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Research Article

Factors associated with smoking among high school students in Korea

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ABSTRACT

Background: Smoking has been a huge economic burden to health care beneficiary and policy makers. However, most smoking-related diseases are preventable by well-planned smoking cessation programs. Therefore, much effort has been made to reduce smoking behaviors, especially among the younger generation. This study examined the association between adolescent smoking and socioeconomic and demographic factors, and the relationship between smoking and sleep disturbance among high school students in Korea.
Methods: A cross-sectional survey was performed during 20 September - 21 October 2006, at 9 randomly selected high schools in the local areas of Gyeonggi province in the mid-western part of Korea (5 schools), and the city of Gwangju in the south-western region of Korea (4 schools).
Results: A self-report questionnaire was responded by 2404 high school students. Compared with the never smoker, current smoker was independently correlated with older age (OR 1.4; P = 0.0009), male gender (OR 4.6; P <0.0001), part-time job (OR 2.1; P = 0.0024), monthly allowance (>$50/month, OR 1.8; P = 0.0018), and casual alcohol use (OR 14.3; P <0.0001). Nonetheless the smoker group slept longer at night (6.5 vs. 6.0 hour, P <0.0001), they took more sleeping pills than the never-smoker (OR 5.1; 95% CI 1.5-17.3). Adjusting other factors, the smoker showed a positive correlation with symptoms of sleep disturbance (adjusted OR 1.5; 95% CI 1.1-2.2).
Conclusion: Smoking in high school students was significantly related to age, gender, family size, money allowance, and alcohol. It was also correlated with sleep disturbances causing insomnia, which could further reduce the quality of sleep and harm to health.

Keywords: Adolescent, Cigarette smoking, Socioeconomic factors, Sleep

INTRODUCTION

Smoking is a preventable major risk factor for chronic diseases, such as cardiovascular illness, lung malignancy, and chronic obstructive pulmonary disease, which increases mortality and morbidity.[1,2] Most smoking-related diseases require long-term inpatient and outpatient medical care for both treatment and follow-up by healthcare professionals and caregivers. Smoking has been a huge economic burden to health care beneficiary and policy makers.[3] However, most smoking-related diseases are preventable by well-planned smoking cessation programs. Therefore, much effort has been made to reduce smoking behaviors, especially among the younger generation.

Adolescents are at a vulnerable stage because they are transitioning from childhood to adulthood. They can be characterized as physiologically intermediate and psychologically unstable. Social states can be easily influenced by the opposite gender, siblings, teachers, and parents especially when they have had a personal or

social dilemma. Most adolescents successfully transition to adulthood, however, some can have behavioral and/or emotional problems in their peer relationships at school or home.[4,5] Previous studies have shown that initiation of smoking is most prevalent during the teenage years, which suggests that smoking is one of the methods used to cope with and to control emotional stress arising from peer relationships.[6]

A 1995 survey of Korean adolescents reported a smoking rate of 26.1% amongst male students and 4.7% amongst female students.[7] Over the last decade, in 2005, the rates had decreased to 15.7% for males and slightly increased to 6.5% for females.[7] Although there was a small increase for males in 2007, the rates remained similar with 16.2% of males and 5.2% of females smoking.[7,8] These changes in the smoking behavior of teenagers paralleled that in adults. According to the Korean Association on Smoking and Health (KASH), the adult smoking rates in 2005 were 50.3% in males and 3.1% in females, and in 2007, they were 42.0% and 4.6%, respectively. Focusing on smoking rates by age, youths in their 20s were found to be the most prevalent smoking group, which indicated an important snap shot of the continuation of smoking behavior from teenagers to adults.

Among college students in Pakistan, the habit of smoking was found to significantly correlate with peer pressure, father's smoking habits, having a non-working mother, and living in local residential areas.[9]

Another study revealed that adolescent males with more income had a higher likelihood of smoking.[10]

One of the recent studies in Korean teenagers showed that they slept to an unusual extent during the day because of nighttime sleep deprivation, which was related to poor performance and emotional instability.[11] Drake et al. suggested that insomnia was observed more often when a smoking or drinking episode occurred near bedtime.[12] These factors continued to worsen insomnia symptoms, which include difficulty in falling asleep, maintaining sleep and early morning awakening.[12] Another study reported that the prevalence of chronic anxiety and/or insomnia was significantly higher among smoking adolescents in Hong Kong.[13]

In this study, we investigated the relationship between cigarette smoking and socioeconomic and demographic factors in high school students in Korea.

