

Factors associated with Intermittent and Light Smoking among Korean High School Students: Intermittent and Light Smoking among Korean Adolescents

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Purpose: The purpose of this study was to identify factors associated with intermittent and light smoking among Korean high school students. **Methods:** In this cross-sectional study, we employed secondary data from the 2015 Korea Youth Risk Behavior Web-Based Survey, and used the biopsychosocial model as a framework. The analysis was performed using the data of 2,851 high school students who smoked. We defined intermittent and light smoking as smoking on 1 to 29 days in a 30-day period and no more than 10 cigarettes per day. A logistic regression analysis using the complex samples procedure was conducted. **Results:** Among all the participants, 1,231 (43.2%) were intermittent and light smokers. Factors significantly predicting intermittent and light smoking were gender and grade (biological factors); subjective stress (psychological factor); and mother's smoking, sibling's smoking and academic achievement (sociocultural factors). **Conclusion:** In smoking cessation programs, health care providers both at school and in the community should consider the unique biological, psychological, and sociocultural characteristics of intermittent and light smoking behavior among high school students.

Key Words: Students, Smoking, Smoking cessation

INTRODUCTION

Adolescence is a critical period for the beginning of health-related risk behaviors such as smoking [1]. Between 12~22% of adolescents in the USA and 27~30% in Europe have smoked cigarettes at some point [2]. According to a national survey in 2015, 17.4% of Korean adolescents had smoked at least once until the time of survey and the current smokers' rate was 7.8% [3]. Intermittent and light smoking was found to be an increasingly common pattern in adolescents [1]. The intermittent smoking rate was 5.6% of high school students, not significantly different from 7.9% of the daily smoking rate [4]. with a rate of 5.6% among high school students, which is not significantly different from the daily smoking rate of 7.9% [4].

Intermittent (non-daily smoking) and light smoking (no more than 10 cigarettes per day) represents the lowest lev-

el among smoking behaviors according to an evaluation of smoking frequency and intensity [5]. Thus, adolescents engaging in intermittent and light smoking might perceive this kind of smoking to cause the least harm or no harm to their health compared to daily and heavy smoking [1]. In this context, intermittent and light smokers were found to be advised to quit smoking by health care providers less often than were heavy smokers [6]. However, intermittent and light smoking increases the risk of cancer, cardiovascular disease, and respiratory symptoms compared to no smoking [5]. On the other hand, since smoking behavior develops as a continuous process from never smoking to daily smoking, intermittent and light smoking was found to be easier to quit than was daily or heavy smoking because of lower nicotine addiction and withdrawal symptoms [7]. Thus, adolescents who are intermittent and light smokers might be an important target

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group for smoking cessation programs at schools and in the community.

The prevalence of intermittent and light smoking in Korea has been found to be higher than in other Asian countries such as China [8,9]; however, research on this smoking behavior including adolescents has been limited to date. The factors associated with intermittent and light smoking have been found to differ from those relating to daily and heavy smoking. Whereas regular and heavy smoking tend to correlate with nicotine dependency, intermittent smoking seems to be more associated with situational factors such as alcohol consumption, being with friends, and being in the same space with smokers [10]. Researchers showed that the demographic and psychological characteristics of intermittent smokers (i.e., decreased smoking in smoking-free areas, self-categorization as non-smoker, and feeling stressed), including social smokers (i.e., those who smoke cigarettes primarily in social situations), differed from those of daily smokers [8,9,11]. Given these findings, Amrock and Weitzman [1] highlighted the need to understand the unique characteristics of intermittent and light smokers among adolescents and adults. The identification of factors associated with intermittent and light smoking among adolescents at various levels would be the first step to maximize the effect of smoking cessation programs by tailoring them to the target group.

As smoking is a chronic behavioral disease associated with genetic, psychological, environmental, and socio-cultural characteristics [4,9], the biopsychosocial model provides a framework for incorporating diverse factors associated with health-related behaviors linking health and sociocultural environment [12]. In previous studies using the biopsychosocial model, factors associated with smoking intention and smoking behaviors have been identified in adolescents and adults [13,14].

