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ORIGINAL ARTICLE

Weight Control Patterns, Substance Use, and Mental Health in Korean Adolescents: A Latent Class Analysis

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Abstract
This study aims to uncover distinctive patterns in weight control methods within latent classes among Korean adolescents. It explores how substance use (i.e., alcohol, traditional cigarettes, e-cigarettes, and heated tobacco products) and mental health (i.e., stress, depression, anxiety, and suicidal ideation) impact each class. Using the cross-sectional secondary dataset from the 2022 Korea Youth Risk Behavior Survey, which includes 26,942 Korean adolescents, latent class analysis categorizes weight control methods into three groups: "Class 1: Medication-Centered Weight Control Group," "Class 2: Diet-Centered Group," and "Class 3: Holistic Approach to Diet and Exercise Group." The results indicate that substance use and mental health challenges both increase the risk of medication-centered or diet-centered weight control practices in male adolescents. In contrast, only mental health challenges heighten the risk in female adolescents. This study contributes to a more profound comprehension of the intricate relationship between substance use, mental health, and weight control practices in Korean adolescents.

Keywords Weight control · Substance use · Mental health · Korean adolescent · Latent class analysis

Adolescence is a phase marked by rapid physical growth and the development of secondary sexual characteristics, underscoring the significance of maintaining a healthy nutritional intake (Cho, 2014). The eating, lifestyle, and weight-related behaviors formed during adolescence are critical to the development and shaping of their psychosocial well-being (Yeatts et al., 2016). While developing healthy weight behaviors during adolescence improves overall well-being, unhealthy behaviors related to weight have been strongly associated with lower life satisfaction and negative emotions (Vander Wal, 2012). In particular, problematic patterns of weight control behaviors formed during this period can persist into early adulthood or beyond, promoting psychological and mental disorders (Neumark-Sztainer et al., 2018). Therefore, identifying problematic weight control behaviors

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in adolescents and empirically investigating their associated risk factors can provide a basis for preventing and addressing these problems.

Weight control behaviors can be beneficial for people with high body mass index (BMI); however, these behaviors can adversely affect people with body dysmorphia who are normal weight but consider themselves obese (Lee & Hong, 2021). South Korea has experienced major socio-cultural changes over the past few decades due to economic growth and globalization. During this process, a preference and admiration for thinness has spread throughout society (Kim et al., 2018). For adolescents who are sensitive to their appearance and peer reputation, this can create psychological pressure to control their weight, leading to cognitive distortions that cause them to falsely view themselves as overweight (Chaung, 2001; Mooney et al., 2009; Neumark-Sztainer et al., 2018). Researchers have shown that this body image distortion can lead to extreme and harmful weight control behaviors (Nagata et al., 2018) and low self-esteem, depression, and anxiety, which undermine adolescents' mental health (Hosseini & Padhy, 2022; Paxton et al., 2006; Yeatts et al., 2016).

Many methods that promise rapid weight loss but pose serious health risks may appeal to adolescents. Austin et al. (2013) identified harmful weight control methods, including extreme food restriction, self-induced vomiting, and the use of laxatives, diuretics, or unprescribed diet pills (Austin et al., 2013). Similarly, Neumark-Sztainer et al. (2012) presented nine inappropriate weight control methods: fasting, eating very little food, using a food substitute, skipping meals, smoking cigarettes, taking diet pills, inducing vomiting, using laxatives, and using diuretics. These inappropriate weight control methods increase the risk of developing eating disorders and are associated with significant weight gain after decade (Neumark-Sztainer et al., 2012).

Many previous studies on weight control behaviors have focused on dichotomous categories such as healthy and unhealthy (Austin et al., 2013; Kennedy et al., 2019; Neumark-Sztainer et al., 2012). However, recent research has revealed that the effects of unhealthy weight control methods vary according to substance use and gender (Lee & Lee, 2019). Furthermore, a study by Kim et al. (2021) found that adolescents combining unhealthy weight control methods with regular exercise were more prone than only exercise or inappropriate weight control methods group to suicidal behavior. These results strongly indicate that traditional dichotomous approaches cannot adequately explain patterns in adolescents' weight control behaviors, and the effects of these behaviors on adolescents may vary. Building on these insights, Park and Kim (2016) highlighted the limitations of traditional variable-centered approaches, particularly in their failure to fully capture individual characteristics associated with weight control behaviors and the heterogeneity of adolescent populations.

Therefore, identifying various latent groups of weight control behaviors among Korean adolescents can provide a deeper understanding of these behaviors and their impacts on this population. A person-centered approach that unveils group characteristics based on individual responses is expected to provide valuable insights into the diverse patterns of weight control behaviors. Therefore, applying latent class analysis as a person-centered approach is necessary.

Previous research has found that weight loss behaviors in female students are associated with anxiety through the mediation of stress (Jang & Kim, 2022). In Canadian adolescents, both boys and girls reported that weight loss intentions were associated with anxiety, depression, and low self-concept (Doan et al., 2021). Additionally, substance use, including alcohol and cigarette smoking (Lee & Lee, 2019; Vidot et al., 2016), and mental health issues (Kim et al., 2021) have been associated with unhealthy weight control behaviors

among adolescents. Specifically, inappropriate weight control methods have been linked to stress and depression (Hinchliff et al., 2016), as well as suicidal ideation and attempts (Kim et al., 2021). Another cross-sectional study reported that adolescents who drink alcohol are more likely to use inappropriate weight control methods compared to non-drinking adolescents, with the likelihood increasing further among binge drinkers (Seo et al., 2017). In particular, binge drinkers were found to be more likely to use tobacco and inappropriate weight control methods simultaneously (Seo et al., 2017). In conclusion, substance use and mental health issues emerge as significant mutual risk factors for adolescents employing unhealthy weight control methods. Therefore, the latent types of weight control methods and associations with substance use and mental health factors must be clarified.

Furthermore, earlier research has identified perceived body image along with demographic factors (i.e., sex, age, socioeconomic status, education level) as influential factors related to weight control behaviors (Choi et al., 2014; Oh et al., 2013; Park & Kim, 2016). While some studies have reported a relationship between Body Mass Index (BMI) and weight control behaviors (Oh et al., 2013), the findings have been inconsistent, with other reports indicating no such relationship (Choi et al., 2014; Park & Kim, 2016).

