RESEARCH ARTICLE

Relationships between Body Image, Body Mass Index, and Smoking in Korean Adolescents: Results of a Nationwide Korea Youth Risk Behavior Web-based Survey

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Abstract

Objective: This study assessed the association between subjective body image or objective body mass index (BMI) and the risk of daily smoking in Korean adolescents, with a purpose of identifying the most suitable models. Materials and Methods: Using the 2013 9th Korea Youth Risk Behavior Web-based Survey data for 72,435 students, odds ratios were calculated for daily smoking in the past month, according to the subjective body image and calculated BMI using a respective multiple logistic regression model. The combined effect of these two factors was also analyzed by pairing a BMI category with a subjective body image category, using odds ratios for the same event within each sex group. Results: Among the surveyed students, 7.2% of boys and 1.8% of girls were classified as daily smokers. Students who perceived themselves as being very obese tended to be at lower risk of daily smoking (OR=0.61 in boys with 95% CI=0.47 to 0.79; OR=0.66 in women with 95% CI=0.47 to 0.93). In addition, boys within the obese or overweight BMI category showed a lower risk of daily smoking (OR=0.86, 95% CI: 0.77-0.96). Lean BMI was significantly associated with higher odds ratios for daily smoking only in female students (OR=1.24, 95% CI: 1.02-1.52). When pairing these two objective and subjective factors, results suggested that subjective body image has a greater effect on daily smoking than BMI in both boys and girls. Conclusions: In both male and female students, subjective body image had a greater effect on daily smoking than body mass index. A model using the combination of BMI and subjective body image was the best fit in girls, in contrast to the model using subjective body image only best suitable in boys, for the prediction of daily smoking. These results including several factors associated with daily smoking in Korean students, provide useful data for the development and implementation of smoking intervention and cessation programs for adolescents.

Keywords: Smoking - body mass index - body image - adolescent - behavior

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Introduction

Adolescent smoking is a major health problem in Korea, the country with the highest rate of adolescent smoking worldwide. In 2013, according to the Korea Youth Risk Behavior Web-based Survey, a national survey conducted jointly between the Ministry of Health and Welfare and the Ministry of Education, the adolescent smoking rate was 9.7%. Although this figure is still high, there has been a steady decline since the record high of 13.3% in 2007. When viewed according to sex, girls exhibit a much lower rate of smoking compared to boys, 4.6% and 14.4%, respectively (Korea Centers for Disease Control and Prevention, 2013). In Korea, however, females tend to be reluctant to disclose their smoking habits; therefore, it is likely that the actual smoking rate for girls is higher than reported (Suh, 2011). The 2013 survey was conducted at a time when tobacco sales to youths were prohibited under the Youth Protection Act, suggesting that a very high level of smoking has persisted.

Tobacco contains more than 4,000 toxic chemical ingredients, such as, nicotine, tar, and carbon monoxide; including more than 20 Grade A carcinogens. These carcinogens are primarily composed of the tar component, which is widely recognized as the cause of medical conditions, such as, cardiovascular or respiratory diseases, in both direct and passive smokers (Centers for Disease Control and Prevention, 2002). Increased duration of exposure sharply increase these risks; and nicotine addiction is greater as well in an individual who started smoking during adolescence compared to an individual who started smoking as an adult (Taioli and Wynder, 1991; Peto et al., 2000). One example of physical Disease or developmental delay in adolescents, caused by smoking, is the increased risk of chronic obstructive pulmonary disease and its early onset (Gold et al., 1996). In addition,

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adolescence is a period of rapid growth in physical and mental status, and smoking can incite other delinquent behaviors. For these reasons, smoking during adolescence is a complex issue that can, not only affect an individual's health in adulthood, but also create future social problems.

According to an investigation into smoking prevention in schools, conducted by the Korean government Ministry of Health and Welfare in 2010, Korean adolescents reported that the primary reasons for smoking include both the direct effects, such as enjoying, relaxation, or habituation, and the social aspects, such as peer pressure or a feeling of independence from their parents. In addition, some adolescents chose to smoke for the purpose of weight control, a trend similar to that seen in young single women. The concern for weight gain is one reason that some adolescents fail in smoking cessation (Suh, 2007).

