 Methodology

1.1 Research group

The research group consisted of 324 female students from the Pedagogical Faculty of the Palacký University in Olomouc, aged between 18 and 30 years. Women were divided into two groups according to their eating habits: Group I (5 meals per day or more) and Group II (4 meals per day or less). The first group of women (Group I) had an average age of 25.9 years ($SD = 2.3$) and the second group of women (Group II) had an average age of 24.4 years ($SD = 2.7$).

Data collection was carried out during October 2014–2016. Each woman signed a written consent to the measurements and was familiarised with the organisational requirements of the research. Somatic measurements and questionnaire investigations of eating habits were carried out within the research framework.

1.2 Somatic research

The standardised anthropometric methods were used to determine basic somatic parameters and somatic indexes. The body height (BH, cm) was determined with an accuracy of 0.5 cm using the P-226 anthropometer (Trystom, Czech Republic). The body mass (BM, kg) was determined using the InBody 720 device. Body Mass Index ($BMI = BM/BH^2$, kg/m^2) was based on the anthropometric parameters, namely BH and BM.

In addition to the basic somatic parameters (BM, BH, BMI) we evaluated the quantity of body fat (BFP, %; BFM, kg), visceral fat (VFA, %), fat free mass (FFM, kg) and skeletal muscle mass (SMM, kg). We also calculated the Body Fat Mass Index ($BFMI = BFM/BH^2$, kg/m^2) and Fat-free Mass Index ($FFMI = FFM/BH^2$, kg/m^2).

The InBody 720 device was used to diagnose the body composition by using the directly controlled multi-frequency bioelectric impedance (1–1,000 kHz). The principle of the bioelectric impedance method lies in differences in the propagation of the high frequency alternating current of different intensity in different biological structures. This is a non-invasive and fast method. The device differentiates body mass into three components – total body water (intracellular and extracellular water), dry matter (proteins and minerals) and body fat. InBody 720 device also analyses the amount of visceral fat, which is defined as the area of the transverse section in the abdominal area at the level of the L_4 – L_5 vertebrae. The method used is unified; the measurement was carried out under the standard conditions given by the device manual (Biospace, Seoul, South Korea). Before each measurement, women were familiarised with the rules that are required to acquire valid body composition data.

1.3 Questionnaire investigation of eating habits

Data relating to eating habits was acquired through an investigation that focused on the frequency of daily food consumption (breakfast, snack in the morning, lunch, afternoon snack, dinner). Based on the recommendations in the “Nutritional Recommendations for the Population of the Czech Republic” (2012) paper, the optimal diet was determined as having five meals over the course of the day (Group I) and non-optimal diet as having four or less daily portions of food (Group II) (SPV, 2012).

Data analysis

Data acquired by the InBody 720 device was processed using the appropriate methods using the Lookin'Body 3.0 program; data relating to eating habits was transferred to MS Excel spreadsheet.

Statistical data analysis was carried out using the statistical program Statistica 10.0 (StatSoft, Tulsa, OK). The basic statistical variables for the monitored parameters and their differences between the groups were calculated. The significance of these differences was tested using the Mann-Whitney U test. Statistical significance was determined at $\alpha < 0.05$.

2 Results and Discussion

We have divided the monitored students into two groups that meet and do not meet the recommended frequency of daily meals. Table 1 presents selected somatic characteristics of the body composition for each group differentiated according to the daily frequency of meals. The average total body water (TBW) in an adult is about 50–60 % of the body weight. The TBW percentage in both groups exceeded the 50 % threshold. From the total body mass (BM, kg), the relative TBW (l) for Group I was 53.3 % and for Group II was 50.9 %. Rokyta (2000) reports that women have a lower water distribution due to a higher proportion of fat tissue, intracellular water (ICW: Intracellular Water, l) is represented by 32 % and extracellular water (ECW: Extracellular Water, l) by 21 %. Our two monitored groups had the following ratios: $ICW:ECW_{Group I} = 33.1 : 20.2$ and $ICW:ECW_{Group II} = 31.4:19.5$. This corresponds to the assumption that the amount of TBW is in reciprocal relationship to the body fat (BFM, kg). The most variable component of the body mass is BFM, which is the main factor of the body composition variability and is easily affected by eating habits. The relative body fat (BFP, %) for Group II exceeds the recommended 28 % according to Wang, Pierson and Heymsfield (1992), yet they are at the lower limit, i.e. $BFM_{Group II} = 29.3$ %. Group I, with the higher TBW, comes up to $BFP = 26.3$ %. Groups of women that have different number of meals per day have statistically significant differences in the parameter associated with the risk aspects of obesity for the body fat, namely BFM: $p = 0.01$ and BFP: $p = 0.005$. Visceral fat (VFA, cm^2) is metabolically more active and its increase in the human body, so-called abdominal obesity, is considered a risk factor for cardiovascular complications (Dukát, 2007). For the VFA we observed lower than the risk levels ($< 100 cm^2$) in both groups, i.e. $VFA_{Group I} = 58.3 cm^2$; $VFA_{Group II} = 67.4 cm^2$, $p = 0.11$.

The ratio between the fat free mass (FFM, kg) and BFM is a function of nutrition and physical activity and thoroughly characterises the somatic condition of the individual. FFM also testifies about the amount of proteins and minerals in the body, which are not significantly higher in Group I, as well as skeletal muscle mass (SMM, kg).

