

## Short Communication

# Beverage consumption among Korean adolescents: data from 2016 Korea Youth Risk Behavior Survey

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**BACKGROUND/OBJECTIVES:** Association between the consumption of sugar-sweetened beverages (SSBs) and obesity is universally a controversial issue. This study was undertaken to examine the beverage consumption pattern of Korean adolescents.

**SUBJECTS/METHODS:** Data was collected from the 2016 Korea Youth Risk Behavior Survey involving 65,528 adolescent respondents. A list of the most frequently consumed beverages was analyzed, and the consumption frequency of carbonated beverages, SSBs, and energy drinks during the past seven-days was assessed. The main reasons for the adolescents to consume the beverages were also determined.

**RESULTS:** The beverage preference of adolescents were carbonated beverages (31.0%), 'fruit and vegetable beverages (17.7%)', 'milk (13.6%)', and 'coffee (12.7%)'. Carbonated beverages and SSBs were consumed more than three times a week by 27.1% and 41.1% of the respondents, respectively. About 86.2% of adolescents did not take of any energy drinks during the last seven-days. Taste was the most common reason that adolescents considered when choosing a drink. Carbonated beverages consumed more frequently by boys than girls, and high school students drank coffee more frequently than middle school students.

**CONCLUSIONS:** Boys had a higher preference for unhealthy beverages than girls, whereas consumption of high-caffeine drinks was greater amongst high-school students than middle school students.

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**Keywords:** Adolescent, carbonated beverage, sugar-sweetened beverage, energy drink, Korea

## INTRODUCTION

The constant increase in obesity has emerged as a major health issue globally. Weight gain in children and adolescents is an increasing concern that requires to be addressed without delay, since it could lead to serious health outcomes in adulthood. According to the Korea Health Statistics 2016, the percentage of obese adolescent boys and girls has increased considerably, from 17.0% and 10.2%, respectively, in 2005 to 19.1% and 14.3%, respectively, in 2016 [1]. Similar trends have been observed in data collected by self-reported weight and height among Korean adolescents in the results of 2017 Korea Youth Risk Behavior Survey (KYRBS) [2].

Sugar-sweetened beverages (SSBs) are associated with weight gain owing to their high added sugar content, low satiety, and the potential of incomplete compensation for calories at meals, leading to increased energy intake [3-4]. Numerous studies worldwide have evaluated the association between SSBs intake and weight gain. To date, several studies in western countries like the US, UK, and Australia have reported beverage consumption statistics based on national surveys [5-7]. Although literature on SSBs consumption and weight gain among Korean adolescents is emerging recently, the results are inconsistent

[8-9]. Furthermore, there are no nationally representative estimates of beverage intake among Korean adolescents that account for their beverage consumption pattern.

The objective of this study therefore was to examine beverage consumption based on gender and school level, using the latest national representative survey, the 2016 KYRBS.

## SUBJECTS AND METHODS

### *Subjects and Study design*

The present study was based on data collected from the 2016 KYRBS. Since 2005, the KYRBS is an ongoing survey with a stratified, clustered, multistage probability sampling design to monitor health-risk behaviors among middle and high school students, conducted by the Centers for Disease Control and Prevention (CDC) in South Korea [7]. A total of 67,983 students from 400 middle schools and 400 high schools were included in the survey. Of these, data of 65,528 students from 800 schools were used for the final analysis (response rate, 96.4%) [8]. The present study was approved by the institutional review board of the Center for Disease Control and Prevention (No.2018-07-04-PE-A).

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**Measurements**

All students completed anonymous self-administered web-based questionnaires during a single class period [10]. The total questionnaire of KYRBS initially included 92 items in 11 domains in 2005, and expanded to 117 items in 15 domains in 2016. The domain on dietary behavior is composed of 12 questions which include skipping breakfast and the frequency of consuming fruits, vegetables, carbonated beverages, and fast food [2]. Since the number of beverages consumed by adolescents has increased in recent times, items such as frequency of consuming SSBs and energy drinks have been added to the questionnaire in 2014. Furthermore, two items, 'frequently consumed beverages' and 'the reasons to drink', were included in 2016 to identify the current status of beverage intake.

