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Dieting and Substance Use Among White and Black Adolescent Girls

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Abstract

Objective: Previous research has found an increasing co-occurrence of dieting and substance use behavior among adolescent girls. However, to date few studies have examined the temporal ordering of these behaviors. Further, limited research has been conducted to explore whether the pathways are similar among both White and Black girls.

Method: For the current study 1,580 girls (grade 6–11; 78.2% White; 21.8% Black) provided data on their dieting behavior and substance use. A cross-lagged panel design was used to examine the concurrent and prospective relationship between dieting behavior and substance use across one year, then by race.

Results: Among the full sample of girls, there was a significant concurrent relationship. Additionally, dieting behavior predicted substance use one year later, but the inverse relationship was not found. For the stratified analysis, dieting behavior and substance use were not correlated among Black girls at either time point, however concurrent relationships were found for White girls. For the prospective pathways non-significant effects were found for both groups.

Discussion: These findings provide support for a temporal relationship between dieting behavior and substance use, such that the former predicts risk for the latter. However, when examined by race, some pathways of the full sample were found for White girls, whereas Black girls did not report an association between study variables. Thus, future studies should consider the impact of race within risk pathways.

Keywords

dieting behavior; substance use; adolescents; race; girls; longitudinal

Introduction

Adolescence is a developmental period during which the prevalence of health compromising behaviors increases (Braams et al., 2015; Ellis et al., 2012). The co-occurrence of

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maladaptive behaviors has been understood within the problem behavior theory, which states that engagement in one problem behavior increases the likelihood of involvement in other problem behaviors (Jessor & Jessor, 1977). In line with this theory, researchers within the eating disorder field have proposed that dieting behaviors, defined as a maladaptive desire or attempt to lose weight among adolescents (Maloney et al., 1989), belong within this problem behavior category (Neumark-Sztainer et al., 1996), given evidence on the co-occurrence of dieting behaviors with other health-compromising behaviors, such as substance use (Eichen et al., 2012; Ross & Ivis, 1999; Stice et al., 2004). For example, Vidot et al. (2016) found among a sample of adolescents aged 12–18, 60.1% of those who reported dieting behavior (i.e., restricting food, using diet pills, vomiting and/or laxatives) also reported substance use. However, a limitation of the problem behavior theory is its focus on the co-occurrence of these behaviors without making inferences of the temporal ordering. Given the negative health consequences associated with both dieting behavior (Larson et al., 2009; McDow et al., 2019; Stachowitz et al., 2014) and substance use (Kaminer, 2016; Schulenberg et al., 2015; Volkow et al., 2014) specifically among adolescents, understanding how these behaviors influence one another is critical.

Directionality Between Dieting Behavior and Substance use

To date, there is a small body of research examining the temporal ordering between dieting behavior and substance use with limited theoretical rationale. The first known study was conducted by Krahn and colleagues (1996), who found a prospective effect of dieting during 6^{th} grade on alcohol use during 9^{th} grade. Other studies have confirmed this effect among adolescents, with dieting leading to later substance use over time (Austin & Gortmaker et al., 2001; Conway et al., 2016; Johnson et al., 2002; Krahn et al., 1996; Measelle et al., 2006; Stice et al., 2004). However, no theory was provided for understanding the link between dieting behavior and substance use.

Regarding the opposing pathway – the effect of substance use on later dieting behavior– the dietary restraint model (Polivy & Herman, 1976a, 1976b, 1985) has been the most commonly utilized theory for understanding this relationship suggesting, that among dieters, alcohol intake can decrease cognitive control which in turn increases risk for binge eating. Stice and colleagues (2004) expanded on this model to include substance use as another type of disinhibiting factor that influences binge eating. Yet, among studies that have investigated the pathway from substance use to dieting behavior, no evidence that substance use leads to later dieting has been found (Conway et al., 2016; Harrop & Marlatt, 2010; Johnson et al., 2002; Krahn et al., 1996; Measelle et al., 2006; Stice et al., 2004). However, there are some inconsistencies in the measurement of the dieting behavior construct across these studies, which warrants further examination. Specifically, dieting behavior has been conceptualized through various terminology (i.e., dieting behavior, disordered eating, unhealthy weight loss practices; Maloney et al., 1989; Neumark-Sztainer et al., 2006; Vidot et al., 2016), and assessed based on diagnostic features (i.e., bulimic symptoms, binging and purging, restrictive eating; Johnson et al., 2002; Measelle et al., 2006; Stice et al., 2004). Examining the relationship between substance use and dieting behavior based on eating disorder diagnosis symptoms can be limiting, as it excludes other dieting behaviors engaged in by adolescents, such as limiting food, exercising to lose weight, and taking diet pills. We posit

that by expanding the construct of dieting behavior from what has been included in previous studies, we are more likely to capture a broader set of behaviors for weight control.

