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CHOCOLATE, SNACKING AND SELECTED DIETARY HABITS IN PUPILS: BMI-FOR AGE APPROACH

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Summary

Besides pleasant taste, the potential health benefits of cocoa and chocolate products have been known for many years. Formerly accepted as a medicine, chocolate nowadays among consumers represents everyday delicacy primarily associated with caries, obesity, high blood pressure, and diabetes. However, recent studies indicate the potential role of chocolate in cardiovascular diseases prevention and benefits linked to lower body mass index (BMI). The presented study aims to examine adolescents' habits regarding chocolate, sweets, salty snacks and fast food consumption as well as corresponding products intake frequency and relate them with BMI. The study population encompassed 525 participants attending elementary and high schools in the province of Vojvodina, Serbia, from which 42.5% were boys and 57.5% girls. The risk for overweight and participants' nutritional status were determined through BMI assessment. The majority of participants had normal range nutritional status (70.5%) followed by overweight (19.8%) and obese (7.6%). Increased number of overweight and obese nutritional statuses was recorded among boys compared to girls. Results revealed that fruits as a snack are most frequently consumed between meals, followed by salty snacks and sweets, regardless of the participants' nutritional status. The highest share of sweets consumption between meals was noticed among participants with obese nutritional status (15%). Furthermore, more than 40% of participants with overweight and normal range nutritional status do not consume chocolate at all, while 2.5% of participants with obese nutritional status stated that they consume chocolate on a daily basis.

Keywords: adolescents, snack, consumption frequency, chocolate, body mass index

Introduction

Leading factor in the prevention of non-communicable diseases (type 2 diabetes and cardiovascular disease) and obesity increment worldwide is associated with a healthy diet maintaining. As recommended by the World Health Organization (WHO), a healthy diet should include high levels of fruits, vegetables, and whole grains consumption alongside with low intake of refined carbohydrates, saturated fats, and salt (WHO, 2018). Considering long life term implications, the corresponding healthy diet adherence should be promoted across all age groups. Despite the fact that parents commonly shape children's dietary habits, changes in the diet are possible during growing up as a consequence of diverse factors influence. In particular, the transition period between adolescence and young adulthood is recognized as a suitable period for the introduction and adoption of healthy dietary habits (Hilger et al., 2017). However, different factors such as school environment (polices regarding diverse food accessibility in schools, the proximity of food stores) socioeconomic status and sociological aspects (peer's body image perception) interfere with the healthy dietary habits embracing in the corresponding life period. All mentioned factors are related with the prolonged time of being outdoors upon beginning of school education (Krusinska et al., 2017; Stevenson et al., 2007). As a consequence of being outdoors, readily accessible food rich in fats and sugars such as fast food and sweets more often becomes a part of the daily food intake, most frequently in a form of snack or even as meal replacement. Another factor which contributes to the corresponding group's food preference is food taste which triggers the generation of related psychological effects such as pleasant fillings and positive mood. In this respect, chocolate is widely consumed although the corresponding mood benefits have been designated as ephemeral (Parker et al., 2006). Conversely, it has been demonstrated that chocolate consumption also induces negative fillings such as guilt, related to the cognition of its nutritional value, lack of control over eating behavior, as well as influence on slenderness and weight (Macht & Dettmer, 2006; Macht & Simons, 2000; Rodgers et al., 2011). Conventional chocolate, as a form of sweets, contains a high share of lipids and carbohydrates and represents a product rich in