An open-ended questionnaire was used to identify frequently consumed beverages during the last seven-days. Responses were categorized into eleven categories based on the Korean food standards codex and CDC's National Youth Physical Activity and Nutrition Study (NYPANS): carbonated beverage, fruit and vegetable beverage, milk, coffee, sports drink, tea, fermented beverage, water, energy drink, soy milk, and others [5]. Respondents who did not drink any beverage during the last seven-days were excluded from the analysis.

Respondents were also asked the daily frequency of consumption during the seven-day period before the survey for the following three beverages: carbonated beverages, sugar-sweetened beverages (SSBs), and energy drinks. SSBs were defined as all types of beverages with added sugars, including fruit and vegetable drinks, sports drinks, sweetened tea, and coffee, but excluding carbonated beverages and energy drinks. The frequency range of the beverages was classified into seven categories: 'none in the past week', 'one or two times a week', 'three or four times a week', 'five or six times a week', 'once a day', 'twice a day', and 'more than three times a day'. The results are presented as the distribution of seven categories and the percentages of adolescents who consume beverages more than three times a week.

Considering the reasons why adolescents choose a drink, respondents were asked to select from one among the eight

reasons indicated for the questions "What is the main reason for drinking beverage?" The responses were: 'Tasty', 'Thirsty', 'Being at home', 'No special reason', 'Instead of meal or snack', 'Healthy', 'With friends', and 'Others'.

**Statistical analysis**

Since a complex survey design was applied to the KYRBS data, we applied the PROC SURVEY procedure of SAS (version 9.4, SAS Institute Inc., Cary, NC, USA) which includes weight, stratification variables, and cluster variables, to achieve representative results. All analyses were examined using frequency analysis and expressed as percentage±SE (weighted %), after which chi-square ( $\chi^2$ -test) was used to determine significance. A *P*-value < 0.05 was considered statistically significant.

**RESULTS**

*General characteristics of subjects*

The general characteristics of the study subjects are presented in Table 1. Our final analysis included 65,528 total responders, including 33,803 (51.6%) boys and 31,725 (48.4%) girls. Considering the school level, 32,219 (49.2%) were middle school students and 33,309 (50.8%) were high school students, with

**Table 1.** School grade distribution according to gender in the 2016 Korea Youth Risk Behavior Survey

	Total (n = 65,528)	Male (n = 33,803)	Female (n = 31,725)
	n (%)	n (%)	n (%)
Grade			
7 <sup>th</sup>	10,483 (16.0)	5,516 (16.3)	4,967 (15.7)
8 <sup>th</sup>	10,517 (16.1)	5,466 (16.2)	5,051 (15.9)
9 <sup>th</sup>	11,219 (17.1)	5,760 (17.0)	5,459 (17.2)
10 <sup>th</sup>	11,355 (17.3)	5,861 (17.3)	5,494 (17.3)
11 <sup>th</sup>	11,070 (16.9)	5,744 (17.0)	5,326 (16.8)
12 <sup>th</sup>	10,884 (16.6)	5,456 (16.1)	5,428 (17.1)
School level			
Middle	32,219 (49.2)	16,742 (49.5)	15,477 (48.8)
High	33,309 (50.8)	17,061 (50.5)	16,248 (51.2)

**Table 2.** Frequently consumed beverages by adolescents who drink the beverages more than once a week in the 2016 Korea Youth Risk Behavior Survey

