

Academic performance, study time, psychological factors, and substance use among Korean adolescents

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ABSTRACT

Substance use and mental health problems often emerge during adolescence. However, relatively few large-scale studies have examined how academic and psychological factors jointly relate to substance use among adolescents in high-pressure educational contexts. This study investigated the associations between perceived academic performance, daily study time, psychological factors (stress, anxiety, and happiness), and alcohol and tobacco use among Korean adolescents. We analyzed the cross-sectional data of 50,914 middle and high school students who participated in the 2023 Korea Youth Risk Behavior Survey. Substance use was defined as any alcohol or tobacco use in the past 30 days. Hierarchical logistic regression models estimated the associations between sociodemographic, psychological, and academic variables and substance use, and interaction terms tested whether the associations between academic performance, study time, and substance use differed across levels of psychological factors. Overall, 12.5% of adolescents reported recent substance use. Higher stress and anxiety and lower happiness were associated with greater odds of use, whereas higher academic performance and longer daily study time were independently associated with lower odds of use. Anxiety and happiness showed small but significant interactions with academic factors, although negative associations between academic performance, study time, and substance use were maintained across levels of psychological functioning. These findings highlight the potential relevance of academic engagement and emotional well-being for school-based strategies to address adolescent substance use in competitive educational contexts such as Korea.

1. Introduction

Adolescence is a developmental period in which experimentation with substances, such as alcohol and tobacco, commonly emerges alongside increasing vulnerability to a range of mental health problems (Degenhardt et al., 2016; Hall et al., 2016). Problematic substance use during adolescence has been linked to neurocognitive changes, subsequent substance use disorders, and enduring mental health difficulties, making it a major public health concern (Gray & Squeglia, 2018; Lees et al., 2020). Globally, understanding adolescent substance use has received sustained attention (Keyes et al., 2019; Ma et al., 2021), and prevention strategies that consider broad individual, familial, and community harm and the substantial social and economic costs associated with substance use have been substantially emphasized (Das et al., 2016). In this context, identifying factors that are reliably associated with adolescents' likelihood of engaging in substance use is essential for

informing preventive efforts (Erskine et al., 2015; Nawi et al., 2021). In particular, focus is needed on academic factors, which constitute one of the domains most closely intertwined with adolescents' daily lives (Bugbee et al., 2019; Zhou et al., 2023).

A substantial body of research has examined the association between adolescents' academic functioning and substance use. Prior studies have consistently shown that adolescents who use alcohol, tobacco, or other drugs tend to have lower grades, more frequent absences or tardiness, and an elevated risk of school dropout and grade retention compared to their non-using peers (Alqahtani et al., 2023; Bugbee et al., 2019). This research stream has typically conceptualized substance use as undermining academic achievement through pathways such as impaired cognitive functioning, reduced school engagement, and increased affiliation with deviant peers. Furthermore, other studies have reported that low academic achievement and diminished academic motivation have been associated with the subsequent initiation or escalation of substance

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use (Morin et al., 2012; Zhou et al., 2023), suggesting that the relationship between academic performance and substance use may be reciprocal rather than strictly unidirectional (Andrade, 2014; Latvala et al., 2014). In Korea, empirical studies document inverse associations between school grades and adolescent drinking and smoking when substance use is modeled as the outcome (Kim & Chun, 2018; Sung et al., 2016). However, school performance has often been treated only as a control variable, with relatively little attention paid to the mechanisms and contextual conditions through which academic functioning and substance use become intertwined.

Psychological factors, such as stress, anxiety, and subjective happiness, are closely intertwined with adolescent substance use. Several studies have reported that adolescents with elevated depressive and anxiety symptoms are more likely to use alcohol and tobacco and that mental health problems and substance use frequently co-occur and may exacerbate each other over time (Cioffredi et al., 2021; Ferreira et al., 2019; Halladay et al., 2024). Adolescents may turn to substances to cope with stress experienced in academic or interpersonal contexts (Stubbs et al., 2017). However, repeated substance use has been associated with worsened mood and increased anxiety levels (Mojtabai & Crum, 2013; Moylan et al., 2013). Furthermore, higher levels of positive well-being indicators, such as happiness and life satisfaction, have been associated with a lower likelihood of engaging in risk behaviors (Kye et al., 2016; Schick et al., 2022), whereas other work suggests that substance use itself may make adolescents feel less happy (Shahab & West, 2012).