In previous studies involving adult women, low body mass index (BMI) and subjective lean body image perception were associated with smoking, and the strength of relationship was higher for BMI. This is in accordance with other studies that demonstrated an association between smoking and low body weight (Hong and Choi, 2007; Jang, 2011; Suh, 2011).

Many studies regarding adolescent smoking, consider it to be a delinquent behavior and as such have investigated its association with a hazardous environment in order to propose measures for prevention. Few studies, however, have investigated the association between smoking and subjective body image. In this study, using the ninth Korea Youth Risk Behavior Web-based Survey, 2013, we determined whether there was an association between subjective body image, and objective BMI, with smoking status. In addition, we investigated the influence of socio-economic or health-related factors on adolescent smoking to determine targets for smoking cessation programs.

Materials and Methods

Study design and participants

The data for this study were obtained from the ninth Korea Youth Risk Behavior Web-based Survey, 2013 (KYRBWS-IX). This is a nationwide, web-based survey conducted jointly by the Korea Centers for Disease Control and Prevention, the Ministry of Health and Welfare, and the Ministry of Education, Science, and Technology to examine the health behaviors of Korean adolescents (middle and high school students).

Study subjects were 75,149 students from 400 middle schools and 400 high schools, selected using a two-stage stratified cluster sampling method from all middle and high school students in Korea. The population of interest was stratified into 43 regional- and school-type variables; each subject was then selected through the school (the first sampling unit) and class (the second sampling unit). The total number of respondents was 72,435 students from 799 schools, with a response rate of 96.4%.

Measuring of variables

The dependent variable in our research was daily smoking and the 12 independent variables were age, household income level, academic performance level, lifetime drinking experience, part-time work experience, stress awareness, experience of sadness or hopelessness in the past 12 months, lifetime sexual experience, treatment due to violence in the past 12 months, exposure to passive smoking at home in the past 7 days, BMI, and subjective body image. All variables were determined through responses from multiple-choice questions; except for age and BMI, the latter was calculated from the height and weight provided with the subjective questions.

Data were analyzed separately for boys and girls. Household income, academic performance, and stress awareness were determined on a 5-point scale and re-classified into 3 groups. Experiential questions were answered yes or no. BMI was categorized into three groups: low bodyweight (BMI<18.5 kg/m^2), normal bodyweight (18.5 kg/m^2≤BMI<23 kg/m^2), and overweight or obese (BMI≥23 kg/m^2), according to the World Health Organization (WHO) BMI classifications for Asians (WHO expert consultation, 2004; Zheng et al., 2011).

The responses for subjective body image consisted of five groups: very lean, slightly lean, moderate, slightly overweight, and very obese. These answers were paired with BMI categories, using each BMI group as a reference point and making two or three combinations of concordant or discordant pairs, for a total of seven categories; normal BMI-moderate body image group as a reference, along with normal BMI-slightly or very lean body image group, normal BMI-overweight or obese body image group, low BMI-slightly or very lean body image group, low BMI-moderate or overweight/obese body image group, obese BMI-moderate or slightly/very lean body image group, and obese BMI-overweight or obese body image group (Jang, 2011).

As a dependent variable, smoking status was adopted from WHO's definition of smoker, which means people who smoke cigarettes daily or occasionally at the time of the survey. 'Daily smoker' is defined as a person who smoke at least once a day or more, otherwise classified into 'occasional smoker' (World Health Organization, 2013). In this study, adolescents were also divided into daily smokers and occasional smokers.

Statistical analysis

For all categorical variables, data are presented as the number of cases and its respective proportion. A chi-square test was performed to determine differences in daily smoking rates among subgroups. Logistic regression analysis was performed to determine the odds ratios of daily smoking due to the change in each variable while controlling the effect of other variables. Three multiple logistic regression models, associated with BMI and body image, were analyzed to compare how much each model can explain daily smoking in adolescents. The models were evaluated using the Akaike Information Criterion (AIC) to determine the respective qoodness of fit. All statistical analyses were performed using SPSS software, version 20.0 (SPSS Inc., Chicago IL).