We also examined the relationship between smoking and the presence of sleep disturbance and sleeping pill use from the youth's self-report questionnaire.

We aimed to provide information on the factors associated with adolescent smoking, which may contribute to the development of smoking prevention programs for the early adolescent.

METHODS

Subjects

A cross-sectional survey was performed during 20 September - 21 October 2006, at 9 randomly selected high schools in the local areas of Gyeonggi province in the mid-western part of Korea (5 schools), and the city of Gwangju in the southwestern region of Korea (4 schools).

We aimed to obtain data from 0.5% of the total 445,430 students (231868 males and 213562 females) in both regions. The questionnaire was distributed to 0.6% of total students, to allow for no response and incomplete answers. Five clusters in Gyeonggi province and four clusters in Gwangju were formed with the support of the officials who were responsible for statistics at the Office of Ministry of Education in Korea for each region. The study was in compliance with the Helsinki declaration and the survey content was reviewed by each school and the office of the ministry of education for both Gyeonggi province and Gwangju. The clusters were designed to maintain socioeconomic and demographic similarity and a school was randomly chosen in each cluster. These schools are located near large cities with the population spread across the upper, middle and lower socioeconomic classes, and best represented regular high school students in Korea. Prior to a main survey, a pilot study was carried out with 108 high school students, who had similar demographics to those in the main study but were not included in the final study. The pilot aimed to identify and correct any confusing questions and to validate the 29 questions given in the final survey. A total of 2694 students were enrolled in the study, and 2431 students responded to the questionnaire. Among these, 27 students were excluded because of incomplete responses to the smoking-related questions. Therefore, surveys completed by 2404 students were used for the analysis. Prior to the survey, we explained the purpose of the survey to the students and each questionnaire was answered anonymously by students themselves. The researchers assured students that no responses would be disclosed to any school authorities or to those with private or personnel relationships with the student.

Assessment

After the pilot study and questionnaire validation, the final 29 questions were used and divided into three subparts. The questionnaire was written in the Korean language. The first part of the survey covered demographic topics: gender, age, year of the school, classification of residency and family size. The second part included questions about individual environments including attention by parents on school performance and health (5 levels each), popularity by peers (4 levels), part time job (yes/no), allowance affordability (7 levels), extra-curricular activities (4 levels) and school grades (5 levels). The third part included questions about physical condition and health. It included height, weight, self-

health awareness (5-point scale), daily average number of cigarettes, smoking status (3 categories), alcohol and caffeinated drink intake. It also included four questions regarding sleep patterns and insomnia symptoms and a question about the use of sleeping pills (Table 1 & Appendix). Smoking status was categorized as smoker (if they answered 'yes' to the question of 'Do you smoke?'), ex-smoker (if they answered 'yes' to the question of 'Smoked before, but have now quit') and never-smoker (if they answered 'yes' to the question of 'Never smoked').

Sleep problems were assessed by asking about the duration of sleep, the duration between lying on the bed and falling asleep, the time they went to bed, and the time they woke in the morning.

Insomnia was evaluated by asking students if they had experienced difficulty in falling asleep, difficulty in getting back to sleep after waking up during the night, awakening too early in the morning, and the use of sleeping pills during the last 30 days. Questions that assessed sleep problems were as follows: 1) Did you experience frequent tossing and turning?, 2) If you woke up in the middle of night, did you have difficulty getting back to sleep?, 3) Do you wake up too early in the morning? If any of the above three questions were answered affirmatively, we considered that as the presence of a combined sleep disturbance. Insomnia was defined as the occurrence of the above problems for three or more nights a week.