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calories while significant nutrients are absent (Cuenca-García et al., 2014). As a consequence, chocolate is considered as unhealthy food associated with caries, obesity, high blood pressure, and diabetes (Corti et al., 2009). However, an interesting fact is that Europe's historical documents associate chocolate with medicine indicating its use in treating numerous disorders such as angina and heart pain. The corresponding concept of potential health benefits provided by chocolate and cocoa beverages consumption was widely accepted until the early 1990s (Keen, 2001). In the past half of the century a noticeable increase in the manufacture of chocolate confectionery was observed (Kleinert-Zollinger and Beckett, 2017). Alongside with chocolate and related products production increase, the perception of chocolate among consumers changed. Previously considered as health beneficial, chocolate gained unfavorable attributes and has been associated with possible negative effects on consumers' health (Keen, 2001). The corresponding negative effects are primarily related to high fat and carbohydrate content in chocolate. Nevertheless, chocolate as well as cocoa also contain unique flavonoid types, primarily catechin and epicatechin, in a form of long polymers (pentamers, hexamers, etc.) (Natsume et al., 2000; Keen, 2001). The presence of such antioxidant compounds is associated with potential health benefits as a consequence of their antioxidant, antihypertensive, anti-atherogenic, antithrombotic and anti-inflammatory effects. Furthermore, the corresponding compounds exhibit influence on blood pressure (Golomb et al., 2012), insulin sensitivity, vascular endothelial function, and nitric oxide activation (Corti et al., 2009). Beneficial long-term effect on weight maintenance was also reported for the intake of catechins which are predominant in chocolate, fruit, vegetables, and tea (Hughes et al., 2008). Weight maintenance alongside with overweight and obesity development nowadays represent emerging problem worldwide. Factors such as high-density energy intake, sedentary lifestyle and lack of physical activity also contribute to the obesity development among young population (Meşe, et al., 2017). Body mass index (BMI) is applied for nutritional status assessment of an individual regarding obesity. According to the WHO, a 4 group classification considering BMI is presented: underweight (BMI<18.5 kg/m^2), normal range (BMI 19−24.99 kg/m^2), overweight (pre-obesity) (BMI≥ 25 kg/m^2) and obese (BMI≥30 kg/m^2) valid for adults of both genders (WHO, 2016). Children's nutritional status is estimated with special Growth Charts for school-aged children and adolescents as well as BMI cut-offs with respect to BMI for adults (WHO, 2007). As reported by Golomb et al. (2012), higher chocolate intake frequency has been related to lower BMI in adults.

Considering inconsistent opinions regarding chocolate consumption and possible health effects, the objective of the present study was to get an insight in young population habits towards chocolate, confectionary products and salty snacks consumption with respect to their BMI.

Materials and methods

Elementary and high schools in the province of Vojvodina, Serbia participated in the study. Cross sectional study involved 525 participants of Hungarian nationality from which 223 were boys (42.5%) and 302 were girls (57.5%) aged from 11 to 18 years. Participants were selected by random sampling among pupils attending 5th (10–12 years) and 7th (13–14 years) grade of elementary school and 3rd (17–18 years) grade of high school. The majority of the participants were from rural area (80%). The basic characteristics of the studied population are presented in Table 1. Participation in the survey was anonymous and on a voluntary basis. Before filling in the questionnaire, participants were informed regarding study's aims as well as that provided data would be handled as confidential.

Table 1. Basic characteristic of the studied population

Education level	Boys		Girls		Total	
	n	%	n	%	n	%
Elementary school 5th grade	66	48.9	69	51.1	135	25.7
Elementary school 7th grade	86	46.2	100	53.8	186	35.4
High school 3rd grade	71	34.8	133	65.2	204	38.9
Total	223	42.5	302	57.5	525	100

The first section of the questionnaire covered demographic data (gender and age) along with social and cultural data focused on degree course and place of residence. The second section was focused on questions

addressing snacking habits (which product is the most preferable snack) and frequency of chocolate consumption as well as accessible high-calorie foods consumption as snacks on daily basis during one week. Provided time for completing the questionnaire was 15 minutes during first class in the morning.

A database in Microsoft Excel 2010 was formed according to the answers provided by the surveyed participants. The survey results were analyzed by using pivot table function in the Microsoft Excel 2010 and expressed as the percentage of participants based on BMI. The assessment of the nutritional status was carried out according to the reference values of BMI-for-age (5 to 19 years) z-scores for boys and girls provided by the WHO (2007). Chi-square test was applied in order to determine the potential relationship between two categorical variables (BMI and frequency of selected products consumption) by testing the deviations of the obtained (empirical) frequencies from some of the expected (theoretical) frequencies. The null hypothesis assumes that there is no relationship between the variables. In cases where more than 20% of the cells had less than 5 expected frequencies, the p values were estimated with Monte Carlo simulation based on 10000 sampled tables (Barceló, 2019). The contingency coefficient (C) is used to estimate the strength of the relationship between the corresponding variables. If the contingency coefficient is less than 0.1, then there is no or negligible relationship between the variables, if C is between 0.1−0.3, then there is a weak relationship, whereas values between 0.3–0.5 or above 0.5 indicate a moderate or a strong relationship, respectively (Baguley, 2012). All statistical analyses were performed using IBM SPSS Statistics software (IBM Corporation, Armonk, USA) with the pre-defined 95% confidence interval ($p < 0.05$). Graphical representation of the analyzed results was performed using Statistica 13.3 (TIBCO Software Inc., USA).

