Relation between High-intensity Physical Activity(Work) and Beverage intake Frequency among Korean

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한국인들의 고강도 신체활동(일)과 음료 섭취빈도 간의 관계

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Abstract The purpose of this study was to examine the relationship between high-intensity physical activity (work) and beverage intake frequency among Koreans. The data used in this study were obtained from the 8th Korea National Health and Nutrition Examination Survey(KNHANES) conducted in 2021. Statistical analyses, including x^2-test, and binary logistic regression, were conducted to examine group differences($p < 0.05$). It was found that 63.6% of the group consumed carbonated water once a week or less, and 68.6% consumed energy drinks once a week or less. These results indicated that carbonated water and energy drinks were more frequently consumed among individuals engaging in high-intensity physical activity(work), and that the majority of beverages were consumed once a week or less. Based on the findings of this study, it was hoped that the results can serve as a basis for the development of healthier alternative beverages to replace carbonated water and energy drinks during high-intensity physical activity(work). Additionally, it highlights the importance of exploring new approaches that promote health and the need for intervention programs aimed at improving health.

Key Words : Carbonated water, Beverages, Energy drinks, High-intensity physical activity(Work), KNHANES

요　약 본 연구의 목적은 한국인에서 고강도 신체활동(일)과 음료수 섭취 빈도와의 관계성을 알아보고자 하였다. 본 연구 대상자는 2021년 제8차 국민건강영양조사(KNHANES)의 데이터를 활용하였다. 데이터 자료 분석은 집단 간 평균 차이, x^2-test, 이분형 로지스틱 회귀분석을 실시하여 분석하였다($p < 0.05$). 탄산음료는 그룹 중 63.6%가 일주일에 한 번 이하로 섭취하였고, 에너지 드링크는 68.6%가 일주일에 한 번 이하로 섭취하였다. 이러한 결과는 고강도 신체활동(일)을 하는 그룹에서 탄산음료와 에너지 드링크가 더 자주 소비되었으며, 대부분의 음료수가 일주일에 한 번 이하로 섭취되었다는 것을 알 수 있었다. 본 연구의 결과를 토대로, 고강도 신체활동(일)을 할 때 탄산음료와 에너지 드링크를 대체할 만큼 건강에 이로운 음료의 개발을 위한 기초 자료로 활용되기를 바라며, 음료수 섭취보다는 건강에 이로운 새로운 접근 방식을 탐구하고 건강증진을 위한 중재 프로그램을 개발의 필요성을 제안하고자 한다.

키워드 : 탄산수, 음료수, 에너지 음료, 고강도 신체활동(일), KNHANES

1. INTRDUCTION

While a beneficial association between physical activity after colorectal cancer diagnosis and survival has been observed[1], it has been found that higher intake of sugar-sweetened beverages significantly increases the risk of cancer recurrence and mortality in stage III colon cancer patients[2].

According to the National Health and Nutrition Examination Survey(NHANES) in the United States, the percentage of sugar intake was 14.3 ± 0.2% among children aged 2-8, 16.2 ± 0.2% among adolescents and teens aged 9-18, and 13.1 ± 0.2% among adults aged 19 and older. This indicates that the highest sugar intake was observed among adolescents and teens[3].

The beverage preference of adolescents was carbonated beverages(31.0%). Carbonated beverages and sugar-sweetened beverageswere consumed more than three times a week by 27.1% and 41.1% of the respondents, respectively. Boys consumed these beverages more frequently than girls. Furthermore, boys had a higher preference for unhealthy beverages than girls, and high school students consumed high-caffeine drinks more frequently than middle school students[4].