Results

General characteristics of participants and association

with daily smoking

The distribution of socio-economic, health status, and body shape-related characteristics associated with daily smoking in male and female students is shown in Table 1. Of the students surveyed, 7.2% of boys and 1.8% of girls were classified as daily smokers; this was related to low economic status within the household and poor academic performance in both sexes. In addition, many of the students within the daily smoker group had experience with drinking alcohol and part-time work. The rates for daily smoking were highest in the normal BMI group and lowest in obese group in both sexes. However, the rates for daily smoking in relation to subjective body image showed different patterns depending on sex; boys who perceived themselves as very lean and girls who perceived themselves as very obese had highest rates of

Table 1. Smoking Status According to Socio-Economic, Health-Related, and Body Shape-Related Factors

	Male				Female			
	<30 days smoking/month	≥30 days smoking/month	Total	p-value	<30 days smoking/month	≥30 days smoking/month	Total	p-value
Age*	14.9±0.05	16.3±0.04	15.0±0.04	<0.001	14.9±0.05	16.1±0.06	14.9±0.05	<0.001
Household income								
High	11,738 (94.8)	654 (5.20)	12,392	<0.001	9,617 (98.8)	116 (1.20)	9,733	<0.001
Middle	14,900 (93.3)	1,085 (6.70)	15,985		17,428 (98.5)	284 (1.50)	17,712	
Low	6,331 (87.9)	867 (12.1)	7,198		7,070 (96.6)	264 (3.40)	7,334	
Academic performance								
High	4,227 (96.8)	138 (3.20)	4,365	<0.001	3,298 (99.3)	20 (0.70)	3,318	<0.001
Slightly above average	7,866 (96.1)	309 (3.90)	8,175		8,439 (99.1)	88 (0.90)	8,527	
Middle	9,101 (94.2)	559 (5.80)	9,660		9,898 (98.9)	124 (1.10)	10,022	
Slightly under average	7,907 (91.4)	749 (8.60)	8,656		8,724 (98.1)	192 (1.90)	8,916	
Low	3,868 (82.4)	851 (17.6)	4,719		3,756 (94.2)	240 (5.80)	3,996	
Lifetime drinking experience,								
No	18,405 (99.1)	167 (0.90)	18,572	<0.001	20,997 (99.9)	14 (0.10)	21,011	<0.001
Yes	14,564 (85.8)	2,439 (14.2)	17,003		13,118 (95.4)	650 (4.60)	13,768	
Lifetime part-time work experience,								
No	29,004 (96.4)	1,039 (3.60)	30,043	N/A	29,468 (99.3)	220 (0.70)	29,688	<0.001
Yes	3,965 (71.9)	1,567 (28.1)	5,532		4,647 (91.8)	444 (8.20)	5,091	
Stress awareness								
Almost absent	7,524 (95.1)	390 (4.90)	7,914	<0.001	4,069 (99.1)	38 (0.90)	4,107	<0.001