These issues may be especially salient in East Asian educational contexts where schooling is characterized by intense academic competition. In particular, Korean adolescents are widely known to experience strong academic pressure arising from an examination-oriented system, extensive participation in private tutoring, and long study hours (Jarvis et al., 2020; Shin et al., 2018). Notably, academic stress has been identified as a major source of psychological distress and suicidal ideation in this population (Kim et al., 2022; Phosaly et al., 2019; Sun-Kyung et al., 2015). In such environments, academic achievement and daily study time function not only as educational indicators but also as core elements of adolescents' identities and their families' expectations (Ahn & Baek, 2012). High levels of academic functioning may strengthen attachment to school and reduce opportunities for engaging in risk behaviors (Nawi et al., 2021). However, the same demands can also be experienced as excessive burden and pressure (Chung & Park, 2024). Psychological difficulties, such as stress and anxiety, may influence both academic engagement and substance use (Kim et al., 2022), raising crucial questions about how academic and psychological factors intersect in shaping health-risk behaviors among adolescents.

Despite the extensive literature stream on academic outcomes and adolescent substance use, relatively few studies have considered academic functioning and psychological factors simultaneously or examined potential interaction effects among academic variables, psychological states, and substance use (Busch et al., 2014; Zhou et al., 2023). Most prior studies have treated academic achievement as either a predictor or consequence of substance use in isolation or have focused primarily on mental health correlates of substance use, without explicitly analyzing the joint or interactive contributions of the academic and psychological domains. Large-scale East Asian studies that integrate school grades, detailed study time indicators, multiple dimensions of psychological functioning, and developmental and demographic characteristics such as school level and sex remain particularly scarce. In this context, the Korea Youth Risk Behavior Survey (KYRBS) provides a valuable opportunity to link academic and psychological indicators with recent substance use in a large nationally representative sample, thereby enabling a more nuanced examination of the protective and risk factors associated with adolescents' substance use.

This study used nationally representative data from the 2023 KYRBS to examine how adolescents' perceived academic performance and daily study time are associated with alcohol and tobacco use and how these

associations relate to psychological factors, including stress, anxiety, and happiness. Three research questions were addressed. First, after adjusting for school level, sex, and perceived economic status, how are stress, anxiety, and happiness associated with adolescents' past-30-day substance use? Second, are perceived academic performance and daily study time independently associated with substance use and can they provide additional explanatory power beyond sociodemographic and psychological factors? Third, do the associations between academic factors and substance use differ in strength across stress, anxiety, and happiness levels, indicating interactions between psychological and academic factors?

Considering that the analyses are based on a large cross-sectional survey, and thus correlational in nature, the study aims to describe and explore patterns of association and potential interactions between academic and psychological factors and adolescent substance use, rather than to infer causal or unidirectional effects. The findings are intended to provide the empirical groundwork for identifying academic and psychological characteristics that may serve as potential protective correlates in school-based prevention policies and programs designed to support adolescents' emotional and academic adjustment.

2. Methods

2.1. Data source and participants

This secondary data analysis used raw data from the 19th KYRBS, administered by the Korea Disease Control and Prevention Agency (KDCA, 2023). The KYRBS is a government-approved national survey (Approval No. 117058) that uses an anonymous, self-administered online format to assess Korean adolescents' health behaviors, mental health, and living environments. The survey uses a stratified sampling method based on geographic region and school level, followed by two-stage cluster sampling, in which schools are selected in the first stage and classes in the second stage. All students in the selected classes participate in the survey. Using stratification based on region size, school level, and sex, the KYRBS aims to produce a sample representative of the population distribution of Korean middle and high school students.

The survey participants were 52,880 students from 796 schools. The KYRBS is administered through an online system in which respondents must complete each item before proceeding to the next, minimizing item nonresponse. Logical inconsistencies and invalid responses are cleaned by the survey agency prior to data release. In the dataset used in this study, only five cases with missing data were identified for perceived economic status and five for perceived academic performance, whereas 1962 cases were missing for the daily study time variable. Logistic regression analyses applied listwise deletion by default, and this approach was adopted in this study. After excluding cases with missing values, the final analytic sample comprised 50,914 adolescents, representing approximately 96% of the total survey participants. Considering the small proportion of missing data, the exclusion of these cases is unlikely to have affected the representativeness of the sample or stability of the estimates. This study analyzed de-identified secondary data from a government-approved national survey and was confirmed to not require institutional review by the authors' Institutional Review Board.