Statistical analysis

Categorical variables were presented as percentages and continuous variables were shown as mean values with their corresponding standard deviation. The chi-square test or analysis of variance (ANOVA) was used to evaluate the association between smoking status and each characteristic. When statistical significance was found with bivariate analysis ($P \leq 0.05$), those variables were further assessed by multivariate logistic analysis to examine the correlation between variables related to socioeconomic factors and smoking status (referenced to those who never smoked). Correlation between smoking and sleep patterns was analyzed using ANOVA and multivariate logistic regression model to assess sleeping disturbance for each smoking status.

RESULTS

Demographic characteristics of survey responders according to smoking status

A total of 2404 students responded to the questionnaire (0.55% of total population, response rate: 90.2%). The subjects comprised 54.2% males and 45.5% females, and the overall smoking rate was 9.8% (data not shown). The smoking prevalence was higher in males than in females (15.1% vs. 3.6%, P <0.0001). The male students who had previously smoked were 6.1% among total male participants, and in females, they were 2.7% (Table 1).

Table 1: Demographic characteristics of study subjects by categories of smoking status.

Characteristics[+]	Total	Smoker (%)	Ex-smoker (%)	Never-smoker (%)	P value[*]
	N=2404	N=236	N=109	N=2059	
Male (n, %)	1302 (54)	196 (15.1)	79 (6.1)	1027 (78.9)	<0.0001[*]
Age, mean ± SD (years)		17.2 ± 0.9	16.7 ± 1.0	16.6 ± 1.0	<0.0001[*]
Daily number of cigarettes smoked (/day)		8.8 ± 5.5	4.7 ± 3.9	NA	<0.0001[*]
Yearly number of cigarettes smoked (pack/year)		1.5 ± 0.7	0.5±0.6	NA	<0.0001[*]
Age of initiating smoking (years)		15.5 ± 1.7	15.2 ± 1.7	NA	0.2373
Number in household					
≤3	290	17.9	5.5	76.6	0.0001[*]
4	1323	8.8	4.5	86.6	
5	585	8.9	3.8	87.4	
≥6	198	7.6	5.6	86.9	
Parents' interest in students' academic achievement					
Very low	29	27.6	17.2	55.2	<0.0001[*]
Low	117	18.8	3.4	77.8	
Normal	978	11.6	5.1	83.3	
High	892	8.2	3.8	88.0	
Very high	384	5.2	4.2	90.6	
Parents' interest in students' health					

Very low	17	23.5	23.5	52.9	
Low	71	18.3	2.8	78.9	
Normal	624	11.2	2.7	86.1	<0.0001*
High	975	9.0	5.6	85.3	
Very high	713	8.6	4.4	87.1	
Popularity by peers					
Very	663	14.3	5.3	80.4	
Regular	1448	8.2	4.3	87.6	<0.0001*
Less	256	6.3	3.5	90.2	
No	23	17.4	8.7	73.9	
Extra activities					
Very active	268	7.5	3.7	88.8	0.0394*
Active	856	7.9	4.1	88.0	
Less active	412	10.2	5.1	84.7	
No activity	854	12.3	5.0	82.7	
Grades					
High	770	8.7	3.8	87.5	
Medium	876	7.8	4.3	87.9	0.0005*
Low	720	13.5	5.6	81.0	
Part time work					
Yes	151	38.4	6.0	55.6	<0.0001*
No	2241	7.8	4.4	87.8	
Monthly allowance					
<$20	451	6.2	2.9	90.9	
$20–49.99	1166	5.7	4.1	90.2	
$50–79.99	427	11.2	6.1	82.7	
$80–99.99	155	17.4	6.5	76.1	<0.0001*
$100–149.99	85	20.0	5.9	74.1	
$150–199.99	38	44.7	2.6	52.6	
>$200	56	53.6	8.9	37.5	
BMI (kg/m^2)					
<18	339	9.7	3.2	87.0	
18 ≤ <20	672	9.7	4.6	85.7	
20 ≤ <22	585	10.4	4.3	85.3	0.7115
22 ≤ <25	464	9.7	5.4	84.9	
≥25	187	13.9	4.3	81.8	
Self-health awareness					
Very healthy	387	13.7	4.4	81.9	
Healthy	1109	8.8	4.4	86.7	
Normal	610	7.9	4.9	87.2	0.1273
Less healthy	254	11.8	3.9	84.3	
Not healthy	31	12.9	6.5	80.7	
Regular exercise					
Yes	896	10.6	6.1	83.3	0.0083*
No	1445	9.7	3.5	86.8	
Alcohol consumption					
Yes	388	42.5	11.9	45.6	<0.0001*
No	1984	3.5	3.2	93.3	
Caffeinated drink consumption					
Daily	412	14.1	7.0	78.9	
Often	1846	8.6	4.1	87.3	0.0002*
Never	98	12.2	2.0	85.7	

SD, Standard deviation; BMI, Body Mass Index

+Data were presented are percentages or mean values and corresponding standard deviations.