A little bit of stress	14,630 (93.7)	982 (6.30)	15,612		13,388 (98.9)	173 (1.10)	13,561	
A lot of stress	10,815 (90.0)	1,234 (10.0)	12,049		16,658 (97.5)	453 (2.50)	17,111	
Experience of sadness or hopelessness in the past 12 months								
No	25,168 (94.1)	1,572 (5.90)	26,740	<0.001	21,754 (99.0)	231 (1.00)	21,985	<0.001
Yes	7,801 (88.6)	1,034 (11.4)	8,835		12,361 (96.8)	433 (3.20)	12,794	
Lifetime sexual experience								
No	31,272 (94.6)	1,795 (5.40)	33,067	<0.001	33,294 (98.6)	513 (1.40)	33,807	<0.001
Yes	1,690 (68.1)	810 (31.9)	2,500		819 (85.3)	151 (14.7)	970	
Experience of being treated due to violence in the past 12 months								
No	31,647 (92.9)	2,444 (7.10)	34,091	<0.001	33,538 (98.3)	632 (1.70)	34,170	<0.001
Yes	1,322 (88.8)	162 (11.2)	1,484		577 (94.4)	32 (5.60)	609	
Experience of second-hand smoking at home in the past 7 days,								
No	23,515 (94.3)	1431 (5.70)	24,946	<0.001	23,147 (98.8)	307 (1.20)	23,454	<0.001
Yes	9,454 (89.0)	1,175 (11.0)	10,629		10,968 (96.9)	357 (3.10)	11,325	
Body mass index (BMI) (kg/m^2)								
≤18.4	8,565 (94.4)	503 (5.60)	9,068	<0.001	8,287 (98.3)	151 (1.70)	8,438	0.722
18.5-22.9	16,238 (91.9)	1,460 (8.10)	17,698		20,095 (98.2)	406 (1.80)	20,501	
≥23.0	8,166 (92.8)	643 (7.20)	8,809		5,733 (98.2)	107 (1.80)	5,840	
Subjective body image								
Very lean	2,306 (91.1)	229 (8.90)	2,535	<0.001	851 (98.1)	14 (1.90)	865	0.928
Slightly lean	9,208 (92.5)	749 (7.50)	9,957		5,882 (98.2)	119 (1.80)	6,001	
Moderate	10,626 (92.5)	884 (7.50)	11,510		12,438 (98.2)	249 (1.80)	12,687	
Slightly overweight	9,516 (93.6	651 (6.40)	10,167		13,042 (98.3)	242 (1.70)	13,284	
Very obese	1313 (93.8)	93 (6.20)	1,406		1,902 (97.9)	40 (2.10)	1,942	
Combination of BMI-subjective body image								
≤18.4-lean	6,819 (93.8)	451 (6.20)	7,270	<0.001	5,195 (98.3)	97 (1.70)	5,292	0.935
≤18.4-moderate or overweight/obese	1,746 (97.1)	52 (2.90)	1,798		3,092 (98.4)	54 (1.60)	3,146	
18.5-22.9-lean	4,624 (90.0)	524 (10.0)	5,148		1,531 (97.9)	36 (2.10)	1,567	
18.5-22.9-moderate	8,128 (91.8)	741 (8.20)	8,869		9,496 (98.2)	197 (1.80)	9,693	
"18.5-22.9 -overweight/obese"	3,486 (94.9)	195 (5.10)	3,681		9,068 (98.2)	173 (1.80)	9,241	
≥23-lean or moderate	1,003 (91.8)	97 (8.20)	1,100		228 (98.6)	4 (1.40)	232	
≥23-overweight/obese	7,163 (93.0)	546 (7.00)	7,709		5,505 (98.2)	103 (1.80)	5,608	
Total	32,969 (92.8)	2,606 (7.20)	35,575		34,115 (98.2)	664 (1.80)	34,779	

