

The Effect of Implementation of Software “Program Prehrane 5.0” in Boarding School Menu Design

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ABSTRACT

Poor eating and lifestyle habits of secondary school students have negative impacts on their health and academic achievement. Balanced and varied menus at boarding schools might be good educational method to change poor eating habits, and a means to incorporate official recommendations into practice.

For this study, a software was employed in analysing the portion of main food groups in the menu of a female boarding school as well as energy and nutritive values in 2007 and 2013; before and during the implementation of software “Program Prehrane 5.0” in menu design. Students at this boarding school, aged 15 to 19 years, were interviewed about foods and beverage intake, using semi-quantitative food frequency questionnaires in 2007 and 2013. The observed characteristics were brought into relation, using regression models.

Descriptive statistical methods were employed in evaluating the harmonization of daily menu energy and macronutritive values. *t*-test with the chosen statistical significance of the 5% risk level was used in studying resemblance/difference of menus in 2007 and 2013. Obtained values were compared with the recommendations for energy and nutrient intakes for adolescents.

Study results show small standard deviations in energy values of menus in 2013 which indicates the balance of this parameter. *t*-test results show the statistically significant differences of menus in 2007 and 2013. The menus in 2013 have better characteristics; average daily energy value, more favourable carbohydrates, fat and protein ratios, as well as more acceptable content of SFA, PUFA and vitamin C. In comparison to the menu in 2007, the menu in 2013 contains more fruits and vegetables which could be a reason of more frequent consumption of these food groups among students. The consumption of breakfast was more frequent during 2013.

Balanced and varied menus, designed according to the recommendations, have a positive impact on eating habits of students.

Keywords; balanced and varied menu, boarding school, fruits, software, vegetables

INTRODUCTION

A varied and balanced diet supports healthy growth and development at adolescence and it plays an important role in disease prevention. It was shown that *healthy* nutrition is positively related to desirable behaviour as well as school performance (Kristjansson et al., 2010; Florence et al, 2008; MacLellan et al., 2008; Wang, Veugelers, 2008). Secondary school students are prone to negative change in eating habits as a result of lifestyle change and development of their independence. It is not rare that some of them skip meals, turn to various fad diets, restrict energy intake, and eliminate some foods or whole food group (even groups) from their diet. Elimination of some foods/food groups could have a negative impact on students' energy and nutrient status, and therefore might affect health and significantly increase risk for cognitive functioning impairment. Therefore, it is extremely important for adolescents to include adequate

amounts of all main foods groups (cereals and their substitutes, vegetables, fruits, meat and its substitutes, milk and fermented dairy drinks and fats) in their daily menu. Because of this, boarding schools play a crucial role in providing nutritious and well balanced meals to secondary school students. Previous studies showed that students, who live away from family home, change their eating habits (Papadaki et al., 2007; Jaworowska, Bazylak, 2007; Shimbo et al., 2004). Diet quality of students at boarding school greatly depends on previously acquired habits as well as the menu offer of these institutions. Knowing the fact that secondary school students are mentally and physically active, balanced and varied menus at these institutions have to ensure micro- and macronutrients in adequate amounts. Menu planning at boarding school is a demanding task which means that all relevant aspects, such as official standards, customs, tradition, students' preferences, seasonal availability of foods and budget, should be taken into consideration. Croatian boarding schools do not employ the same standards for menu planning so there is a diversity of menu quality (Bosanac, 2012). Moreover, one of previous studies showed that only 35% of menus at boarding schools in Croatia were nutritive balanced (Krešić et al., 2008).

For this study, a computer program was employed in analysing the portion of main food groups in the menu of a female boarding school as well as the energy and nutritive values in 2007 and 2013; before and during the implementation of software "Program Prehrane 5.0" (Bosanac, Gašparović, 2014) in menu design.

MATERIALS & METHODS

Subjects

Upon approval of the master, this study was conducted at the female boarding school in Split, Croatia. This institution, with the capacity of 153 places (MZOS, 2014), offers students accommodation, supervision and three meals (breakfast, lunch and dinner) prepared in its kitchen. The subjects of the survey included secondary school students at this boarding school. Girls, aged 15 to 19 years, were interviewed voluntarily and anonymously about their foods and drinks intake, using semi-quantitative food frequency questionnaires in 2007 (N=98) and 2013 (N=134).