Thus, the purpose of this study was to identify the factors associated with intermittent and light smoking among Korean high school students.

METHODS

1. Design and Conceptual Model

This cross-sectional study used secondary data from the 2015 Korea Youth Risk Behavior Web-Based Survey (KYRBS). We used the biopsychosocial model as a framework for investigating the factors associated with intermittent and light smoking among high school students.

Based on this model, smoking behaviors can be influenced by biological, psychological, and sociocultural factors [15]. According to a previous study with Korean male adolescents using the biopsychosocial model, factors associated with smoking intention were emotional stress and risk-taking tendency as psychological factors, and the belief that adolescents' smoking is socially acceptable, close friends' smoking, siblings' previous or current smoking, and low family socioeconomic status as sociocultural factors [14]. In the same vein, Rondina Rde et al. reported that personality, mental disorder (e.g., depression, anxiety), and excessive alcohol consumption were factors significantly associated with smoking [16]. In addition, psychosocial factors associated with adolescents' smoking according to another study were personal stress, depression, personal health concern, risk behaviors such as alcohol use, parental smoking, sibling smoking, peer smoking, and school performance, and socio-demographic factors included parental socioeconomic status and income [17]. According to a literature review, the following factors were identified as potentially related to smoking behavior in adolescents: (1) gender and grade as biological factors [18]; (2) depressive symptoms [16], subjective stress [19], perceived health status [19], and alcohol use as psychological factors [10]; and (3) type of school [9], family socioeconomic status [14,19], parents' educational level [4], having parents [20] and siblings [21] who are current smokers, exposure to second-hand smoking at home [9], having close friends who are current smokers [20], seeing teachers and other staff smoking at school [20], and participating in anti-smoking education at school as sociocultural factors [22].

2. Participants

The KYRBS is an online survey performed annually to monitor health-related behaviors of Korean adolescents. In the 2015 KYRBS, a sample of 70,362 adolescents including middle and high school students was selected from 800 schools in 17 provinces of the Republic of Korea. Of these students, 68,043 (96.7%) participated in the survey, of which 33,744 were high school students. We used the data from 2,851 high school students who were current smokers and answered questions for the evaluation of biopsychosocial factors.

3. Instruments

The biopsychosocial factors considered for analysis are listed in Table 1. In this study, we defined intermittent and

light smoking as smoking on 1~29 days in a 30-day period and no more than 10 cigarettes per day respectively [11].

4. Data Analysis

We conducted complex sampling analysis using SPSS Statistics 22.0 program following the analysis guidelines

of the 2015 KYRBS. Descriptive statistics (frequencies and percentages) were calculated for the biological, psychological, and sociocultural factors. Subsequently, a logistic regression analysis using the complex samples procedure was conducted to identify the factors associated with intermittent and light smoking among the high school students.

Table 1. Measurement of Biopsychosocial Factors

Variables		Measurement
Biological factors	Gender	Male or Female
	Grade	1 st , 2 nd , or 3 rd
Psychological factors	Perceived health status	Subjects responded to a question on their perceived health status (with possible responses of very healthy, healthy, fair, unhealthy, or very unhealthy). They were reclassified as healthy, fair, or poor
	Subjective stress	Subjects responded to a question on subjective stress (with possible responses of extremely high stress, high stress, low stress, almost none, not at all). They were subsequently classified as having "high stress," "low stress," and "no stress"
	Depressive symptoms	Subjects responded to a question asking if they had felt sad or hopeless during the past 12 months (with possible responses of yes or no)
	Alcohol consumption	Subjects responded to a question about whether they had drank alcohol in the past 30 days (with possible responses of yes or no)
Sociocultural factors	Family socioeconomic status	Subjects responded to a question on their perceived household economic status. They were then reclassified as high, middle, and low
	Father's education level	Subjects responded to a question about their father's education level (with possible responses of less than middle school, high school graduation, and above college)
	Mother's education level	Subjects responded to a question about their mother's education status (with possible responses of less than middle school, high school graduation, and above college)
	Father's smoking	Subjects indicated whether their father smoked or not
	Mother's smoking	Subjects indicated whether their mother smoked or not
	Sibling's smoking	Subjects indicated whether a brother or sister smoked or not
	Exposure to secondhand smoking at home	Subjects indicated whether they had been exposed to secondhand smoking related to their family at home during the past 7 days or not
	Close friends' smoking	Subjects indicated how many close friends smoked (with possible responses of all, most, some, or none)
	Observing teachers and other staff smoking at school	Subjects responded whether school employees smoked at school or not.
	Academic achievement	Subjects ranked their academic achievement as high, upper-middle, middle, lower-middle, and low based on their own grade. They were subsequently reclassified as high, middle, or low
	Participation in anti-smoking education	Subjects responded with whether they had received education for smoking prevention and cessation during classes in the last year or not.