*Statistical significance is based on chi-square test or ANOVA, as appropriate P value <0.05 is considered significant

The mean age to start smoking was 15.5 years old in the smokers and 15.2 years old in ex-smokers in this study. Smoking prevalence was significant and positively correlated with age, number in the household, parents' interest in academic achievement and student's health, part-time employment, higher monthly allowance, alcohol use (P ≤0.0001). Grades (P = 0.0005) and regular exercise (P <0.0083) were also significant and negatively correlated with smoking (Table 1).

Interestingly, self-reported popularity by peers was more likely to be related to higher smoking rates, with the highest 'very high' (14.3%) and the lowest 'no' (17.4%) groups smoking more than those in the middle 'regular' (8.2%) and 'less' (6.3%) peer popularity groups. BMI and self-health awareness did not show a significant relationship with any smoking status groups.

Correlations of the socioeconomic and demographic variables with smoking status of high school students

We did the correlation between both socioeconomic and demographic variables and smoking status for both genders, and adjusted them to all other covariates. Older group (OR 1.4; P = 0.0009), male gender (OR 4.6; P <0.0001), small number of people in household (≤3 members) (OR 2.2; P = 0.0010), having part-time employment (OR 2.1; P = 0.0024), more allowance (>$50/month, OR 1.8; P = 0.0018), regular alcohol intake (OR 14.3; P <0.0001) were all significantly positively correlated with high school students who currently smoked. Moreover, the more interest parents showed in the student's academic achievement, the less the student was likely to smoke (OR 0.7; P = 0.0002; Table 2).

Relationship of smoking to sleep disturbance and sleeping pill use

The correlation between sleeping and smoking was assessed. Smokers had a longer duration of sleep than those who had never smoked (6.5 vs. 6.0 hour, P <0.0001). However, a longer sleep at night would usually mean a better rest, but the smokers in our study required a longer time to fall asleep after going to bed, which would imply that smokers had greater difficulty initiating sleep than those who had never smoked (20.9 vs. 14.1 min, P <0.0001). Furthermore, current smokers were more likely to go to bed after 2 am than those who had never smoked (10.2% and 3.8%, respectively, P <0.0001); they also had greater difficulty with getting up in the morning than those who had never smoked (63.5% and 91.5%, respectively, P <0.0001; Table 3).

The smoker group showed a significantly higher use of sleeping pills than ex-smokers or those who had never smoked (3.0% vs. 1.8% or 0.7%, respectively; P <0.0050; Table 3).

Table 2: Correlations of variables that influence adolescent smoking.

Variables	Smoker vs. never-smoker		Ex-smoker vs. never-smoker	
	Adjusted OR*	P value+	Adjusted OR*	P value+
Age	1.4	0.0009*	0.9	0.2348
Gender				
Male	4.6	<0.0001*	1.3	0.0011*
Female (reference)	1.0		1.0	
Number in household				
≤ 3	2.2	0.0010*	1.5	0.1851
≥4 (reference)	1.0		1.0	
Parents' interest in academic achievement (5 points scale)	0.7	0.0002*	0.7	0.0177*
Part-time work				
Yes	2.1	0.0024*	0.7	0.3607
No (reference)	1.0		1.0	
Monthly allowances				
< $50 (reference)	1.0		1.0	
$50–99.99	1.8	0.0018*	1.4	0.1574
>=$100	4.3	<0.0001*	1.4	0.3737
Caffeinated drink consumption				
Daily	1.3	0.2882	1.7	0.0325*
Not daily (reference)	1.0		1.0	
Alcohol consumption				
Yes	14.3	<0.0001*	6.6	<0.0001*
No (reference)	1.0		1.0	
Regular exercise				
Yes	0.7	0.0783*	1.3	0.1812
No (reference)	1.0		1.0	