daily smoking. Within the combination BMI-subjective body image groups, the highest smoking rate was for individuals within the "normal BMI- slightly or very lean body image" group.

Multiple logistic regression models for factors related to daily smoking

Three models were analyzed, those containing BMI (Model 1), subjective body image (Model 2), or a "BMI-subjective body image" combination (Model 3), in addition to students' socio-economic and health status-related factors. Generally, in both sexes, higher rates of daily smoking were associated with lower academic performance, lifetime alcohol drinking, lifetime sexual experience, engaging in part-time work, experience of sadness or hopelessness in the last 12 months, and

Table 2. Odds Ratios for Daily Smoking by Each Related Factor

	Male			Female		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Age*	1.36 (1.31-1.41)	1.35 (1.30-1.40)	1.36 (1.30-1.41)	1.19 (1.12-1.28)	1.19 (1.11-1.27)	1.19 (1.12-1.27)
Household income						
High	1.00	1.00	1.00	1.00	1.00	1.00
Middle	0.89 (0.78-1.00)	0.88 (0.78-1.00)	0.88 (0.78-1.00)	0.88 (0.71-1.10)	0.88 (0.71-1.10)	0.87 (0.70-1.09)
Low	0.96 (0.84-1.10)	0.96 (0.84-1.10)	0.96 (0.83-1.10)	1.03 (0.79-1.34)	1.03 (0.79-1.35)	1.03 (0.79-1.34)
Academic performance						
High	1.00	1.00	1.00	1.00	1.00	1.00
Slightly above average	1.14 (0.90-1.45)	1.13 (0.89-1.44)	1.14 (0.89-1.44)	1.17 (0.75-1.83)	1.17 (0.75-1.84)	1.17 (0.75-1.85)
Middle	1.49 (1.17-1.88)	1.48 (1.17-1.88)	1.48 (1.17-1.88)	1.20 (0.74-1.95)	1.20 (0.74-1.95)	1.20 (0.74-1.95)
Slightly under average	2.02 (1.62-2.51)	2.01 (1.61-2.50)	2.01 (1.62-2.50)	1.51 (0.95-2.39)	1.51 (0.95-2.40)	1.52 (0.95-2.42)
Low	3.75 (2.98-4.71)	3.77 (3.00-4.75)	3.74 (2.98-4.70)	3.30 (2.09-5.23)	3.34 (2.11-5.30)	3.32 (2.09-5.29)
Lifetime drinking experience,						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	8.08 (6.78-9.63)	8.05 (6.75-9.59)	8.05 (6.76-9.60)	30.9 (18.2-52.5)	30.9 (18.2-52.5)	31.1 (18.3-52.7)
Lifetime part-time work experience,						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	4.02 (3.63-4.45)	4.02 (3.63-4.46)	4.01 (3.62-4.45)	3.78 (3.20-4.45)	3.79 (3.21-4.47)	3.77 (3.20-4.44)
Stress awareness						
Almost absent	1.00	1.00	1.00	1.00	1.00	1.00
A little bit of stress	1.00 (0.86-1.15)	1.00 (0.87-1.15)	1.00 (0.86-1.15)	0.94 (0.67-1.31)	0.93 (0.67-1.31)	0.94 (0.67-1.31)
A lot of stress	1.26 (1.09-1.47)	1.28 (1.10-1.48)	1.27 (1.09-1.47)	1.11 (0.80-1.54)	1.12 (0.80-1.55)	1.12 (0.80-1.55)
Experience of sadness or hopelessness in the past 12 months						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.12 (1.02-1.24)	1.12 (1.02-1.24)	1.12 (1.02-1.24)	1.56 (1.32-1.86)	1.58 (1.33-1.87)	1.56 (1.32-1.86)
Lifetime sexual experience						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	3.70 (3.29-4.18)	3.69 (3.28-4.16)	3.71 (3.29-4.19)	4.31 (3.35-5.56)	4.27 (3.31-5.50)	4.31 (3.35-5.55)
Experience of being treated due to violence in the past 12 months						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.04 (0.79-1.39)	1.06 (0.80-1.40)	1.05 (0.79-1.39)	1.23 (0.78-1.94)	1.24 (0.78-1.97)	1.24 (0.79-1.96)
Experience of second-hand smoking at home in the past 7 days,						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.44 (1.30-1.59)	1.44 (1.30-1.59)	1.44 (1.30-1.59)	1.75 (1.47-2.09)	1.76 (1.48-2.10)	1.76 (1.47-2.09)
Body mass index (BMI) (kg/m2)						
≤18.4	1.10 (0.97-1.25)			1.24 (1.02-1.52)		
18.5-22.9	1.00			1.00		
≥23.0	0.86 (0.77-0.96)			0.85 (0.69-1.04)		
Subjective body image						
Very lean		1.04 (0.86-1.27)			1.03 (0.57-1.86)	
Slightly lean		1.03 (0.91-1.17)			0.95 (0.75-1.21)	
Moderate		1.00			1.00	
Slightly overweight		0.88 (0.77-1.00)			0.78 (0.65-0.94)	
Very obese		0.61 (0.47-0.79)			0.66 (0.47-0.93)	
Combination of BMI-subjective body image						
≤18.4-lean			1.07 (0.93-1.25)			1.07 (0.82-1.39)
≤18.4-moderate or overweight/obese			0.84 (0.59-1.20)			1.22 (0.89-1.67)
18.5-22.9-lean			0.96 (0.83-1.12)			0.85 (0.58-1.27)
18.5-22.9-moderate			1.00			1.00
"18.5-22.9 -overweight/obese"			0.79 (0.65-0.97)			0.82 (0.65-1.02)
≥23-lean or moderate			0.75 (0.55-1.02)			0.83 (0.27-2.57)
≥23-overweight/obese			0.83 (0.72-0.96)			0.76 (0.61-0.94)
AIC	663,459.40	662,986.80	663,013.50	210,924.10	210,843.00	210,755.90