RESULTS

1. Intermittent and Light Smoking among High School Students

Among all participants (current smokers), 1,317 (46.9%) high school students were intermittent smokers; and 1,534 (53.1%) daily smokers. In addition, 2,340 (83.2%) high school students were light smokers; and 511 (16.8%) were daily smokers. By combining smoking frequency and intensity, 1,231 (43.2%) high school students were intermittent and light smokers; 86 (3.0%) were intermittent and heavy smokers; 1,109 (38.9%) were daily and light smokers; and 425 (14.9%) were daily and heavy smokers.

2. Biological, Psychological, and Sociocultural Factors

Table 2 shows frequencies and percentages of the biological, psychological, and sociocultural factors according to intermittent and light smoking and other smoking behaviors (intermittent and heavy smoking, daily and light smoking, and daily and heavy smoking). Regarding the biological factors for intermittent and light smokers, 80.2% of participants were male. As for the psychological factors, 66.4% of intermittent and light smokers reported no depressive symptoms, and 64.9% had consumed alcohol in the last 30 days. Regarding sociocultural factors, 95.8% of intermittent and light smokers had non-smoking mothers and 87.5% had non-smoking siblings, 44.7% did not observe their teachers or other staff smoking at school, and 27.8% reported high academic achievement.

3. Factors associated with Intermittent and Light Smoking among High School Students

Table 3 shows the results of the logistic regression analysis in terms of the factors associated with intermittent and light smoking among Korean high school students. Regarding biological factors, we found that female high school students were more likely to be intermittent and light smokers than male high school students (OR: 1.53, 95% CI: 1.23~1.90, $p < .001$). In addition, 1st year students were more likely to smoke intermittently and lightly than were 3rd grade students (OR: 1.56, 95% CI: 1.29~1.90], $p < .001$).

As for psychological factors, high school students with high levels of subjective stress were more significantly likely to engage in intermittent and light smoking than were high school students without subjective stress (OR:

1.46, 95% CI: 1.23~1.72, $p < .001$).

Finally, regarding sociocultural factors, adolescents whose mothers (OR: 1.96, 95% CI: 1.36~2.82, $p < .001$) and siblings (OR: 1.27, 95% CI: 1.02~1.58, $p = .035$) who were current smokers had higher odds of engaging in intermittent and light smoking than did their counterparts with non-smoking mothers and siblings. In addition, high school students with middle (OR: 1.25, 95% CI: 1.05~1.50, $p = .014$) and high (OR: 1.62, 95% CI: 1.32~1.98, $p < .001$) academic achievement were more likely to engage in intermittent and light smoking than were high school students with low academic achievement.