Dieting and Substance use among White and Black girls

There is also concern about the generalizability of the findings on the association between dieting behavior and substance use across racial/ethnic groups, as much of the research previously outlined were comprised largely of White girls (e.g., 95.5% White in Krahn et al., 1996, 68% White and 7% Black in Measelle et al., 2006). It is plausible that differences will be observed across racial/ethnic groups, as studies have found that Black girls report higher levels of body satisfaction compared to their peers (Rodgers et al., 2017; Rothstein et al., 2017), which is associated with lower prevalence of dieting behavior (Neumark-Sztainer et al., 2002). Whereas White girls report more weight-related concerns leading to an increased prevalence of dieting behavior (Garry et al., 2003; Neumark-Sztainer et al., 2002). In relation to substance use, differences have also been found, with Black girls reporting higher rates of marijuana use and White girls reporting higher rates of alcohol, cigarette, and illicit substance use (Chung et al., 2013; Kann et al., 2016; Keyes et al., 2015). Thus, these differences across race in both dieting behavior and substance use may also indicate differences in the concurrent and temporal association between the two behaviors by race. Understanding the relationship between dieting behavior and substance use among Black and White girls can also guide future research to better understand risk pathways that can be generalized across cultural groups, and whether there are pathways that may be more culturally specific for certain groups.

The Present Study

The current study aims to add to the body of literature on the association between dieting behavior and substance use by examining their bidirectional effect among a large community sample of White and Black adolescent girls over a one-year period. We aim to focus on girls given evidence that dieting behaviors and substance use were not observed to be associated among boys (Austin & Gortmaker, 2001; Eichen et al., 2012). We hypothesize that a concurrent and prospective relationship will be found between dieting behavior on later substance use. Although previous literature has not observed an effect for the converse relationship, as an exploratory aim, we will examine the pathway between substance use on later dieting behavior. We will also examine whether these pathways are found separately among White and Black girls, hypothesizing that a significant concurrent and temporal pathway will be found for White girls. However, given the lack of published studies examining these risk pathways as a function of race, no a priori hypotheses were determined for Black girls.

Methods

Participants and Procedures

The current study is a secondary data analysis of a 5-year parent study, through which participants in grades 4–12 within a large Midwestern county in the United States completed a survey assessing various youth health behavior outcomes (see Barnes et al., 2009, for further information about the parent study). Due to high attrition across waves, for the

current study, data were used across a one-year period among participants who completed at least one substance or dieting measure in the designated period. Additionally, the current study was restricted to only students in grades 6–11 at time 1, who self-identified as female, and who self-identified as non-Hispanic White or non-Hispanic Black. Thus, the current sample comprised of 1,580 adolescent girls (1,235 White and 345 Black) that were in 7th grade on average at time 1 (mean=7.44, SD=1.36). See Table 1 for complete descriptive statistics.

Measures

Demographics.—Participants were asked to indicate their gender, grade, and racial/ethnic background (i.e., African American/Black, American Indian/Alaskan Native, Hispanic, Asian/Pacific Islander, Multiracial, White, and Other).

Dieting behavior.—The dieting behavior measure was created for the parent study, but similar to other scales among adolescents (Neumark-Sztainer et al., 2006; Neumark-Sztainer et al., 2011; Measelle et al., 2006; Vidot et al., 2016). Participants were asked to indicate the extent to which they have exhibited six dieting behaviors in the past year: “tried to lose weight,” “eaten less food to lose weight,” “exercised to lose weight,” “gone without eating for one day or more to lose weight,” “taken any diet pills, powders, or liquids to lose weight without a doctor’s advice,” and “vomited or taken laxatives to lose weight.” Response choices were on a 4-point Likert scale, 1 (*Never*), 2 (*Not much*), 3 (*Sometimes*), 4 (*A lot*). The scores were summed, ranging from 6–24, representing a composite dieting behavior score. The internal consistency was high across the two time-points (White: α = .83 at both time points; Black: α = .81 and α = .84), similar to other studies using similar scales, α=.83–.97 (Neumark-Sztainer et al., 2006; Neumark-Sztainer et al., 2011; Measelle et al., 2006; Vidot et al., 2016).