	Total (n = 52,508)	Gender		<i>P</i> -value <sup>1)</sup>	School level		<i>P</i> -value
		Male (n = 27,183)	Female (n = 25,325)		Middle (n = 25,645)	High (n = 26,863)	
		% (SE)	% (SE)		% (SE)	% (SE)	
Carbonated beverages	31.0 (0.4)	36.4 (0.4)	25.1 (0.4)	< 0.0001	34.5 (0.4)	28.2 (0.5)	< 0.0001
Fruit and vegetable beverages	17.7 (0.2)	14.8 (0.2)	21.0 (0.3)	< 0.0001	18.1 (0.3)	17.4 (0.3)	0.1150
Milk	13.6 (0.2)	11.5 (0.2)	15.9 (0.3)	< 0.0001	14.3 (0.3)	13.0 (0.3)	0.0013
Coffee	12.7 (0.2)	12.0 (0.3)	13.5 (0.4)	0.0027	7.8 (0.2)	16.8 (0.3)	< 0.0001
Sports drinks	7.6 (0.2)	9.9 (0.2)	5.0 (0.2)	< 0.0001	8.1 (0.3)	7.2 (0.2)	0.0065
Water	3.6 (0.1)	2.8 (0.1)	4.4 (0.1)	0.0002	4.0 (0.1)	3.3 (0.1)	0.0010
Tea	3.6 (0.1)	2.3 (0.1)	4.2 (0.1)	< 0.0001	3.3 (0.1)	3.8 (0.1)	0.0175
Fermented beverages	3.2 (0.1)	3.3 (0.1)	4.0 (0.1)	< 0.0001	3.5 (0.1)	3.1 (0.1)	0.0255
Energy drinks	1.0 (0.1)	1.4 (0.1)	0.6 (0.1)	< 0.0001	0.9 (0.1)	1.1 (0.1)	0.0456
Soy milk	0.8 (0.0)	0.6 (0.0)	1.0 (0.1)	< 0.0001	0.7 (0.1)	0.9 (0.1)	0.0032
Others	5.1 (0.1)	4.9 (0.2)	5.3 (0.1)	0.1591	4.8 (0.1)	5.3 (0.2)	0.0418

<sup>1)</sup> *P*-values were calculated using chi-square test

a similar distribution between boys and girls.

#### Frequently consumed beverages

Table 2 shows the beverages frequently consumed by adolescents. During the seven-day period before survey, the beverages consumed in order of frequency were 'carbonated beverages (31.0%)', 'fruit and vegetable beverages (17.7%)', 'milk (13.6%)', 'coffee (12.7%)', 'sports drinks (7.6%)', 'water (3.6%)', 'tea (3.6%)', 'fermented beverages (3.2%)', 'energy drinks (1.0%)', 'soy milk (0.8%)', and 'other beverages (5.1%)'. Boys drank carbonated beverages, sports drinks and energy drinks more frequently than girls, but girls consumed other beverages such as fruit and vegetable beverages, milk, and coffee more often than boys. The frequency of coffee consumption was twice as high in high school students as compared to middle school students, whereas carbonated beverages were more frequently consumed by middle school students than high school students. Fruit and vegetable beverage consumptions were statistically similar at the school level.

#### Frequency of beverage consumption

Analysis of beverage consumption revealed that about half the Korean adolescents consumed carbonated beverages one or two times a week (48.7%), and 27.1% consumed more than three times a week (Table 3). The frequency of drinking carbonated beverages more than three times a week was about

10% higher amongst boys than girls (32.5% and 21.2%, respectively), and the proportion was higher in the middle school as compared to high school (Fig. 1).

Considering the type and frequency, the most common response was consuming SSBs one or two times a week (43.2%). The percentage of adolescents who drank SSBs more than three times a week was 41.1%, with number of boys being slightly higher than girls (42.8% and 39.8%, respectively). Furthermore, high school students (42.9%) consumed SSBs more often than middle school students (39.6%).

No energy drinks were consumed by most adolescents (86.2%) during the seven-days before the survey period. Energy drinks were consumed more than three times a week by 3.9% of adolescents, with boys (4.3%) being little more frequent than girls (3.5%), and high school students (4.5%) having slightly higher proportion than middle school students (3.3%).

