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ASSESSING INTAKE OF WATER AND SUGAR-SWEETENED BEVERAGES IN ADOLESCENTS: ITS RELATIONSHIP WITH WEIGHT STATUS

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Abstract

Background and aims. *The aim of the study is to evaluate fluid intake during adolescence and correlate it with weight status.* ***Material and methods***. *We assessed fluid intake using a validated questionnaire in a group of 106 adolescent students (22 boys - 20.8%), aged 15-19 years. Weight status was evaluated with the BMI-for-age values,using growth normograms.* ***Results***. *There were no statistically significant differences in the frequency of water intake between sexes (p>0.05). Water intake at least 3 times a day was declared by 72.16% of normal weight students and in 66% of overweight and obese, the difference being statistically significant (p=0.003). Boys consumed larger amounts of water (p=0.042) than girls. Intake of 100% natural fruit juice was significantly higher in boys compared to girls (p=0.002). A significantly higher percentage of normal weight adolescents consumed≤500 mL/day non-carbonated (p=0.004) and carbonated (p<0.001) sugar-sweetened beverages compared to the overweight or obese, who consumed ≥500 mL/day.* ***Conclusions***. *The quantitative and qualitative assessment of fluid intake among adolescents is a mandatory step in the assessment of calorie and nutritional intake. Promoting low-calorie fluid intake in this age group, along with the principles of healthy eating, could contribute to achieving an optimal weight status.*

key words: *adolescent, sugar-sweetened beverages, weight status, healthy diet.*

Background and aims

Assessing fluid intake among teenagers has become a concern of the medical world in the current context of the obesity epidemic. The growing prevalence of weight excess worldwide has been accompanied by a parallel increase in the consumption of sugar-sweetened beverages (SSB). Recent studies have shown the contribution of high-calorie beverage intake to the developmentof excess weight [1,2], even in children and adolescents [3,4], together with a high-calorie diet and physical inactivity [5,6]. SSB are considered an important calorie source, with fast absorption rate, which do not promote satiety; this leads to a calorie surplus which

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disturbs the body`s energy balance and increases the risk of obesity. Furthermore, the amount of salt in diet is a determining factor for daily fluid intake, and published studies have already shown that high-sodium diets predict the intake of SSB [7]. Therefore, the modern environment is prone to the development and progression of weight excess among children and adolescents, with increased cardio-metabolic risk in adult life [8]. Overweight and obesity are associated with an increased risk of atherosclerotic cardiovascular diseases, dyslipidemia, hypertension, hyperuricemia, dysglycemia,with all their consequences [9]. It becomes obvious that there is a need for the assessment of fluid intake in adolescents, both quantitatively and qualitatively, and for the promotion of fluid intake according to the principles of healthy eating. Hence, the aim of our study was to assess fluid intake in a group of adolescents and evaluate differences in intake between sexes and in relation to weight status.

Materials and methods

This was a descriptive study which included students from a high school in Iaşi, 9th to 12th grade (one class for each study year), in June and July 2014. For each participant we filled out an individual sheet that included age, sex and the anthropometric parameters. We also applied a validated questionnaire which assessed the intake of water and other beverages by frequency and quantity [10]. The questionnaire was translated and adapted to focus particularly on water, fruit juice and SSB intake. We used weight and height as anthropometric parameters, measured under standard conditions: in the morning, in light clothing, with calibrated equipment. We determined weight status on the basis of the calculated body mass index (BMI) and the growth nomograms according to gender.

Statistical analysis. All variables were introduced in an Excel® database (Microsoft Office 2013). The statistical analysis of the data was performed using the SPSS® (Statistical Package for the Social Science) version 13.0 software for Windows. Quantitative variables were analysed using ANOVA and t-test and qualitative variables with the chi-square test. A p-value<0.05 was considered to be statistically significant.

Results

We studied a group of 106 adolescents, 22 boys (20.8%) and 84 girls (79.2%). The distribution of students according to age is given in Figure 1. Group analysis in terms of growth curve according to the BMI-for-age values using growth charts showed that most of the adolescents (91.5%) had a normal weight (Figure 2).