Questionnaires and menus data collection

Questionnaires included a series of multiple-choice and open-end questions that assessed various eating habits of the students, in terms of the frequency of meals as well as type, quantity and frequency of the food consumed.

Daily menus of ten consecutive working days were collected in October 2007 and in December 2013; before and after the software "Program Prehrane 5.0" was employed in menu planning at the boarding school.

Energy and nutritive values as well as portions of the main foods groups in the menus were analysed using the software "Program Prehrane 5.0".

Data analysis

Data were analysed using descriptive statistics and crosstabs using the program SPSS v.17. The application of crosstabs gave an insight into the multidimensionality of the consumer consumption of different foods and their preferences. *t-test* was used to analyse the similarity of difference in the average energy-nutritional composition of meal offer at the boarding school. Level of significance was 5% (i.e., $P < 0.05$) in studying resemblance/difference of menus in 2007 and 2013. Obtained values were compared with the official standards for energy and nutrient intakes of adolescents (Regulation 146/2012, 2012). Portions of the main foods groups in the menus were compared with international recommendations (USDA, 2005; Whitney, Rolfes, 1999).

RESULTS & DISCUSSION

Analyses showed that the average energy value of daily menus at the boarding school in the year 2007 was 12462.9 kJ (2978.7 kcal) compared with 10399.3 kJ (2485.5 kcal) in 2013. If we take 10179.7 kJ (2433 kcal) as the standard for the average energy value of daily menu for students age 14 to 18 years

(Regulation 146/2012, 2012) as it was accepted by the software „Program Prehrane 5.0“, the average menu in the year 2013 was in a good correlation with the recommendations. What is more, small standard deviations in energy values of the menus indicate the harmonisation of this parameter in the observed period (fig. 1). *t-test* (with $p=0.005992$) indicates significant difference between the average energy values of menus in 2007 and 2013. The average energy value of daily menus in 2007 was well above needs of an average female secondary school student and the large standard deviation presumes imbalance. Consumption of those menus during a longer period of time, increases the risk for overweight and obesity among female students which could have negative impact on their health. Results of earlier study in Croatia alert this possibility. They showed that the average energy values of daily menus at boarding schools, and the presence of fat, exceed female students' needs (Gajdoš et al., 2004). On the other hand, unjustified large meals at boarding school could lead to significant *plate waste*.

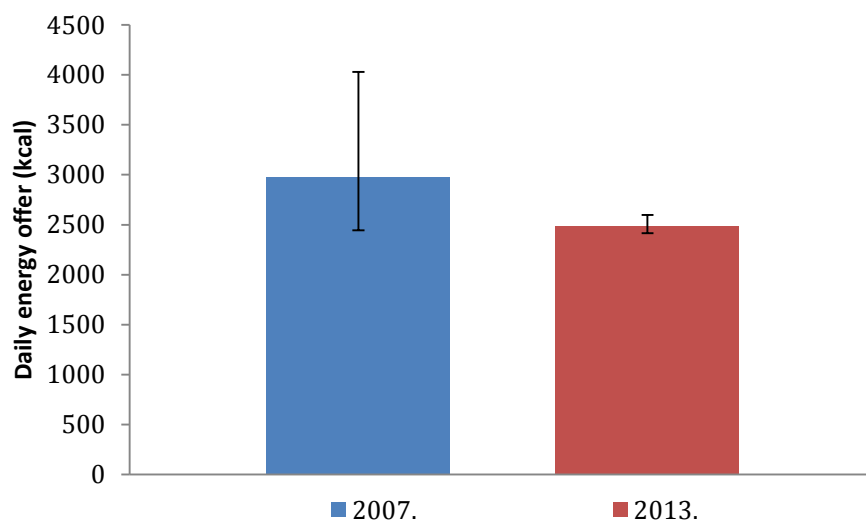


Figure 1. Average energy values and standard deviations of ten consecutive daily menus in the years 2007 and 2013