Adolescents were the main consumers of energy drinks, with a prevalence rate ranging from 52% to 68%, which was higher than that in adults. The exact amounts of energy drinks ingredients vary among manufacturers. When examining the quantities, caffeine content ranges from 75 to 240 mg, and the average taurine content was 342.28 mg/100 mL. However, potential side effects from excessive consumption or contraindications were often overlooked by consumers[5]. Ingesting high-calorie energy drinks without carefully considering their energy intake as part of the total daily energy drinks intake can promote weight gain. Adolescents (aged 12 to 18) should exercise caution when considering the consumption of energy drinks, particularly in excessive amounts(e.g., 〉 400 mg), and seek paren-

tal guidance. Additionally, energy drinks consumption was not recommended for children aged 2 to 12 and individuals sensitive to caffeine[6]. People eat and drink was one of the most important determinants of health and health equity[7].

In most countries, there was a lack of information regarding recent estimates and trends of intake, as well as variations by education or urbanization[8]. Additionally, sugar-sweetened beverages have been associated with cardiometabolic diseases and social inequities[9].

After the outbreak of coronavirus disease 2019 (COVID-19), college students showed the highest increase in consumption of bubble tea, packaged fruits and vegetable juices. This, coupled with a lack of exercise, resulted in the highest rates of overweight and obesity among college students[10]. The consumption of beverages plays a crucial role in maintaining proper hydration levels, especially for physically active individuals. However, fluid requirements can vary based on several factors such as climate, age, gender, body size, sweat production, food habits, and the intensity and duration of physical activity[11,12]. While a study has been conducted on the beverage consumption of European adolescents, most published research tends to focus on the relationship between sugar-sweetened beverages and overweight individuals [13].

The Korea National Health and Nutrition Examination Survey(KNHANES) classified physical activity into high-intensity and moderate-intensity activities, and categorizes them as work-related or leisure-related. High-intensity activities were defined as vigorous activities that make you breathe heavily or your heart beat rapidly. The frequency of beverage intake was surveyed among individuals aged 6-29 years old. The purpose of this study was to investigate the association between high-intensity physical activity(work) and beverage intake frequency, and to provide a basis for developing guidelines for appropriate beverage consumption

and enhancing the effectiveness of work-related physical activity.

2. METHODS

2.1 Study design and procedure

The subjects of this study were participants in the 8th 3rd year (2021) of the Korea National Health and Nutrition Examination Survey (KNHANES VIII-1), which was part of the Korea Health Statistics 2021[14]. The dataset used in the study consisted of a total of 7,090 subjects, excluding missing data. The Korea Health Statistics 2021 survey was divided into a health survey, screening survey, and nutrition survey.

2.2 Study participants and sampling

This study utilized health survey data from the 8th KNHANES, first-year data(2021), obtained from the website(https://knhanes.kdca.go.kr)[14].

The data used in this study does not include personally identifiable information of the participants.

Gender, age, education level, Subjective health and beverages were used to identify related to high-intensity physical activity(work) level. Age was reclassified into groups such as 1-29 years old, 30-64 years old, 45-64 years old, and over 65 years old. Gender, education level, Subjective health, beverages and high-intensity physical activity(work) level background were used as questions investigated in KNHANES VIII-1.

2.3 High-intensity physical activity(work)

The definition of high-intensity activity was vigorous physical activity that causes heavy breathing or a significantly increased heart rate. The question in this category asked about the nature of the individual's current activities, taking into consideration their working hours. The options included paid work, unpaid work, school/education, housework, agriculture, fishing, livestock farming, and job-seeking.

Question: Does your job involve high-intensity physical activity that lasts for at least 10 minutes and includes significant breathlessness or a very rapid heart rate? Yes, No, Not applicable(children, adolescents), Unknown(No response). In this case, "Yes" was classified as "Yes" and "Not applicable (children, adolescents)" was classified as "Yes." "No" and "Unknown(No response)" were classified as "No."

2.4 Frequency of beverage consumption

This item pertains to the frequency of beverage consumption. The beverages included carbonated water, soda, sports drink, and energy drink. The frequency of consumption was categorized into the following options: ≤ once a week, once a week, 2-4 times a week, 5-6 times a week, once a day, twice a day, and unaffected (for ages other than 6-29). Participants were asked to provide their responses based on the frequency of beverage consumption. It should be noted that this question was applicable only to individuals aged 6-29 years old.