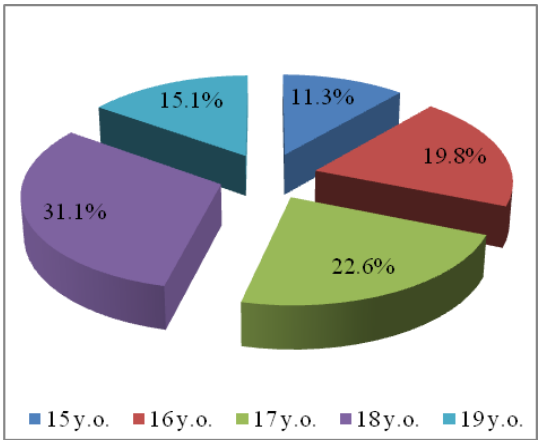

Figure 1. *Group structure according to age.*

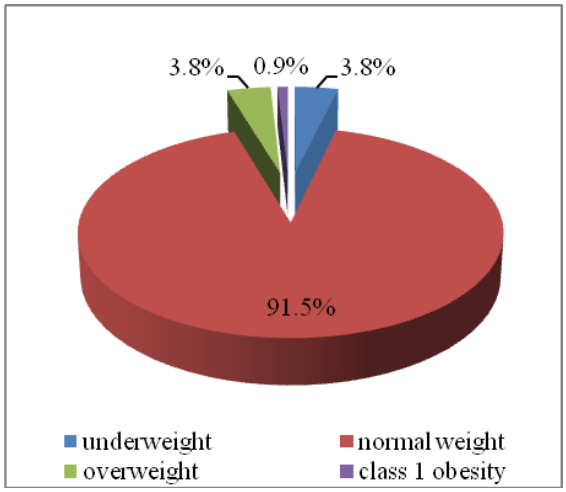

Figure 2. *Group structure according to weight.*

With regard to water consumption, the majority of students (75 students, 70.75%) declared intake of 3 or more times a day, the remaining 31 students (29.25%) admitting to a less frequent water intake.

We observed no statistically significant differences in the frequency of water intake in the studied group between sexes (p>0.05). There were statistically significant differences in the quantity of water consumed by girls compared to boys, who declared a larger intake of water (p=0.042) as detailed in Table 1.

The results showed statistically significant differences in terms of weight status (normal weight compared to overweight and obese) and frequency of water consumption (p=0.003). We found that 72.16% of normal weight students declared water intake at least 3 times a day, whereas 66% of overweight and obese consumed water at least 3 times per day, the difference being statistically significant (p=0.003).

Table 1. Water intake distribution according to gender.

Quantity of water	Girls		Boys	
	No.	%	No.	%
<150 mL/day	4	4.8	–	–
250 mL/day	20	23.8	1	4.5
500 mL/day	5	6.0	2	9.1
1000 mL/day	22	26.2	7	31.8
2000 mL/day	23	27.4	4	18.2
>2000 mL/day	10	11.9	8	36.4

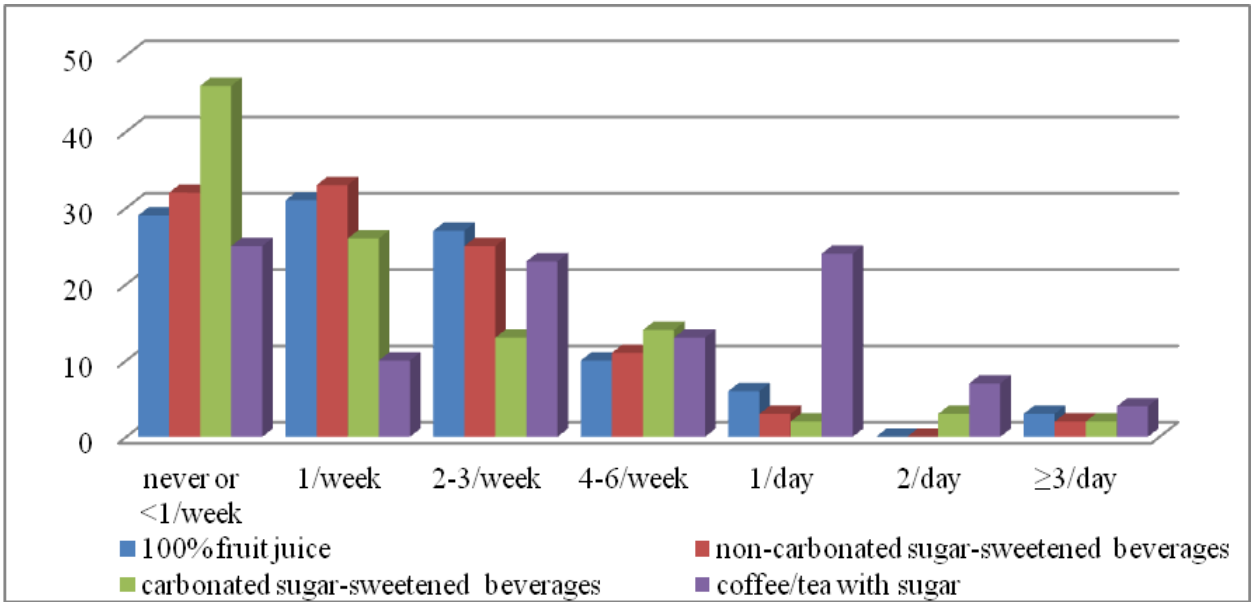

Figure 3. *Frequency of SSB intake in the studied group.*

We observed no statistically significant differences between sexes in the frequency of 100% fruit juice intake (p=0.585), non-carbonated SSB (p=0.373), and coffee/tea with sugar (p=0.643). We found statistically significant differences between girls and boys in the frequency of carbonated SSB intake (p=0.023), meaning that 72.6% of girls and 50% of boys declared intake of less than once per week. Figure 3 describes the frequency of SSB intake for the entire group.