DISCUSSION

This study is the first trial to identify the factors associated with intermittent and light smoking among Korean high school students. We found that the biological factors associated with intermittent and light smoking among high school students were gender and grade. In other words, females and 1st grade high school students demonstrated greater odds of such smoking behavior compared to male and 3rd grade high school students. In a previous study with adolescent smokers in the US aged 13~17 years, those engaging in intermittent smoking began smoking at an older age and smoked more lightly (no more than 10 cigarettes per day) than did daily smokers [11]. This suggests that years of smoking might be associated with level of nicotine dependency [11]. Thus, 1st grade students with less years of smoking and lower nicotine dependency were more able to smoke intermittently and lightly than were 3rd grade students. In addition, females were found to be more likely to smoke intermittently and lightly than were males in a previous study [7]. In a previous research with Asian adolescents, smoking prevalence was higher among males than females [22]. And a previous study with Korean early adolescents showed that males had an approximately two-fold higher relative risk of smoking than did females [23]. In many Asian cultures, smoking is not a socially acceptable behavior among adolescents [24]. In particular, in the Republic of Korea, smoking is perceived to be associated with delinquency among adolescents, likely a result of Korea's confucian culture. Furthermore, Korean society has traditionally been an inordinately harsh judge of female adolescents who engage in socially unacceptable behaviors such as smoking. In this context, Korean female adolescents might begin smoking at an older age than male adolescents. Thus, female high school students would tend to smoke intermittently and lightly, with lower nicotine addiction, and more motiva-

Table 2. Characteristics of Biological, Psychological, and Sociocultural Factors

(N=2,851)

Variables	Categories	Intermittent and light smoker (n=1,231)	Intermittent and heavy smokers (n=86)	Daily and light smokers (n=1,109)	Daily and heavy smokers (n=425)
		n [†] (%) [‡]	n [†] (%) [‡]	n [†] (%) [‡]	n [†] (%) [‡]
Biological factors					
Gender	Male	989 (80.2)	65 (77.1)	931 (84.3)	354 (83.7)
	Female	242 (19.8)	21 (22.9)	178 (15.7)	71 (16.3)
Grade	1 st	355 (29.1)	30 (34.4)	219 (19.1)	96 (22.8)
	2 nd	405 (32.4)	22 (26.1)	395 (35.4)	142 (34.9)
	3 rd	471 (38.5)	34 (39.5)	495 (45.5)	187 (42.3)
Psychological factors					
Perceived health status	Healthy	877 (72.3)	58 (68.4)	771 (68.5)	294 (68.7)
	Fair	274 (21.8)	19 (20.7)	263 (24.2)	84 (19.1)
	Poor	80 (5.9)	9 (10.9)	75 (7.3)	47 (12.2)
Subjective stress	High	500 (41.2)	38 (40.3)	480 (43.9)	209 (47.6)
	Low	535 (42.8)	31 (41.0)	438 (39.6)	142 (33.4)
	None	196 (16.0)	17 (18.7)	191 (16.5)	74 (19.0)
Depressive symptoms (in a year)	Yes	401 (33.6)	50 (53.1)	398 (35.9)	186 (44.2)
	No	830 (66.4)	36 (46.9)	711 (64.1)	239 (55.8)
Alcohol consumption (in 30 days)	Yes	807 (64.9)	66 (74.3)	833 (75.0)	366 (84.3)
	No	424 (35.1)	20 (25.7)	276 (25.0)	59 (15.7)
Sociocultural factors					
Family socioeconomic status	High	392 (33.0)	34 (42.9)	340 (32.0)	165 (38.9)
	Middle	558 (44.1)	30 (34.5)	511 (45.1)	156 (37.1)
	Low	281 (22.9)	22 (22.6)	258 (22.9)	104 (24.0)
Father's educational level	≤ Middle school	59 (4.6)	8 (11.7)	63 (4.8)	29 (7.0)
	High school	558 (42.7)	36 (35.7)	505 (44.5)	208 (45.8)
	≥ College	614 (52.7)	42 (52.6)	541 (50.7)	188 (47.2)
Mother's educational level	≤ Middle school	36 (2.9)	9 (8.5)	52 (4.3)	23 (6.0)
	High school	687 (55.3)	43 (54.1)	625 (56.3)	240 (52.6)
	≥ College	508 (41.8)	34 (37.4)	432 (39.4)	162 (41.4)
Father's smoking	Yes	584 (46.9)	29 (33.9)	575 (51.3)	224 (49.7)
	No	647 (53.1)	57 (66.1)	534 (48.7)	201 (50.3)
Mother's smoking	Yes	54 (4.2)	10 (8.5)	83 (7.2)	50 (10.8)
	No	1,177 (95.8)	76 (91.5)	1,026 (92.8)	375 (89.2)
Sibling's smoking	Yes	160 (12.5)	15 (16.2)	160 (14.6)	91 (19.9)
	No	1,071 (87.5)	71 (83.8)	949 (85.4)	334 (80.1)
Exposure of second handed smoking at home	Yes	478 (38.1)	57 (66.4)	430 (37.0)	210 (48.8)
	No	753 (61.9)	29 (33.6)	679 (63.0)	215 (51.2)
Smoking of close friend	All	43 (3.6)	28 (35.7)	166 (14.7)	153 (37.1)
	Most	468 (38.3)	36 (40.6)	674 (60.8)	221 (49.2)
	Some	671 (54.1)	17 (18.6)	243 (21.8)	41 (10.6)
	None	49 (4.0)	5 (5.1)	26 (2.7)	10 (3.1)
Observing teachers and other staff smoking at school	Yes	674 (55.3)	63 (74.9)	694 (64.4)	293 (67.2)
	No	557 (44.7)	23 (25.1)	415 (35.6)	132 (32.8)
Academic achievement	High	338 (27.8)	25 (29.4)	230 (20.0)	102 (23.2)
	Middle	332 (26.9)	23 (32.7)	281 (26.7)	79 (19.9)
	Low	561 (45.3)	38 (37.9)	598 (53.3)	244 (56.9)
Participation in anti-smoking education (in a year)	Yes	737 (58.6)	34 (39.4)	667 (58.6)	244 (56.9)
	No	494 (41.4)	52 (60.6)	442 (41.4)	181 (43.1)