2.5 Data analysis

KNHANES was conducted periodically to assess the health and nutritional status of the Korean population. This study used data from the 8th 3rd year (2021) to investigate the relationship between frequency of beverage consumption and high-intensity physical activity(work) as data from the National Health and Nutrition Examination Survey. Chi-Squared(x^2) test was performed to analyzed the independence between two variables and relevance. Logistic regression analysis was performed for the causal relationship between the frequency of beverage consumption and high-intensity physical activity(work) and the odds ratio(OR) and 95% confidence interval(C.I.) were shown. Statistical package for the social sciences for Windows version 21.0(SPSS Inc., USA) was used. For all statistical tests, $p < 0.05$ was taken as the significant level.

3. RESULTS & DISCUSSION

3.1 Socio-demographic characteristics according to High-intensity physical activity (work)

The relationship between beverage intake frequency and high-intensity physical activity (work) was investigated, and lifestyle, eating habits, consumption patterns, and perception of sweetness were compared between the two groups by age(6-29 years old). Table 1 shows the results of the correlation analysis, indicating significant differences at the significance level for gender, age, education, and subjective health between the group not engaged in high-intensity physical activity(work) and the group that engaged in it.

Table 1. Socio-demographic characteristics according to high-intensity physical activity(work)

Variable	Categories	High-intensity physical activity (work)/N(%)		$x^2(p)$
		No	Yes	
Gender	Male	2,440 (43.5)	596 (53.1)	34.382 (.000)
	Female	3,165 (56.5)	527 (46.9)	
Age (years)	1-29	655 (11.7)	1,063 (94.7)	3388.136 (.000)
	30-64	3,160 (56.4)	51 (4.5)	
	≤ 65	1,790 (31.9)	9 (.8)	
Education	≤Middle school	1,013 (19.3)	887 (79.0)	1724.229 (.000)
	Middle school	534 (10.2)	148 (13.2)	
	High school	1,753 (33.4)	57 (5.1)	
	≥College	1,945 (37.1)	31 (2.8)	
Subjective Health	Very good	271 (4.8)	352 (31.3)	1029.061 (.000)
	Good	1,468 (26.2)	442 (39.4)	
	Normal	2,458 (43.9)	265 (23.6)	
	Bad	878 (15.7)	53 (4.7)	
	Very bad	203 (3.6)	11 (1.0)	

p<.05

In the group that engaged in high-intensity physical activity(work), the proportion of males was 53.1% while females accounted for 46.9%. These findings indicate a difference in the gender distribution within the group.

The group that engaged in high-intensity physical activity (work) was analyzed to have the following age distribution: 53.1% in the age range of 1-29, 4.5% in the age range of 30-64, and 0.8% in the age range of 65 and above. These findings indicate variations in the age composition within the group.

The group that engaged in high-intensity physical activity(work) was analyzed to have the following educational distribution: 79.0% had a middle school education or lower, 13.2% had a high school education, 5.1% had a college education, and 2.8% had a bachelor's degree or higher. These findings indicate variations in the educational background within the group. In the group that engaged in high-intensity physical activity(work), the subjective health was analyzed to be as follows: 31.3% reported very good, 39.4% reported good, and 23.6% reported normal. On the other hand, in the group that did not engage in high-intensity physical activity(work), the subjective health was analyzed to be:reported normal(43.9%), bad(15.7%), and very bad(3.6%). These findings indicate that the group engaged in high-intensity physical activity(work) had a higher proportion of individuals reporting good or very good subjective health compared to the group that did not engage in such activity.

According to a similar study, Individuals with higher levels of education tend to make healthier lifestyle choices and aspire to live a healthy life[15]. Furthermore, it has been well-documented that there are significant associations between education, general health, and health behaviors[16,17].

3.2 Frequency of beverage consumption according to High-intensity physical activity (work)

Table 2 shows the results of the correlation anal-

ysis, indicating significant differences at the significance level for carbonated water, soda, sports drink, and energy drink between the group not engaged in high-intensity physical activity(work) and the group that engaged in it.

