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Obesogenic clusters: multidimensional adolescent obesity-related behaviors in the U.S.

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Abstract

Background—Diet, physical activity, and psychosocial factors are independent and potentially interactive obesity determinants, but few studies have explored complex behavior patterns.

Purpose—Examine obesity-related behavior patterning and identify high risk adolescent groups.

Methods—Cluster analysis identified groups with shared behavior patterns in the National Longitudinal Study of Adolescent Health (1995 & 1996, ages 11–21; N=9,251). Descriptive and multivariate regression analyses compared sociodemographics and prevalent and incident obesity across clusters.

Results—Seven and six clusters in males and females, respectively, represented behavior patterns such as School Clubs & Sports, Sedentary Behaviors, Dieting, and Junk Food & Low Activity. Sociodemographics varied across clusters. Compared to School Clubs & Sports clusters, adjusted odds of prevalent and incident obesity were higher for most clusters in females but not males.

Conclusions—Cluster analysis identified several obesogenic behavior patterns, highlighting areas for future research and potential avenues for interventions that target broad lifestyle factors.

Keywords

obesity; physical activity; diet; adolescents; behavior patterning

INTRODUCTION

As overweight and obesity prevalence has increased in children and adults in the United States (1) and beyond (2,3), so has the number of identified obesity risk factors. Factors ranging from television viewing (4,5) to sugar-sweetened beverage consumption (6–8) and acculturation (9) are associated with increased obesity risk, while behaviors such as physical activity (10–12) and breakfast consumption (13) appear to be protective. Indeed, obesity etiology is multifactorial, involving myriad determinants under biologic, social, and societal levels of influence (14,15).

Further, many of these behaviors are inter-related, particularly in adolescents: for example, high-calorie snack food consumption increases with hours of television viewing (16), while many seemingly contrary behaviors such as sedentary and physical activities co-occur (17, 18). Further, various behaviors may exert combined effects on health, rather than independent effects implied by examination of behaviors in isolation. Pattern analysis, such as cluster

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analysis, may therefore better address the complexity of obesity-related behavior patterning than single or joint risk factors. For example, using cluster analysis, Nelson et al found that patterning of various types of physical activity and sedentary behavior, such as computer games and skateboarding, were strong predictors of degree of physical activity decline and obesity incidence from adolescence to young adulthood (17).

However, existing studies examined patterning of a limited number (19,20) or scope (17,21) of adolescent health behaviors, so little is known about patterning of a broader range of social and health behaviors and their associated obesity risk. Cluster analysis is a technique that empirically derives shared behavior patterns and clusters individuals into mutually exclusive groups (22), an approach that is particularly valuable in the absence of prior knowledge about behavior patterning.

Additionally, obesity prevention and treatment strategies have demonstrated limited success in adolescents (23). School-based programs and household-level interventions often target a specific age group (24,25) or sociodemographic profile (26,27), but these target groups are heterogeneous. For example, adolescent girls versus boys experience different barriers to physical activity (28), and home environments may differ by sociodemographic factors (29). Approaches like cluster analysis can identify high risk groups which recognize the natural patterning of behaviors in adolescents. Obesity prevention interventions can then be tailored for and targeted to these high risk groups. Further, intervention outcomes can be evaluated within subgroups with high risk behavior profiles identified by cluster analysis.

We build on prior work focused on physical activity and sedentary behaviors in The National Longitudinal Study of Adolescent Health (Add Health) population (e.g., (17,30)) to specifically examine the patterning of a wide and expanded range of diet, activity, and other obesity-related behaviors. We used cluster analysis to identify obesogenic behavior clusters and compare them with respect to obesity prevalence during adolescence and five-year obesity incidence. The central goals were to generate hypotheses related to (1) physical activity and diet behavior patterning and (2) high risk adolescent groups that can be tested in other populations.

METHODS

Study Population

Add Health is a prospective cohort study of more than 20,000 adolescents representative of the U.S. school-based population in grades 7 to 12 in 1994–95 followed into adulthood. Add Health included a core sample plus subsamples of selected minority and other groupings collected under protocols approved by the Institutional Review Board at the University of North Carolina at Chapel Hill. The survey design and sampling frame have been discussed elsewhere (12). Add Health includes two waves collected during *adolescence*: Wave I (n=20,745, measured 1994–1995; 11–22 years) and Wave II (n=14,738 school-aged adolescents, high school dropouts included, measured April to August, 1996; 12–22 years); and one during *young adulthood*: Wave III (n=15,197, measured August 2001 to April 2002; 18–25 years).

Of 13,570 adolescents in the probability sample, the final sample includes 8,840 adolescents for cluster analysis. Study exclusions include: reported pregnancy in females at Wave I or II (n=390), mobility-disability (n=76), or missing cluster input variables (n=4,709). For obesity models, exclusions also include respondents outside the appropriate age range (Wave II, 13–20 years, n=39 excluded; Wave III, 19–26 years, n=115 excluded). All analyses were conducted in 2006–2007. Participation in school clubs, team sports, and individual sports obtained from the Wave I in-school questionnaire accounted for 76% of observations excluded due to missing data. However, these variables were complete for the vast majority of respondents and were important in a previous analysis of activity behaviors (17) and were therefore retained for analysis.

Cluster Development

Cluster analysis is an exploratory analytical method that explicitly addresses inter-related behaviors by grouping individuals with similar behaviors within mutually exclusive clusters (22). While resulting clusters are specific to this analysis, the results are informative for identifying broad behavior patterns that could be explored in other populations.

Input Variables—36 variables were used for cluster analysis, comprised of 11 composite diet variables (aggregated from 76 diet variables) and 25 variables measuring activities and other health behaviors. Input variables and associated survey items are listed in the Appendix. Cluster analysis using large numbers of aggregated variables are routinely conducted using dietary data (31–33). To obtain more stable clusters, highly skewed variables were truncated; upper values were combined until they contained no less than 1% of males or females. Unless otherwise noted, all input variables were obtained from Wave II interviews.

Dietary data included 76 variables on consumption and type (e.g., regular or low fat) of 55 food and beverage items on the previous day. For interpretability, these variables were combined into 11 composite variables representing *the number of food/beverage types* consumed. Variables were combined to generally reflect existing food groups (34) and beverage classifications (35). Fast food and meal frequency and vitamin/mineral consumption were also included.

Number of weekly bouts of six activities and hours of three sedentary behaviors were obtained from Wave II interviews. Participation in Physical Education (PE) classes, and participation in school clubs, team sports, and individual sports were obtained from Wave I, in-school questionnaires. For participants interviewed while school was not in session, PE frequency was imputed from mean values of students in the same grade and school (n=2,814); differences in PE frequency were primarily related to grade and school, likely due to school or district-level PE requirements, and not significantly related to sex. The survey questions were based on self-report physical activity questionnaires that have been validated in other large-scale epidemiologic studies (36). While validation of self-reported sedentary behavior is scant (37), it is highly predictive of Body Mass Index (BMI) and obesity (e.g., (4,5)).

Parental involvement variables included independence in decisions about foods consumed and television viewing, weekly number of evening meals with parents, and participation in sports with a resident parent. Other variables included use of a community recreation center, alcohol use, smoking, and dieting or exercising to lose weight.