Existing research on weight control has consistently underscored gender differences (Bae & Yoon, 2023; Kim et al., 2002; Neumark-Sztainer et al., 2012), predominantly concentrating on female students' weight control methods (Balantekin et al., 2018; Philippi & Leme, 2018; Polskaya et al., 2023) while neglecting male students. However, data from the 2022 Korea Youth Risk Behavior Survey conducted by the Ministry of Education (MOE), the Ministry of Health and Welfare (MOHW), and the Korea Disease Control and Prevention Agency (KDCA) (MOE et al., 2022a) revealed that, as of 2022, 24.7% of male students and 39.2% of female students in Korea had attempted to lose weight. Inappropriate weight control methods, such as vomiting, fasting, and adopting a whole-food diet, were reported by 26.3% of female students and 17.6% of male students (MOE et al., 2022a). From 2017 to 2022, the prevalence of inappropriate weight control methods increased by only 0.6% (from 23% to 23.6%) among female students but by 4% among male students (from 13.6% to 17.6%) (MOE et al., 2022a). Hence, gender-specific differences in the types of weight control methods utilized by adolescents must be identified and assessed to better understand and prevent problematic weight control behaviors among adolescents.

In this context, our study aims to categorize adolescent weight control behaviors through latent class analysis and explore predictive factors related to mental health and substance use experiences within each identified type. Furthermore, we intend to investigate the gender-specific influencing factors highlighted consistently in previous studies. The research questions are as follows.

1. How can adolescent weight control methods be typified into latent groups?
2. Which substance use experiences and mental health factors influence adolescent weight control behaviors, and how does this influence differ according to gender?

Methods

Sample and Procedures

A cross-sectional secondary dataset was acquired from the 2022 Korea Youth Risk Behavior Survey (KYRBS) (MOE et al., 2022b). KYRBS is dedicated to the comprehensive

examination of health behaviors among South Korean adolescents aged 13 to 18, encompassing diverse domains, including smoking, alcohol consumption, dietary habits, and other pertinent aspects. The study sample consisted of students enrolled in middle and high schools nationwide as of April 2022. Adolescents were meticulously chosen through a multi-stage sampling process of population stratification, sample allocation, and sample extraction stages to produce a nationally representative dataset (MOE et al., 2022b). As a result, 51,850 students from 798 schools (398 middle schools and 400 high schools) participated in this survey (MOE et al., 2022b). In the present study, 26,942 Korean adolescents with a history of engaging in weight control efforts formed the definitive sample.

Measurements

Weight Control Methods

The investigation into *weight control methods* employed the following inquiry format, as outlined in MOE et al. (2022c): "Please describe the actions you have undertaken to regulate your weight in the past 30 days." Each query incorporated nine distinct methods, encompassing *regular exercise, reduced meal proportions, herbal medicine use, diet supplements, prescription medicine use, non-prescription medicine use, use of vomiting and diarrhea medication, fasting,* and *whole food diet.* Participants were allowed to provide duplicate responses for nine distinct methods. Additionally, they were required to indicate their response for each method with a binary code, using "No" (0) or "Yes" (1).

Substance Use

Respondents' historical patterns of *alcohol use* for lifetime were assessed via the following inquiry in KYRBS (MOE et al., 2022b): "Have you ever consumed more than a single alcoholic beverage, except in circumstances such as taking a few sips during a memorial service or as part of a sacrament (religious ceremony)?". The history of *traditional cigarette use* for lifetime was ascertained through the question: "Have you ever smoked one or two regular cigarettes?" Adolescents' use of *liquid-type e-cigarettes* for lifetime was determined with the following question: "Have you ever utilized liquid-type e-cigarettes?" Similarly, previous *heated tobacco products (HTPs)* use for lifetime was revealed through the question: "Have you ever utilized e-cigarettes that contain nicotine (e.g., IQOS, GLO, and LIL)?" Participants' responses to each of these inquiries were categorized as either "No" (0) or "Yes" (1).

For frequency of alcohol, traditional cigarette, liquid-type e-cigarettes, and HTPs use, the following questions were asked in KYRBS: "How many days in the past 30 days did you drink at least one drink of alcohol?", "How many days in the past 30 days did you smoke traditional cigarettes (cigarettes)?", "How many days in the past 30 days did you use liquid-type electronic cigarettes containing nicotine?", "How many days in the past 30 days did you use HTPs (such as IQOS, glo, or Lil) at least once?". Response options ranged from (1) No days (coded as 0) to (8) Every day (coded as 7).

For the amount of alcohol, traditional cigarettes, and HTPs used in the past 30 days, respectively, the following questions were asked in KYRBS: "How much alcohol did you consume on average when you drank?" (i.e., Response options ranged from (1) None to (6) 2 bottles of soju or more (or 8 bottles of beer, 12 glasses of whiskey)), "How many traditional cigarettes did you smoke on average per day in the past 30 days?" (i.e., Response

options ranged from (1) None to (7) 20 cigarettes or more per day), "How many HTPs (such as IQOS, glo, or Lil) did you use on average per day in the past 30 days?" (i.e., Response options ranged from (1) None to (7) 20 units or more per day). For liquid-type electronic cigarettes, the KYRBS dataset did not ask about the amount, so it was not available for analysis. We included frequency and amount of substance use in descriptive analysis and BCH procedure, but not in multivariate logistic regression, due to multicollinearity issues and inadequate model fit.

Mental Health

Within the KYRBS (MOE et al., 2022b), the survey evaluated participants' *stress* levels through a single inquiry: "To what extent do you feel stressed these days?" The response options included (1) Never, (2) Rarely, (3) Occasionally, (4) Frequently, and (5) Always. (1) was assigned the code "No" (0), while (2) to (5) were assigned the code "Yes" (1). *Depression* was measured by one question: "Over the past year, have you ever experienced such profound feelings of sadness or despair that it resulted in an interruption of your daily routines lasting for a minimum of two weeks?" Participants responded either "No" (0) or "Yes" (1). For *anxiety disorder*, a shortened version of the Generalized Anxiety Disorder (GAD-7) was employed, featuring seven questions (Spitzer et al., 2006). The assessment tool initiated with the question, "Over the last two weeks, how often have you been bothered by the following concerns?" and enumerated seven issues, such as "Feeling apprehensive as if something dreadful might occur," with four response choices (e.g., (1) Not at all, (2) Several days, (3) More than half the days, (4) Almost every day). The presence of *suicidal ideation* was evaluated through a single inquiry: "In the preceding 12 months, have you ever entertained thoughts of taking your own life?" Participants responded either "No" (0) or "Yes" (1).

Covariates

The covariates examined in the analysis included gender (categorized as male or female), school type (categorized as middle school or high school), academic performance (categorized as low, average, or high), socioeconomic status (SES) (categorized as low, average, or high), and perceived body image (categorized as underweight, normal, or obese).

