Research Article

Health Behaviors and Academic Performance Among Korean Adolescents

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SUMMARY

Purpose: This study aimed to examine the most prominent health-related behaviors impacting the academic performance of Korean adolescents.
Methods: The 2012 Korea Youth Risk Behavior Web-Based Survey data were analyzed using an ordinal regression analysis after adjusting for general and other health behaviors.
Results: Before adjustment, all health behaviors were significantly associated with academic performance. After adjustment for other health behaviors and confounding factors, only smoking [odds ratio (OR) = 2.07, 95% confidence interval (CI) (1.98, 2.16), $p < .001$], alcohol consumption [OR = 1.22, 95% CI (1.18, 1.27), $p < .001$], and physical activity [OR = 1.09, 95% CI (1.06, 1.13), $p < .001$] were associated with lower academic performance, and engaging in a regular diet [OR = 0.65, 95% CI (0.65, 0.62), $p < .001$] was associated with higher academic performance.
Conclusions: Regular diet, reducing smoking and alcohol drinking, and physical activity should be the target when designing health interventions for improving academic performance in Korean adolescents.

Introduction

Successful academic performance is key during adolescence, and in predicting occupational and social success in one's lifetime [1]. Therefore, positive academic outcomes during adolescence have become a public concern, making the primary goal of schooling a global issue [2]. In accordance, there is a strong tradition and emphasis on education to produce positive academic performance for schoolchildren in Korea [3].

Health has long been a factor influencing academic performance among adolescents [4,5]. Health behaviors, defined as "any kind of behavior undertaken by individuals that potentially influences their health" [6], have included health-risk behaviors with immediate or later negative health consequences and health-promoting behaviors producing positive health outcomes [7]. Health behaviors among adolescents, studied in previous research, have been summarized as tobacco use, substance use, sexual behavior, violence, physical activity (exercise & sedentary activity), and nutrition (dietary behavior & nutrition) [8,9]. Much literature exploring the relationship

between health behaviors and academic performance has examined health behaviors either as a means of achieving health or as an end in itself [4,5,8]. Health behaviors themselves, independent of health, have placed emphasis on adolescence since it is an important period for forming lifelong health behaviors and habits [10]. Most related studies have found reciprocal or antecedent associations based on cross-sectional and longitudinal methods, respectively, and specifically, positive associations between unhealthy behaviors and poor academic achievement [4,5,8].

However, most previous studies exploring the relationship between health behaviors and academic performance have focused on single or small subsets of health behaviors rather than including multiple behaviors comprehensively [4,5,8]. Since many health behaviors cluster together, the effects of studies performed without multibehavioral analyses are more likely to be overestimations of true effects due to interbehavioral confounding [8]. More importantly, previous studies have rarely controlled for other confounding factors, nor have they used nationally representative data. The relationships of health behaviors and academic performance have been revealed to be mediated by psychosocial problems (e.g., stress), social structures, and demographics, and were found to be dependent on social context factors in review studies [5,8]. Exploring key health behaviors is necessary to plan public strategies to make the best use of scarce resources.

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Therefore, this study was conducted to examine the most prominent health behaviors associated with academic performance, after adjusting for other health behaviors and confounding factors including health status, stress, household socioeconomic status (SES), and sex and age using a nationally representative sample of Korean adolescents.

Methods

Data and study design

This study used the data of the 2012 Korea Youth Risk Behavior Web-Based Survey (KYRBS) [11], conducted by the Korean Centers for Disease Control and Prevention. The KYRBS, an online self-administered questionnaire survey, was conducted annually to monitor the prevalence of health risk behaviors in Korean adolescents. To select a nationally representative sample of middle and high school students, this survey used a stratified, three-stage cluster sampling design that considered (a) county size (large/small cities & urban areas); (b) the degree of urbanicity, the number of schools, and the population; and (c) random sampling of classrooms in each grade. The respondents' data were assigned weights to assure equal probability of being sampled and to cover missing data. Of a total of 76,980 students from these sampling frames, 74,186 students completed the survey with a response rate of 96.4%. This study analyzed 74,186 adolescents aged 12–18 years in total.

Ethical considerations

The Korean Centers for Disease Control and Prevention provided the raw KYRBS data after reviewing our study's purpose and data analysis plans, and we were permitted to use the data on September 12, 2013. The KYRBS was officially approved by the Statistics Korea (Certificate Number: 11758). All study participants completed the survey under the condition of anonymity.