2.2. Measures

The dependent variable in this study was substance use, which was assessed based on whether the respondents had engaged in alcohol use or smoking during the past 30 days. Alcohol use was coded as present if the respondents reported drinking at least one day in the past 30 days, excluding the response category indicating no use. Smoking was coded as present if the respondents had used any of the following at least once in the past 30 days: conventional cigarettes, liquid-type e-cigarettes, or heated tobacco products. Adolescents who reported either drinking or

smoking were coded as the substance use group (1), and those who did not report either behavior were coded as non-users (0).

Psychological factors included stress, anxiety, and happiness. Stress was measured with a single item (i.e., “How much stress do you usually feel?”) rated on a 5-point Likert scale (1 = very much, 5 = not at all). The item was reverse-coded such that higher scores indicated higher stress levels. Anxiety was measured using the Generalized Anxiety Disorder-7, which includes seven items assessing symptoms such as nervousness, uncontrollable worry, excessive worry, difficulty relaxing, restlessness, irritability, and fear of something awful happening. Items were rated on a 4-point scale (1 = not at all, 4 = nearly every day), recoded to a 0–3 scale, and summed to yield a total score ranging from 0 to 21, with higher scores indicating higher anxiety. Happiness was measured with a single item (i.e., “How happy do you usually feel?”) rated on a 5-point Likert scale (1 = very happy, 5 = very unhappy). The item was reverse-coded such that higher scores indicated greater happiness.

Academic factors included perceived academic performance and daily study time. Academic performance was measured using a 5-point scale and reverse-coded such that higher scores indicated better perceived achievement (1 = lowest to 5 = highest). Study time was measured by asking respondents to report the number of minutes spent per day on academic activities over the past seven days, including school classes, private academy lessons, homework, studying using digital devices, and viewing educational broadcasts. Reported minutes were first divided by 60 to convert them into hours. Weighted average daily study time was calculated by multiplying weekday study hours by five, multiplying weekend study hours by two, summing these values, and then dividing the total by seven, yielding a continuous measure of average daily study time.

The control variables included school level, sex, and perceived economic status. School level was coded as 0 = middle school and 1 = high school to reflect developmental differences. Sex was coded as 0 = male and 1 = female based on biological sex. Economic status was measured with a single item rated on a 5-point scale (1 = high, 5 = low). The item was reverse-coded such that higher scores indicated better perceived economic status.

2.3. Data analysis

All analyses were conducted using SPSS 26.0. Descriptive statistics and group differences between substance users and non-users were examined. Chi-square tests were used for categorical variables (school level and sex), and independent samples *t*-tests were used for continuous variables.

Hierarchical binary logistic regression analyses were conducted to estimate the associations between substance use and the main study variables. Model 1 included demographic factors (school level, sex, and economic status). Model 2 added psychological factors (stress, anxiety, and happiness) to estimate their main effects. Model 3 added academic factors (academic performance and study time) to examine the independent contributions of psychological and academic variables. In Model 4, interaction terms were introduced to test whether psychological factors moderated the associations between academic performance or study time and substance use. Model 4a included three interaction terms between academic performance and each of the three psychological factors, and Model 4b included interactions between study time and psychological factors. All continuous variables were mean-centered before creating the interaction terms to reduce multicollinearity. A summary of the variables entered at each step is presented in Table 1.

Regression results were reported using unstandardized coefficients (B), standard errors (SE), Wald statistics, *p*-values, odds ratios (OR), and 95% confidence intervals (CI). Model fit was assessed using $-2 \text{ Log Likelihood}$ ($-2LL$) and Nagelkerke R^2 . Chi-square difference tests were used to examine whether model fit improved significantly across successive models.

For significant interaction effects, simple slope analyses were

Table 1

Summary of hierarchical logistic regression models.