Analysis

In the initial phase of our analysis, descriptive statistics were employed to assess the distribution of variables and furnish a comprehensive overview of the sample. Subsequently, we employed latent class analysis (LCA) to identify unique patterns of weight control methods within each subgroup of substance use and mental health. LCA, a statistical methodology designed to uncover latent classes or hidden clusters when dealing with categorical observed variables (Oberski, 2016), involves two principal steps: determining the optimal number of latent classes (K) to effectively model the observed data and summarizing the resulting findings (Oberski, 2016). LCA is a person-centered approach, discerning similar behavioral patterns based on an individual's responses to multiple indicators (Hong et al., 2022). To evaluate equality across latent layers, we incorporated auxiliary variables following the Bose–Chaudhuri–Hocquenghem (BCH) method (Asparouhov & Muthen, 2014).

These auxiliary variables encompassed measures of sociodemographic characteristics, substance use and mental health.

For statistical assessment, we employed the Lo–Mendell–Rubin adjusted likelihood ratio test (LMR-LRT) and the bootstrap likelihood ratio test (BLRT) to ascertain whether our specified model exhibited a superior fit compared to a model with one fewer class (K-1) (Lo et al., 2001). Furthermore, we considered the Akaike information criteria (AIC), Bayesian information criterion (BIC), and sample-size adjusted Bayesian information values to assess model fit, with lower values signifying improved fit (Lo et al., 2001). To gauge classification accuracy, we examined entropy values, where higher values indicated improved classification and stronger delineation (Lo et al., 2001). The LCA was executed using Mplus version 8.9 (Muthén & Muthén, 1998).

We applied a full information maximum likelihood (FIML) approach within Mplus version 8.9 (Muthén & Muthén, 1998). Extensive simulation studies have demonstrated that this approach is effective in mitigating or eliminating bias associated with missing data (Collins et al., 2001; Hong et al., 2022), rendering it widely accepted for handling missing data in the context of LCA (Muthén & Shedden, 1999).

Subsequently, our focus shifted towards exploring the relationships between auxiliary variables (i.e., substance use and mental health) and latent classes (i.e., weight control subgroups) by conducting multivariate logistic regression analyses utilizing SPSS 29.0. To bolster the reliability of our findings, we controlled for covariates, including sex, school type, academic performance, socioeconomic status, and perceived body image. To assess the possibility of multicollinearity, we further conducted Principal Component Analysis (PCA), which is a multivariate statistical technique that combines multiple variables with high intercorrelations to create new artificial variables (principal components) that encapsulate the information of the original variables (Liu et al., 2003). To determine the suitability of PCA, measures such as the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity are conducted (Constantin, 2014). The KMO test is considered acceptable when the sample adequacy measure is 0.6 or higher, and Bartlett's test is deemed significant if the p-value is 0.05 or lower (Kim et al., 2017). In this study, the Kaiser–Meyer–Olkin (KMO) value was 0.733, and Bartlett's test showed significant results ($p < 0.001$). Furthermore, the correlation matrix showed that all eight independent variables had correlations less than 0.75, indicating a low risk of multicollinearity (Jung et al., 2023). Additionally, the total variance explained showed that the eight independent variables contributed relatively evenly to the variance, suggesting that the variables are not highly correlated (Kim et al., 2017; Zhang et al., 2011).

Results

Descriptive Statistics

The study comprised a cohort of 26,942 adolescents (52.0% male; 48.0% female) aged between 12 and 18, with an average age of 15.03 (SD = 1.71). Among these participants, 55.7% were enrolled in middle schools, while 44.3% were attending high schools. 19.1% perceived themselves as underweight, 34.2% as normal weight, and 46.7% as obese. Within the cohort, 35.8%, 9.5%, 7.7%, and 4.3%, respectively, reported using alcohol, traditional cigarettes, liquid-type e-cigarettes, and HTPs. The mean frequencies of alcohol, traditional cigarette, liquid-type e-cigarette, and HTPs were 0.61 ($SD = 1.06$), 0.28 ($SD = 1.17$), 0.19

(*SD*=0.86), and 0.12 (*SD*=0.70), respectively, suggesting an average occurrence of zero to one or two days per month. The mean amounts of alcohol, traditional cigarette, and HTPs were 0.33 (*SD*=0.97), 0.15 (*SD*=0.78), and 0.08 (*SD*=0.55), respectively, indicating an average consumption of less than one to two glasses of soju (or less than one bottle of beer), fewer than one cigarette per day, and less than one unit per day over a 30-day period. Furthermore, 74.3% engaged in regular exercise, 68.5% practiced reduced meal portions, 3.5% experimented with herbal medication use, 18.7% had used diet supplements, 2.2% explored prescription medication use, 3.2% explored non-prescription medication use, 3.1% experimented with vomiting and diarrhea medication usage, 12.0% attempted fasting, and 8.0% tried a whole-food diet. Table 1 provides a detailed breakdown of these statistics. Stress was reported by 84.6% of respondents, while 31.6% and 15.7% reported experiencing depression and suicidal ideation, respectively. The mean for anxiety disorder was 0.32 (*SD*=0.46).

Latent Class Analysis (LCA)

Latent Class Analysis of Substance Use Subgroups

In the context of substance abuse, the analysis favored a three-class solution as the most optimal model. This decision has been primarily underpinned by a confluence of critical factors, notably including a significantly high entropy value (0.738), highly meaningful LMR-LRT value (p=0.000), and BLRT value (p=0.000), complemented by the presence of lower AIC, BIC, and adjusted BIC scores. Classification is deemed suitable when the proportion of subgroups within the resulting latent layer remains above the threshold of 1% of the total (Clark, 2010; Jung & Wickrama, 2008; Ku & Chung, 2019; Lee et al., 2021b; Lo et al., 2001).

Within the paradigm of this three-class model, we designated Class 1 as the "Medication-Centered Weight Control Group," Class 2 as the "Diet-Centered Group," and Class 3 as the "Holistic Approach to Diet and Exercise Group." Adolescents in Class 1 (1.6%) showed significantly elevated levels of reliance on various weight control modalities, in stark contrast to the other cohorts. Over 80% of participants in Class 1 reported using herbal medicine, dietary supplements, prescription medication, non-prescription medication, and vomiting and diarrhea medication. Moreover, they relied extensively on fasting and whole foods. The MOE et al. (2022c) have collectively deemed the following practices as inadvisable for weight management: unsupervised consumption of weight loss medications, self-induction of vomiting or the use of diarrhea-inducing substances post-meals, prolonged fasting (exceeding 24 h), and mono-dieting. Comprehensively, Class 1 has been deemed the "Medication-Centered Group."

Adolescents in Class 2 (31.5%) exhibited a relatively heightened propensity for employing diet-related methodologies, encompassing reduced meal portions, dietary supplements, fasting, and adherence to a whole-food diet regimen. Moreover, they displayed a slightly augmented inclination towards both prescription and non-prescription medication usage when compared to Class 3, but still lower than Class 1. Furthermore, approximately 80% of Class 2 participants reported engaging in a consistent regimen of physical exercise. Consequently, this cluster has been denoted as the "Diet-Centered Group."