Table 2. Consumption of beverages according to high-intensity physical activity(work)

Variables	Categories	High-intensity physical activity (work)/N(%)		$x^2(p)$
		No	Yes	
Carbonated Water	≤ once a week	405(8.7)	599(63.6)	1814.798 (.000)
	once a week	39(.8)	49(5.2)	
	2-4 times a week	46(1.0)	30(3.2)	
	5-6 times a week	13(.3)	3(.3)	
	once a day	5(.1)	2(.2)	
	twice a day	4(.1)	2(.2)	
	Unaffected (ages other than 6-29)	4131 (89.0)	257 (27.3)	
Soda	≤ once a week	158(3.4)	289(30.7)	1813.368 (.000)
	once a week	130(2.8)	168(17.8)	
	2-4 times a week	172(3.7)	194(20.6)	
	5-6 times a week	28(.60)	17(1.8)	
	once a day	20(.4)	12(1.3)	
	twice a day	3(.1)	4(.4)	
	3 times a day	1(.)	1(.)	
	Unaffected (ages other than 6-29)	4131 (89.0)	257 (27.3)	
Sports Drink	≤ once a week	334(7.2)	507(53.8)	1800.434 (.000)
	once a week	91(2.0)	106(11.3)	
	2-4 times a week	65(1.4)	58(6.2)	
	5-6 times a week	6(.1)	8(.8)	
	once a day	9(.2)	4(.4)	
	twice a day	4(.1)	1(.1)	
	3 times a day	3(.1)	1(.)	
	Unaffected (ages other than 6-29)	4131(89.0)	257(27.3)	
Energy Drink	≤ once a week	445(9.6)	646(68.6)	1812.901 (.000)
	once a week	26(.6)	23(2.4)	
	2-4 times a week	30(.6)	12(1.3)	
	5-6 times a week	6(.1)	2(.2)	
	once a day	3(.1)	2(.2)	
	twice a day	1(.)	0(.)	
	3 times a day	1(.)	0(.)	
	Unaffected (ages other than 6-29)	4131 (89.0)	257 (27.3)	

$p < .05$

According to a similar study in 2019, Galimov et al.[18] reported that 61.7% of German adolescents (aged 9-19) had used energy drinks at least once.

Degirmenci et al.[19] found that 52.3% of Norwegian adolescents(aged 12-19) consumed energy drinks at least once a month.

In the group that engaged in high-intensity physical activity work), carbonated water was found to be consumed ≤ once a week(63.6%), once a week(5.2%), and 2-4 times a week(3.2%).

In the group that engaged in high-intensity physical activity(work), it was analyzed that soda was consumed ≤ once a week(30.7%), once a week (17.8%), and 2-4 times a week(20.6%). In the group that engaged in high-intensity physical activity (work), it was analyzed that sports drink was consumed ≤ once a week(53.8%), once a week (11.3%), and 2-4 times a week(6.2%). In the group that engaged in high-intensity physical activity (work), it was analyzed that energy drink was consumed ≤ once a week(68.6%), once a week (2.4%), and 2-4 times a week(1.3%).

Health experts at Columbia University recommend drinking 20 oz(approximately 590ml) of water two hours before exercise, an additional 8 oz (approximately 240ml) during warm-up, and another 8 oz(approximately 240ml) every 10-20 minutes depending on sweat loss[20]. This advice highlights the importance of maintaining proper fluid intake and consuming adequate hydration before and after exercise.

3.3 Correlation between age and High-intensity physical activity (work), frequency of beverage consumption

As shown in Table 3, the age(6-29 years old) was directly strong positive correlated with carbonated water, soda, sports drink and energy drink(r=742, $p < 0.01$). The age(6-29) was directly moderate negative correlated with high-intensity physical activity (work)(r=-.589, $p < 0.01$). Additionally, high-intensity physical activity(work) appears to have a negative

Table 3. Correlation between age and high-intensity physical activity(work), frequency of beverage consumption

