Table 4: Beverage consumption by gender and weight status (n=607).

	Gender		**Weight status**		
Fluid (ml/d)	Boys n=324	Girls n=283	N n=402	OW n=152	OB n=53
Water	885.2±13	798±11	891±5	853±9	801±12
100% fruit juice	152 ± 25	148 ± 22	139 ± 10	148 ± 11	156 ± 16
SSBs	440 ± 37	410 ± 31	380 ± 10	420 ± 13	**435 ± 12***
Whole milk	207 ± 16	221 ± 18	200 ± 7	208 ± 8	212 ± 16
2% milk	199 ± 12	201 ± 24	201 ± 8	199 ± 5	201 ± 11
1% milk	122 ± 21	144 ± 15	128 ± 11	133 ± 7	139 ± 12
Skim milk	178 ± 20	176 ± 12	175 ± 3	180 ± 2	182 ± 4
Chocolate milk	238 ± 14	206 ± 12	208 ± 9	212 ± 11	221 ± 12
Energy (kcal)					
Water	0	0	0	0	0
100% fruit juice	295 ± 26	279 ± 21	270 ± 10	277 ± 11	298 ± 13
SSBs	859 ± 41	862 ± 49	920 ± 21	967 ± 20	**1,060 ± 18***
Whole milk	170 ± 17	179 ± 15	172 ± 9	174 ± 12	177 ± 11
2% milk	152 ± 14	144 ± 17	144 ± 3	148 ± 6	153 ± 3
1% milk	120 ± 12	122 ± 11	111 ± 9	117 ± 8	121 ± 6
Skim milk	192 ± 18	190 ± 18	89 ± 4	91 ± 6	92 ± 4
Chocolate milk	212 ± 18	221 ± 16	209 ± 13	214 ± 12	220 ± 11

Data presented as mean ± standard error. Statistically significant difference (p<0.05).

*Statistically significant differences between normal and overweight and normal and obese group after.

N: normal, OW: overweight, OB: obese, SSBs: sugar sweetened beverages. One-way ANOVA was used for assessing statistically significant differences in beverage intake between the different categories.

Table 5: Odd ratios for effect of SSBs intake on overweight and obesity.

Overweight and obesity (n=205)		
	OR (95% CI)	p
Model 1	3.18 (1.51, 4.19)	0.001
Model 2	2.95 (1.23, 3.60)	0.008
Model 3	2.57 (1.06, 3.38)	0.029

Statistical significant difference (p<0.05).
Model 1: unadjusted effects,
Model 2: adjusted for age, gender and income
Model 3: adjusted for age, gender, income, energy intake and physical activity,
OR=odds ratio, CI=confidence interval,
Multivariate logistic regression analysis was used for estimating the above Odds Ratios.

results apparently indicated that only 4.7% and 3.7% of children consumed 1% or skimmed milk, respectively.

Our data also reported that children consumed a mean amount of about 150 of 100% fruit juice per day, which is within the AAP recommendations of 100-180ml/day[12]. The amount of SSBs consumed by children in our study was higher compared to 100% fruit juices. In addition, obese children were found to consume significantly more SSBs compared to normal pears. This is a concern because these drinks have extra empty calories, and have no nutritional benefit compared with 100% fruit juices[17].

In our study, SSBs were the second most commonly consumed beverages. Recent data from European countries[18] showed that SSB intake were the largest contributors of total beverage energy intake. This data is also supported by Wang et al[16] who reported increased caloric contribution to weight in children who consumed sugar beverages and sodas. In addition, recently published reviews have linked the intake of sugar beverages with the intake to excess weight gain[8,19,20], although inconclusive evidence[21] also exists. In our study the increased energy intake was found to be associated with the quantity of fruit drinks and soda consumed by children. Moreover, this increased energy intake was also related with an elevated BMI.

High intake of SSB would also influence the association between the genetic predisposition and adiposity. In a very recent study by Qi et al[22], the authors analyzed the interaction between genetic predisposition and the intake of SSB in relation to body-mass index in three prospective cohorts of American men and women. It was found that the combined genetic effects on BMI and obesity risk among persons consuming one or more servings of SSB per day were approximately twice as large as those among persons consuming less than one serving per month. These data suggest that persons with greater consumption of sugar-sweetened beverages may be more susceptible to genetic effects on adiposity.

The prevalence of overweight and obesity in our study was 25% and 9%, respectively. The results are comparable with a recent Greek study by Antonogeorgos et al[23] where OW and OB levels of 27.6% and 9% were found, respectively. Similarly, in another nationwide study by Farajian et al[24] the authors examined 2,315 primary school children and found overweight rates of 29.5% for boys and girls and obesity rates of 13.1% and 9%, respectively.

In addition, a study by Manios et al[25] in 2,374 children found OW rates of 16.2% and OB rates of 17.5%. This difference compared to the present results is possibly due to the larger number of participants (2,374 vs. 607) and/or different method used to assess overweight and obesity values.

Limitations of our study include the 24-hour dietary recall used to assess the dietary patterns, as well as that this analysis was performed in a small sample of Thessaloniki. Thus, it was not a national representative sample. Moreover, we did not take into account factors such as breastfeeding and hours of watching TV or working on the computer. Finally, we did not include the genetic predisposition that could provide us with important information for the needs of our study.

Conclusions:

Children consuming sugar beverage drinks were 2.57 times more likely to become obese compared to normal peers. SSBs but not 100% fruit juices and milk are associated with obesity. Awareness of these trends among pediatricians will be critical in assisting children and parents to identify concrete targets of suboptimal dietary patterns that may contribute to excess caloric intake and obesity. Further studies investigating the relationship among beverage consumption, total energy intake, and development of overweight are needed.

Conflicts of interest

None declared.

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