Model	Variables added at each step
Model 1	School level, sex, economic status
Model 2	Stress, anxiety, happiness
Model 3	Academic performance, study time
Model 4a	AP $\times$ stress, AP $\times$ anxiety, AP $\times$ happiness
Model 4b	ST $\times$ stress, ST $\times$ anxiety, ST $\times$ happiness

Note. Each model includes all variables entered in the preceding model. AP = academic performance; ST = study time.

conducted by estimating the association between the predictor and substance use at low (-1 SD), mean, and high ($+1 \text{ SD}$) levels of the moderator. These analyses enabled a clearer interpretation of how psychological factors influence the strength of the associations between academic performance or study time and substance use. The significance level was set at 0.05 for all analyses.

3. Results

3.1. Descriptive statistics and group differences

Among the 50,914 adolescents in the final analytical sample, 12.5% ($n = 6377$) reported at least one episode of alcohol use or smoking within the past 30 days. Group comparisons between users and non-

Table 2

Participants' demographic, psychological, and academic characteristics ($N = 50,914$).

Variables	Total M $\pm$ SD, n (%)	Non-users M $\pm$ SD, n (%)	Users M $\pm$ SD, n (%)	χ^2/t	p
Substance use					
No	44,537 (87.5%)				
Yes	6377 (12.5%)				
Demographic factors					
School level				1550.53	<.001
Middle school	27,418 (53.9%)	25,450 (92.8%)	1968 (7.2%)		
High school	23,496 (46.1%)	19,087 (81.2%)	4409 (18.8%)		
Sex				256.83	<.001
Male	25,769 (50.6%)	21,943 (85.1%)	3826 (14.9%)		
Female	25,145 (49.4%)	22,594 (89.9%)	2551 (10.1%)		
Economic status	3.40 $\pm$ 0.89	3.42 $\pm$ 0.88	3.27 $\pm$ 0.97	12.81	<.001
Psychological factors					
Stress	3.25 $\pm$ 0.91	3.24 $\pm$ 0.90	3.40 $\pm$ 0.97	-13.03	<.001
Anxiety	4.19 $\pm$ 4.56	4.05 $\pm$ 4.44	5.12 $\pm$ 5.19	-17.45	<.001
Happiness	3.66 $\pm$ 0.98	3.69 $\pm$ 0.97	3.49 $\pm$ 1.04	14.84	<.001
Academic factors					
Academic performance	3.10 $\pm$ 1.16	3.14 $\pm$ 1.15	2.81 $\pm$ 1.19	21.59	<.001
Study time	6.40 $\pm$ 3.45	6.47 $\pm$ 3.44	5.94 $\pm$ 3.53	11.38	<.001

Note. M = mean; SD = standard deviation. Values represent means and standard deviations for continuous variables and frequencies with percentages for categorical variables. χ^2 tests were used for categorical variables (school level and sex). Independent samples *t*-tests were used for continuous variables.

users revealed significant differences across all demographic, psychological, and academic factors (Table 2).

At the demographic level, substance use was more prevalent among high school students (18.8%) than middle school students (7.2%), $\chi^2(1) = 1550.53$, $p < .001$. The prevalence was also higher among male students (14.9%) than among female students (10.1%), $\chi^2(1) = 256.83$, $p < .001$. Adolescents who reported substance use indicated slightly lower perceived economic status than non-users ($M = 3.27$, $SD = 0.97$ vs. $M = 3.42$, $SD = 0.88$), $t = 12.81$, $p < .001$.

Psychological factors also differed between groups. Users reported higher stress ($M = 3.40$, $SD = 0.97$) than non-users ($M = 3.24$, $SD = 0.90$), $t = -13.03$, $p < .001$, and higher anxiety scores ($M = 5.12$, $SD = 5.19$ vs. $M = 4.05$, $SD = 4.44$), $t = -17.45$, $p < .001$. Conversely, happiness levels were lower among users ($M = 3.49$, $SD = 1.04$) than among non-users ($M = 3.69$, $SD = 0.97$), $t = 14.84$, $p < .001$.

Regarding academic factors, adolescents who reported substance use exhibited lower self-rated academic performance ($M = 2.81$, $SD = 1.19$) than non-users ($M = 3.14$, $SD = 1.15$), $t = 21.59$, $p < .001$. Users also reported shorter average daily study time ($M = 5.94$ h, $SD = 3.53$) than non-users ($M = 6.47$ h, $SD = 3.44$), $t = 11.38$, $p < .001$.

Overall, adolescents who reported substance use showed consistent differences compared to non-users across demographic, psychological, and academic factors, with users exhibiting greater psychological difficulties and lower academic functioning.