Variables	Age	High-intensity physical activity (work)	Carbonated water	Soda	Sports drink	energy drink
Age	1	-.589**	.742**	.742**	.742**	.742**
High-intensity physical activity (work)	-.589**	1	-.564**	-.564**	-.564**	-.564**
Carbonated water	.742**	-.564**	1	1.000**	1.000**	1.000**
Soda	.742**	-.564**	1.000**	1	1.000**	1.000**
Sports drink	.742**	-.564**	1.000**	1.000**	1	1.000**
energy drink	.742**	-.564**	1.000**	1.000**	1.000**	1

**p<.01

correlation with carbonated water, soda, sports drink, and energy drink consumption(r=-.564, *p*<0.01). Age does not seem to have a strong correlation with the other variables. Carbonated water was directly strong positive correlation with Soda, sports drink, energy drink(r=1.000, *p*<0.01).

The correlation between the variables was 1.000, indicating a very strong positive correlation. This suggests that there was a very close relationship in frequency of beverage consumption level.

We advise monitoring and adjusting fluid intake before and after exercise to ensure proper hydration.

3.4 Validation of the effect of High-intensity physical activity(work) wand frequency of beverage consumption by regression analysis

As shown in Table 4 were validation of the effect of high-intensity physical activity(work) wand frequency of beverage consumption. For carbonated water, the odds ratio was ≤ once a week was 23.774(95% Cl: 19.892-28.413), once a week was 20.195(95% Cl: 13.019-31.328), and 2-4 times a week was 10.483(95% Cl: 6.507-16.889), compared to Unaffected(ages other than 6-29)(*p*<.000).

For soda, the odds ratio was ≤ once a week was 29.401(95% Cl: 23.331-37.051), once a week was 20.772(95% Cl: 15.995-26.976), 2-4 times a week was 18.130(95% Cl: 14.249-23.067), 5-6 times a week was 9.759(95% Cl: 5.273-18.063)), once a day was 9.644(95% Cl: 4.663-19.947), and twice a day was 21.432(95% Cl: 4.771-96.267) compared to Unaffected (ages other than 6-29)(*p*<.000).

Table 4. Validation of the effect of high-intensity physical activity (work) and frequency of beverage consumption by regression analysis

Variables	High-intensity physical activity (work)	
	OR (95% CI)	*p*
Carbonated water		
Unaffected (ages other than 6-29)	1.0 (ref.)	.000
≤ once a week	23.774(19.892-28.413)	.000
once a week	20.195(13.019-31.328)	.000
2-4 times a week	10.483(6.507-16.889)	.000
5-6 times a week	3.709(1.050-13.099)	.042
once a day	6.430(1.241-33.300)	.027
twice a day	8.037(1.465-44.084)	.016
Soda		
Unaffected (ages other than 6-29)	1.0 (ref.)	.000
≤ once a week	29.401(23.331-37.051)	.000
once a week	20.772(15.995-26.976)	.000
2-4 times a week	18.130(14.249-23.067)	.000
5-6 times a week	9.759(5.273-18.063)	.000
once a day	9.644(4.663-19.947)	.000
twice a day	21.432(4.771-96.267)	.000
3 times a day	16.074(1.003-257.719)	.050
Sports Drink		
Unaffected (ages other than 6-29)	1.0 (ref.)	.000
≤ once a week	24.400(20.239-29.416)	.000
once a week	18.723(13.772-25.455)	.000
2-4 times a week	14.343(9.850-20.885)	.000
5-6 times a week	21.432(7.381-62.231)	.000
once a day	7.144(2.185-23.354)	.001
twice a day	4.018(.448-36.083)	.214
3 times a day	5.358(.555-51.690)	.147
Energy Drink		
Unaffected (ages other than 6-29)	1.0 (ref.)	.000
≤ once a week	23.334(19.598-27.783)	.000
once a week	14.219(8.001-25.270)	.000
2-4 times a week	6.430(3.253-12.707)	.000
5-6 times a week	5.358(1.076-26.678)	.040
once a day	10.716(1.783-64.416)	.010
twice a day	.000(.0-.)	1.000
3 times a day	.000(.0-.)	1.000

p<.05

For sports drink, the odds ratio was ≤ once a week was 24.400(95% Cl: 20.239-29.416), once a week was 18.723(95% Cl: 13.772-25.455), 2-4 times a week was 14.343(95% Cl: 9.850-20.885), 5-6 times a week was 21.432(95% Cl: 7.381-62.231), and once a day was 7.144(95% Cl: 2.185-23.354) compared to Unaffected (ages other than 6-29)(p<.000).