exposure to passive smoking at home in the last 7 days. There was, however, no significant effect of household economic status and experience of being treated due to violence on daily smoking rates, when adjusted for other independent variables.

Model 1: Logistic regression model containing body mass index: In boys, the odds ratio for daily smoking was lower in the overweight or obese group (0.86; 95% CI: 0.77-0.96) and higher in the low bodyweight group (1.10; 95% CI: 0.97-1.25) compared with the normal bodyweight group, although the results for the latter were not statistically significant. In girls, the low bodyweight group had significantly higher odds ratio for daily smoking than the normal bodyweight group (1.24; 95% CI: 1.02-1.52).

Model 2: Logistic regression model containing subjective body image: There was no significant relationship between the perception of being very lean or slightly lean and daily smoking in either sex. Boys who perceived themselves as being very obese demonstrated lower odds ratios for daily smoking compared to the moderate body image perception group (0.61; 95% CI: 0.47-0.79). Girls who perceived themselves as being very obese showed an odds ratio of 0.66 (95% CI: 0.47-0.93) compared to the moderate body image perception group, and was lower than the odds ratio of the slightly overweight group compared to moderate group (0.78; 95% CI: 0.65-0.94).

Model 3: Logistic regression model containing a combination of body mass index-subjective body image: Compared to the "normal BMI-moderate body image" group, boys in the "normal BMI-overweight or obese body image" group had an odds ratio of 0.79 (95% CI: 0.65-0.97) for daily smoking, while the "obese BMI-overweight or obese body image" group had an odds ratio of 0.83 (95% CI: 0.72-0.96). In female students, only the "obese BMI-overweight or obese body image" group had a statistically significantly reduced odds ratio for daily smoking compared to the "normal BMI-moderate body image" group (0.76; 95% CI: 0.61-0.94).

Discussion

In this study, we compared subjective body image with BMI, and determined their associations with daily smoking. Boys who had a very obese body image or a BMI within the overweight to obese range were less likely to be daily smokers. In contrast, girls who had a slightly overweight or very obese body image reported lower daily smoking rates, while those with a low BMI were significant more likely to be daily smokers.

When comparing the odds ratios for daily smoking according to the combinations of BMI and subjective body image, in male students, among the BMI group of overweiqht or obese and that of normal, significantly lower daily smoking rates were observed only in the combinations with slightly overweight or obese body image perception. However, when the group with overweight or obese BMI was combined with moderate or lean body image, a significant relationship with low risk of daily smoking was not observed. And we can remind that, from Model 1 and Model 2 for male students in Table 2, overweight or obese BMI was significantly related to low daily smoking rate; however, moderate or lean body image perception was not. Therefore, there seem to be a greater association between daily smoking and subjective body image than with BMI. In contrast, in female students, only a combination of overweight or obese BMI and overweight or obese body image perception showed a significantly lower risk of daily smoking. In Models 1 and 2, an overweight or obese BMI was not related to low daily smoking rate, but the subjective perception of slightly overweight or obese body image was related. This suggests that subjective body image also has a greater effect on daily smoking than BMI in female students.