Cluster Analysis—Respondents were partitioned into clusters using SAS FASTCLUS, SAS version 9 (Research Triangle Institute, Research Triangle Park, NC, 2004). Continuous variables were z-score transformed to standardize scaling across variables. Dissimilarity, used to allocate individuals into clusters, was measured by Euclidean distance, a measure of the difference between individuals that incorporates values of all input variables (22,38).

Four through eight cluster solutions were generated for males, females, and males and females combined. Cluster solutions are sensitive to the initial cluster center (i.e., seed values), so in order to identify optimal initial cluster centers, an algorithm performed 1,000 iterations of each cluster procedure using randomly generated initial group centers and identified the iteration with the largest overall r^2 value. The r^2 value represents the heterogeneity between, relative to heterogeneity within, clusters. This approach reduced the subjectivity involved in selecting 15 candidate solutions (sex-specific and combined sex, each with four through eight clusters).

In the absence of standard cluster selection methods, we used the following criteria, drawn from other studies (39,40) and methodological texts (22), to select final cluster solutions from the 15 candidate solutions: (1) strength of behavior patterns within clusters (i.e., variables with mean z-scores ≤−0.5 or ≥0.5), (2) detection of additional distinct behavior patterns when additional clusters were added, (3) robust clusters across solutions, and (4) cluster solutions yielding sufficient numbers (>5% of sample). Cluster robustness was determined by comparing the defining characteristics of clusters obtained from extensive manual repetition of cluster analyses and the algorithm described above. For example, the *School Sports and Clubs* cluster (Table 1) emerged in every one of dozens of manual cluster analyses conducted. To further demonstrate the robustness of the cluster solution, sex-specific cluster analyses were replicated in an internal 50% random sample using the same algorithm, specifying the number of clusters in the final cluster solutions.

Cluster names and descriptions reflect distinguishing patterns of each cluster. Key behaviors were identified based on the direction and strength of the average z-scores (i.e., ≤−0.5 or ≥0.5) within each cluster for continuous variables, or the proportion reporting each behavior relative to other clusters for binary variables. Interpretation of clusters should be conducted with reference to the mean z-scores or proportions of each behavior within or across clusters.

Analyses of Clusters

Statistical analyses were performed using Stata, version 9.2 (Stata Corporation, College Station, TX, 2006). Descriptive analysis of cluster variables used post-stratification weights to allow results to be representative of adolescents attending U.S. middle- and high-schools during Wave I data collection (1994–1995). Survey design effects were controlled for in all analyses. Because the final cluster solutions were sex-specific, all subsequent analyses were stratified by sex.

Descriptive Analysis—Sociodemographic characteristics of each cluster were examined and compared to a referent cluster (*School Clubs & Sports*) using the design-based F test at a 95% confidence level with Bonferroni correction for multiple comparisons.

Obesity Models—BMI was calculated from measured height and weight; for <1% and <3% of height and weight measurements, respectively, missing measurements were replaced with self-reported values. Adolescent and adult obesity were defined by BMI greater than or equal to: (1) the age-and sex-specific Centers for Disease Control (CDC) 95th percentile or (2) BMI≥30 kg/m^2 to account for discrepant adolescent and adult definitions in studies spanning both lifecycle phases (41). Sex-stratified multivariate logistic regression modeled prevalent obesity in 8,686 respondents 13–20 years of age (mean=15.7±0.12) at Wave II and incident obesity in 6,029 respondents 19–26 years of age (mean=21.4±0.12) at Wave III as a function of cluster membership. All models were adjusted for race, household income, highest parental education attained, region, and Wave-specific age and season.

Incident obesity models excluded adolescents obese at Wave II but were not adjusted for baseline BMI (Wave II) due to concerns that cluster membership may have already influenced baseline BMI, so controlling for BMI may bias associations toward the null. Other concerns regarding baseline adjustment are described by Glymour et al (42). In a separate analysis (not shown), controlling for baseline BMI z-scores, based on age-and sex-specific CDC growth curves, attenuated the observed associations, but statistical significance was retained for all but the Sedentary Behavior cluster in females.

RESULTS

Cluster Solutions

Final cluster solutions included seven clusters in males and six clusters in females (Table 1). Sex-specific solutions were selected because they revealed clusters unique to males or females and stronger (judged by higher z-scores) behavior patterning. The r^2 values, representing the heterogeneity between, relative to heterogeneity within, clusters were 18.3% and 16.9% for males and females, respectively (Table 1). Cluster analysis conducted in an internal 50% random sample yielded similar behavior patterns.

Males were grouped into three physically active clusters: the *School Clubs & Sports* cluster was characterized by participation in many school clubs and sports, the *Sports* cluster by participation in school sports and frequent bouts of sports (but not school clubs), and the *Moderately Active* cluster by weakly elevated frequency of housework, hobbies, skating, sports, and exercise. In females, only the *School Clubs & Sports* cluster was characterized by high physical activity.

Food patterning also varied by sex: in males, two clusters exhibited high food consumption, one reflecting a balanced diet and a high proportion trying to lose weight (*Dieters*), the other reflecting energy dense, low nutrient diets and high smoking prevalence (*Junk Food & Smoking*). Food patterning in females included one cluster characterized by low food intake and high smoking prevalence (*Restrictive Dieting & Smoking*), while other clusters reported high but balanced food consumption (*High Consumers*) or generally low intake with high fast food consumption and low physical activity levels (*Junk Food & Low Activity*).

The *School Clubs & Sports* and *Sedentary Behaviors* clusters were common to males and females. In addition, a *Low Diet & Activity* cluster including males who reported low food consumption and few activities and an *Average Diet & Activity* cluster group including females who reported average diet and activity also emerged.

Observed behaviors are displayed in Table 2 and Table 3. Z-score transformed variables were used to identify characteristic behavior patterns within clusters, while mean frequencies and proportions are provided for interpretability.

Sociodemographic Characteristics

Sociodemographics varied substantially across clusters (Table 4 & Table 5). In general, males and females in the *School Clubs and Sports* clusters were less likely to be obese and more likely to be white and have higher parental education and household income than other clusters, though this pattern varied. There was also variation by age, region, and season.

Association with Obesity

Sex-specific baseline obesity prevalence and five-year incidence were compared across clusters, adjusting for sociodemographic characteristics and using the *School Clubs & Sports* cluster as the referent group (Figure 1 & Figure 2). Unadjusted baseline (Wave II) obesity prevalence was 14.6% (males) and 11.0% (females), while five-year (Wave II to III) obesity incidence was 10.6% and 14.1% among males and females, respectively (data not shown).

In females, all clusters except *Junk Food & Low Activity* were associated with prevalent obesity compared to the *School Clubs & Sports* cluster. These associations were slightly attenuated in longitudinal analysis (Figure 1). Among males, only the *Junk Food & Smoking* cluster was associated with prevalent or incident obesity (Figure 2).

DISCUSSION

Cluster analysis was used to identify homogeneous groups of adolescents with distinct patterns of obesity-related behaviors. Sex-specific cluster membership varied by sociodemographics and in association with obesity. Compared to the *School Clubs & Sports* clusters, most behavior patterns had higher odds of prevalent and incident obesity in females, but not males. Overall, these results underscore the complexity of obesity-related behaviors and identify several multidimensional behavior patterns in adolescents that may not be captured using traditional multivariate techniques.