Substance use.—The substance use measure was adapted from items included in various national studies conducted among youth (e.g., Monitoring the Future, Johnston et al., 2012). Participants were asked to indicate how many days in the past 30 days had they engaged in the following six behaviors: “smoked cigarettes,” “used smokeless tobacco,” “had at least one drink of alcohol,” “used marijuana,” “used inhalants,” and “used other drugs (cocaine, ecstasy, LSD, crank).” Response choices were provided on a 7-point Likert scale, with 1 (*0-days*), 2 (*1 or 2 days*), 3 (*3–5 days*), 4 (*6–9 days*), 5 (*10–19 days*), 6 (*20–29 days*) and 7 (*everyday*). The scores were summed to represent a composite substance use score, ranging from 6–42. Previous studies using this measure among adolescents have found high internal consistency, α = .87 (Litwiller & Brausch, 2013), with acceptable scores found for the current study across the two time-points (White: α = .86 and α = .88; Black: α = .69 and α = .73).

Data Analysis

Skewness and kurtosis of the study variables were assessed, indicating that their distributions were approximately normal except for substance use (time 1: skewness = 8.65, kurtosis = 97.19; time 2: skewness = 5.52, kurtosis = 36.01) given that substance use reporting was low. Given the presence of nonnormality and to handle missing data with the

dataset, robust full information maximum likelihood estimation method (MLR) was used to estimate the model in Mplus version 8.0 (Muthén & Muthén, 1998; 2010). MLR is an appropriate method to deal with missing data without deleting any cases. It will also produce standard errors that are robust to nonnormality, thus addressing the skew of the substance use variable.

For the first study aim examining the concurrent and prospective relationship between substance use and dieting behavior, pathways were examined using path analysis where standardized path coefficients and correlations were examined (see Figure 1). For the second aim, race was stratified in the model, using multiple group analysis, to examine whether the proposed pathways were observed within each racial group. A chi-square difference test was also performed to examine whether the parameter estimates were statistically different between White and Black girls. Specifically, chi-square test statistic were compared between two models: the model with all the path coefficients to be different across groups (full model) and the model with all the path coefficients to be the same across groups (restricted model). Grade was included as a covariate in all models. To assess model fitness, based on the recommendations by Hu and Bentler (1999), the indicators used to determine good fit were the chi-square test statistic and degrees of freedom ratio less than 2.0 (χ^2/df; Kline, 2015; Ullman, 1996), the root mean squared error of approximation less than .06 (RMSEA; Browne & Cudeck, 1993; Steiger & Lind, 1980), the standard root mean squared residuals less than .08 (SMSR; Bentler, 1995), and the comparative fit index of at least .90 (CFI; Bentler, 1990). Additionally, we examined whether the model exhibited statistically significant paths that explained substantial variance in the outcomes (Burkholder & Harlow, 2003).

Power Analysis

A power analysis was conducted using the simulation approach proposed by Muthén and Muthén (2002). Specifically, we simulated 1000 datasets based on the covariance matrix of the variables in the Black group, given that they had a smaller sample size, and fit the tested model for both the full sample and the stratified model. The power for target parameters is estimated based on the percentage of the datasets in which the estimates were significant. The power analysis suggested that n = 1000 was needed to achieve 80% power to detect the effect of dieting behavior at time 1 on substance use at time 2, and n = 5000 was needed to obtain sufficient power to detect the impact of substance use at time 1 on dieting behavior at time 2.

Results

Preliminary Analyses

While composite variables were used for all study analyses, table 2 represents the prevalence of study variables by specific type. Dieting behavior was common, with 80.9% of youth reporting dieting behavior at time 1, which slightly increased to 81.6% at time 2. Additionally, 17.6% reported substance use at time 1, which increased to 22.2% by time 2. However, neither increase in prevalence was statistically significant. Differences in prevalence of dieting behaviors and substance use endorsement were examined by race

(see Table 1). Although rates of dieting behavior and substance use appear slightly higher for White girls, independent samples t-test revealed that the differences in means for all variables by race were not statistically significant.

Full Sample Path Analysis

A cross lagged panel model was used to test the concurrent and prospective relationship across a one-year period between dieting behavior and substance use (see Figure 1). The model fit the data well, $\chi^2(7) = 357.06$, $p < .001$; RMSEA <.001; CFI = 1.00; SMSR <.001. A positive association was found between substance use and dieting behavior at both time 1 ($r = .220$, $p < .001$) and time 2 ($r = .203$, $p = .013$) after controlling for grade at time 1. After controlling for substance use and grade at time 1, a prospective relationship was also observed with dieting behavior predicting later substance use ($\beta = .074$, $p = .023$). However, after controlling for dieting behavior and grade at time 1, substance use was not found to predict later dieting behavior ($\beta = .028$, $p = .421$).