Those in Class 3 (66.9%), constituting the most substantial segment of the study cohort, evinced a substantial predilection for constructive weight control strategies, notably characterized by regular exercise routines and moderated meal portions. In particular, more than 70% reported engaging in regular physical exercise, while approximately 55% adhered to controlled meal portions. Remarkably, fewer than 5% reported adopting alternative methodologies, such as herbal medicine, dietary supplements, prescription medication,

Table 1 Descriptive Statistics

	Variables	*n*	%
Sociodemographic characteristics	Age	*M* = 15.03	*SD* = 1.71
	Gender		
	Male	12,942	48.0%
	Female	14,000	52.0%
	School type		
	Middle school	15,017	55.7%
	High school	11,925	44.3%
	Academic performance		
	High	10,111	37.5%
	Average	8,219	30.5%
	Low	8,612	32.0%
	SES		
	High	11,068	43.3%
	Average	12,230	45.4%
	Low	3,043	11.3%
	Perceived body image		
	Underweight	5,132	19.1%
	Normal	9,227	34.2%
	Obese	12,583	46.7%
Weight control methods	Regular exercise	20,013	74.3%
	Reduced meal portions	18,466	68.5%
	Herbal medication use	956	3.5%
	Diet supplements	5,054	18.7%
	Prescription medication use	595	2.2%
	Non-prescription medication use	849	3.2%
	Vomiting and diarrhea medication usage	833	3.1%
	Fasting	3,238	12.0%
	Whole-food diet	2,152	8.0%
Substance use	Alcohol use		
	Lifetime use	9,657	35.8%
	Frequency in 30 days	*M* = 0.61	*SD* = 1.06
	Amount in 30 days	*M* = 0.33	*SD* = 0.97
	Traditional cigarette use		
	Lifetime use	2,561	9.5%
	Frequency in 30 days	*M* = 0.28	*SD* = 1.17
	Amount in 30 days	*M* = 0.15	*SD* = 0.78
	Liquid-type e-cigarette		
	Lifetime use	2,080	7.7%
	Frequency in 30 days	*M* = 0.19	*SD* = 0.86
	HTPs		
	Lifetime use	1,158	4.3%
	Frequency in 30 days	*M* = 0.12	*SD* = 0.70

Table 2 (continued)

	Variables	*n*	%
	Amount in 30 days	*M* = 0.08	*SD* = 0.55
Mental health	Stress	22,782	84.6%
	Depression	8,511	31.6%
	Anxiety disorder	*M* = 0.32	*SD* = 0.46
	Suicidal ideation	4,328	15.7%

Note. In the case of the "Weight control methods" category, duplicate responses were allowed

non-prescription medication, vomiting and diarrhea medication, fasting, and mono-dieting. Consequently, this category has been referred to as the "Holistic Approach to Diet and Exercise Group." (For additional details, please refer to Table 2 and Fig. 1.)

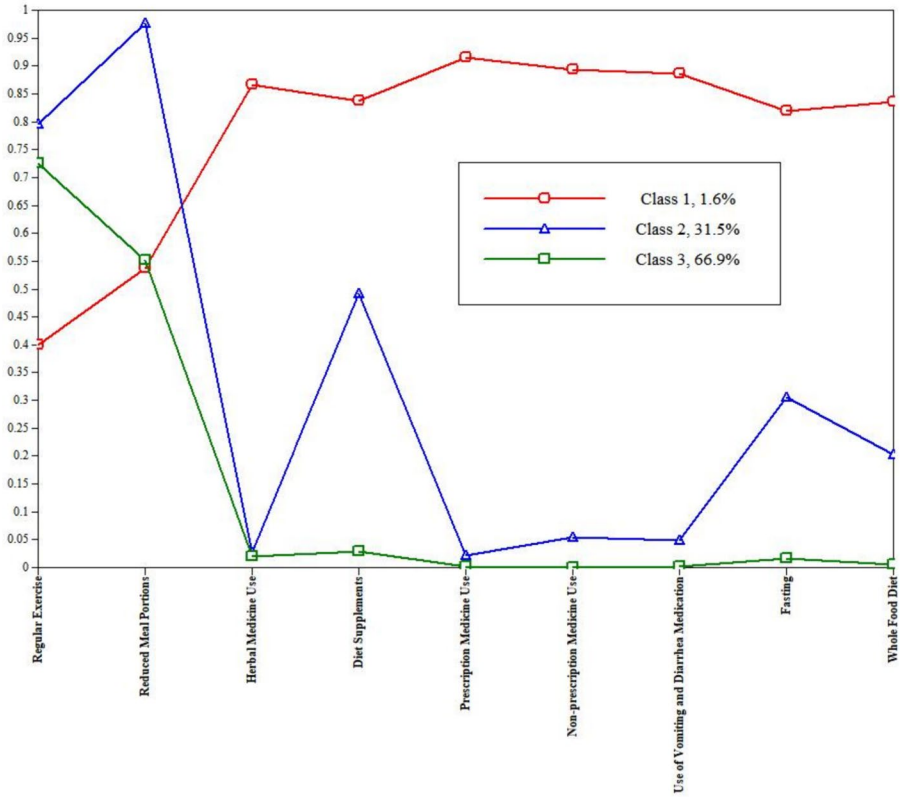
BCH Procedure for Testing Equality Across Weight Control Subgroups

In the assessment of the equality across each latent layer, we incorporated BCH auxiliary variables, specifically encompassing measures of sociodemographic characteristics (i.e., sex, school type, academic performance, SES, and perceived body image), substance use (i.e., alcohol use, traditional cigarette use, liquid-type e-cigarette use, and heated tobacco products use), and mental health (i.e., stress, depression, anxiety disorder, and suicidal ideation) (Asparouhov & Muthen, 2014). Cross-class equality tests for gender, school type, academic performance, SES, and perceived body image (obese and underweight) all revealed significant differences in the overall test ($p < 0.001$ for sex, school type, academic performance, and low SES, $p < 0.01$ for high SES, and $p < 0.05$ for perceived body image).