Key Behavior Patterns

Physical Activity—Adolescents in the *School Clubs & Sports* clusters generally had the lowest odds of obesity, despite relatively average diets and other behaviors. Involvement in school activities may be causally associated with obesity through factors such as increased physical activity or elevated self esteem (43). Alternatively, this association may reflect predominantly lean adolescents joining school activities, the role of these behaviors as proxies for healthy family and social environments, or other non-causal pathways. Regardless of the mechanism, school is a promising setting for encouraging physical activity, and results for the *School Clubs & Sports* cluster identifies a marker for decreased obesity incidence.

Three clusters representing 39% of males versus only one cluster representing 19% of females were physically active. These results are consistent with prior research in Add Health (12,30) and other adolescent study populations (19,44–47) indicating lower physical activity among females, possibly reflecting less variety in activities preferred or available to females. For example, low membership in the *School Clubs and Sports* cluster may reflect lack of club and sports opportunities that appeal to girls.

Diet—In females, the dieting cluster was characterized by food restriction and high smoking prevalence, consistent with evidence of smoking as a weight loss strategy, particularly among girls (48,49). In contrast, males in the *Dieting* cluster had high but balanced overall food consumption and somewhat elevated exercise frequency. Contrasting dieting behaviors in males and females alludes to differences in coping strategies and social pressures to remain or become thin (49–51).

Obese or non-obese individuals on an upward weight trajectory may be more likely to diet and more likely to become obese in adolescence or young adulthood, which is one possible explanation for elevated obesity odds in the *Restrictive Dieting & Smoking* cluster in both cross-sectional and longitudinal analyses. Alternatively, other investigators have suggested that short-term dieting, compensatory over-eating, or ineffective dieting methods may explain this counterintuitive association (52,53).

Lower cross-sectional obesity odds in the *Junk Food & Smoking* cluster in males may also reflect the dynamic relationship between diet and weight status. This cluster is comprised of a higher relative proportion of low SES adolescents who may select low-cost, energy dense foods to meet energy needs yet remain resistant to weight gain (54). However, the negative association between the *Junk Food & Smoking* cluster and obesity was not maintained in the long term.

Despite evidence of associations between sedentary behaviors and other risk factors (16,55), males and females in the *Sedentary Behaviors* clusters were remarkably average relative to other obesity-related behaviors. However, many combinations of associated behaviors may not be common enough to emerge in cluster analysis.

Other patterns—The *Low Diet & Activity* cluster is consistent with energy balance and hence the observed lack of association with obesity. However, this and a similar *Reports Few Activities* cluster found in an analysis conducted by Nelson et al. (17), could arise if the questionnaire did not capture relevant foods or activities for these individuals. In females, elevated relative obesity odds in the *Average* diet and activity cluster is consistent with national increases in obesity; that is, the "average" modern lifestyle is associated with positive energy balance. This issue underscores the importance of normative shifts in diet and activity. Notably, in females, only the *High Consumer* luster was characterized by high fruit and vegetable intake, but high levels of all food types in this group is consistent with the absence of a protective association between this cluster and obesity.

Associations with Obesity

In general, clusters were associated with prevalent and incident obesity in females but not males. Consistent associations in cross-sectional versus longitudinal analyses could reflect early establishment of obesity-related behaviors. Alternatively, these behavior clusters may represent endogenous characteristics such as health-related beliefs that carry through into adulthood. Key predictors of incident obesity in adolescent males missing from this analysis such as salient body composition differences and growth rates may explain the lack of obesity associations and larger variability observed in males. Additionally, building muscle mass is more common for adolescent males (50), and high BMI due to larger muscle mass may impact sports participants more than others, thereby attenuating the observed associations with obesity.

Relevance for Prevention

These behavior patterns are relevant for obesity prevention because they can help to identify adolescent subgroups at higher risk for obesity and reveal issues specific to each obesogenic cluster. For example, females in the *Restrictive Dieting & Smoking* cluster have both elevated risk of obesity and motivation for weight control and may therefore benefit from interventions promoting healthy weight control strategies.

Additionally, while these behavior patterns are hypothesis generating and should be tested in other populations, they suggest potential intervention strategies. For instance, high incident obesity associated with the *Restrictive Dieting & Smoking* cluster suggests that interventions should inform adolescents about weight-related and other negative consequences of these behaviors. Similarly, females in the *School Clubs and Sports* cluster exhibited the lowest obesity incidence, yet only a small proportion of females were included in this cluster, suggesting that increased resources for school activities attractive to adolescent girls may be a promising strategy for obesity prevention in females. Lastly, the shift in cluster membership across age groups from *School Clubs and Sports* and *High Consumers* in younger females to *Junk Food and Low Activity* and *Restrictive Dieting and Smoking* in older female adolescents suggests the importance of obesity prevention strategies that attract and retain females as they age into young adulthood, a key period of physical activity decline (44,56,57). The feasibility and effectiveness of implied targeted intervention strategies need to be investigated in future studies.

Observed relationships between obesogenic clusters, obesity, and sociodemographic characteristics highlight the complexity of behavior change within a Socioecologic framework (58). For example, the *Sedentary Behaviors* clusters were characterized by lower SES adolescents, who may be more likely to have obese parents (59) and thus less likely to be exposed to and acquire healthy lifestyles (60), may live in neighborhoods without recreational facilities (61), or attend schools offering fewer sports teams or clubs. While existing recommendations to limit sedentary behavior (62) are well supported (4,5,63), these results suggest that low-income and Black adolescents may be in most need of interventions aimed at reducing sedentary behaviors, and that these interventions may need to address a broad range of behavioral determinants. More generally, clusters of behaviors may occur in response to common intrapersonal and environmental influences. If so, these root problems must be addressed before one can hope for behavior change or reduction in complex conditions such as obesity.

Future work should attempt to replicate and investigate these behavior patterns in other study populations and examine the social and environmental contexts in which these behaviors take place. Detailed studies should examine pathways through which these behavior patterns are related to obesity, particularly for the *School Clubs & Sports* clusters. Specifically, differentiation of mediators from causal and moderating factors is needed before making causal conclusions.

Strengths and Limitations

This study is not without limitations. While the dietary assessment tool was crude, thus precluding estimation of total energy intake, the Add Health diet instrument was appropriate because study aims concerned broad diet behavior patterning. While the weaknesses of self-report recall measures of diet and activity are well known (64–66), our diet and activity survey questions were based on questionnaires demonstrated to be reliable and valid in other large population surveys and have been shown to be important predictors of obesity (30,67). Nevertheless, measurement error could have contributed to the modest r^2 values in this study, or resulted in spurious behavior patterns or biased obesity associations. R^2 values for cluster analysis are not routinely reported, but the values obtained in this study fall within the range reported for factor analysis, an alternative pattern analysis technique (33). To address robustness of the cluster solutions, we replicated these clusters in a 50% internal random sample, finding that the clusters reported in this manuscript emerged repeatedly in these analyses, consistent with other studies demonstrating internal reproducibility of cluster solutions (68). In addition, because the dietary, school participation, and parental involvement variables were only available during adolescent timepoints (Wave I and/or II), the analysis used cross-sectional adolescent behavior data to study associations with baseline prevalent and five-year incident obesity.