Multigroup Analysis by Race

Multigroup analysis was used to stratify the model by race to test the second aim. The model fit the data well, $\chi^2(14) = 416.54$, $p < .001$; RMSEA<.001; CFI = 1.00; SMSR <.001 (see Figure 1). Among White youth, the concurrent relationship between substance use and dieting behavior was significant at both time points (time 1: $r = .259$, $p < .001$; time 2: $r = .234$, $p = .008$). The prospective effect of dieting behavior at time 1 on substance use one year later did not reach statistical significance ($\beta = .071$, $p = .065$). Additionally, substance use at time 1 did not predict later dieting behavior ($\beta = .031$, $p = .458$). For Black youth, the concurrent association between substance use and dieting behavior was not statistically significant at either time point (time 1: $r = .020$, $p = .705$; time 2: $r = .058$, $p = .664$). Moreover, there were no significant prospective paths; dieting behavior did not predict later substance use ($\beta = .084$, $p = .107$) and substance use did not predict later dieting behavior ($\beta = .027$, $p = .577$). The chi-square difference test was also not significant ($\chi^2 = 2.164$, $df = 4$, $p = .706$), indicating that the path coefficients were not significantly different between White and Black adolescent girls.

Discussion

Given the limited number of studies examining the relationship between adolescent dieting behavior and substance use, and the narrower focus in the conceptualization and measurement of dieting behavior in previous studies (Eichen et al., 2012; Krahn et al., 1996; Measelle et al., 2006; Stice et al., 2004), the first aim of the current study was to examine the concurrent and prospective relationship between adolescent dieting behavior and substance use utilizing a broad definition of dieting behaviors. It was hypothesized that dieting and substance use would be positively associated and would prospectively predict each other. Our findings were partially supported. Consistent with previous literature (Bulgin & Amar, 2016; Conway et al., 2016; Harrop & Marlatt, 2010), dieting behavior and substance use co-occurred and dieting behavior predicted substance use over the course of one-year. Yet, contrary to our hypothesis, though consistent with previous literature (e.g., Conway et al., 2016; Harrop & Marlatt, 2010; Measelle et al., 2006; Stice et al., 2004), the inverse

relationship was not found. Our findings add to the current literature by finding support for the dieting-substance use risk pathway even when examining dieting behaviors that are not considered diagnostic features of eating disorder pathology.

Stratification of the Model by Race

The second aim of the current study was to examine whether the relationship between dieting behavior and substance use would be different for White girls compared to Black girls, given that previous literature has not examined these pathways among racial/ethnic minority youth. Our findings indicate that White girls who engaged in dieting behavior were also likely to be engaged in substance use, yet no statistically significant prospective effect was found. However, for Black girls dieting and substance use were not related for any of the pathways examined. It is plausible that the significant prospective relationship among the full sample was primarily driven by the effect among White youth. Thus, future research is needed to confirm the presence of these risk pathways for White girls. Moreover, the lack of any effects found for Black girls suggests that dieting behavior may not have a strong association with substance use for Black girls. However, given that the current study is one of the first, to our knowledge, to examine these risk pathways among racial/ethnic minority youth, additional research is warranted to confirm whether concurrent and prospective associations are found for Black girls.

Future Directions

In addition to the need for more research confirming the relationships observed among White and Black girls, future studies can also build off the current study's findings. First, future studies might combine research on motives of dieting (i.e., disinhibition, thinness, expectancies, risk taking, impulse control) with research on the co-occurrence of these behaviors across cultures. It could be that the relationship is attenuated based on motives for engagement in dieting behaviors and that these motives may differ by race. Second, it is possible that effects of dieting behavior on substance use are developmentally anchored. Given evidence on increases in substance use (Johnston et al., 2012; Miech et al., 2016) and dieting behavior (Krahn et al., 1996) across adolescence, there might be a specified period during adolescence when the effect becomes present, as well as periods in which one behavior may have a stronger effect on the other. In addition, it could be that effects may be observed with more time elapsed between assessments. Third, we did not find an association between dieting behavior and substance use for Black girls, however it is unknown whether this relationship is observed for other racial/ethnic minorities. Previous studies have found similar prevalence rates of concurrent dieting behavior and substance use among Hispanic, Asian, and White girls (Neumark-Sztainer et al., 2002). Thus, future studies are needed to examine whether the relationships observed between dieting behavior and substance use are also found among other racial/ethnic adolescent girls.