In the context of substance use, including alcohol, traditional cigarettes, liquid-type e-cigarettes, and HTPs, Class 1, also known as the "Medication-Centered Weight Control Group," consistently had the highest means, with values of 0.505, 0.198, 0.194, and 0.122, respectively. Class 2, the "Diet-Centered Group," followed closely with means of 0.431, 0.115, 0.091, and 0.050, while Class 3, the "Holistic Approach to Diet and Exercise Group," showed means of 0.321, 0.083, 0.068, and 0.038, respectively. These differences were statistically significant in the overall test ($p < 0.001$). For the frequency and amount of alcohol, traditional cigarette, liquid-type e-cigarette, and HTPs, the differences were not statistically significant in the overall test. However, the frequency of traditional cigarette use was statistically higher in Class 2 (0.283) and Class 3 (0.288) compared to Class 1 (0.184), respectively ($p < 0.05$). The amount of traditional cigarette use was higher in Class 3 (0.159) compared

Table 2 Fit Indices for Latent Class Analysis of Substance Use

Number of Latent Class	AIC	BIC	Adjusted BIC	LMR_LRT (p-value)	BLRT (p-value)	Entropy
1-class	154,046.718	154,120.531	154,091.929	-	-	-
2-class	142,297.947	142,453.775	142,393.393	0.0000	0.0000	0.868
3-class	137,195.386	137,433.228	137,341.067	0.0000	0.0000	0.738
4-class	136,399.219	136,719.075	136,595.134	0.0000	0.0000	0.658
5-class	136,113.889	136,515.760	136,360.039	0.0002	0.0000	0.709



Note. Class 1: Medication-Centered Weight Control Group; Class 2: Diet-Centered Group; Class 3: Holistic Approach to Diet and Exercise Group

Fig. 1 Item Probabilities for Weight Control Method. Note. Class 1: Medication-Centered Weight Control Group; Class 2: Diet-Centered Group; Class 3: Holistic Approach to Diet and Exercise Group

to Class 1 (0.091) ($p < 0.05$). Regarding the frequency of HTP use, both Class 2 (0.115) and Class 3 (0.118) showed statistically higher rates than Class 1 (0.062), respectively ($p < 0.05$). Similarly, the amount of HTP use in Class 2 (0.079) and Class 3 (0.077) was statistically higher than in Class 1 (0.035), respectively ($p < 0.05$).

In terms of stress, the "Diet-Centered Group" (Class 2) had the highest mean at 0.906, followed by the "Holistic Approach to Diet and Exercise Group" (Class 3) with a mean of 0.818, and the "Medication-Centered Weight Control Group" (Class 1) with a mean of 0.791. These differences were statistically significant ($p < 0.001$). For depression and anxiety, the "Diet-Centered Group" (Class 2) exhibited the highest means at 0.445 and 1.839, respectively, followed by the "Medication-Centered Weight Control Group" (Class 1) with means of 0.403 and 1.756, and the "Holistic Approach to Diet and Exercise Group" (Class 3) with means of 0.253 and 1.530, respectively. In terms of suicidal ideation, the "Medication-Centered Weight Control Group" (Class 1) had the highest mean at 0.295, followed by Class 2 and Class 3 with means of 0.243 and 0.114, respectively. The overall test showed these variations to be statistically significant ($p < 0.001$). For a more comprehensive presentation of these findings, please refer to Table 3.

Table 3 Equality Tests Cross Classes using the BCH Procedure

		N	*M*	*SE*	x^2
Gender: Female	Class 1	422	0.457	0.026	1017.887***
	Class 2	8,497	0.701	0.006	
	Class 3	18,023	0.436	0.004	
	Class 1 vs. 2				84.633***
	Class 1 vs. 3				0.710
	Class 2 vs. 3				1014.045***
School type: High school	Class 1	422	0.532	0.026	27.118***
	Class 2	8,497	0.463	0.007	
	Class 3	18,023	0.431	0.004	
	Class 1 vs. 2				6.589*
	Class 1 vs. 3				15.253***
	Class 2 vs. 3				14.169***
Academic performance:High	Class 1	422	0.358	0.025	154.486***
	Class 2	8,497	0.306	0.006	
	Class 3	18,023	0.408	0.004	
	Class 1 vs. 2				4.135*
	Class 1 vs. 3				4.124*
	Class 2 vs. 3				153.635***
Academic performance: Low	Class 1	422	0.355	0.025	166.439***
	Class 2	8,497	0.392	0.007	
	Class 3	18,023	0.285	0.004	
	Class 1 vs. 2				2.091*
	Class 1 vs. 3				7.984**
	Class 2 vs. 3				163.143***
SES: High	Class 1	422	0.470	0.026	11.709**
	Class 2	8,497	0.414	0.007	
	Class 3	18,023	0.441	0.004	
	Class 1 vs. 2				4.468*
	Class 1 vs. 3				1.270
	Class 2 vs. 3				9.752**
SES: Low	Class 1	422	0.124	0.017	60.500***
	Class 2	8,497	0.144	0.005	
	Class 3	18,023	0.098	0.003	
	Class 1 vs. 2				1.277
	Class 1 vs. 3				2.230
	Class 2 vs. 3				59.657***
Perceived body image: Obese	Class 1	422	0.487	0.026	6.200*
	Class 2	8,497	0.453	0.007	
	Class 3	18,023	0.473	0.004	
	Class 1 vs. 2				1.630
	Class 1 vs. 3				0.259
	Class 2 vs. 3				5.687*

Table 3 (continued)

		N	*M*	*SE*	x^2
Perceived body image: Underweight	Class 1	422	0.195	0.020	6.685*
	Class 2	8,497	0.203	0.005	
	Class 3	18,023	0.185	0.003	
	Class 1 vs. 2				0.133
	Class 1 vs. 3				0.246
	Class 2 vs. 3				6.605*
Alcohol: Lifetime use	Class 1	422	0.505	0.026	204.285***
	Class 2	8,497	0.431	0.007	
	Class 3	18,023	0.321	0.004	
	Class 1 vs. 2				7.748**
	Class 1 vs. 3				50.743***
	Class 2 vs. 3				166.738***
Alcohol: Frequency in 30 days	Class 1	422	0.620	0.049	0.207
	Class 2	8,497	0.613	0.014	
	Class 3	18,023	0.606	0.009	
	Class 1 vs. 2				0.015
	Class 1 vs. 3				0.074
	Class 2 vs. 3				0.151
Alcohol: Amount in 30 days	Class 1	422	0.324	0.049	0.045
	Class 2	8,497	0.331	0.013	
	Class 3	18,023	0.328	0.008	
	Class 1 vs. 2				0.018
	Class 1 vs. 3				0.005
	Class 2 vs. 3				0.037
Traditional cigarette: Lifetime use	Class 1	422	0.198	0.020	62.464***
	Class 2	8,497	0.115	0.004	
	Class 3	18,023	0.083	0.002	
	Class 1 vs. 2				15.987***
	Class 1 vs. 3				31.584***
	Class 2 vs. 3				34.058***
Traditional cigarette: Frequency in 30 days	Class 1	422	0.184	0.044	5.424
	Class 2	8,497	0.283	0.016	
	Class 3	18,023	0.288	0.010	
	Class 1 vs. 2				4.407*
	Class 1 vs. 3				5.424*
	Class 2 vs. 3				0.083