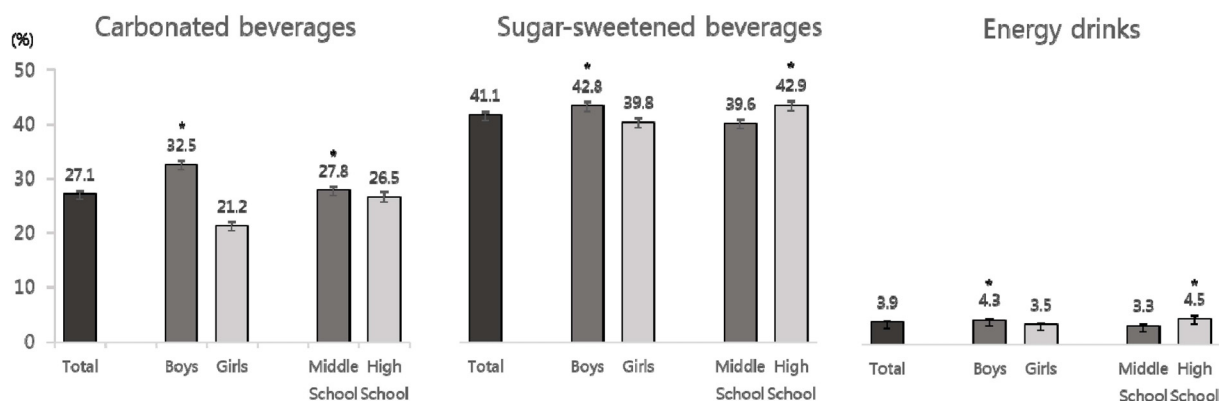
#### Reasons to drink beverages

The main indications for drinking beverages were 'tasty (42.4%)', 'thirsty (24.3%)', 'being at home (10.6%)', 'no special reason (8.0%)', 'instead of meal or snack (4.1%)', 'healthy (2.1%)', and 'with friends (0.4%)' (Table 4). For both boys and girls, the main reason for drinking beverage was 'tasty', which accounted for more than 40% for both genders. Boys tended to drink beverages because of 'thirsty (29.0%)', whereas girls were likely to drink beverages because of 'being at home (12.0%)', 'no

**Table 3.** Frequency of beverage consumption by adolescents during last seven-days in the 2016 Korea Youth Risk Behavior Survey

	Total (n = 65,528)	Gender		P-value <sup>1)</sup>	School level		P-value
		Male (n = 33,803)	Female (n = 31,725)		Middle (n = 32,219)	High (n = 33,309)	
	% (SE)	% (SE)	% (SE)		% (SE)	% (SE)	
<b>Carbonated beverages</b>							
None	24.2 (0.3)	19.2 (0.3)	29.6 (0.4)	<.0001	24.6 (0.3)	23.9 (0.4)	0.2485
1-2 times a week	48.7 (0.2)	48.3 (0.3)	49.2 (0.3)	0.0285	47.7 (0.3)	49.6 (0.3)	<.0001
3-4 times a week	18.9 (0.2)	22.3 (0.3)	15.1 (0.2)	<.0001	19.1 (0.3)	18.6 (0.3)	0.2672
5-6 times a week	4.3 (0.1)	5.4 (0.1)	3.2 (0.1)	<.0001	4.5 (0.1)	4.2 (0.1)	0.0589
Once a day	2.0 (0.1)	2.6 (0.1)	1.5 (0.1)	<.0001	2.2 (0.1)	1.9 (0.1)	0.0575
Twice a day	0.9 (0.0)	1.1 (0.1)	0.7 (0.0)	<.0001	1.0 (0.1)	0.8 (0.1)	0.0206
More than three times a day	0.9 (0.0)	1.2 (0.1)	0.7 (0.0)	<.0001	0.9 (0.1)	0.9 (0.1)	0.9745
<b>Sugar-sweetened beverages</b>							
None	15.4 (0.2)	15.3 (0.2)	15.5 (0.2)	0.6323	16.6 (0.2)	14.4 (0.3)	<.0001
1-2 times a week	43.2 (0.2)	41.8 (0.3)	44.7 (0.3)	<.0001	43.8 (0.3)	42.7 (0.3)	0.0182
3-4 times a week	26.4 (0.2)	27.2 (0.3)	25.7 (0.3)	<.0001	25.1 (0.3)	27.6 (0.3)	<.0001
5-6 times a week	8.0 (0.1)	8.4 (0.2)	7.5 (0.2)	<.0001	7.9 (0.2)	8.0 (0.2)	0.7843
Once a day	4.3 (0.1)	4.4 (0.1)	4.1 (0.1)	0.2089	3.9 (0.1)	4.6 (0.1)	0.0002
Twice a day	1.5 (0.0)	1.6 (0.1)	1.5 (0.1)	0.4318	1.5 (0.1)	1.6 (0.1)	0.3353
More than three times a day	1.2 (0.0)	1.3 (0.1)	1.1 (0.1)	0.0246	1.2 (0.1)	1.2 (0.1)	0.8314
<b>Energy drinks</b>							
None	86.2 (0.2)	85.0 (0.2)	87.6 (0.2)	<.0001	87.0 (0.2)	85.6 (0.2)	<.0001
1-2 times a week	9.9 (0.1)	10.7 (0.2)	8.9 (0.2)	<.0001	9.8 (0.2)	10.0 (0.2)	0.4610
3-4 times a week	2.2 (0.1)	2.4 (0.1)	2.0 (0.1)	0.0014	1.9 (0.1)	2.5 (0.1)	<.0001
5-6 times a week	0.8 (0.0)	0.9 (0.1)	0.6 (0.0)	<.0001	0.6 (0.0)	0.9 (0.1)	0.0008
Once a day	0.5 (0.0)	0.5 (0.0)	0.5 (0.0)	0.5469	0.4 (0.0)	0.6 (0.0)	0.0003
Twice a day	0.2 (0.0)	0.2 (0.0)	0.2 (0.0)	0.0234	0.2 (0.0)	0.2 (0.0)	0.0693
More than three times a day	0.2 (0.0)	0.3 (0.0)	0.1 (0.0)	<.0001	0.2 (0.0)	0.2 (0.0)	0.3946