A large proportion of respondents had missing data (34.7%). Imputation was inappropriate because of potential artificial creation of behavior patterns. Because in-school survey data contributed the greatest number of exclusions (76%), excluded respondents were comprised primarily of students absent from school. Thus the excluded respondents were older, had high smoking prevalence, lower participation in sports, and had less healthy diets (males only), but were similar on other behaviors, sociodemographics, and obesity. For these exclusions to substantially change the cluster solutions, they would have to exhibit vastly different behavior patterning, such as healthy diets paired with the observed high smoking prevalence. To the contrary, excluded individuals reported behaviors consistent with the *Junk Food & Smoke* cluster in males and *Junk Food, Low Diet & Activity* and *Restrictive Dieting & Smoke* clusters in females.

Study strengths include examination of a wide range of obesity-related behaviors in a nationally representative sample of adolescents followed over a critical five-year period of high obesity incidence. In contrast with tabular methods used in other studies (19), cluster analysis groups individuals with shared behaviors into a manageable number of behavior patterns. Examination of obesity-related behavior patterns and their impact on obesity prevalence and incidence has been an understudied area, as most studies focus on discrete behaviors. While cluster analysis is hypothesis generating and is empirically, rather than theoretically, based and data-specific, the method is valuable for identifying complex and multifactorial behavior patterns that can be examined in other studies and can inform interventions.

Conclusions

Cluster analysis identified several understudied obesogenic behavior patterns, highlighting areas for future research and potential avenues for intervention. These results suggest that among females, sports and/or school clubs had the lowest odds of obesity relative to a wide range of behavior patterns which appear to increase obesity risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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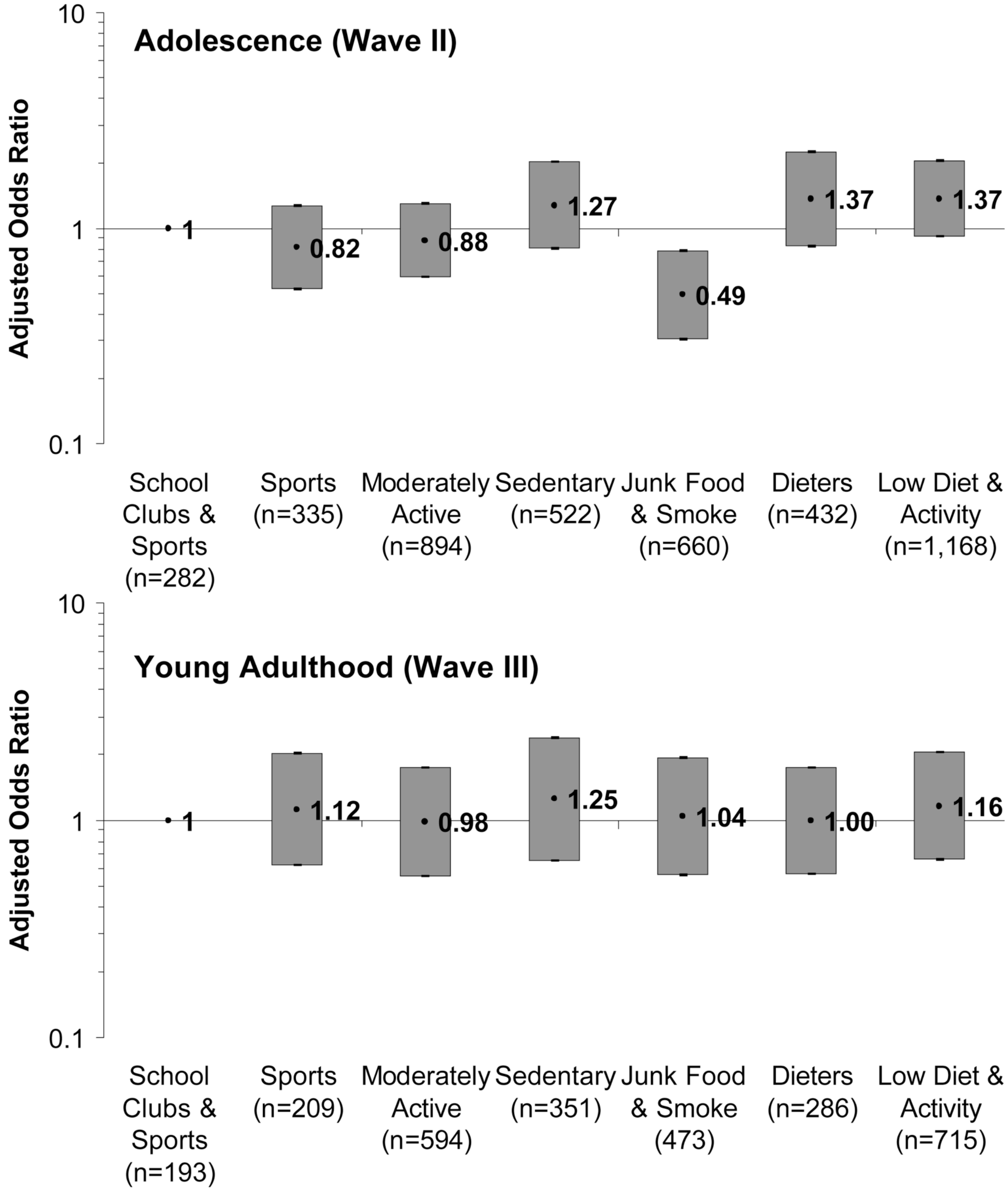

Figure 1.

Logistic regression using activity clusters to predict odds of prevalent (Wave 2) and incident (Wave 3) obesity[a], MALES[b]

[a] Odds ratios determined from logistic regression models, adjusting for age, race, household income, highest parental education, region, and season. *School Clubs & Sports* cluster was the referent cluster. Obesity defined as BMI greater than or equal to (1) the age-and sex-specific Centers for Disease Control (CDC) 95th percentile or (2) 30 kg/m^2. Bars represent 95% confidence intervals.