Table 3 (continued)

		N	*M*	*SE*	x^2
Traditional cigarette: Amount in 30 days	Class 1	422	0.091	0.030	4.987
	Class 2	8,497	0.152	0.010	
	Class 3	18,023	0.159	0.007	
	Class 1 vs. 2				3.643
	Class 1 vs. 3				4.927*
	Class 2 vs. 3				0.267
Liquid-type e-cigarette: Lifetime use	Class 1	422	0.194	0.020	60.210***
	Class 2	8,497	0.091	0.004	
	Class 3	18,023	0.068	0.002	
	Class 1 vs. 2				24.781***
	Class 1 vs. 3				39.003***
	Class 2 vs. 3				23.751***
Liquid-type e-cigarette: Frequency in 30 days	Class 1	422	0.132	0.034	3.038
	Class 2	8,497	0.185	0.011	
	Class 3	18,023	0.192	0.007	
	Class 1 vs. 2				2.134
	Class 1 vs. 3				2.972
	Class 2 vs. 3				0.212
HTPs: Lifetime use	Class 1	422	0.122	0.017	34.437***
	Class 2	8,497	0.050	0.003	
	Class 3	18,023	0.038	0.002	
	Class 1 vs. 2				18.244***
	Class 1 vs. 3				25.433***
	Class 2 vs. 3				10.141***
HTPs: Frequency in 30 days	Class 1	422	0.062	0.025	4.804
	Class 2	8,497	0.115	0.009	
	Class 3	18,023	0.118	0.006	
	Class 1 vs. 2				3.991*
	Class 1 vs. 3				4.797*
	Class 2 vs. 3				0.042
HTPs: Amount in 30 days	Class 1	422	0.035	0.017	5.893
	Class 2	8,497	0.079	0.008	
	Class 3	18,023	0.077	0.005	
	Class 1 vs. 2				5.445*
	Class 1 vs. 3				5.511*
	Class 2 vs. 3				0.066
Stress	Class 1	422	0.791	0.021	249.049***
	Class 2	8,497	0.906	0.004	
	Class 3	18,023	0.818	0.003	
	Class 1 vs. 2				29.599***
	Class 1 vs. 3				1.683
	Class 2 vs. 3				242.217***

Table 3 (continued)

		N	*M*	*SE*	x^2
Depression	Class 1	422	0.403	0.025	532.050***
	Class 2	8,497	0.445	0.007	
	Class 3	18,023	0.253	0.004	
	Class 1 vs. 2				2.466
	Class 1 vs. 3				35.087***
	Class 2 vs. 3				513.906***
Anxiety disorder	Class 1	422	1.756	0.042	607.267***
	Class 2	8,497	1.839	0.010	
	Class 3	18,023	1.530	0.005	
	Class 1 vs. 2				3.628
	Class 1 vs. 3				28.924***
	Class 2 vs. 3				591.651***
Suicidal ideation	Class 1	422	0.295	0.023	383.164***
	Class 2	8,497	0.243	0.006	
	Class 3	18,023	0.114	0.003	
	Class 1 vs. 2				4.620*
	Class 1 vs. 3				59.448***
	Class 2 vs. 3				337.680***

* $p < .05$; ** $p < .01$; *** $p < .001$

Class 1: Medication-Centered Weight Control Group; Class 2: Diet-Centered Group; Class 3: Holistic Approach to Diet and Exercise Group

Multivariate Logistic Regression for Weight Control Classes

The results of the multivariate logistic regression, aimed at investigating the relationship between auxiliary variables (such as substance use and mental health) and latent classes (the weight control subgroups), are presented in Table 4. We developed a multinomial logistic model for distinguishing between men and women. In Models 1 and 2, Class 3 ("Holistic Approach to Diet and Exercise Group") serves as the reference category, with Model 1 representing the analysis for the male group and Model 2 for the female group. In Models 3 and 4, Class 2 serves as the reference category, with Model 3 representing the analysis for the male group and Model 4 for the female group.

The analysis revealed that, as a consequence of Model 1 (male), higher SES ($B=0.627$, $p<0.05$), alcohol use ($B=0.753$, $p<0.01$), liquid-type e-cigarette use ($B=1.015$, $p<0.05$), anxiety disorder ($B=0.544$, $p<0.001$), and suicidal ideation ($B=0.814$, $p<0.01$) were associated with an increased risk of being in Class 1 ("Medication-Centered Weight Control Group") when compared to Class 3 ("Holistic Approach to Diet and Exercise Group"). Model 2 (female) revealed that lower stress ($B=-0.532$, $p<0.05$) and higher suicidal ideation ($B=0.710$, $p<0.05$) heightened the possibility of being in Class 1 compared to Class 3.

Moreover, in Model 1 (male), not having high academic performance ($B=-0.231$, $p<0.01$), having low academic performance ($B=0.196$, $p<0.05$), alcohol use ($B=0.311$, $p<0.001$), traditional cigarette use ($B=0.353$, $p<0.05$), stress ($B=0.278$, $p<0.05$),

Table 4 Regression Results of Subtypes of Weight Loss Methods

Variables (Ref)	Model 1 (Ref: Class 3)		Model 2 (Ref: Class 3)		Model 1 (Ref: Class 3)		Model 2 (Ref: Class 3)		Model 3 (Ref: Class 2)		Model 4 (Ref: Class 2)	
	Class 1				Class 2				Class 1			
	Male		Female		Male		Female		Male		Female	
	B (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*
School type (middle school)	.246 (.238)	1.279	.340 (.237)	1.405	.079 (.064)	1.082	.065 (.080)	1.067	.167 (.240)	1.182	.275 (.245)	1.316
Academic performance												
High (average)	.266 (.314)	1.305	-.468 (.282)	.626	-.231 (.078)	.794**	-.131 (.099)	.878	.497 (.316)	1.644	-.337 (.293)	.714
Low (average)	.592 (.309)	1.808	-.254 (.275)	.776	.196 (.077)	1.217*	.135 (.099)	1.144	.396 (.310)	1.485	-.388 (.286)	.678
SES												
High (average)	.627 (.259)	1.873*	.024 (.244)	1.024	.088 (.069)	1.092	.055 (.085)	1.057	.539 (.260)	1.715*	-.031 (.254)	.969
Low (average)	.112 (.360)	1.119	-.094 (.386)	.910	.173 (.095)	1.189	-.002 (.132)	.998	-.061 (.360)	.940	-.091 (.399)	.913
Perceived body image												
Obese (normal)	-.009 (.264)	.991	-.028 (.262)	.973	-.073 (.070)	.929	-.144 (.087)	.866	.065 (.266)	1.067	.116 (.271)	1.123
Underweight (normal)	.298 (.307)	1.347	.271 (.306)	1.311	.130 (.085)	1.139	-.034 (.109)	.967	.168 (.308)	1.183	.305 (.318)	1.356
Alcohol: Lifetime use (no)	.753 (.264)	2.124**	.475 (.247)	1.609	.311 (.073)	1.364***	.152 (.085)	1.164	.443 (.266)	1.557	.323 (.256)	1.382
Traditional cigarette: Lifetime use (no)	-.289 (.477)	.749	-.219 (.447)	.804	.353 (.175)	1.424*	.133 (.166)	1.142	-.642 (.478)	.526	-.351 (.466)	.704