<sup>1)</sup> P-values were calculated using chi-square test



**Fig. 1.** Percentage of adolescents consuming beverages more than three times a week during the last seven-days in 2016 Korea Youth Risk Behavior Survey. *P*-values were calculated using chi-square test, \* *P*-values < 0,05

**Table 4.** Reasons to drink beverages given by adolescents in the 2016 Korea Youth Risk Behavior Survey

	Total (n = 65,528)	Gender		<i>P</i> -value <sup>1)</sup>	School level		<i>P</i> -value
		Male (n = 33,803)	Female (n = 31,725)		Middle (n = 32,219)	High (n = 33,309)	
		% (SE)	% (SE)		% (SE)	% (SE)	
Tasty	42.4 (0.2)	42.3 (0.3)	42.5 (0.3)	0.6846	43.0 (0.3)	41.8 (0.3)	0.0096
Thirsty	24.3 (0.2)	29.0 (0.3)	19.1 (0.2)	< .0001	25.8 (0.3)	23.0 (0.3)	< .0001
Being at home	10.6 (0.1)	9.3 (0.2)	12.0 (0.2)	< .0001	11.5 (0.2)	9.8 (0.2)	< .0001
No special reason	8.0 (0.1)	7.0 (0.1)	9.2 (0.2)	< .0001	7.7 (0.1)	8.4 (0.2)	0.0034
Instead of meal or snack	4.1 (0.1)	2.4 (0.1)	6.0 (0.1)	< .0001	3.9 (0.1)	4.4 (0.1)	0.0109
Healthy	2.1 (0.1)	2.2 (0.1)	1.9 (0.1)	0.0346	1.9 (0.1)	2.2 (0.1)	0.0543
With friends	0.4 (0.0)	0.4 (0.0)	0.5 (0.0)	0.3549	0.3 (0.0)	0.5 (0.0)	< .0001

<sup>1)</sup> *P*-values were calculated using chi-square test

special reason (9.1%)', and 'instead of meal or snack (6.0%)'. Middle school students usually drank beverages for three reasons: 'tasty (43.0%)', 'thirsty (25.8%)' and 'being at home (11.5%)'. High school students drank beverages mainly for 'no special reason (8.4%)', 'instead of meal or snack (4.4%)', and 'with friends (0.5%)'.