As figure 2 indicates, there are also differences among macronutrients composition of menus in the years 2007 and 2013. The ratios of carbohydrates, fats and proteins of the average menu energy content in 2007 were 50.9, 34 and 15% respectively. On the other hand, in the year 2013, on average, 51.5% of daily menu energy came from carbohydrates, 31.1% from fats and 17.2% from proteins. If we compare the menus in 2013 with those in 2007, it is obvious the fat content was reduced significantly ($p=0.034$). As a result, there is a significant reduction in content of saturated fatty acids ($p=0.047$) as well as polyunsaturated fatty acids ($p=0.036$). It is important to say that content of monounsaturated fatty acids were not significantly reduced thanks to increase of olive oil use in meal preparation. Authorities urge the restriction on fat intakes (EFSA, 2010; Guay et al., 2012), especially those rich in saturated fatty acids (Habib, 2011; Vennice, Rasmussen, 2014).

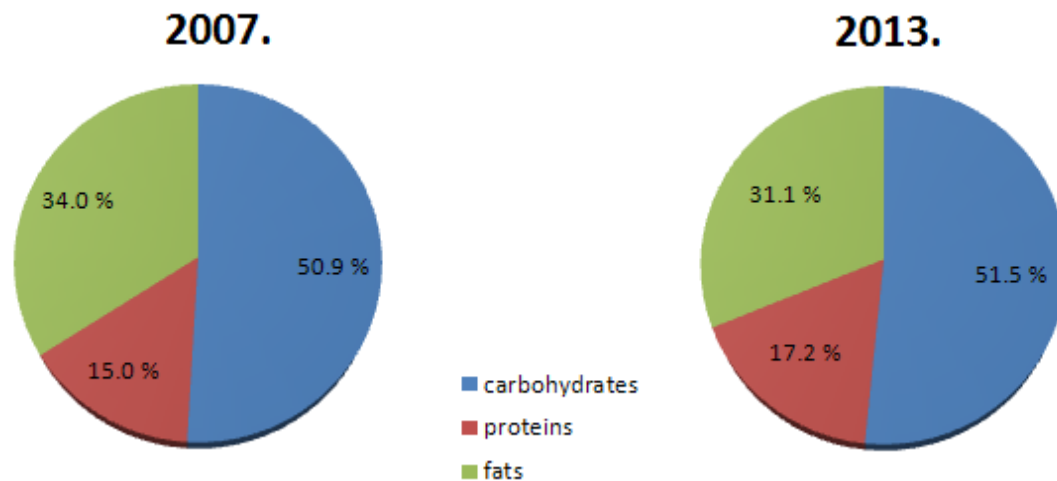


Figure 2. Average macronutrients composition of ten consecutive daily menus in the years 2007 and 2013 (

The World Health Organization (WHO) advocates that energy which comes from added sugars should be less than 10% of daily energy intake. Moreover, a reduction to below 5% of total daily energy intake would have additional benefits (WHO, 2014). It has to be mentioned that, compared with the offer in 2007, the female boarding school cut the mass of cakes up to 50% and decreased the frequency of their presence in the menus. This action is a good example of reducing refined sugars in adolescents' diet and is in line with national official recommendations (Regulation 146/2012, 2012).

Although result of the *t-test* presents significantly lower content of carbohydrates in menus in the year 2013 ($p=1.29 \cdot 10^{-3}$) which came as a result of lower energy content of these menus, the presence of fibre is higher (24.7 g in 2013 vs. 23.2 g in 2007). There is no doubt that higher content of fibre is attributed to more frequent presence of fruits, vegetables, legumes and whole cereals in the menu offers of the boarding school. The daily portion of fruit servings increased from 1.55 in the year 2007 to 2.15 after the implementation of the software. It is followed by the significant increase of vitamin C content (*t-test* resulted with $p=1.24 \cdot 10^{-4}$), which in practice means almost a doubled presence of this nutrient (170 mg vs. 93.5 mg).