[b] The National Longitudinal Study of Adolescent Health

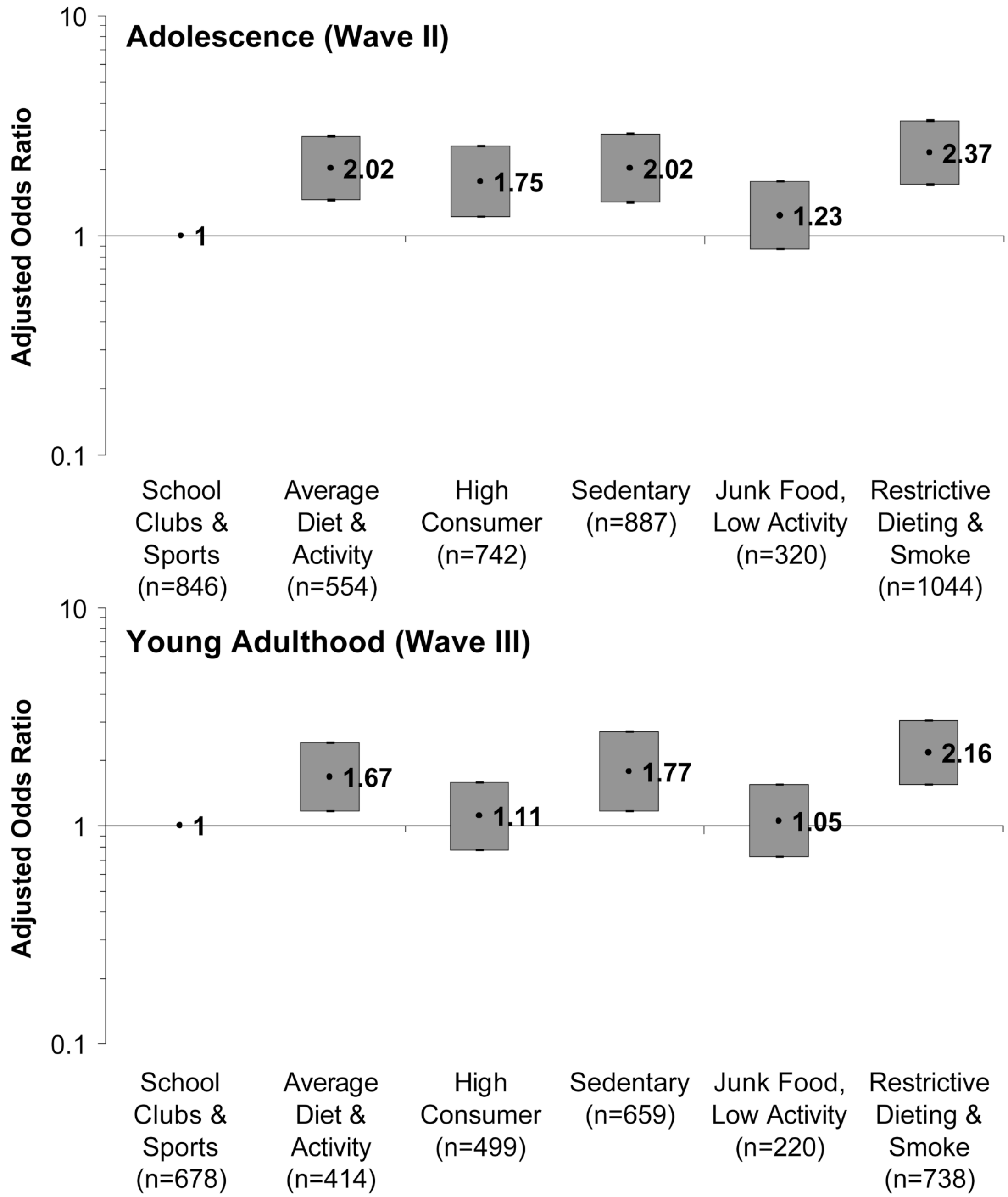

Figure 2.

Logistic regression using activity clusters to predict odds of prevalent (Wave 2) and incident (Wave 3) obesity[a], FEMALES[b]

[a] Odds ratios determined from logistic regression models, adjusting for age, race, household income, highest parental education, region, and season. *School Clubs & Sports* cluster was the referent cluster. Obesity defined as BMI greater than or equal to (1) the age-and sex-specific Centers for Disease Control (CDC) 95th percentile or (2) 30 kg/m^2. Bars represent 95% confidence intervals.

[b] The National Longitudinal Study of Adolescent Health

Table 1

Obesogenic behavior cluster descriptions, by sex[a]

Cluster	Description
MALES (n=4358, r^2=0.183[b])	
(M1) School Clubs & Sports	Average diet; involvement in school sports & clubs; exercise to lose weight
(M2) Sports	Low-average food consumption; frequent sports bouts, involvement in school sports
(M3) Moderately active	Average balanced diet, moderate physical activity
(M4) Sedentary Behaviors	High hours TV & video viewing and computer games
(M5) Junk Food & Smoke	High consumption of meat, added fat, sweets, and fried foods; frequent fast food, smoking
(M6) Dieters	High consumption of nutrient dense foods; diet & exercise to lose weight
(M7) Low Diet & Activity	Low food consumption, few activities
FEMALES (n=4482, r^2=0.169[b])	
(F1) School Clubs & Sports	Average diet; involvement in school sports & clubs; frequent physical activity bouts
(F2) Average Diet & Activity	Average balanced diet; average activities
(F3) High Consumer	High consumption of all food items, with particularly high consumption of nutrient dense foods
(F4) Sedentary Behaviors	High hours TV & video viewing & computer games
(F5) Junk Food & Low Activity	Frequent fast food, low fruit consumption; infrequent physical activity bouts
(F6) Restrictive Dieting & Smoking	Low food consumption, infrequent meals; diet & exercise to lose weight; smoking

[a]The National Longitudinal Study of Adolescent Health (Waves I and II)

[b]r^2 represents the heterogeneity between, relative to within, clusters

Table 2

Frequency[a] of specific behaviors by obesogenic behavior cluster, MALES[b] [mean±SE (z-score)]