Results and discussion

The majority of the surveyed population were elementary school pupils (35.4% and 25.7% from 7th and 5th grade, respectively) followed by high school pupils (38.9%). Considering gender, girls were more numerous regardless of the education level (Table 1). Nutritional status of the studied population according to the BMI-for-age addressing gender is reported in Table 2.

Regardless of gender, participants with normal range nutritional status were the most numerous (~70%, Table 2) indicating awareness and developed healthy eating habits among the studied young population. Participants with overweight nutritional status were the second largest group in the studied population with ~20% (Table 2).

Table 2. Distribution of participants by gender and (n) in the studied population according to the BMI-for-age

BMI classification*	Boys		Girls		Total	
	n	%	n	%	n	%
Underweight	2	0.9	9	3	11	2.1
Normal range	142	63.7	228	75.5	370	70.5
Overweight	53	23.8	51	16.9	104	19.8
Obese	26	11.6	14	4.6	40	7.6
Total	223	100	302	100	525	100

*according to the reference values of BMI-for-age (5 to 19 years) z-scores for boys and girls provided by the WHO (2007)

Underweight nutritional status in the studied population was recorded in a small share of 2.1% while obese nutritional status was represented with 7.6% share (Table 2). According to the results, more overweight and obese boys (23.8% and 11.6%, respectively) participated in the study compared to the girls (16.9% and 4.6%, respectively) (Table 2). Furthermore, the number of girls with normal range nutritional status was about 11% higher with respect to boys (Table 2). Considering underweight nutritional status, higher share was noticed among girls (3%) compared to boys (0.9%) (Table 2).

The presented results regarding sweets, including chocolate, fruit and salty snacks consumption habits and weekly consumption frequency of such products are expressed as a percentage based on the corresponding BMI classification. The obtained results from the statistical analysis were summarized in Table 3.

Results addressing the question about eating habits between meals are presented in Fig. 1. As noticeable on Fig. 1, a high share of participants declared that they consume fruits between meals (30−53%) especially in groups with overweight (53.9%), normal (43.8%) and obese (30%) nutritional statuses. The obtained results regarding fruit consumption are

in agreement with results from a study conducted among university students in Germany where 26.9% of students consumed fresh fruit several times on daily basis (Hilger et al., 2017). Following fruits, the second most consumed product are salty snacks with a share of 36.4−14.4% regardless of the nutritional status group. Salty snacks are the most consumed products between meals for underweight nutritional status group (36.4%) followed by normal (26.5%) and obese (25%) nutritional status groups. Sweets (chocolate and other confectionary products) consumption in the highest share was noticed for the obese nutritional status group (15%) and subsequently normal, underweight and overweight nutritional status groups (10.5%, 9.1%, and 5.8%, respectively). The consumption of cereal bars between meals is more frequent among obese (10%) and underweight (9.1%) nutritional status groups, while share of the corresponding product consumption in normal and overweight nutritional status groups is quite similar (5% and 6.6%, respectively).