Limitations

Although this study has important implications for prevention of substance use and dieting behavior among adolescent girls, there are some limitations to note. First, although this is the first study, to our knowledge, to examine the association between dieting behavior and substance use by race, and there was a relatively large number of Black girls included

in the study, we were underpowered to test the prospective pathways among the Black group. Thus, although the significance levels found among the Black girls were far from reaching statistical significance indicating of a lack of an association between the two constructs, additional research with larger sample sizes are needed to confirm whether pathways are present for Black girls. Second, the present sample had low reported substance use compared to national samples (Johnston et al., 2012; Kann et al., 2016), which may impact the generalizability of the findings. Relatedly, the substance use measure found a lower reliability among Black girls relative to White girls, indicating the composite measure for substance use may not hold as well for Black girls. Third, our findings may be limited based on measurement issues such that the dieting and substance use variables did not use the same time frame. Dieting behaviors were asked within the past year and substance use was past month, possibly reducing the variability of responses for substance use during a developmental period when most adolescents are not using substances. Fourth, the dieting construct was not a validated measure and was conceptualized for the parent study. This measure was meant to be inclusive of compensatory and exercise behaviors, as well as intentions to lose weight to capture the totality of dieting behaviors. Although our aims were adequately achieved, this remains a limitation of interpretation of study findings. Finally, the parent study did not provide age, weight, or BMI, thus the present study is limited in its ability to control for other demographic variables. Future studies may evaluate the impact of these variables within risk pathways.

Conclusion

With support for both the concurrent and prospective effects of general dieting behavior on later substance use among adolescent girls, our findings highlight the need to also focus on dieting behavior as a public health concern that may increase risk for engagement in substance use among adolescent girls. Moreover, given that some associations were observed for White girls and not for Black girls it is plausible that pathways may not generalizable across racial/ethnic groups, warranting future research. The current study can also serve as a catalyst for examining variation in risk based on developmental period and mechanisms underlying risk pathways. Such findings can help inform and extend our understanding of risk processes regarding dieting behavior and substance use for girls across adolescence, and ultimately inform prevention programming to decrease the long-term impact of both behaviors among at-risk youth.

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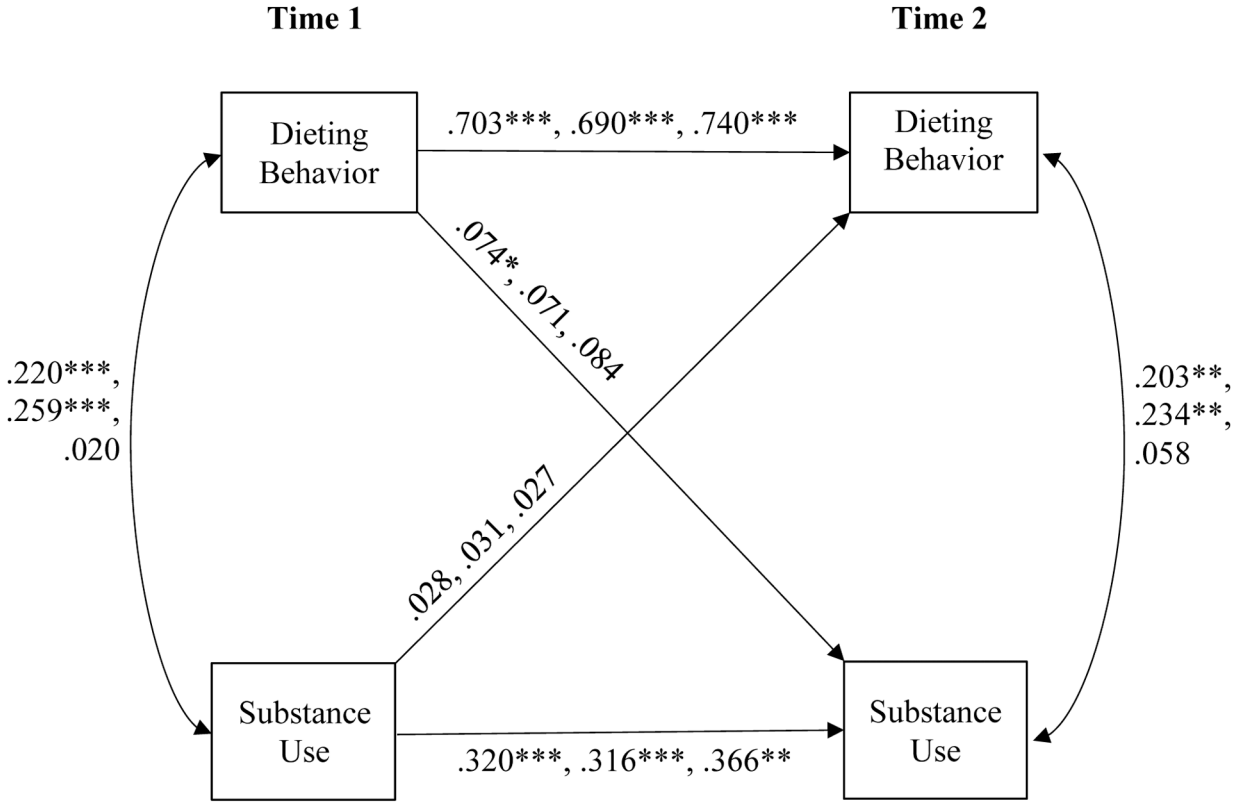