*Adjusted for all other covariates
+χ^2 significant values for continuous variables (P <0.1)
OR, Odds ratio

The influence of smoking status on sleep disturbance was assessed independently for smokers and ex-smokers, when other variables were adjusted to reference those who had never smoked. The smoking group showed an odds ratio of 1.6 taking a longer time until falling asleep (95% confidence interval: 1.1-2.5, P <0.05). When all the symptoms of sleep disturbance were combined, the odds ratio for smokers to have sleep disturbance was 1.5 (95%

confidence interval: 1.1-2.2, P <0.05). The odds ratios for sleeping pill use were 5.1 for smokers (95% confidence interval: 1.5-17.3, P <0.01) and 2.6 for ex-smokers (95% confidence interval: 0.5-12.2, P = NS) when referenced to those who had never smoked (Table 4).

Table 3: The association of characteristics of sleep pattern and smoking status.

Variables	Smoker (%)	Ex-smoker (%)	Never-smoker (%)	P-value
	N=236	N=107	N=2018	
Duration of sleeping (hour)	6.5 ± 1.7	6.3 ± 1.3	6.0 ± 1.2	<0.0001
Duration to fall asleep (min)	20.9 ± 24.3	16.7 ± 20.5	14.1 ± 17.6	<0.0001
Time to bed (%)				
Up to 12 am	35.6	29.2	26.1	<0.0001
12 to 2 am	52.6	62.2	63.2	
Later than 2am	10.2	3.8	3.8	
Time of waking (%)				
Up to 7 am	63.5	86.7	91.5	<0.0001
7 to 8 am	33.1	12.4	7.5	
Later than 8 am	3.4	1.0	0.9	
Difficulty in returning to sleep during the night				
0-2 days/week	86.0	88.8	91.6	0.0122
≥ 3 days/week	14.0	11.2	8.4	
Sleeping pill use	3	1.8	0.7	0.0050[#]

[#]Analyzed by Fisher test.

Table 4: Correlation between sleep disturbance and sleeping pill use and smoking.

Variables	Difficulty in falling asleep	Difficulty in getting back to sleep	Awakening too early in the morning	Combined sleep disturbance	Sleeping pill use
	Adjusted OR[*] (95% CI)	Adjusted OR[*] (95% CI)	Adjusted OR[*] (95% CI)	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Smoking status					
Smoker	1.6[+] (1.1-2.5)	1.3 (0.8-2.1)	1.4 (0.8-2.4)	1.5[+] (1.1-2.2)	5.1[++] (1.5-17.3)
Ex-smoker	1.2 (0.7-2.0)	1.1 (0.6-2.2)	1.6 (0.9-3.0)	1.3 (0.9-2.1)	2.6 (0.5-12.2)
Never-smoker (reference)	1.0	1.0	1.0	1.0	1.0

[*]Adjusted for all other covariates
[@]P <0.1, [+]P <0.05, [++]P <0.01, [+++]P <0.001
[|]Combined model with difficulty in falling asleep, getting back to sleep, or awakening too early

DISCUSSION

C. Shin et al. reported that smoking during adolescence caused a four-fold increase in the prevalence of airway obstructive disease in Korea.[14] Moreover, adolescent smoking has been shown to be related to several somatic disorders such as sleep disturbance, headache and abdominal pain.[15] Although the incidence of smoking-related diseases is low in adolescents, smoking at this age should be handled seriously because smoking in early

adulthood is closely connected to the initiation of smoking during the teens. In addition, the smoking-related diseases and undiagnosed behavioral symptoms can progress to chronic conditions and complications in the later stages of their lives. Similarly, the study by Mattila and collaborators found that daily smoking was one of the strongest risk factors for hospitalization with lower back pain among adolescents.[16] There has long been a tendency for young people to start smoking at young age. The age of smoking initiation is reported to be less than 18 years old in many countries.[17] Some researchers suggest that the smoking-associated disadvantages are three times greater in people who started smoking before they were 16 years old than those who started in their 20s.[18,19] George et al. reported that gender, age, and the smoking status of parents and close friends were significant determinants of an adolescent's exposure to environmental tobacco smoke, which concurs with our own results.[20]