3.2. Factors associated with adolescent substance use

Hierarchical logistic regression analyses were used to examine whether demographic, psychological, and academic factors were

associated with the likelihood of substance use among adolescents (Table 3). Adding psychological (increase in Nagelkerke $R^2 = 0.015$; $\Delta\chi^2(3) = 432.47$, $p < .001$) and academic ($\Delta R^2 = 0.013$, $\Delta\chi^2(2) = 369.46$, $p < .001$) factors significantly improved model fit.

In Model 1, high school students had higher odds of substance use than middle school students ($OR = 2.930$, 95% CI [2.768, 3.101]). Female students had lower odds than male students ($OR = 0.632$, 95% CI [0.599, 0.668]). Higher perceived economic status was associated with lower odds of substance use ($OR = 0.866$, 95% CI [0.840, 0.893]).

In Model 2, when psychological factors were added, stress ($OR = 1.073$, $p < .001$) and anxiety ($OR = 1.044$, $p < .001$) showed positive associations with substance use, whereas happiness showed a negative association ($OR = 0.935$, 95% CI [0.905, 0.966]). These associations remained statistically significant after academic factors were introduced.

In Model 3, academic performance ($OR = 0.881$, 95% CI [0.859, 0.903]) and study time ($OR = 0.945$, 95% CI [0.937, 0.952]) were negatively associated with substance use, indicating that higher academic functioning was associated with lower odds of substance use, net of demographic and psychological factors.

Models 4a and 4b tested whether psychological factors moderated the associations between substance use, academic performance, and study time. Anxiety showed significant interactions with both academic performance ($OR = 1.006$, 95% CI [1.001, 1.011]) and study time ($OR = 1.002$, 95% CI [1.000, 1.004]). Happiness also demonstrated a significant interaction with study time ($OR = 1.010$, 95% CI [1.001, 1.019]). These findings indicate that the associations between academic factors and substance use varied across anxiety and happiness levels. The direction of the associations remained negative across all models.

Table 3

Results of hierarchical logistic regression models predicting substance use ($N = 50,914$).

Variable	Model 1 OR [95% CI]	Model 2 OR [95% CI]	Model 3 OR [95% CI]	Model 4a OR [95% CI]	Model 4b OR [95% CI]
School level	2.930*** [2.768, 3.101]	2.967*** [2.803, 3.141]	3.121*** [2.942, 3.310]	3.116*** [2.938, 3.305]	3.118*** [2.940, 3.307]
Sex	0.632*** [0.599, 0.668]	0.565*** [0.534, 0.598]	0.601*** [0.568, 0.636]	0.601*** [0.568, 0.637]	0.602*** [0.568, 0.637]
Economic status	0.866*** [0.840, 0.893]	0.903*** [0.876, 0.931]	0.967* [0.937, 0.999]	0.967* [0.937, 0.999]	0.967* [0.937, 0.999]
Stress		1.073*** [1.033, 1.114]	1.091*** [1.050, 1.132]	1.094*** [1.052, 1.136]	1.090*** [1.049, 1.132]
Anxiety		1.044*** [1.037, 1.051]	1.045*** [1.038, 1.052]	1.047*** [1.040, 1.054]	1.046*** [1.039, 1.053]
Happiness		0.935*** [0.905, 0.966]	0.951** [0.920, 0.983]	0.953** [0.921, 0.985]	0.955** [0.924, 0.987]
Academic performance			0.881*** [0.859, 0.903]	0.874*** [0.852, 0.897]	0.881*** [0.859, 0.903]
Study time			0.945*** [0.937, 0.952]	0.944*** [0.937, 0.952]	0.944*** [0.937, 0.952]
AP $\times$ Stress				1.017 [0.986, 1.049]	
AP $\times$ Anxiety				1.006* [1.001, 1.011]	
AP $\times$ Happiness				1.007 [0.980, 1.035]	
ST $\times$ Stress					0.999 [0.989, 1.010]
ST $\times$ Anxiety					1.002* [1.000, 1.004]
ST $\times$ Happiness					1.010* [1.001, 1.019]
-2 Log Likelihood	36,492.00	36,059.53	35,690.07	35,679.17	35,683.33
Nagelkerke R^2	0.070	0.085	0.098	0.099	0.099
χ^2 (df)	1923.34 (3)***	2355.81 (6)***	2725.27 (8)***	2736.17 (11)***	2732.01 (11)***