[†] Under weighted; [‡] Weighted.

Table 3. Associated Factors on Intermittent and Light Smoking among High School Students (N=2,851)

Variables	Categories	OR	95% CI	p	
Biological factors	Gender (Ref.: male)	Female	1.53	1.23~1.90	< .001
	Grade (Ref.: 3 rd)	2nd	1.09	0.90~1.32	.400
		1st	1.56	1.29~1.90	< .001
Psychological factors	Perceived health status (Ref.: poor)	Fair	1.39	0.98~1.96	.062
		Healthy	1.21	0.66~2.24	.543
	Subjective stress (Ref.: none)	Low	1.16	0.98~1.37	.088
		High	1.46	1.23~1.72	< .001
	Depressive symptoms (in a year) (Ref.: no)	Yes	1.15	0.99~1.35	.074
Alcohol consumption (in 30 days) (Ref.: no)	Yes	0.85	0.32~2.29	.748	
Sociocultural factors	Family socioeconomic status (Ref.: low)	Middle	0.89	0.73~1.08	.234
		High	0.48	0.11~2.08	.324
	Father's educational level (Ref.: less than middle school)	High school	1.03	0.72~1.48	.878
		Above college	1.11	0.77~1.59	.580
	Mother's educational level (Ref.: less than middle school)	High school	1.05	0.87~1.27	.604
		Above college	0.63	0.39~1.01	.053
	Father's smoking (Ref.: no)	Yes	1.04	0.89~1.21	.633
	Mother's smoking (Ref.: no)	Yes	1.96	1.36~2.82	< .001
	Sibling's smoking (Ref.: no)	Yes	1.27	1.02~1.58	.035
	Exposure to secondhand smoking at home (Ref.: no)	Yes	1.01	0.85~1.20	.882
	Close friend's smoking (Ref.: no)	Yes	1.16	0.76~1.78	.489
	Observing teachers and other staff smoking at school (Ref.:no)	Yes	0.88	0.70~1.10	.259
	Academic achievement (Ref.: low)	Middle	1.25	1.05~1.50	.014
High		1.62	1.32~1.98	< .001	
Participation in anti-smoking education (in a year) (Ref.: no)	Yes	0.92	0.78~1.07	.275	

Ref.=reference; OR=odds ratio; CI=confidence interval.

tion to quit [25].