	School Clubs & Sports (n=285)	Sports (n=527)	Moderately Active (n=904)	Sedentary Behaviors (n=339)	Junk Food & Smoke (n=671)	Dieters (n=444)	Low Diet & Activity (n=1,188)
Food & beverage intake (previous day)							
Diet beverages (%)	0.07±0.01	0.04±0.01	0.06±0.01	0.05±0.01	0.03±0.01	**0.11±0.01**	0.06±0.01
Regular beverages (mean #)	1.16±0.04 (−0.18)	1.33±0.03 (0.07)	1.28±0.02 (−0.01)	1.43±0.03 (0.22)	1.62±0.02 (0.49)	1.20±0.03 (−0.13)	1.10±0.02 (−0.27)
Juice (mean #)	0.73±0.04 (0.07)	0.65±0.03 (−0.05)	0.80±0.02 (0.18)	0.60±0.04 (−0.10)	0.77±0.03 (0.13)	1.00±0.03 (0.46)	0.43±0.02 (−0.35)
Fruit (mean #)	1.29±0.07 (0.00)	1.10±0.05 (−0.15)	1.63±0.04 (0.27)	1.01±0.06 (−0.22)	1.57±0.05 (0.22)	**2.39±0.06 (0.87)**	**0.63±0.02 (−0.52)**
Vegetables (mean #)	2.45±0.10 (0.00)	2.12±0.08 (−0.16)	2.56±0.06 (0.06)	2.11±0.10 (−0.16)	3.20±0.08 (0.37)	**4.41±0.10 (0.96)**	**1.43±0.04 (−0.50)**
Lowfat foods (mean #)	0.38±0.04 (−0.15)	0.33±0.03 (−0.21)	0.29±0.02 (−0.25)	0.33±0.04 (−0.20)	0.35±0.02 (−0.19)	**2.54±0.05 (2.19)**	0.22±0.01 (−0.33)
Meat (mean #)	1.49±0.06 (−0.18)	1.55±0.04 (−0.12)	1.55±0.03 (−0.12)	1.78±0.06 (0.09)	**2.69±0.04 (0.90)**	2.02±0.05 (0.30)	1.18±0.02 (−0.46)
Added fat (mean #)	1.00±0.05 (−0.03)	0.91±0.04 (−0.14)	0.95±0.03 (−0.09)	0.90±0.05 (−0.14)	**1.51±0.03 (0.54)**	**1.80±0.04 (0.86)**	0.62±0.02 (−0.45)
Sweets (mean #)	1.27±0.06 (−0.13)	1.24±0.04 (−0.16)	1.27±0.03 (−0.13)	1.54±0.06 (0.11)	**2.35±0.04 (0.82)**	1.76±0.06 (0.30)	0.95±0.03 (−0.41)
Fried food (mean #)	1.03±0.05 (−0.08)	1.12±0.03 (0.02)	0.89±0.02 (−0.24)	1.20±0.05 (0.12)	**1.82±0.03 (0.84)**	1.15±0.04 (0.06)	0.81±0.02 (−0.34)
Dairy items (mean #)	1.37±0.04 (0.00)	1.40±0.03 (0.04)	1.48±0.02 (0.14)	1.24±0.04 (−0.17)	1.48±0.03 (0.14)	**1.94±0.03 (0.75)**	1.03±0.02 (−0.44)
Other diet variables (past wk)							
Vitamins (%)	0.19±0.02	0.24±0.02	0.24±0.01	0.16±0.02	0.23±0.02	**0.34±0.02**	0.15±0.01
Fast food (# meals)	2.09±0.10 (−0.08)	2.05±0.07 (−0.10)	1.77±0.05 (−0.27)	2.34±0.09 (0.07)	**3.32±0.07 (0.63)**	1.83±0.07 (−0.23)	2.19±0.05 (−0.02)
Meals/day (#)	2.45±0.03 (0.05)	2.61±0.02 (0.31)	2.62±0.02 (0.33)	2.37±0.03 (−0.08)	2.46±0.02 (0.07)	2.55±0.03 (0.22)	**2.12±0.02 (−0.50)**
Evening meals w/parent(s) (#)	4.54±0.14 (−0.05)	5.15±0.09 (0.21)	5.73±0.06 (0.45)	4.51±0.13 (−0.06)	4.13±0.09 (−0.22)	5.21±0.10 (0.23)	3.78±0.07 (−0.37)
Make own decisions re: food (%)	0.85±0.02	0.82±0.02	0.82±0.01	0.84±0.02	0.85±0.01	0.82±0.02	0.87±0.01
Activities (past week)							
Television (# hrs)	13.10±0.71 (−0.19)	13.60±0.47 (−0.15)	13.83±0.39 (−0.13)	**37.24±0.94 (1.58)**	14.14±0.47 (−0.11)	12.78±0.51 (−0.21)	14.37±0.35 (−0.09)
Video (# hrs)	3.37±0.22 (−0.19)	3.30±0.14 (−0.20)	3.19±0.10 (−0.22)	**15.24±0.53 (2.00)**	4.12±0.15 (−0.05)	3.96±0.19 (−0.08)	3.29±0.11 (−0.20)
Computer/video games (# hrs)	2.75±0.25 (−0.13)	2.37±0.14 (−0.20)	3.07±0.14 (−0.07)	**14.13±0.48 (2.01)**	2.37±0.13 (−0.20)	2.96±0.20 (−0.09)	2.06±0.10 (−0.26)
Housework (# bouts)	3.46±0.10 (0.04)	3.31±0.07 (−0.05)	4.05±0.05 (0.39)	3.50±0.09 (0.06)	3.07±0.06 (−0.19)	3.76±0.08 (0.22)	2.94±0.05 (−0.27)
Hobbies (# bouts)	3.29±0.11 (0.25)	2.52±0.08 (−0.14)	3.67±0.06 (0.44)	3.06±0.11 (0.13)	2.36±0.07 (−0.23)	3.43±0.09 (0.32)	2.09±0.05 (−0.36)
Skating (# bouts)	1.19±0.10 (−0.02)	1.32±0.08 (0.06)	1.97±0.07 (0.43)	1.31±0.10 (0.05)	0.93±0.06 (−0.16)	1.43±0.08 (0.12)	0.67±0.04 (−0.31)
Sports (# bouts)	2.73±0.12 (−0.16)	**4.23±0.07 (0.56)**	3.91±0.06 (0.41)	3.19±0.11 (0.06)	2.94±0.08 (−0.06)	3.60±0.09 (0.26)	**1.82±0.05 (−0.60)**
Exercise (# bouts)	2.72±0.11 (−0.01)	3.20±0.09 (0.23)	3.65±0.06 (0.46)	2.71±0.11 (−0.02)	2.32±0.07 (−0.22)	3.66±0.08 (0.47)	**1.76±0.05 (−0.50)**
Hanging out (# bouts)	3.80±0.10 (0.08)	3.55±0.07 (−0.06)	3.75±0.06 (0.05)	3.88±0.10 (0.12)	3.94±0.06 (0.16)	3.72±0.08 (0.04)	3.35±0.06 (−0.17)
School clubs (#)	**3.72±0.08 (2.63)**	0.57±0.03 (−0.10)	0.48±0.02 (−0.18)	0.53±0.05 (−0.14)	0.38±0.03 (−0.27)	0.77±0.05 (0.07)	0.37±0.02 (−0.28)
School team sports (#)	**1.56±0.09 (0.51)**	**2.42±0.05 (1.27)**	0.73±0.03 (−0.23)	0.93±0.05 (−0.05)	0.77±0.03 (−0.20)	1.12±0.05 (0.12)	0.50±0.02 (−0.43)
School indiv. sports (#)	**0.78±0.04 (1.21)**	**0.72±0.03 (1.08)**	0.04±0.01 (−0.38)	0.12±0.02 (−0.21)	0.13±0.01 (−0.17)	0.23±0.02 (0.03)	0.06±0.01 (−0.33)
Make own decisions re: TV (%)	0.85±0.02	0.82±0.02	0.81±0.01	0.86±0.02	0.87±0.01	0.82±0.02	0.86±0.01
Physical Education (# days, past wk)	2.02±0.11 (−0.22)	3.40±0.08 (0.48)	2.90±0.06 (0.22)	2.59±0.10 (0.07)	2.11±0.07 (−0.18)	2.61±0.09 (0.08)	1.91±0.06 (−0.28)
Play sports with parent(s) (%)	0.30±0.03	0.45±0.02	0.39±0.02	0.31±0.03	0.27±0.02	0.43±0.02	0.15±0.01
Use recreation center (%)	0.27±0.03	0.29±0.02	0.24±0.01	0.25±0.02	0.27±0.02	0.31±0.02	0.19±0.01
Other Behaviors							
Alcohol (days/mo)	1.64±0.25 (0.01)	1.05±0.14 (−0.13)	0.86±0.09 (−0.17)	2.01±0.32 (0.09)	2.75±0.23 (0.26)	1.35±0.18 (−0.06)	1.77±0.12 (0.04)
Smoking (%)	0.14±0.02	0.10±0.01	0.13±0.01	0.19±0.02	**0.28±0.02**	0.11±0.02	0.22±0.01
Diet to lose weight (%)	0.08±0.02	0.04±0.01	0.04±0.01	0.06±0.01	0.03±0.01	**0.10±0.01**	0.06±0.01
Exercise to lose weight (%)	**0.20±0.02**	0.13±0.01	0.18±0.01	0.17±0.02	0.11±0.01	**0.21±0.02**	0.16±0.01

[a]Means and proportions are unweighted to more accurately represent cluster analysis results. Binary variables were not z-score transformed. **Bold** font represents key behaviors in the cluster.