The quantities of SSB consumed by the students included in the study are presented in Table 2. We observed that the majority of students (61 students, 57.54%) declared an intake of 250 mL/day of 100% fruit juice. Regarding non-carbonated SSB, 41 students (38.67%) declared an intake of 250 mL/day and for carbonated SSB, 37 students (34.9%) declared an intake <150 mL/day. The intake of coffee/tea with sugar was 250 mL/day for 51 students (48.11%), detailed in Table 2.

Table 2. The quantities of SSB consumed by the students included in the study.

Type of beverage (no./%)	<150 mL/day	250 mL/day	500 mL/day	1000 mL/day	2000 mL/day	>2000 mL/day
100% fruit juice	22 20.75%	61 57.54%	17 16.03%	6 5.66%	-	-
non-carbonated SSB	28 26.41%	41 38.67%	26 24.52%	6 5.66%	4 3.77%	1 0.94%
carbonated SSB	37 34.90%	29 27.35%	29 27.35%	7 6.60%	2 1.88%	2 1.88%
coffee / tea with sugar	32 30.18%	51 48.11%	19 17.92%	1 0.94%	2 1.88%	1 0.94%

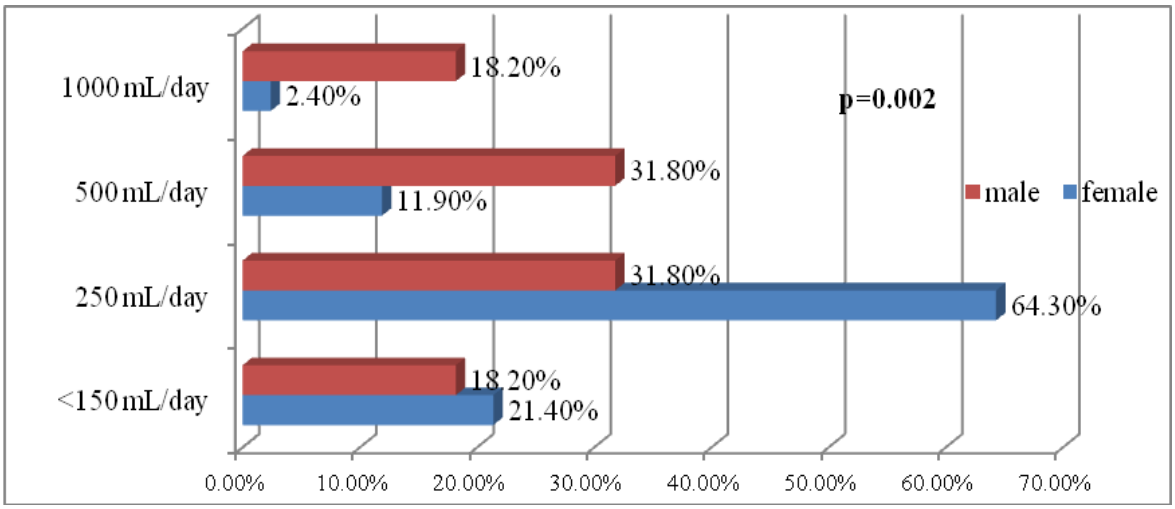

Figure 4. *Intake of 100% fruit juice.*

Table 3. Quantities of 100% fruit juice consumed by students in the study group.

	Underweight	Normal weight	Overweight	Obese
<150 mL/day	1 (25%)	21 (21.6%)	-	-
250 mL/day	3 (75%)	55 (56.7%)	3 (75%)	-
500 mL/day	-	16 (16.5%)	1 (25%)	-
1000 mL/day	-	5 (5.2%)	-	1 (100%)

Among normal weight students, 91.7% declared ≤500 mL/day non-carbonated SSB intake compared to 50% of overweight (p=0.004). Regarding consumption of carbonated SSB, 92.8% of normal weight students declared ≤500 mL/day compared to 25% of the overweight (p<0.001).