The Korean Association on Smoking and Health (KASH) reported that the smoking rate among middle and high school students in 2007 was 13.3%, which is slightly higher than the 9.8% from our study.[7] Another study showed that among middle and high school students from the southern part of Korea who smoked, 83% smoked approximately 10 cigarettes per day, whereas our study assessed the daily average to be 8.8 cigarettes.[21] Our study did not include middle school students; however, the selection of subjects in our study seemed to reflect the general high school adolescent population in the rural areas of Korea.[20]

To analyze the correlation between smoking and each covariate, the individual magnitude of smoking exposure needed to be distinguished carefully. Therefore, unlike most studies, which have divided the subjects into two groups, such as smokers and non-smokers, we categorized the study subjects into three different smoking status groups: smokers, ex-smokers, and never-smokers. Although the ex-smokers did not smoke at the time of study, they had been exposed to cigarettes previously. Therefore, their baseline health, physically and psychologically, may not be the same as students who have never smoked.

In this study, caffeinated drinks were significantly associated with the ex-smokers only, and not with the smokers. It may be too early to postulate any conclusion, but a possible explanation might be that ex-smokers may use caffeinated drinks as a nicotine substitute after quitting.

A large number of family members and high parental attention could be considered to increase family intervention for quitting cigarettes. Part-time employment and allowances could be interpreted giving the student the financial ability for students to be exposed to smoking behavior. In the multivariate logistic regression analysis, regular exercise was found to be inversely correlated with the smoker. Fife-Schaw et al. take a similar point of view and suggested that exercise reduces both the desire to smoke and cigarette withdrawal symptoms.[22]

One of the frequently occurring complaints related to smoking among adolescents is a difficulty in sleeping. Wong and colleagues reported that children who indicate having trouble sleeping and are overtired were more likely to be substance abusers than their peers with sufficient sleep.[23] Schoenborn and Adams found that the prevalence of cigarette smoking was higher among those who slept less than 6 hours per night.[24] The smoker group in this study reported a longer duration of sleep during the night than the other two groups. However, they tended to go to bed later at night, have more difficulty falling asleep again after waking up during the night, and had more difficulty in waking in the following morning than the ex-smoker or never-smoker groups. Therefore, it can be postulated that the quality of sleep in the smoker group may be poor. Poor sleep can be associated with other psychological and physiological stresses, diseases, and habits such as alcohol use, apart from smoking. Therefore, we excluded the factors of age, gender, alcohol, caffeine use; and we still found the same results as above. Indeed, the combined sleep disturbance was significantly correlated with smoking. The ex-smoker group also showed some sleep disturbance that may be due to their previous exposure to cigarette smoke, but this also depends upon the timing of quitting cigarettes. This result also supported our idea to separate smokers, ex-smokers and those who had never smoked into different groups. To gather more details on the influence of smoking cigarettes on sleep, an interventional study needs to be designed that includes polysomnography measurements.

Because our survey targeted high school students, we did not expect many to be using sleeping pills. Three percent of the students in the smoking group reported that they had taken sleeping pills, which was a significantly higher rate than that of students who had never smoked. However, this result requires further investigation because of the small sample size.

Smoking cessation campaigns have been targeted at a wide variety of groups in our population, consequently smoking rates have been dropping since the early 2000s. The results of our study suggest that several factors are potentially associated with high school student smoking behavior, as well as sleepiness. Therefore, the present study can assist in the development of programs optimized for smoking cessation and disease prevention by reducing the smoking rates in adolescents, as well as morbidity and mortality over the long term.

One of the limitations of the present study was the cross-sectional study design; we were therefore unable to account for smoking and its correlated factors with regard to long-term consequences. The survey questionnaire was

based on self-reported history and by design did not contain any objective measures.

CONCLUSION

Smoking among Korean high school students is strongly associated with various socioeconomic and demographic variables such as student's age, the number of family members, parents' interest in the student's health, and academic performance, popularity among peers, amount of allowance, and alcohol use. More importantly, adolescent smoking is closely correlated with sleep disturbances.

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