**DISCUSSION**

Analyzing beverage consumption by gender and school level, carbonated beverages, fruit and vegetable beverages, milk, and coffee were found to be the preferable beverages among adolescents. While carbonated beverages, sports drinks, and energy drinks were consumed more frequently by boys than girls, fruits and vegetable beverages, milk, and coffee were consumed more frequently by girls. Carbonated beverages were often consumed by middle school students as compared to high school students, whereas coffee was the preferred beverage of high school students. In all, 27.1% carbonated drinks, 41.1% SSBs and 3.9% energy drinks were consumed by adolescents more than three times a week, the main reasons influencing the choice of the beverage type were 'taste' and 'thirst'.

These results are similar with findings from other studies. The largest two US national surveys - National Health and Nutrition Examination Survey (NHANES) and the National Youth Physical

Activity and Nutrition Study (NYPANS) - also showed high beverage consumption among US adolescents aged 12-19 years. Frequently consumed beverages by US adolescents were carbonated soft drinks, milk products, and fruit juice or drinks, which are similar to our findings [12]. Some studies in Mexico, Canada, and Europe also reported that consumption of soft drinks is highest among teenagers [13-15]. Conversely, some Asian countries such as Iran and China report a higher intake of milk than regular soft beverages [16].

Frequently consumed beverages differed by gender and school level. Our results reveal that unhealthy beverages were consumed more often by boys than by girls, and coffee was the preferred beverage amongst high school students as compared to middle school students. In other Korean researches, the consumption of three types of unhealthy beverages (carbonated beverages, SSBs, and energy drinks) were significantly higher in Korean boys than girls [8-9, 17-19]; however, studies concerning school level were inconsistent [20-21].

About 40% of male middle school students preferred and frequently consumed carbonated beverages. For Korean adolescents, carbonated beverage is the number one source of sugar, and consumption of SSBs is on the rise [2, 22]. Similar to Korea, carbonated beverages account for more than a half of SSBs (which are the top source of added sugar) among US children and adolescents [23-24]. Apart from behavioral factors

like low physical activity, dietary factors like excessive sugar intake are reported to be associated with adolescent obesity [25-26]. While SSBs intake is considered a major contributing factor to obesity in western studies, Korean studies showed inconsistent results associating SSBs consumption and weight status [8-9]. Hence, further research is required to examine the relationship between SSBs consumption and weight change in Korean adolescents.

The consumption of coffee by female high school students (18.0%) was twice as much as male middle school students (7.7%). Coffee intake is closely related to caffeine intake. Caffeine-containing beverages frequently consumed by adolescents include coffee, carbonated beverages, processed milk, tea, and energy drinks [19]. Therefore, it is expected that increasing beverage consumption leads to a proportional caffeine intake. Attention to caffeine overdose is important, since caffeine intake has side effects of difficulty in sleeping, feeling tired in the morning, and depression in adolescents [27-28].

Regardless of the gender, taste was the primary reason for adolescents to drink beverages [19, 21, 29], while the number of adolescents who chose 'thirsty' significantly differed by gender. This can be comparable to their physical activity. According to the result of China national cross-sectional study, SSBs intake was higher in male than in female, and was also higher in adolescents who were physically more active [30]. Moreover, our results of 2016 KYRBS revealed that boys were twice as active as girls [2], thereby leading to the assumption that boys drank beverages more often due to thirst than girls.

This study has some limitations. First, the questionnaire used in this study asks only the frequency of beverage consumption; hence, the actual amount of beverage consumed could not be estimated. Thus, future research needs to measure the amount of beverage consumption to get more comprehensive results. Second, although SSBs are usually defined as all types of beverages including sugar, consumption of SSBs and carbonated beverages were asked separately in this survey. Therefore, SSBs consumption needs to be interpreted carefully. Despite these limitations, our study has its strength, being the first study to evaluate beverage consumption by Korean adolescents using a large nationally representative sample of middle and high school students.

To conclude, our study found that carbonated beverages, fruit and vegetable beverages, milk, and coffee were the frequently consumed beverages by adolescents. Boys were more likely to consume unhealthy beverages than girls, and high school students consumed high-caffeine drinks like coffee and energy drinks more frequently than middle school students. We believe that it is important to educate male middle school students to drink healthy beverages other than carbonated beverages when they are thirsty. High school students, especially girls, also need to be advised on the side effects of beverages with high caffeine content.

## CONFLICT OF INTEREST

The authors declare no potential conflicts of interests.

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