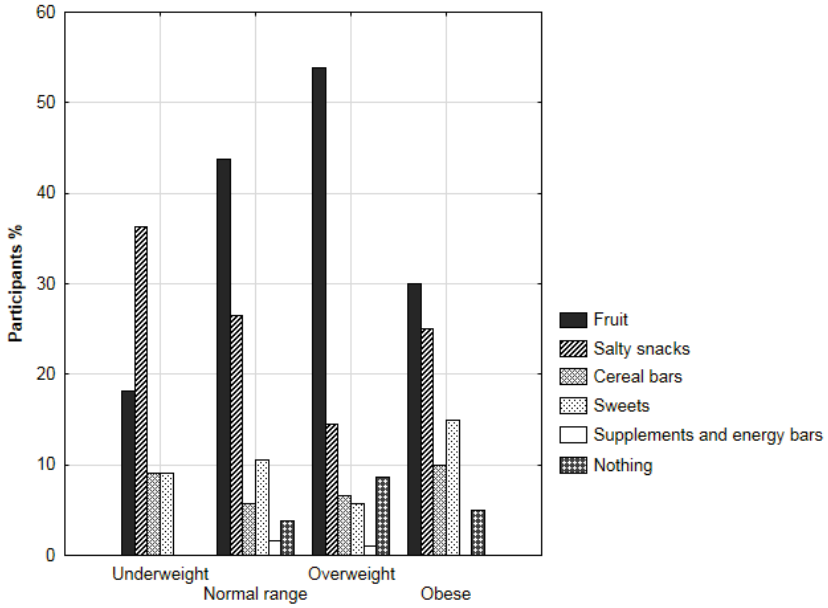

Fig. 1. Studied population eating habits between meals according to the BMI-for-age

Supplements and energy bars are not recognized as preferable snack between meals as noticeable on Fig. 1. Only participants from the normal range and overweight nutritional status groups reported consumption of the corresponding products in a small share of 0.9−1.6%. Snack skipping was most commonly among overweight participants (8.6%) followed by obese nutritional status participants probably due to the widespread opinion that a reduced number of daily meals will contribute to weight control.

The weekly consumption frequency of chocolate, fast food, sweets and salty snacks in the studied population considering classification according to BMI-for-age is illustrated in Fig. 2. As regards to chocolate consumption, 46.8% of participants with overweight nutritional status and 40.8% of participants with normal range nutritional status stated that they do not consume chocolate at all. However, chocolate consumption once a week was similar for all nutritional status groups ranging from 27% for normal range to 30% for obese participants (Fig. 2). Hilger et al. (2017) reported that 4.5% of university students ate chocolate several times on daily basis and also related the frequency of chocolate consumption with gender. When considering chocolate consumption two or three times per week, participants with underweight nutritional status were the most numerous (36.4 and 18.2%, respectively) followed by participants with normal range nutritional status (13.8 and 4%, respectively) (Fig. 2). The pattern of chocolate consumption from one to seven times within a week with a decreasing tendency, from day one to day seven, was observed only within participants with overweight nutritional status. Nevertheless, 2.5% of participants with obese nutritional status also stated that they consume chocolate every day in a week (Fig. 2). The obtained significance value is 0.044, indicating a statistically significant relationship. However, the value of contingency coefficient is under 0.3, indicating a weak relationship between BMI and chocolate consumption (Table 3).

Table 3. p-values and contingency coefficients from the statistical analysis of relationship between BMI and selected products consumption

Variables	Pearson Chi-Square value (χ2)	Degrees of freedom (df)	Asymp. Sig. (2-sided)[b]	Monte Carlo Sig. (2-sided)[c]			Contingency coefficient (C)
				Sig.	Lower bound	Upper bound	
Eating habits between meals	21.998[a]	15	0.108	0.115	0.107	0.123	0.210
Consumption frequency of:							
Chocolate	36.605[a]	21	0.019	0.044*	0.039	0.049	0.265
Sweets	32.930[a]	21	0.047	0.079	0.072	0.086	0.253
Fast food	22.134[a]	21	0.392	0.375	0.362	0.387	0.208
Salty snacks	16.248[a]	18	0.575	0.553	0.541	0.566	0.180

[a]More than 20% of the cells had less than 5 expected frequencies.
[b]Asymp. Sig. is the p-value based on chi-square approximation.
[c]Based on 10000 sampled tables.
*significant at $p < 0.05$.

With respect to sweets consumption, obtained results for all nutritional status groups were very similar to the chocolate consumption frequency (Fig. 2). The explanation of such similar results could be found in the fact that for most of the participants' term "sweets" relates with chocolate in the first place.

When addressing the fast food consumption, 55.8% of participants with overweight nutritional status do not eat fast food at all, likewise 53.5% of participants with normal and 50% of participants with obese nutritional status (Fig. 2). The corresponding results are consistent with the results from the study of Hilger et al. (2017) who found that 52.5% of university students consumed fast food less than once a week, while 1.9% of participants ate fast food frequently (4−7 times weekly). 21.9%, 25%, and 15% of participants with normal, overweight and obese nutritional status confirmed that they consume fast food once a week which was approximately two times higher compared to fast food consumption twice a week within these nutritional status groups (Fig. 2).