[b]The National Longitudinal Study of Adolescent Health (Waves I and II)

Table 3

Frequency[a] of specific behaviors by obesogenic cluster, FEMALES[b] [mean±SE (z-score)]

	School Clubs & Sports (n=856)	Average Diet & Activity (n=1,064)	High Consumer (n=560)	Sedentary Behaviors (n=328)	Junk Food, Low Activity (n=913)	Restrictive Dieting & Smoke (n=761)
Food & beverage intake (previous day)						
Diet beverages (%)	0.12±0.01	**0.15±0.01**	0.09±0.01	0.05±0.01	0.04±0.01	0.11±0.01
Regular beverages (mean #)	1.05±0.02 (−0.05)	0.76±0.02 (−0.45)	1.40±0.03 (0.45)	1.30±0.04 (0.30)	1.32±0.02 (0.34)	0.95±0.02 (−0.19)
Juice (mean #)	0.67±0.02 (0.07)	0.64±0.02 (0.03)	**1.13±0.03 (0.75)**	0.61±0.04 (−0.02)	0.41±0.02 (−0.31)	0.41±0.02 (−0.30)
Fruit (mean #)	1.62±0.04 (0.27)	1.45±0.04 (0.14)	**2.41±0.06 (0.92)**	1.11±0.06 (−0.14)	**0.58±0.03 (−0.57)**	0.76±0.03 (−0.42)
Vegetables (mean #)	2.53±0.06 (0.11)	2.68±0.05 (0.19)	**4.29±0.09 (1.02)**	1.90±0.09 (−0.21)	1.55±0.05 (−0.39)	**1.18±0.05 (−0.58)**
Lowfat foods (mean #)	0.87±0.04 (0.21)	0.80±0.03 (0.14)	**1.44±0.06 (0.78)**	0.33±0.04 (−0.34)	0.30±0.02 (−0.37)	0.25±0.02 (−0.41)
Meat (mean #)	1.05±0.03 (−0.14)	0.91±0.02 (−0.28)	**2.15±0.05 (0.98)**	1.30±0.05 (0.12)	1.38±0.03 (0.19)	0.74±0.03 (−0.45)
Added fat (mean #)	1.04±0.03 (0.05)	0.97±0.02 (−0.03)	**1.66±0.04 (0.78)**	0.97±0.05 (−0.03)	0.97±0.03 (−0.03)	**0.54±0.02 (−0.54)**
Sweets (mean #)	1.18±0.03 (−0.03)	1.00±0.03 (−0.20)	**2.05±0.05 (0.80)**	1.37±0.06 (0.15)	1.41±0.03 (0.19)	**0.62±0.03 (−0.56)**
Fried food (mean #)	0.85±0.03 (−0.09)	0.61±0.02 (−0.39)	**1.37±0.04 (0.53)**	1.10±0.05 (0.21)	1.30±0.03 (0.45)	0.60±0.02 (−0.39)
Dairy items (mean #)	1.53±0.03 (0.35)	1.43±0.02 (0.22)	**1.67±0.03 (0.52)**	1.06±0.04 (−0.22)	1.05±0.02 (−0.24)	**0.66±0.02 (−0.71)**
Other diet variables (past wk)						
Vitamins (%)	0.31±0.02	0.30±0.01	0.33±0.02	0.18±0.02	0.15±0.01	0.17±0.01
Fast food (# meals)	1.69±0.05 (−0.21)	1.26±0.03 (−0.47)	2.35±0.07 (0.18)	2.37±0.10 (0.19)	**3.40±0.06 (0.80)**	1.57±0.05 (−0.28)
Meals/day (#)	2.52±0.02 (0.41)	2.56±0.01 (0.47)	2.44±0.02 (0.28)	2.09±0.04 (−0.26)	2.16±0.02 (−0.15)	**1.59±0.02 (−1.03)**
Evening meals w/parent(s) (#)	5.37±0.07 (0.33)	5.49±0.06 (0.38)	5.22±0.09 (0.27)	4.29±0.14 (−0.11)	3.55±0.08 (−0.42)	**3.24±0.09 (−0.54)**
Make own decisions re: food (%)	0.86±0.01	0.86±0.01	0.81±0.02	0.88±0.02	0.92±0.01	0.90±0.01
Activities (past week)						
Television (# hrs)	10.17±0.31 (−0.26)	10.32±0.29 (−0.25)	13.62±0.52 (0.00)	**34.52±0.91 (1.62)**	13.64±0.40 (0.01)	12.70±0.44 (−0.07)
Video (# hrs)	2.83±0.10 (−0.20)	2.49±0.08 (−0.27)	3.63±0.15 (−0.05)	**16.61±0.49 (2.42)**	3.09±0.11 (−0.15)	2.70±0.12 (−0.23)
Computer/video games (# hrs)	0.92±0.07 (−0.11)	0.83±0.05 (−0.14)	1.48±0.10 (0.07)	**5.90±0.41 (1.55)**	0.67±0.05 (−0.19)	0.76±0.06 (−0.17)
Housework (# bouts)	4.13±0.05 (0.19)	3.94±0.05 (0.07)	4.20±0.06 (0.23)	4.04±0.09 (0.13)	**2.99±0.06 (−0.50)**	3.93±0.06 (0.07)
Hobbies (# bouts)	3.42±0.06 (0.46)	2.82±0.06 (0.14)	2.88±0.08 (0.17)	2.34±0.10 (−0.12)	1.66±0.05 (−0.48)	2.20±0.07 (−0.19)
Skating (# bouts)	**1.41±0.06 (0.52)**	0.48±0.03 (−0.21)	1.26±0.07 (0.40)	0.79±0.07 (0.03)	0.31±0.02 (−0.34)	0.50±0.04 (−0.19)
Sports (# bouts)	**4.04±0.06 (1.07)**	1.19±0.04 (−0.38)	2.33±0.08 (0.21)	1.62±0.10 (−0.16)	1.01±0.05 (−0.47)	1.52±0.06 (−0.21)
Exercise (# bouts)	**4.03±0.06 (0.61)**	2.51±0.05 (−0.21)	3.37±0.07 (0.25)	2.94±0.10 (0.02)	**1.88±0.05 (−0.55)**	3.03±0.07 (0.07)
Hanging out (# bouts)	3.86±0.06 (0.16)	2.86±0.06 (−0.38)	3.98±0.07 (0.23)	3.70±0.10 (0.08)	3.62±0.06 (0.03)	3.76±0.07 (0.11)
School clubs (#)	**1.96±0.06 (0.59)**	1.22±0.04 (0.05)	0.88±0.05 (−0.20)	1.02±0.07 (−0.10)	0.83±0.04 (−0.23)	0.79±0.04 (−0.27)
School team sports (#)	**1.73±0.04 (0.93)**	0.47±0.02 (−0.31)	0.55±0.03 (−0.23)	0.63±0.05 (−0.15)	0.58±0.03 (−0.20)	0.65±0.03 (−0.14)
School indiv. sports (#)	**0.69±0.02 (0.89)**	0.13±0.01 (−0.25)	0.18±0.02 (−0.15)	0.15±0.02 (−0.21)	0.16±0.01 (−0.19)	0.13±0.01 (−0.23)
Make own decisions re: TV (%)	0.83±0.01	0.85±0.01	0.78±0.02	0.89±0.02	0.89±0.01	0.86±0.01
Physical Education (# days, past wk)	3.08±0.06 (0.41)	1.80±0.06 (−0.25)	2.87±0.08 (0.30)	2.45±0.11 (0.09)	1.77±0.06 (−0.26)	2.17±0.07 (−0.06)
Play sports with parent(s) (%)	**0.43±0.02**	0.18±0.01	**0.31±0.02**	0.18±0.02	0.11±0.01	0.10±0.01
Use recreation center (%)	0.23±0.01	0.15±0.01	0.19±0.02	0.18±0.02	0.15±0.01	0.15±0.01
Other Behaviors						
Alcohol (days/mo)	0.74±0.08 (−0.08)	0.45±0.04 (−0.17)	1.28±0.18 (0.09)	0.90±0.20 (−0.03)	0.84±0.08 (−0.05)	2.04±0.18 (0.33)
Smoking (%)	0.11±0.01	0.12±0.01	0.14±0.01	0.12±0.02	0.21±0.01	**0.27±0.02**
Diet to lose weight (%)	0.18±0.01	0.22±0.01	0.18±0.02	0.21±0.02	**0.13±0.01**	**0.30±0.02**
Exercise to lose weight (%)	0.38±0.02	0.39±0.01	0.35±0.02	0.41±0.03	**0.25±0.01**	**0.45±0.02**