Table 4 (continued)

Variables (Ref)	Model 1 (Ref: Class 3)		Model 2 (Ref: Class 3)		Model 1 (Ref: Class 3)		Model 2 (Ref: Class 3)		Model 3 (Ref: Class 2)		Model 4 (Ref: Class 2)	
	Class 1				Class 2				Class 1			
	Male		Female		Male		Female		Male		Female	
	B (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*	*B* (*SE*)	*OR*
Liquid-type e-cigarette: Lifetime use (no)	1.015 (.516)	2.760*	.183 (.480)	1.201	.054 (.217)	1.055	-.334 (.199)	.716	.962 (.516)	2.616	.517 (.506)	1.678
HTPs: Lifetime use (no)	.767 (.512)	2.153	.836 (.481)	2.306	.148 (.248)	1.159	-.130 (.231)	.878	.619 (.507)	1.858	.966 (.516)	2.627
Stress (no)	-.614 (.346)	.541	-.532 (.270)	.588*	.278 (.110)	1.320*	.204 (.110)	1.227	-.892 (.352)	.410*	-.736 (.285)	.479**
Depression (no)	.012 (.271)	1.012	-.103 (.289)	.902	.271 (.072)	1.311***	.237 (.095)	1.268*	-.259 (.273)	.772	-.340 (.298)	.712
Anxiety disorder	.544 (.153)	1.723***	.153 (.190)	1.165	.258 (.050)	1.294***	.179 (.066)	1.196**	.286 (.154)	1.332	-.026 (.196)	.974
Suicidal ideation (no)	.814 (.278)	2.257**	.710 (.324)	2.034*	.184 (.085)	1.201*	.247 (.123)	1.280*	.631 (.280)	1.879*	.463 (.337)	1.589
Cox & Snell R^2	0.68		0.21		0.68		0.21		0.68		0.21	
NagelkerkeR^2	0.90		0.31		0.90		0.31		0.90		0.31	

* $p < .05$; ** $p < .01$; *** $p < .001$

depression ($B = 0.271$, $p < 0.001$), anxiety disorder ($B = 0.258$, $p < 0.001$), and suicidal ideation ($B = 0.184$, $p < 0.05$) heightened the risk of being Class 2 ("Diet-Centered Group") compared to Class 3 ("Holistic Approach to Diet and Exercise Group"). In Model 2 (female), depression ($B = 0.237$, $p < 0.05$), anxiety disorder ($B = 0.179$, $p < 0.01$), and suicidal ideation ($B = 0.247$, $p < 0.05$) was positively related to being in Class 2 compared to Class 3.

In Model 3 (male), high SES ($B = 0.539$, $p < 0.05$), low stress ($B = -0.892$, $p < 0.05$), and suicidal ideation ($B = 0.631$, $p < 0.05$) were associated with an increased risk of belonging to Class 1 ("Medication-Centered Weight Control Group") when compared to Class 2 ("Diet-Centered Group"). In Model 4 (female), low stress ($B = -0.736$, $p < 0.01$) heightened the possibility of being in Class 1 compared to Class 2.

Discussion

Three latent classes were derived from the outcomes of LCA concerning weight control methods among Korean adolescents: "Class 1: Medication-Centered Weight Control Group," "Class 2: Diet-Centered Group," and "Class 3: Holistic Approach to Diet and Exercise Group." Furthermore, for males, alcohol, traditional cigarette, and liquid-type e-cigarette use, along with mental health factors, were found to be predictive of the type of weight control method employed. In contrast, for females, only mental health factors predicted the type of weight control methods adopted.

The results reveal that while Class 3 utilized the most appropriate methods, Classes 1 and 2 concurrently employed both positive and inappropriate weight control methods. The Medication-Centered Weight Control Group (Class 1) exhibited lower adherence to conventional healthy weight control practices (i.e. exercise, reduced meal portion) compared to the other two classes. However, it is characterized by the distinctive use of prescribed medications and herbal medicine alongside a concurrent engagement in inappropriate methods, such as misuse of non-prescription drugs and laxatives, including vomiting and fasting. Conversely, the Diet-Centered Group (Class 2) demonstrated the highest adherence to exercise and dietary adjustments but concurrently employed hazardous dietary control methods, including skipping meals and adopting extreme diets like the whole-food diet.

This juxtaposition of healthy and inappropriate practices within the same weight control strategy is an unprecedented finding not corroborated by previous binary variable-centric studies. These results underscore a previously overlooked aspect—adolescents, even when resorting to inappropriate weight control methods, tend to integrate positive and negative approaches to weight control. Consequently, emphasizing information and education on healthy weight control practices becomes imperative, given the mixed nature of adolescent weight control strategies.

Furthermore, the Medicine-Centered Group was identified not only as the most prone to substance use (i.e. alcohol use, liquid type e-cigarette use) but also as the most susceptible to severe mental health issues and suicidal thoughts. In particular, males who reported using alcohol and liquid type e-cigarettes were more than twice as likely to be in the Medication-Centered Group as in the Holistic Approach to Diet and Exercise Group. These findings partially support previous research that males and females who drink alcohol are more likely to attempt inappropriate weight control methods (Seo et al., 2017; Weng et al., 2022). Our findings also align with those of Kilibarda et al. (2020), demonstrating

a significant association between unhealthy weight control behaviors and smoking, particularly smoking for weight control purposes. Kilibarda et al. (2020) observed a greater likelihood of resorting to smoking for weight control among male adolescents than their female counterparts, implying that smoking might serve as a method to sustain weight loss from extreme weight control practices.

Hence, accurate information is needed regarding the connection between engaging in inappropriate weight control methods and alcohol and tobacco use among adolescents. Ministry of Health and Welfare Korea Health Promotion Institute (2016) advises that alcohol consumption, long-term smoking, and smoking cessation have negative effects on obesity and weight management (Ministry of Health and Welfare Korea Health Promotion Institute, 2016). However, it does not address various weight management methods, nor does it mention that alcohol and smoking can lead to the adoption of inappropriate weight management strategies. Therefore, information related to drug prevention should be integrated into weight control education.