An inverse relationship between the BMI and the frequency of consumed meals has been demonstrated in adults (Kant & Schatzkin, 1995).

The average Body Mass Index (BMI, kg/m^2) is within the normal mass category ($BMI: \leq 25 kg/m^2$) for both groups (Table 2). For a more objective assessment of the occurrence of health risk from the point of view of the body composition, splitting up the BMI into the Body Fat Mass Index (BFMI, kg/m^2) and the Fat Free Mass Index (FFMI kg/m^2) is used (Hainer et al., 2011; Kyle et al., 2004; Riegerová, Přidalová, & Ulbrichová, 2006). For women the BFMI's health safe zone is defined within $3.9 kg/m^2$ and $8.1 kg/m^2$. BFMI average falls into the health safe zone with the two groups having statistically significant differences, that is to say $BFMI_{Group I} = 6.3 kg/m^2$, $BFMI_{Group II} = 7.4 kg/m^2$, $p = 0.008$. This index may also be referred to as the body risk index of obesity. FFMI takes

better account of, among other things, the lower or higher representation of SMM – diagnosis of sarcopenia, i.e. malnutrition or higher development of muscle mass. The FFMI optimal range is within 14.6 kg/m² and 16.7 kg/m² (Kyle et al., 2004). Schutz et al. (2002) gives a classification for the age range of 18–34 years, which is set for BFMI at 5.5 kg/m² and for FFMI at 15.4 kg/m². $FFMI_{Group I} = 16.8 \text{ kg/m}^2$ and $FFMI_{Group II} = 16.6 \text{ kg/m}^2$ ($p = 0.39$) correspond to a higher development of muscle mass.

Rokyta (2000) states that the even energy intake during the day maintains increased metabolic rate and prevents storage of reserves in the body. Regular intake of food during the day is considered as the nutritional factor that is an independent predictor of proportionate mass (Ma, 2003). In addition to receiving the appropriate amount of energy, it is important to spread it appropriately to more meals throughout the day, that to say, three main meals and two snacks. Based on our results, we can confirm this theory as the statistically lower body fat (BFM, BFP, BFMI) has been demonstrated in persons with at least five portions per day. It is generally recommended to consume food with a lower energy value and a lower glycaemic index in the afternoon (Machová & Kubátová, 2010). The question is what food and how much to consume. Due to the amount of body fat found, the daily serving can exceed the recommended amount of food by its volume and caloric intake. Hřivnová, Kopecký, Knausová and Vařeková (2013) state that the risk level of cholesterol intake exceeds 48 % on weekends in the PdF UP female students.

Table 1

Selected somatic characteristics in relation to the eating habits

Variable	Group I		p	Group II	
	Mean	SD		Mean	SD
BH (cm)	168.8	8.1	0.33	167.7	6.9
BM (kg)	66.3	13.1	0.67	67.8	16.1
TBW (l)	35.4	6.7	0.26	34.5	6.4
ECW (l)	13.4	2.5	0.35	13.1	2.3
ICW (l)	22.0	4.3	0.22	21.3	4.0
BFM (kg)	17.8	8.8	0.01	20.7	10.5
BFP (%)	26.3	8.6	0.005	29.3	8.6
VFA (cm ²)	58.3	34.5	0.11	67.4	42.1
FFM (kg)	48.4	9.2	0.26	47.1	8.7
SMM (kg)	45.5	8.7	0.25	44.3	8.2
proteins	9.5	1.8	0.22	9.2	1.7
minerals	3.4	0.6	0.29	3.3	0.6

Note: BH – Body Height, BM – Body Mass, TBW – Total Body Water, ECW – Extracellular Body Water, ICW – Intracellular Body Water, BFM – Body Fat Mass, BFP – Body Fat Percentage, VFA – Visceral Fat Area, FFM – Fat-free Mass, SMM – Skeletal Muscle Mass.

Table 2

Indices of selected body composition health indicators

Variable	Group I		p	Group II	
	Mean	SD		Mean	SD
BMI (kg/cm ²)	23.2	4.0	0.29	34.6	4.3
BFMI (kg/m ²)	6.3	3.1	0.008	15.1	5.1
FFMI (kg/m ²)	16.8	2.0	0.39	18.9	1.9

Note: BMI – Body Mass Index, BFMI – Body Fat Mass Index, FFMI – Fat-free Mass Index.

Conclusions

We assess the body composition relating to eating habits in the monitored groups of women as acceptable. Because the pedagogical disciplines are involved in shaping the level of pupils' health literacy, the results of the research are used in the framework of academic educational reality in disciplines related to the topic of health literacy and health education.

The average BMI values are in the normal weight category (BMI: ≤ 25 kg/m²) for both groups. It has been proven that the energy absorbed in five portions per day has an optimal effect on the body composition. Statistically significantly, lower body fat (BFM, BFP) has been demonstrated in women with at least five portions per day (Group I). The recommended standards relating to the average values of somatic characteristics were confirmed for the Group I. The BFP average of > 28 % is indicating overweight condition for women with dietary habits of four or fewer portions per day (Group II). The average BFMI for obesity falls within the safe range of 3.9 m² to 8.1 kg/m², even though the Group I has statistically significantly lower values. FFMI results show higher muscle development in both groups of women. Positive results of the somatic diagnostics based on good eating habits may be the motivation to maintain preventive nutritional measures leading to a healthy lifestyle.

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