Variable measurements

The general, health behavioral, and academic performance variables were identified from the results of the KYRBS. Academic performance, the dependent variable, was assessed with self-reported academic grades in the 12-month period by a 5-point scale (low, low-middle, middle, high-middle, & high), and was categorized into three groups: low, middle, and high.

Health behaviors [7], the independent variables, were composed of smoking, alcohol consumption, sexual activity, suicidal ideation, physical activity, Internet use, weight changes, and regular diet. All health behavioral variables were identified in two ways (yes or no) by assessing whether the adolescents had ever smoked and used alcohol in their lifetime; whether they had ever had intercourse with the same or the opposite sex; whether they had seriously considered suicide in the last 12 months; whether physical activity of any kind amounted to at least 60 minutes in the last 7 days; whether they had used the Internet during the last 30 days; whether weight control efforts for decreasing, increasing, and maintaining weight in the last 30 days were made; and whether the adolescents consumed three meals a day in the last 7 days.

General characteristics for covariates include demographics, social structures, health status, and psychosocial problems such as age/school, sex, household SES, father's and mother's education, subjective health status, and stress, respectively. Household SES was categorized into three groups by subjective household SES: low, middle, and high SES. Father's and mother's education levels were categorized into three groups: up to middle school, high school, and university. Subjective health status was categorized

into three groups: unhealthy, average, and healthy. Stress was identified in two ways (yes/no) by assessing whether more than average stress was felt.

Data analysis

Based on the complex survey design, all data were weighted by the proportion of sex, school class, and grade in a geographic area. Descriptive statistics and chi-square tests were used to compare general and health behavioral characteristics according to academic performance. Univariate ordinal logistic regression was used to estimate the influence of each health behavior on academic performance, and multivariate ordinal logistic regression was conducted to estimate the effects of individual health behaviors after adjustment for general, stress, and other health behavioral variables, displaying only the variables that showed valid model fitting on the model. Adjustments were made for school, sex, household SES, father's education, mother's education, subjective health status, and stress. All statistical analyses were performed including the analysis of complex survey data by the use of SPSS 20.0 (IBM Corp, Armonk, NY, USA).

Results

Data of a total of 74,186 respondents composed of 28,810 low (38.6%), 19,854 middle (26.8%), and 25,522 high (34.6%) academic performance adolescents including middle and high school students were analyzed, and the respondents' general and health behavioral characteristics according to academic performance are presented in Tables 1 and 2, respectively. Significant academic performance differences were found with regard to all the general and health behavioral characteristics. Adolescents who were high school students, female, and in a lower SES household, and those who had parents with less education, perceived health status as unhealthy, and higher stress level than average showed significantly lower academic performance. Those engaging in smoking, alcohol consumption, sexual activity, suicidal ideation, physical activity, and who had weight changes tended to show lower academic performance, and those engaging in Internet use and a regular diet tended to show higher academic performance.

The relationship between health behaviors and academic performance is presented in Table 3. Before adjustment, all health behaviors were significantly associated with academic performance: those engaging in smoking [OR = 2.14, 95%CI (2.06, 2.21), $p < .001$], alcohol consumption [OR = 1.60, 95%CI (1.55, 1.65), $p < .001$], sexual activity [OR = 1.59, 95%CI (1.49, 1.70), $p < .001$], suicidal ideation [OR = 1.47, 95%CI (1.42, 1.53), $p < .001$], physical activity [OR = 1.15, 95%CI (1.12, 1.18), $p < .001$], and who experienced weight changes [OR = 1.14, 95%CI (1.11, 1.18), $p < .001$] reported lower academic performance, and those engaging in Internet use [OR = 0.71, 95%CI (0.68, 0.74), $p < .001$] and a regular diet [OR = 0.48, 95%CI (0.46, 0.49), $p < .001$] reported higher academic performance. After adjustment of general and other health behavioral variables, only smoking, alcohol consumption, physical activity, and regular diet were significantly associated with academic performance: those engaging in smoking [OR = 2.07, 95%CI (1.98, 2.16), $p < .001$], alcohol consumption [OR = 1.22, 95%CI (1.18, 1.27), $p < .001$], and physical activity [OR = 1.09, 95%CI (1.06, 1.13), $p < .001$] reported lower academic performance, and those engaging in a regular diet [OR = 0.65, 95%CI (0.65, 0.62), $p < .001$] reported higher academic performance.