In addition, among psychological factors, high subjective stress was associated with intermittent and light smoking. According to Shiffman et al. intermittent smoking is stimulated by external stress rather than an internal drive for nicotine intake [26]. In addition, intermittent smoking is likely to occur in stressful situations rather than social situations such as drinking alcohol or interacting with smokers [16]. Furthermore, intermittent and light smokers were shown to be more likely to smoke when they experienced psychological stress owing to an ongoing stressor [8]. Similarly, previous research reported smoking as a stress-relief method in Korean students [27]. Smoking might be associated with insufficient leisure time for resolving stress; indeed, Korean students living in a sociocultural atmosphere in which academic achievement

was emphasized were found to experience more severe stress than did those in other environments [27]. Accordingly, in our study, high school students with middle and high academic achievement were more likely to engage in intermittent and light smoking than were students with low academic achievement. In Korea, high school students with middle and high academic achievement might experience more competition in university entrance examinations in an attempt to enter a socially desirable university. On the other hand, students with low academic achievement may be excluded from the competition. Thus, the students with middle and high academic achievement might experience more severe daily academic stress than do those with low academic achievement, and this unrelieved academic stress might lead to intermittent and light smoking. Therefore, developing appropriate inter-

ventions would be required for relieving stress among adolescents to increase prevention and cessation of intermittent and light smoking in schools and communities.

Additionally, high school students whose mothers and siblings smoked were more likely to engage in intermittent and light smoking. Intermittent and light smokers tend to smoke when smoking is permitted [8]. In particular, Korean individuals tend to perceive that smoking in females and adolescents is an undesirable behavior that defies social norms and parental authority [28]. This perception regarding adolescents' smoking is associated with Confucian culture, which considers smoking behavior as a symbol of male adulthood [37]. Furthermore, in Korean societies influenced by a collective culture, acceptability in terms of social norms determines the behavior of each individual [29]. Thus, Korean adolescent smokers need to believe that their smoking behavior is socially acceptable in order to justify their socially inappropriate behavior [14]. In this context, smoking mothers and siblings might provide a reference for socially normative beliefs that justify smoking behavior. Thus, smoking cessation of family members should be a priority in order to facilitate the prevention and cessation of intermittent and light smoking in adolescents.

School-based smoking prevention programs are considered the most effective interventions for adolescent smoking. Such programs increase smoking knowledge and critical attitude, and reduce smoking intention; more specifically, school-based smoking prevention programs have been found to be effective for increasing health knowledge and promoting a critical attitude in relation to smoking, and decreasing smoking intention and behaviors in both the short and long term [30]. In addition, adolescents spend most of their week days at school and tend to learn health promotion behaviors from school health providers. Thus, schools could be the primary setting for health promotion education, including smoking prevention. We particularly recommend tailored school-based education programs that consider the above biological, psychological, and socio-cultural factors.

Our study has several limitations. First, we did not examine the association with all potentially associated factors (e.g., the media, certain family environmental factors, and other parental factors) noted in previous studies because of the limitations of secondary data analysis. Original studies are needed to identify various associated biological, psychological, and sociocultural factors. Second, our study identified general factors associated with intermittent and light smoking among Korean high school students; however, these factors might differ according to

demographic characteristics (e.g., age and area of residence). Thus, further research would be needed to examine the associations between these biopsychosocial factors and intermittent and light smoking among high school students considering specific demographic characteristics.

CONCLUSION

The purpose of this study was to identify the factors associated with intermittent and light smoking among Korean smoking high school students. We used the data from 2,851 currently smoking high school students of the 2015 KYRBS. We used the biopsychosocial model as a framework.

In conclusion, intermittent and light smoking among Korean high school students was associated with gender and grade (biological factors), subjective stress (psychological factor); and mother's smoking, sibling's smoking and academic achievement (sociocultural factors). Health care providers in both schools and communities should consider these specific factors when designing smoking cessation interventions for intermittent and light smoke adolescents.

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