Given the large body of research showing that unhealthy weight control and distorted self-perceptions of one's weight are positively associated with suicidal ideation among adolescents (Haynes et al., 2019; Kim & Seo, 2021; Liu et al., 2023), we suggest that the adolescents in the Medication-Centered Group have distorted self-perceptions regarding weight. In particular, Kim and Seo (2021) found that Korean adolescents who perceived themselves as overweight experienced increased suicidal ideation and plans when they engaged in inappropriate weight control behaviors (Kim & Seo, 2021), partially supporting our findings. Therefore, a follow-up study should investigate the level of body image distortion among the Medication-Centered Group and its relationship with inappropriate weight control behaviors.

The Diet-Centered Group, characterized by adopting reduced food intake, diet supplements, fasting, and whole-food diets, exhibited the second-highest risk of substance use and faced inherent difficulties related to stress, depression, and anxiety disorder. The likelihood of suicidal ideation in this group was lower compared to the Medication-Centered Weight Control Group but higher compared to the Holistic Approach to Diet and Exercise Group.

In particular, among males, predictors of membership in the Diet-Centered Group included various mental health factors (stress, depression, anxiety disorder, suicidal ideation), alcohol use, and traditional tobacco use, especially in instances of lower academic achievement. These findings challenge the traditional notion that diet-centric weight control methods are predominantly employed by females (Kim et al., 2002), providing novel insights. Recent studies suggest that, while females may pursue weight loss to achieve slimness, males engage in irregular eating patterns to achieve lean muscularity, leading to psychological issues associated with appearance-related stress (Byrne et al., 2023). Considering this, male adolescents in the Diet-Centered Group may be more responsive to stress related to changes in muscularity and weight, potentially leading to a range of mental health issues. Therefore, addressing the unique perspectives of male adolescents engaged in diet-centric weight control methods may require an approach distinct from that applied to traditionally studied female-centric dieters.

Conversely, female members of the Diet-Centered Group exhibited a greater vulnerability in mental health, with anxiety disorder, depression, and suicidal ideation identified as significant predictive factors. Adolescent girls may experience psychological challenges due to heightened concerns about their appearance and fear of negative peer evaluations, as reported in previous studies (Kim & Lee, 2021). Additionally, the mediation of stress through body dissatisfaction leading to suicidal ideation further emphasizes the importance of fostering a healthy body image for mental well-being (Noh & Choi, 2009). Moreover,

social and cultural influences, including peer impacts and media sensitivity, contribute to a higher likelihood of diet restriction and extreme dieting among female adolescents (Balantekin et al., 2018). Thus, educating young females on peer-centric healthy weight control methods is crucial. However, recent reports suggest that contemporary male adolescents also internalize idealized body standards (Byrne et al., 2023). Consequently, future research should explore weight control methods, media influences, and peer networks among male and female adolescents to address the broader impact of societal and cultural factors on adolescents' mental well-being.

These studies indicate that offering comprehensive health education to girls is essential to help them cultivate an objective perception of their body image. Moreover, implementing programs that encompass early screening and intervention for a spectrum of mental health issues would likely be effective. Specifically, adolescents in the Diet-Centered Group must undergo screening for distorted body image and mental health issues and receive counseling as needed. Additionally, nutrition education in the Diet-Centered Group can promote healthy eating habits, supported by Lee et al. (2021a) findings that nutrition education in school effectively improves dietary habits and corrects body image misconceptions in Korean adolescents.

Taking the above into account, here are our proposed future prevention efforts related to adolescent weight control: Adolescents need comprehensive education on various weight control methods, including their pros and cons. Considering the study by Lee et al., (2021a), this education should be integrated into a broader eating and nutrition curriculum, enabling students to make informed and healthy choices. There are also a number of mental health problems and substance use risks associated with adolescent use of non-prescription weight loss products, including medications and dietary supplements, which can have long-term effects on adolescents (Hall et al., 2024). Therefore, the implementation of youth protection policies, including strong warnings and regulation of adolescent use of these products, is necessary. Moreover, teachers, social workers, and counselors should be trained to recognize the need for mental health assessments for not only girl but boys who are engaged inappropriate weight control behavior, allowing for early intervention to prevent potential mental health issues.

This study had several limitations. The use of cross-sectional secondary data restricted our exploration of causal or longitudinal relationships among variables. Additionally, a mere 1.6% of participants belonged to Class 1. While existing literature deems proportions exceeding 1% within resulting latent layers appropriate (Clark, 2010; Jung and Wickrama, 2008; Ku and Chung, 2019; Lee et al., 2021b; Lo et al., 2001), future studies should be conducted on an increased number of adolescents using medication-centered weight control methods. Moreover, this study investigated weight control methods without considering BMI. In essence, this overlooks the possibility of inappropriate weight control, even when appropriate methods were used, in cases where there is body image distortion despite having a low BMI. Future studies should include BMI for a more comprehensive understanding. We incorporated lifetime use, frequency, and amount of substance use in our study due to the lack of validated measurements in the KYRBS dataset. Although KYRBS is a nationally representative dataset conducted by South Korean government institutions, we recognize potential concerns regarding the survey questions, as they are not based on validated scales. Furthermore, we encountered challenges in including frequency and amount of substance use in the multivariate logistic regression analysis due to issues with model fit and multicollinearity. Therefore, we recommend that future studies delve deeper into these relationships using validated scales or by incorporating frequency and amounts of substance use.

Despite the limitation, we believe our contribution to the current literature is significant, as it offers novel insights into the associations between types of substance use (alcohol, traditional cigarette, liquid-type e-cigarette, and HTPs), mental health problems (stress, depression, anxiety disorder, and suicidal ideation), and latent classes of weight control methods (Medication-Centered Weight Control Group, Diet-Centered Group, and Holistic Approach to Diet and Exercise Group) by sex. These findings can serve as a preventive resource to help adolescents understand the issues associated with various weight control methods and to guide them in choosing healthier approaches to weight management.

Conclusion

This study seeks to categorize weight control methods among Korean adolescents and evaluate the relationship between each category and substance use and mental health. It underscores gaps in the existing literature, exposing a lack of empirical evidence explaining how specific aspects of substance use and mental health contribute to weight control patterns among Korean adolescents. Furthermore, the research identifies an elevated risk of substance use and mental health issues among those utilizing medication-centered and diet-centered weight control methods, highlighting heightened vulnerability. Furthermore, we investigated gender variations within the context of these influences. The study recommends effective interventions, including preventive education, to discourage the progression from substance use and mental health problems to medication-centered or diet-centered weight control methods.

Data Availability Data will be made available on request.

Declarations

Informed Consent Not applicable.

Human and Animal Rights No animal or human studies were carried out by the authors for this article.

Conflict of Interest None.

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