Discussion

This study was conducted to investigate the health behaviors significantly related to academic performance among Korean

Table 1 *General Characteristics of Sample Participants According to Academic Performance.*

Sample characteristics	Total (N = 74,186)		Low (n = 28,810 38.6 %)		Middle (n = 19,854 26.8 %)		High (n = 25,522 34.6 %)		χ^2	p
	n	%[a]	n	%[a]	n	%[a]	n	%[a]		
Age (M ± SD)	14.94 ± 0.02		14.98 ± 0.02		15.06 ± 0.02		14.80 ± 0.03			
School type										
Middle school	37,297	49.0	14,205	47.9	9,310	45.4	13,782	53.1	286.78	< .001
High school	36,889	51.0	14,605	52.1	10,544	54.6	11,740	46.9		
Sex										
Male	38,221	52.5	14,782	52.3	9,949	51.1	13,490	53.8	31.67	< .001
Female	35,965	47.5	14,028	47.7	9,905	48.9	12,032	46.2		
Household SES										
Low	17,020	22.6	9,471	32.5	3,712	18.5	3,837	14.7	6,393.06	< .001
Middle	34,884	46.7	13,980	48.5	10,960	54.9	9,944	38.3		
High	22,282	30.7	5,359	19.0	5,182	26.6	11,741	47.0		
Father's education										
Up to middle school	3,208	4.6	1,536	6.3	787	4.2	885	3.4	1,676.77	< .001
High school	25,521	40.6	10,729	48.5	7,141	41.4	7,651	32.3		
University	32,212	54.8	9,380	45.2	8,678	54.3	14,154	64.3		
Mother's education										
Up to middle school	3,138	4.7	1,500	6.3	812	4.5	826	3.3	1,718.75	< .001
High school	32,712	52.5	13,189	60.1	9,185	54.1	10,338	44.1		
University	25,507	42.8	7,116	33.6	6,724	41.4	11,667	52.6		
Subjective health status										
Unhealthy	5,266	7.0	2,562	8.7	1,184	5.9	1,520	5.9	711.37	< .001
Average	18,759	25.1	8,200	28.5	5,103	25.3	5,456	21.1		
Healthy	50,161	68.0	18,048	62.8	13,567	68.8	18,546	73.0		
Stress (Yes)	31,366	41.9	13,895	47.9	7,870	39.1	9,601	37.3	1,667.96	< .001

Note. SES = socioeconomic status.
[a] Weighted percentages considering the complex survey design.

adolescents in order to manage health to enable academic performance. The study found that smoking, alcohol consumption, physical activity, and regular diet were the associated factors.

Smoking and alcohol consumption, and sexual activity have been correlated among Korean adolescents [12]. However, whereas smoking and alcohol consumption remained associated with lower academic performance, sexual activity was no longer associated with it in our multivariate analysis. Simple statistical tests like univariate analysis tend to reject the null hypothesis more often than the nominal alpha level suggests that they should, resulting in false significant results [8,13]. This is why multibehavioral analysis was necessary. However, this result also might have occurred from including only adolescents in school and excluding those who dropped out of school. Consequences of sexual activity, such as pregnancy, rather than sexual activity itself, are what commonly results in academic interruption in Korea [14].

For Korean adolescents, academic stress caused by academic underachievement contributes to delinquency behaviors such as tobacco and alcohol use [3,15]. However, these behaviors themselves, except for the effects of stress, were associated with academic performance as shown in this study. The literature suggests multifactorial risk factors of tobacco and alcohol use among Korean adolescents including relationships with family, peers, and teachers, the relationship between home and school, parent-related life events and media, parenting practices and academic stress, and the Asia-Pacific financial crisis in 1997 [3]. Similarly, the effects of tobacco and alcohol use on academic performance showed a more complex negative finding rather than a straightforward finding and interacted with or were mediated by the underlying psychosocial context in previous longitudinal studies [4,8]. The negative effects mostly have been explained by the idea that adolescents trade losing interest in academic performance for a gain in social status [8].

As for physical activity, this study found that Korean adolescents engaging in physical activity increased the odds of a lower academic performance, which is not consistent with most previous study results [5,8]. This finding could be explained by assuming that adolescents who did not engage in physical activity, compared with those who did, spent their time studying. Adolescents with higher academic grades may have less time to engage in physical activity and have more time to concentrate on studying. The results are also likely due to a lack of absolute time, intensity, and type of physical activity in the middle and high school students who spend most of their time focusing on academics, thus weakening the impact of physical activity on academic performance. In this study, physical activity of any kind amounting to at least 60 minutes in the last 7 days was used to measure physical activity. Previous studies have shown that 3 days per week or 5 or more times of exercise per week [16,17], "moderate" or "rigorous" physical activity [16,18], or team and in-school exercise [19] have a positive correlation with academic performance. Further study on the effect of physical activity on academic performance for different intensities of exercise may be necessary.