Note. Odds ratios (OR) and 95% confidence intervals (CI) are reported. All continuous predictors, including stress, anxiety, happiness, academic performance (AP), and study time (ST), were mean-centered prior to creating interaction terms. AP $\times$ Stress, AP $\times$ Anxiety, and AP $\times$ Happiness represent the interactions between centered academic performance and each psychological factor; ST $\times$ Stress, ST $\times$ Anxiety, and ST $\times$ Happiness represent the interactions between centered study time and each psychological factor. $p < .05$, ** $p < .01$, *** $p < .001$.

3.3. Interaction effects (simple slopes)

Interaction terms were examined to determine whether psychological factors moderated the associations between academic performance and study time and substance use. Three interactions reached statistical significance: academic performance $\times$ anxiety, study time $\times$ anxiety, and study time $\times$ happiness (Table 3). Interactions involving stress were not significant.

Simple slope analyses were used to clarify these effects. For academic performance, a negative association with substance use was observed across all levels of anxiety, with slopes of -0.140 at low anxiety, -0.134 at the mean, and -0.128 at high anxiety. These values indicated a slight reduction in the magnitude of the association as anxiety increased, although the overall pattern remained negative (Fig. 1).

A similar pattern emerged for study time. The simple slopes were -0.059 at low anxiety, -0.057 at the mean, and -0.055 at high anxiety, indicating a slightly smaller magnitude of the association at higher anxiety levels. In relation to happiness, the simple slopes for study time were -0.067 at low happiness, -0.057 at the mean, and -0.047 at high happiness, indicating that the negative association between study time and substance use was somewhat weaker among adolescents who reported greater happiness.

Overall, although the strengths of the associations varied across anxiety and happiness levels, negative associations between academic factors and substance use were consistently observed across all levels of the moderators.

4. Discussion

This study extends previous research by showing that academic and psychological factors were jointly associated with recent substance use in a large, nationally representative sample of Korean adolescents. Overall, poorer psychological functioning, reflected in higher stress and anxiety and lower happiness, was associated with higher odds of substance use, whereas better perceived academic performance and longer study time were associated with lower odds, even after adjustment for sociodemographic and psychological factors. Although anxiety and happiness modestly altered the strength of some associations, the overall pattern remained consistent, with academic factors showing negative associations with substance use across levels of psychological functioning. Taken together, these findings suggest that adolescent substance use may be better understood through the intersection of psychological functioning and academic engagement than through either domain alone, particularly in the context of Korean adolescents.

In this study, higher stress and anxiety and lower happiness were associated with a greater likelihood of substance use, consistent with prior research showing that adolescents experiencing psychological difficulties report alcohol and tobacco use more often than their peers (Cioffredi et al., 2021; Ferreira et al., 2019; Halladay et al., 2024; Mojtabai & Crum, 2013). The positive association between stress and substance use is consistent with stress-coping perspectives and with prior studies reporting that stress and substance use often co-occur in adolescence (Stubbs et al., 2017). In the Korean context of competitive entrance examinations and long study hours (Jarvis et al., 2020; Shin et al., 2018), such patterns suggest that maladaptive coping and substance use may co-occur in specific subgroups (Bonilha et al., 2013). However, happiness was negatively associated with substance use, which aligns with findings that higher subjective happiness and life satisfaction are linked to lower engagement in health-risk behaviors (Kye et al., 2016; Schick et al., 2022). Considering that positive emotional states are often accompanied by greater resilience and more adaptive coping (Akhtar & Boniwell, 2010), interventions that aim to promote emotional well-being in high-stress academic environments may represent a potential avenue for reducing risks related to adolescent substance use (Jeong & Lim, 2025).