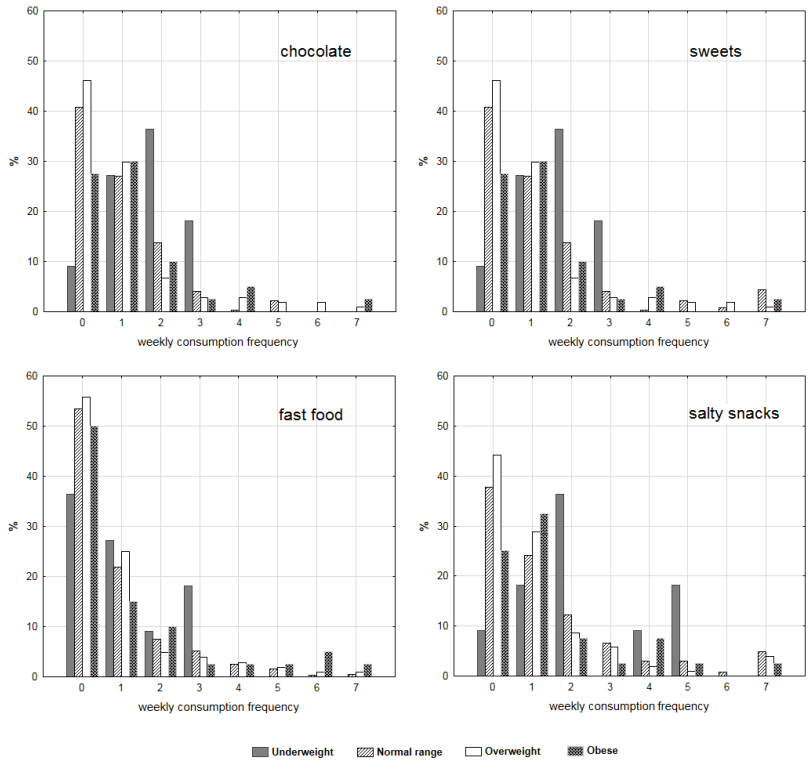

Fig. 2. Weekly consumption frequency of targeted products in the studied population according to the BMI-for-age

The observed fast food consumption frequency within participants with underweight nutritional status was one, two or three times per week with the highest percentage (27.3%) for fast food eaten once a week. Furthermore, the habit of fast food consumption, in higher extent, six or seven times per week was observed within participants with obese nutritional status (5 and 2.5%, respectively), while large differences in fast food consumption for four or five times per week were not observed within participants with normal, overweight and obese nutritional statuses (Fig. 2). Participants with obese nutritional status consume fast food more often that other participants in the sample, however, the chi-square test has showed no statistically significant dependence between BMI and fast food consumption ($\chi^2 = 22.13$, df = 21, p = 0.375).

As regard to salty snacks consumption, comparing participants with normal range and overweight nutritional status, large differences were not observed since 37% stated that they do not consume salty snacks at all (Fig. 2). Furthermore, similarly to fast food, a higher percentage of participants with obese nutritional status (25%) stated that they do not eat salty snacks when compared to participants with underweight nutritional status (9.1%). Nevertheless, the habit of salty snacks consumption once per week was the most notable among participants with obese nutritional status (32.5%) followed by participants with overweight, normal range and underweight nutritional status (Fig. 2). The snacks consumption frequency two, four or five times per week was higher among participants with underweight nutritional status (36.4, 9.1, and 18.2%, respectively) compared to other nutritional status groups (Fig. 2). However, the habit of salty snacks consumption every day in a week was observed within participants with normal range as well as overweight and obese nutritional status (2.5−4.8%) (Fig. 2). Nevertheless, statistical significance between BMI and salty snack consumption was not observed (Table 3).

Conclusions

The presented study relates adopted habits and consumption frequency in terms of chocolate, salty snacks, and fruit intake with the body mass index. As regards to habits related to food and products consumption between meals, surveyed participants' preference was directed towards fruits especially in overweight and normal range nutritional status groups. The highest share of sweets consumption including chocolate was observed within obese nutritional status group as well as tendency in snack exclusion from daily meals. Besides the fact that statistical analysis showed a statistically significant relationship between BMI and chocolate consumption the strength of the corresponding relationship was week according to the contingency coefficient. Although the most of participants fall within normal range nutritional status, increasing number of overweight and obese participants in elementary school imply that further education of young population should be conducted in order to adopt and practice balanced diet.

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