This study also found that for Korean adolescents, not eating 3 meals a day regularly increased the odds of a lower academic performance, consistent with the findings of most previous studies [4,5,8]. Unhealthy nutrition is the only health behavior affecting academic performance in a straightforward way [8,20]. Nutrition quality, including nutrient composition and meal patterns such as intake/omission of breakfast and regular diet, have been regarded to lead to a lack of nutrition, affecting cognitive ability and behavior [21]. Meal patterns especially affected academic performance after eliminating malnourished and obese cases [21,22], as shown in the present study's results, controlling for household SES and weight control. However, there is only one limited longitudinal study on these associations, which did not sample representative populations and did not control for any confounding factors [8,20]. Thereby, to improve academic performance, interventions of acknowledging the importance of and conducting intake of 3 meals a day for adolescents are necessary.

In decision making analysis, the most statistically influential independent or confounding factors associated with a dependent variable are presented from top to bottom nodes in order [23]. In

Table 2 *Health Behavioral Characteristics According to Academic Performance.*

Subject characteristics	Total (N = 74,186)		Low (n = 28,810)		Middle (n = 19,854)		High (n = 25,522)		χ^2	p
	n	%[a]	n	%[a]	n	%[a]	n	%[a]		
Health behaviors										
Smoking (Yes)	18,298	24.6	9,725	33.7	4,250	21.5	4,323	16.7	2,267.23	< .001
Alcohol consumption (Yes)	35,003	47.0	15,707	54.6	9,034	45.3	10,262	39.9	1,196.31	< .001
Sexual activity (Yes)	4,007	5.5	2,044	7.3	881	4.5	1,082	4.4	272.86	< .001
Suicidal ideation (Yes)	13,635	18.3	6,434	22.4	3,224	16.1	3,977	15.4	535.85	< .001
Physical activity (Yes)	34,523	45.2	14,042	47.3	9,235	45.3	11,246	42.9	103.91	< .001
Internet use (Yes)	63,853	86.0	23,992	83.3	17,233	86.8	22,628	88.4	299.93	< .001
Weight changes (Yes)	35,537	47.8	14,392	49.9	9,500	47.8	11,645	45.6	96.84	< .001
Regular diet (Yes)	42,234	57.1	13,116	45.7	11,689	59.1	17,429	68.4	2,874.58	< .001

[a] Weighted percentages considering the complex survey design.

Table 3 *Ordinal Logistic Regression of Health Behavioral Variables on Academic Performance.*

Variables	Univariate			Multivariate[a]		
	OR	95% CI	p	OR	95% CI	p
Health behaviors						
Smoking (Yes)	2.14	2.06, 2.21	< .001	2.07	1.98, 2.16	< .001
Alcohol consumption (Yes)	1.60	1.55, 1.65	< .001	1.22	1.18, 1.27	< .001
Sexual activity (Yes)	1.59	1.49, 1.70	< .001	1.07	0.99, 1.17	.107
Suicidal ideation (Yes)	1.47	1.42, 1.53	< .001	−		
Physical activity (Yes)	1.15	1.12, 1.18	< .001	1.09	1.06, 1.13	< .001
Internet use (Yes)	0.71	0.68, 0.74	< .001	−		
Weight changes (Yes)	1.14	1.11, 1.18	< .001	−		
Regular diet (Yes)	0.48	0.46, 0.49	< .001	0.65	0.65, 0.62	< .001
Stress	1.42	1.38, 1.46	< .001	1.14	1.10, 1.18	< .001

Note. CI = confidence interval; OR = odds ratio.
[a] Multivariate ordinal regression model, adjusted for general and health behavioral variables.

this study, after SES, the behaviors of a regular diet and smoking were the second or third node in the Classification and Regression Tree analysis yet it is not presented in the study. Therefore, a regular diet, reducing smoking and alcohol intake, and decreasing physical activity should be the target, in that order, to improve and maintain academic performance. A future longitudinal study on the health behaviors that have been confirmed to be associated with academic performance is required.

This study is limited in that the study used secondary data acquired from a web-based self-reported survey. Evaluation of academic performance and health behaviors based on self-reports may include errors [11,24]. However, the questionnaires were generally reliable in a test-retest reliability study [25,26]. This study is also limited in that the data are cross-sectional data at a given point in time and cannot identify causality. However, the strength of this study is that nationally representative data are used.

Conclusion

Among all the various health behaviors, regular diet, reducing smoking and alcohol intake, and physical activity should be the target when designing health interventions for improving academic performance.

Conflicts of interest

There is no conflict of interest.

Acknowledgments

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