Academic performance and daily study time showed modest but

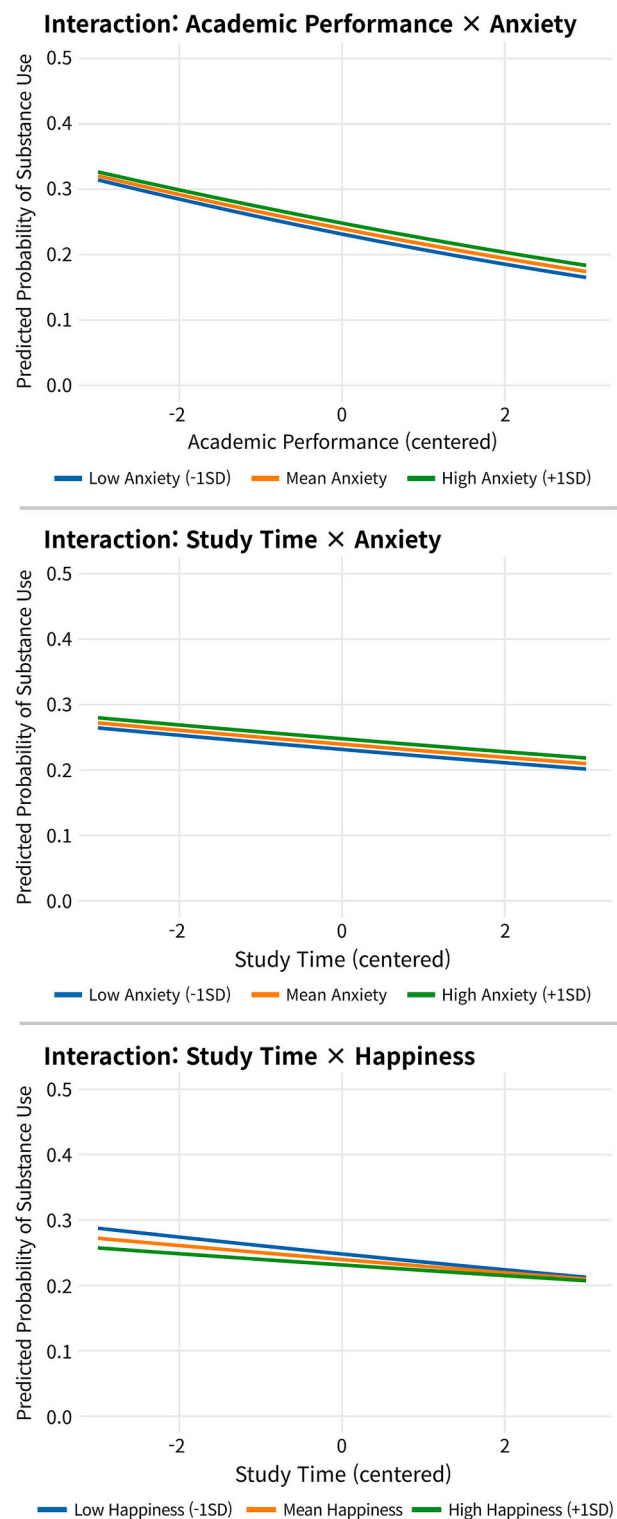


Fig. 1. Simple slope plots illustrating three interaction effects on substance use.

robust negative associations with substance use, even after controlling for psychological factors. This pattern is consistent with previous findings that adolescents with higher academic achievement and greater investment in academic activities report lower levels of alcohol and tobacco use (Alqahtani et al., 2023; Bugbee et al., 2019; Zhou et al., 2023). These associations align with the idea that greater academic engagement is accompanied by less unstructured leisure time and fewer opportunities for contact with deviant peers (Henry et al., 2012), and

that higher achievement tends to co-occur with stronger school attachment and adherence to school norms (Nawi et al., 2021). Academic success has also been reported to co-occur with greater self-efficacy and a stronger future orientation, both of which have been associated with lower substance use. (Arthur et al., 2015). Academic factors remained associated with substance use independent of psychological factors, suggesting that school environments that support academic engagement and achievement, alongside emotional support, may be relevant contexts for adolescent substance use prevention (Das et al., 2016; Nawi et al., 2021).

Analyses of modifications based on psychological factors showed that anxiety interacted significantly with academic performance and study time, and happiness interacted with study time. However, negative associations between academic factors and substance use remained across all levels of psychological factors. The somewhat weaker negative association between academic performance and substance use at higher anxiety levels suggests that among adolescents with elevated anxiety, high performance and low substance use do not always co-occur to the same extent (Choi et al., 2019; Chung & Park, 2024; DeMartini & Carey, 2011). Conversely, among adolescents with high happiness, substance use remained relatively low even when study time was shorter, suggesting that the negative association between study time and substance use was less pronounced at higher levels of happiness (Schick et al., 2022). Overall, the interaction effects were small, and the protective negative associations of academic factors with substance use were preserved across the psychological spectrum, supporting the interpretation that academic engagement and achievement are relatively robust protective correlates.