There were no statistically significant differences in the frequency of 100% fruit juice intake analysed by gender (p=0.585) or according to weight status (p=0.865). There were statistically significant differences between the quantities consumed according to gender: the majority of girls (54 students, 64.3%) consumed 250 mL/day and the majority of boys, 250 mL/day (7 students, 31.8%) and 500 mL/day (7 students, 31.8%) as shown in Figure 4.

We noted that the underweight students had a maximum intake of 250 mL/day 100% fruit juice, while the obese students declared an intake of 1000 mL/day. Most normal weight students (56.7%) declared an intake of 250 mL/day100%

fruit juice, and the overweight of ≥250 mL/day as shown in Table 3. The difference in quantities according to weight status was statistically significant, with overweight and obese students declaring a higher intake of fruit juice compared to normal weight students (p=0.022).

Discussions

SSB contribute significantly to the total calorie intake, especially during adolescence, a nutritionally vulnerable period due to the accelerated growth rate, the more or less healthy nutritional temptations associated with reduced physical activity. In the analysed high school group, 9th to 12th grade, aged 15-19, we found no statistically significant differences in the rate of water consumption for the two sexes (p>0.05), but there were significant differences in water consumption between students according to their weight status. A percentage of 72.16% of normal weight students declared a water intake of at least 3 times a day, while a much smaller percentage of overweight and obese (66%) declared the similar intake and the differences were statistically significant (p=0.003). Boys consumed a larger amount of water (p=0.042) compared to girls. A significantly higher proportion of boys consumed ≥500 mL/day 100% natural fruit juice than girls, of whom a higher proportion consumed 250 mL/day (p=0.002). A significantly higher percentage of normal weight adolescents consumed ≤500 mL/day non-carbonated (p=0.004) and carbonated (p<0.001) SSB compared with those who were overweight and obese, most of whom consumed ≥500 mL/day.

Studies show that the contribution of sugary drinks to the calorie intake of children and adolescents has increased steadily in recent years. A study published in 2008 showed that 10-15% of the daily calorie intake of these age groups came from the sugary drinks consumed at all ages, both at home and at school [11].

Our results complement the existing data in the literature on fluid intake in adolescents. Thus, a study that included 4283 Australian children aged 2 to 16 years, reported that 62% of them had an intake of sugary drinks; older children and those with low socioeconomic status were more prone to consuming these beverages. Moreover, salt intake was positively associated with the intake of sugary drinks. Those who drank more than one serving of such beverages were 26% more likely to be obese or overweight [12].

A study published in 2012 analysed in 11.209 high school students the relation between intake of SSB and demographic characteristics, weight status, availability of vending machines in schools and behaviour factors. The majority (64.9%) of these students, regardless of ethnic background, drank these beverages at least once a day, whereas 22% consumed these drinks ≥3 times/day. The risk of being in this last category was increased for boys, those who ate fast-food meals more than once per week and those who watched TV more than 2 hours/day [13].

Another survey conducted in Texas in 2010, which included students in the 4th, 8th and 11th grade, analysed the intake pattern of five types of beverages (milk, 100% natural fruit juice, fruity drinks, sweetened carbonated soft drinks, diet carbonated soft drinks). It showed that a very high percentage of students in public schools consumed high-calorie beverages with low nutritional density [14]. The reasons for such behaviour could be an increase in consumer access to less healthy beverages, an increase in their availability through participation in various social events as children grow older (e.g., eating out, sporting events, etc.) and increased availability of financial resources.

Given that children's risk of becoming obese increases 1.6 times if they drink 350 mL of SSB daily [15], interventions that promote the

consumption of water or low-calorie beverages could significantly decrease this risk. However, for children and adolescents, we should not focus on only one component of eating behaviour. Health promotion policies should address all aspects of a healthy lifestyle, from promoting healthy nutrition, to insuring an adequate hydration with a limited intake of sugary drinks and promoting physical activity. According to the nutrition guide for children and adolescents, calorie-dense foods and high-calorie beverages with a minimal nutritional content should be consumed occasionally and in small amounts, in the context of a healthy balanced diet [16].

One limitation of this study is the distribution of subjects according to weight status, with a net majority of normal weight and a very low number of overweight and obese students. This distribution created difficulties in interpreting the results of the statistical analysis. It would be useful to follow these subjects in time, in order to evalute a possible correlation between SSB intake (quantities and frequency) and weight gain.

Conclusions

Our results support literature data claiming that teenagers consume SSB more often and in larger quantities than recommended. In our study, children with excess weight had a less frequent intake of water and consumed larger amounts of SSB than the normal weight students. The quantitative and qualitative assessment of fluid intake among adolescents is a mandatory step in the assessment of caloric and nutritional intake. Further studies are required to show that promoting low-calorie fluid intake in this age group, along with the principles of healthy eating, could contribute to achieving an optimal weight status.

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