We calculated the AIC value in each model. In boys, the lowest AIC value was observed for Model 2, meaning the best fit was the model using subjective body image. In girls, however, Model 3, using the combination of BMI and subjective body image, was the best fit.

Other variables associated with the risk of daily smoking in male and female adolescents were analyzed. Factors positively associated with daily smoking rate were middle or low academic performance, stress awareness, experience of drinking, part-time work, and sexual experience. Household income level showed no significant relationship with daily smoking in both sexes. Several studies have reported other various factors associated with smoking intentions regarding to starting or quitting smoking, such as parental smoking, students' alcohol consumption habits, having friends who smoke, poor knowledge about the ill effects on health due to smoking, and so on (Hock et al., 2014; Ozawa et al., 2008). We need to further investigate about these factors and more closely care or concern the smoking status of students who are likely to be exposed to those environments.

A similar study on Korean adults revealed slightly different results (Jang, 2011). In female adults, lean body image perception was significantly related to increased smoking rate; this contrasts with our results that showed no similar relationship in adolescent girls. In addition, there was no significant association between a slightly overweight body image perception and daily smoking in women, but adolescent girls with this body image perception exhibited a significantly lower smoking rate. In contrast, low BMI was associated with high daily smoking rates in girls, but there was no association between BMI and smoking risk in female adults. Interestingly, the model using combinations of BMI and subjective body image recorded the best model fitness value with AIC for adult females, followed by BMI and subjective body image perception. In our study, the best model for girls was same as that for adults, but subjective body image model was more suitable than BMI model for explaining odds of daily smoking in female adolescents.

And another research studied for the relationship between BMI and smoking among adolescents in Denmark (Dhariwal et al., 2010) showed an opposing results. In addition to they revealed no significant association between daily smoking and BMI in both sexes, for the odds of all smoking they showed a positive relationship with increasing BMI among boys. However, differently

with that study, we adopted BMI as a categorical variable and also considered subjective body image together with it. Our study result about BMI was similar to another research conducted among Canadian students that showed decreased susceptibility of being a smoker in increased BMI category group (Leatherdale et al., 2008). And the result about subjective body image was also supported by this research that suggested adolescents who perceived themselves as being underweight were more likely to be susceptible for smoking. However, for the adolescents who considered themselves overweight or obese, our study revealed generally decreased risk for smoking and was in contrast with other previous researches (Tomeo et al., 1999; Fulkerson and French, 2003; Neumark-Sztainer et al., 2006). Such opposing results or trends between overweight and obese group by BMI and subjective body image categories, has been previously explained by the wish of losing weight among overweight youth, which makes themselves more likely to smoke (Lowry et al., 2002).

The current study has several limitations. First, it was a cross-sectional study using data from the ninth Korea Youth Risk Behavior Web-based Survey; therefore, it is difficult to establish a definite causal or temporal relationship between independent variables and daily smoking. The survey was performed using the self-reporting method, which relies on a participant's memory and subjective judgment; therefore, there is the possibility of errors due to individual differences in standards of judgment regarding economic status, academic performance, stress awareness, sadness and hopelessness, etc. Furthermore, the reliability of the answers is unknown. It is possible that some individuals may have concealed their smoking habits; therefore, the actual smoking rate may be different from that reported by male and female students. In response to this limitation, a previous study on Korean adult women confirmed the participants smoking status by measuring the urine cotinine level (Jang 2011). Chemical analysis can be a useful alternative method for studies containing variables such as this. In spite of its limitations, our research is the first study looking at the association between subject body image, BMI, and daily smoking in Korean students, using the Korea Youth Risk Behavior Web-based Survey as a data source.

Our study revealed the differences in smoking rates and characteristics between boys and girls, and determined how BMI and subjective body image affects daily smoking in adolescents. Furthermore, we suggested a suitable model for male and female adolescent smoking, respectively, mainly regarding to these two body shape-related factors. We could also identify other factors that could affect smoking behavior in students and demonstrated the differences with those of adults, providing evidence for the necessity of separate policies or interventions regarding smoking cessation in adolescents and adults.

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