Furthermore, high school students had approximately three times higher odds of substance use than middle school students, girls had lower odds than boys, and higher perceived economic status was associated with lower odds of substance use. These patterns are broadly consistent with prior findings on age, gender, and socioeconomic differences in adolescent substance use (Degenhardt et al., 2016; Kim & Chun, 2018; Sung et al., 2016; Whitesell et al., 2013). Importantly, the difference between middle and high school students suggests that developmental stage should be considered when interpreting the joint associations of academic and psychological factors with substance use; the inclusion of middle school students is particularly meaningful because earlier adolescence may represent a critical period before substance use becomes more established. Taken together, these findings underscore the value of targeted prevention strategies that consider school level, gender, and socioeconomic conditions alongside academic engagement and psychological functioning.

4.1. Limitations and directions for future research

Some general limitations should be considered when interpreting the findings of this study. The analyses relied on cross-sectional, self-reported survey data from Korean adolescents; key constructs such as substance use, stress, and happiness were measured with relatively simple indicators; and family, peer, school, and community-level characteristics were not included. Collectively, these features may constrain causal inference, measurement precision, and generalizability. Furthermore, the large nationally representative sample and joint examination of academic and psychological correlates can be regarded as strengths, and these caveats are best understood as indicating priorities for future work rather than fundamentally undermining the conclusions. For example, future research could use longitudinal designs to clarify developmental pathways and potential causal relationships between academic factors, psychological adjustment, and substance use. Studies could also incorporate objective indicators, such as school records, more fine-grained measures of substance use and mental health, and multi-level analyses that include family, peer, school, and community contexts, to confirm and extend the correlational patterns observed in this study.

4.2. Policy and clinical implications

The findings of this study suggest that efforts to prevent adolescent substance use should target both academic and emotional domains while considering differences by school level and sex. At the school level, prevention programs may need to move beyond informational approaches to include strategies that actively foster academic engagement and provide support to students with learning difficulties, with particular attention to the transition from middle to high school, given the higher odds observed among high school students (Griffin & Botvin, 2010; Henry et al., 2012; Shin et al., 2018). Furthermore, schools should seek to reduce excessive achievement pressure and enhance students' subjective well-being, for example, through curricula and positive psychology programs that cultivate diverse strengths and promote happiness (Ahn & Baek, 2012; Akhtar & Boniwell, 2010; Schick et al., 2022). In clinical and community settings, screening for substance use should routinely include the assessment of anxiety, stress, and related symptoms, and integrated interventions that address both emotional difficulties and substance use are warranted given their frequent co-occurrence (Cioffredi et al., 2021; Vorspan et al., 2015). For adolescents with high anxiety, in whom the protective association with academic achievement may be weaker, early identification and treatment of anxiety disorders, along with support for adaptive coping, may be especially important (DeMartini & Carey, 2011; Moylan et al., 2012). Overall, the independent and interactive associations of academic and psychological factors with substance use underscore the need for coordinated, multi-sector approaches that link schools with health and social services to support adolescents who face both academic and psychological challenges (Busch et al., 2014; Das et al., 2016; Nawi et al., 2021).

4.3. Conclusion

Using data from the 2023 KYRBS, this study examined the joint associations of academic and psychological factors with past-30-day substance use among 50,914 Korean middle and high school students. Higher perceived academic performance and longer daily study time were associated with lower odds of substance use, whereas higher stress and anxiety and lower happiness were associated with higher odds. Although anxiety and happiness modestly modified some academic-substance use associations, the negative associations of academic factors with substance use were maintained across levels of psychological functioning. By examining academic and psychological domains together in a large, nationally representative sample, this study provides empirical groundwork for prevention approaches that address both academic engagement and psychological functioning among Korean adolescents.

CRediT authorship contribution statement

Jeong Soo Kim: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Sun Mi Kim:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Doug Hyun Han:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

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Not applicable.

Data availability

The data that support the findings of this study are openly available from the Korea Youth Risk Behavior Survey at <https://www.kdca.go.kr/yhs/>.

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