For energy drink, the odds ratio was ≤ once a week was 23.334(19.598-27.783)), once a week was 14.219(8.001-25.270), and 2-4 times a week was 6.430(3.253-12.707), compared to Unaffected(ages other than 6-29)(p<.000).

According to a study in South China[21], consumption of sugar-sweetened beverages in children increases the risk of obesity and high triglyceride levels.

There was a strong positive correlation between high-intensity physical activity and soda consumption. As the frequency of soda consumption per week increases, the association with high-intensity physical activity becomes stronger.

Similarly, sports drink and energy drink consumption also show a positive correlation with high-intensity physical activity, following a pattern similar to soda. It may increase our understanding of the factors associated with frequent consumption of beverages and will be useful for planning evidence-based educational programs focused on exercise and wise coansumption of beverage

These findings contribute to our understanding of the relationship between beverage consumption and high-intensity physical activity, highlighting the importance of considering the impact of physical activity on beverage choices. Further research was needed to explore the underlying factors driving these associations and to develop targeted interventions for promoting healthier beverage choices among individuals engaged in high-intensity physical activity.

5. CONCLUSION

In the group that engaged in high-intensity physical activity (work), the analysis revealed that carbonated water consumption in the same group was found to be ≤ once a week (63.6%), once a week (5.2%), and 2-4 times a week (3.2%). Similarly, energy drink consumption was ≤ once a week (68.6%), once a week (2.4%), and 2-4 times a week (1.3%).

Furthermore, there was a strong positive correlation between the age of individuals (6-29 years old) and the consumption of carbonated water, soda, sports drinks, and energy drinks (r=.742, p<0.01). Additionally, a strong positive correlation was observed between high-intensity physical activity and soda consumption. As the frequency of soda consumption per week increased, the association with high-intensity physical activity became stronger. Similarly, sports drink and energy drink consumption also displayed a positive correlation with high-intensity physical activity, following a similar pattern to soda.

In conclusion, there was a relationship between high-intensity physical activity(work) and beverage consumption, and it was observed that the frequency of consumption for each beverage was predominantly ≤ once a week.

REFERENCES

[1] E. L. Van Blarigan & J. A. Meyerhardt. (2015). Role of physical activity and diet after colorectal cancer diagnosis. *J Clin Oncol. 33*, 1825-1834. DOI : 10.1200/JCO.2014.59.7799

[2] M. A. Fuchs et al. (2014). Sugar-sweetened beverage intake and cancer recurrence and survival in CALGB 89803 (Alliance). *PLoS One. 17, 9(6)*, e99816.
DOI : 10.1371/journal.pone.0099816.

[3] R. L. Bailey, V. L. Fulgoni, A. E. Cowan, P. C. Gaine. (2018). Sources of added sugars in young children, adolescents, and adults with low and high intakes of added sugars. *Nutrients. 10(1)*, 102. DOI : 10.3390/nu10010102

[4] J. H. Kim, S. H. Yun, K. W. Oh. (2019). Beverage consumption among Korean adolescents: data from 2016 Korea Youth Risk Behavior Survey. *Nutr Res Pract. 13(1)*, 70-75. DOI : 10.4162/nrp.2019.13.1.70

[5] J. Erdmann et al. (2021). Effects of Energy Drink Consumption on Physical Performance and Potential Danger of Inordinate Usage. *Nutrients. 13(8)*, 2506. DOI : 10.3390/nu13082506