Lower acceptable proportion of refined sugars and restricted intake of fats mean larger presence of low-fat sources of proteins; whole cereals, vegetables and legumes. The menus in the year 2013 contained more serving of vegetables than in the year 2007 (5.4 vs. 3.9) and more unrefined cereals (e. g. millet) as was recommended by the software "Program Prehrane 5.0" and other authors (USDA, 2005; Whitney, Rolfes, 1999). As a result, *t-test* (with $p=1.99 \cdot 10^{-3}$) indicated the higher proportion of proteins. It is important to encourage young students to consume more unprocessed foods as earlier survey research showed that people who ate more vegetables, fruits, meat, fish, and whole grains were less anxious and depressed than those whose diet was rich in refined grains, beer, processed, fried, and sugary foods (Jacka et al., 2010). Also, cereals and substitutes (e.g. potatoes) contain starch and are recognised as a prime source of energy in human nutrition.

Last but not least, it is interesting to see visual improvement of students' eating habits after the software "Program Prehrane 5.0" implementation in menu planning (figure 3). The percentage of girls who consumed breakfast, at least five times per week, increased nearly 12% (from 38.8% in 2007 to 50.4% in 2013). Daily consumption of vegetables remains low, although it more than doubled; from 7.1% in 2007 to 18.2% in 2013. Before only 21.4% of the girls consumed fruits every day, while in the year 2013 the number jumped to 53.2%. Adolescents should consume fruits on a daily basis, which, because of their sweetness as well as water and fibre content, enhance satiety and combats problems regarding overweight

and obesity. There is no reason not to believe that students consumed more fruits and vegetables as a result of more frequent presence of these foods groups in menu.

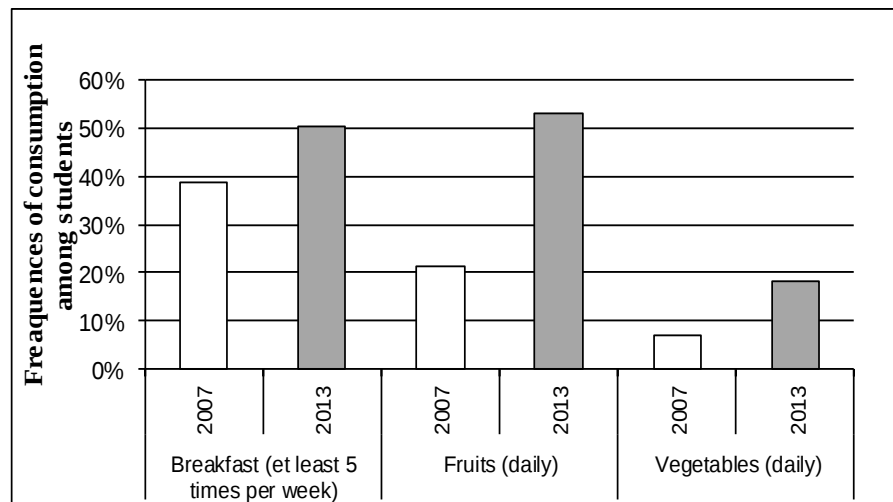


Figure 3. Frequency of breakfast, fruits and vegetables consumption among students at the female boarding school in 2007 (N=98) and 2013 (N=134)

We do hope that these results would have a positive impact on students' nourishment as an earlier research showed a positive correlation between secondary school students' mass and fruits and vegetables consumption (Roseman et al., 2007). Also it is well documented that fruit and vegetable consumption, as opposed to unhealthy food choices (e.g. fast food), positively correlate with secondary school end-of-the-year achievement (Sigfusdottir et al., 2007; Kristjansson et al., 2010; Deliens et al., 2013). This study supports research conducted in Texas, USA, which showed positive change in secondary students' eating habits, after nutrients profile of school meals improved. As a result, students consumed more fruits and less sweetened drinks and snacks (Cullen et al., 2008).

CONCLUSION

This study shows that the software "Program Prehrane 5.0" is a useful tool in menu planning at the female boarding school as its use resulted in better energy and nutrient profile, as well as more adequate proportion of main foods groups in the menu.

The results also confirm the hypothesis that balanced and varied menus, designed according to the expert and official recommendations, have a positive impact on eating habits of students at the boarding school.

It is believed that the acquired improvement of student eating habits would have a positive effect on their diet and health in the future.

It is advisable to employ the software "Program Prehrane 5.0" in designing menus at boarding schools.

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