Figure 1.

Cross lagged panel design time model predicting the co-occurrence and temporal ordering of dieting behavior and substance use across one year

Notes: Single direction arrows depict standardized coefficients representing the pathways for the association of dieting behavior and substance use for the total sample, White girls, and then Black girls respectively, across one year. Double arrows are Pearson's correlations. All pathways control for time 1 grade and the time 1 value of the outcome variable. Not included in the figure, for ease of presentation, are disturbance terms and error terms.

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

Table 1.

Descriptive statistics for year 1 grade, dieting behavior, and substance use among total sample and by race

	Total M (sd)	White M (sd)	Black M (sd)
Year 1 Grade	7.44 (1.36)	7.44 (1.35)	7.44 (1.38)
Dieting Behavior (DB)			
DB time 1	11.18 (4.10)	11.21 (4.07)	11.06 (4.24)
DB time 2	11.37 (4.20)	11.49 (4.14)	10.92 (4.41)
Substance Use (SU)			
SU time 1	6.62 (2.61)	6.67 (2.83)	6.43 (1.57)
SU time 2	7.24 (4.04)	7.31 (4.29)	6.96 (2.95)

Notes: White (n = 1235); Black (n = 345).

Mean (M) and standard deviations (sd) for each variable at both time frames. Dieting behavior scores ranged from 6–24, with higher scores indicating a greater number of dieting behaviors used and/or greater prevalence of dieting behavior. Substance use scores ranged from 6–42, with higher rates indicating a greater number of substances used and/or greater prevalence of substances use.

Table 2.

Percent of dieting behavior and substance use endorsement across one year by group

	Time 1		Time 2	
	White	**Black**	**White**	**Black**
Dieting Behavior (%)				
Tried to lose weight	**77.55**	**69.12**	**80.68**	**68.75**
Eaten less food to lose weight	**57.61**	**56.64**	61.32	54.93
Exercised to lose weight	**78.81**	**68.15**	**79.88**	**66.67**
Gone without eating for one day or more to lose weight	27.33	27.89	29.70	30.51
Taken any diet pills powders or liquids to lose weight without a doctors advice	9.70	9.76	11.17	8.93
Vomited or taken laxatives to lose weight	6.33	7.40	9.40	8.63
Substance Use (%)				
Smoked cigarettes	**5.43**	**3.23**	**9.80**	**4.46**
Use smokeless tobacco	1.07	1.18	2.29	1.80
Have at least one drink of alcohol	**15.50**	**14.16**	**23.67**	**19.35**
Use marijuana	4.45	6.18	**9.29**	**11.61**
Use inhalants to get high	**2.55**	**2.08**	3.51	2.98
Use other drugs (cocaine, ecstasy, LSD, crank)	1.40	1.18	3.26	2.08

Notes: The table represents items from the dieting behavior and substance use constructs. The percentages indicate a chosen value other than "never" in the past year for dieting behavior and "zero days" in the past month for substance use. However, predictive and concurrent pathways were not dichotomous. Additionally, composite scores for each behavior were used for analysis. Bolding indicates significant differences in prevalence between White and Black groups at each time frame where $p < .05$. Not presented are percentage of reported denies for each item, which is the inverse of percentages presented. Values do not reflect MLR computation and thus rows do not add up to equal the subsamples ($N = 1580$).