[6] A. R. Jagim. et al. (2023). International society of sports nutrition position stand:energy drinks and energy shots. *JOURNAL OF THE INTERNATIONAL SOCIETY OF SPORTS NUTRITION. 20(1)*, 2171314. DOI : 10.1080/15502783.2023.2171314

[7] L. Lara-Castor et al. (2023). Sugar-sweetened beverage intakes among adults between 1990 and 2018 in 185 countries. *Nature Communications. 14*, 5957. DOI : 10.1038/s41467-023-41269-8

[8] E. C. Kosova & A. A. Bremer. (2013). The Relationships between Sugar-Sweetened Beverage Intake and Cardiometabolic Markers in Young Children. *J Acad Nutr Diet. 113(2)*, 219-227. DOI : 10.1016/j.jand.2012.10.020

[9] Malik, V. S. & Hu, F. B. (2019). Sugar-sweetened beverages and cardiometabolic health: an update of the evidence. *Nutrients. 11(8)*, 1840. DOI : 10.3390/nu11081840. 1840

[10] Y. Sahasakul, N. Amonsusawat, P. Phansuea. (2023). Lifestyles, Food Consumption Frequencies, and Eating Behaviors among Three Main Disciplines of Undergraduate Students during the Early COVID-19 Outbreak in Thailand. *Nutrients. 15*, 2765. DOI : 10.3390/nu15122765

[11] H. S. Yoon. (2006). Assessment on the dietary attitudes, stress level andnutrient intakes by food record of food and nutrition major female university students. *Korean J Nutr. 39*, 145-59.

[12] H. R. Lieberman. (2007). Hydration and cognition: A critical review and recommendations for future research. *J. Am. Coll. Nutr. 26*, 555S-561S. DOI : 10.1080/07315724.2007.10719658.

[13] V. B. Malik, M. B. Schulze, F. B. Hu. (2006). Intake of sugar-sweetened beverages and weight gain: A systematic review. *Am. J. Clin. Nutr. 84*, 274-88.

[14] KDCA. (2021). *Data Downloads.* https://knhanes.kdca.go.kr/knhanes/sub03/sub03_02_05.do

[15] N. M. Davies, M. Dickson, G. Davey Smith et al. (2018). The causal effects of education on health outcomes in the UK Biobank. *Nat Hum Behav 2*, 117–125. DOI : 10.1038/s41562-017-0279-y

[16] Giorgio Brunello, Margherita Fort, Nicole Schneeweis, Rudolf Winter-Ebme. (2016). The Causal Effect of Education on Health: What is the Role of Health Behaviors?. *Health Econ. 25*, 314-33. DOI : DOI: 10.1002/he.

[17] P. Böckerman et al. (2017). Does higher education protect against obesity? Evidence using Mendelian randomization. *Preventive Medicine. 101*, 195-198. DOI : 10.1016/j.ypmed.2017.06.015.

[18] A. Galimov, R. Hanewinkel, J. Hansen, J. B. Unger, S. Sussman, M. Morgenstern. (2019). Energy drink consumption among German adolescents: Prevalence, correlates, and predictors of initiation. *Appetite. 1(139)*, 172-179. DOI : 10.1016/j.appet.2019.04.016.

[19] N. Degirmenci, I. N. Fossum, T. A. Strand, A. Vaktskjold, M. N. Holten-Andersen. (2018). Consumption of Energy Drinks among Adolescents in Norway: A Cross-Sectional Study. *BMC Public Health. 18*, 1391. DOI : 10.1186/s12889-018-6236-5.

[19] Barry M. Popkin, Kristen E. D'Anci, and Irwin H. Rosenberg. (2011). Water, Hydration and Health. *Nutr Rev. 68(8)*, 439-458. DOI : 10.1111/j.1753-4887.2010.00304.x

[20] B. He, W. Long, X. Li, W. Yang, Y. Chen, Y. Zhu. (2018). Sugar-Sweetened Beverages Consumption Positively Associated with the Risks of Obesity and Hypertriglyceridemia Among Children Aged 7–18 Years in South China. *J Atheroscler Thromb. 25(1)*, 81-89. DOI : 10.5551/jat.38570

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