[a]Means and proportions are unweighted to more accurately represent cluster analysis results. Binary variables were not z-score transformed. **Bold** font represents key behaviors in the cluster.

[b]The National Longitudinal Study of Adolescent Health (Waves I and II)

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Table 4

Sociodemographic characteristics [% (SE)][a] within obesogenic behavior cluster, MALES[b]

	School Clubs & Sports	Sports	Moderately Active	Sedentary Behaviors	Junk Food & Smoke	Dieters	Low Diet & Activity
Race/ethnicity							
White	72.8 (4.8)	75.6 (3.3)	74.8 (3.2)	**56.1 (5.1)**	64.7 (4.6)	**77.5 (3.4)**	67.0 (4.2)
Black	13.9 (3.6)	13.0 (2.4)	10.2 (1.9)	**26.1 (4.2)**	18.1 (3.8)	**6.0 (1.3)**	14.9 (2.8)
Native American/Asian	6.6 (2.1)	3.3 (1.2)	6.4 (1.7)	**5.9 (1.6)**	5.2 (1.9)	**6.8 (1.8)**	4.8 (1.2)
Hispanic	6.8 (2.1)	8.1 (1.7)	8.6 (1.6)	**12.0 (3.1)**	12.0 (2.7)	**9.7 (2.4)**	13.4 (2.6)
Parental education							
<HS	3.6 (1.4)	9.0 (2.3)	**9.7 (1.6)**	**22.5 (3.4)**	15.0 (2.4)	7.2 (1.6)	**16.1 (2.1)**
HS/GED	32.8 (4.2)	25.7 (2.8)	**34.4 (2.4)**	**32.9 (3.4)**	36.4 (2.7)	29.8 (3.1)	**33.8 (2.0)**
Some college	29.9 (4.0)	31.3 (3.1)	**31.4 (2.3)**	**27.9 (3.5)**	24.8 (2.5)	31.5 (3.0)	**28.8 (2.0)**
College or greater	33.8 (4.2)	34.0 (3.0)	**24.6 (2.1)**	**16.8 (2.6)**	23.8 (2.6)	31.4 (3.1)	**21.4 (1.9)**
Household Income Tertile							
1	22.9 (4.4)	22.9 (2.7)	**27.8 (2.4)**	**39.0 (4.0)**	**35.1 (3.4)**	20.6 (2.8)	**32.7 (2.8)**
2	30.2 (3.6)	38.4 (2.7)	**42.0 (2.3)**	**40.2 (3.5)**	**40.1 (2.7)**	36.6 (3.3)	**40.7 (2.4)**
3	46.9 (5.0)	38.6 (3.5)	**30.2 (2.7)**	**20.9 (3.1)**	**24.8 (3.2)**	42.8 (3.8)	**26.7 (2.8)**
Age group							
<=15 years	40.6 (6.1)	**55.8 (5.1)**	**55.3 (4.4)**	49.6 (5.0)	28.5 (3.6)	49.3 (5.1)	33.8 (4.4)
16–17 years	35.3 (4.1)	**33.2 (3.7)**	**35.6 (3.6)**	36.3 (4.2)	49.4 (2.7)	38.2 (4.1)	40.4 (2.7)
>=18 years	24.1 (4.6)	**11.0 (2.2)**	**9.1 (1.5)**	14.1 (2.8)	22.1 (2.1)	12.5 (2.2)	25.8 (2.6)
Region							
West	13.4 (2.9)	15.2 (2.4)	13.1 (1.5)	**10.1 (2.1)**	**10.7 (2.3)**	19.5 (2.4)	12.6 (2.0)
Midwest	34.9 (6.2)	32.5 (3.9)	28.6 (3.0)	**24.6 (4.0)**	**25.0 (3.8)**	25.5 (3.7)	31.0 (4.1)
South	31.4 (4.2)	31.1 (3.8)	38.2 (3.1)	**52.8 (4.2)**	**50.1 (4.0)**	36.2 (3.4)	43.0 (3.7)
Northeast	20.3 (4.0)	21.3 (2.9)	20.1 (2.8)	**12.5 (2.8)**	**14.2 (2.3)**	18.8 (2.3)	13.4 (2.1)
Season							
Spring	54.6 (6.1)	60.7 (3.8)	63.2 (2.9)	48.4 (3.8)	56.4 (3.4)	64.1 (3.4)	50.9 (3.0)
Summer/Fall	45.4 (6.1)	39.3 (3.8)	36.8 (2.9)	51.6 (3.8)	43.6 (3.4)	35.9 (3.4)	49.1 (3.0)
Obesity[c]							
Obese	11.8 (2.2)	11.0 (1.9)	14.1 (1.8)	**23.8 (3.4)**	8.5 (1.7)	16.6 (2.8)	17.0 (1.5)

[a] Means and proportions are weighted for national representation. **Bold** font represents statistical significance compared to the School & Sports Cluster ($p<0.05$ with Bonferroni correction using the design-based F-test).

[b] The National Longitudinal Study of Adolescent Health (Waves I and II)

[c] Obesity defined as BMI≥age- and sex-specific Centers for Disease Control (CDC) 95^{th} percentile or BMI ≥ 30 kg/m^2

Table 5

Sociodemographic characteristics [% (SE)][a] by obesogenic behavior cluster, FEMALES[b]

	School Clubs & Sports	Average Diet & Activity	High Consumer	Sedentary Behaviors	Junk Food, Low Activity	Restrictive Dieting & Smoke
Race/ethnicity						
White	83.8 (2.5)	**74.5 (3.4)**	**65.1 (4.0)**	**44.9 (6.2)**	**64.3 (4.3)**	**64.9 (3.9)**
Black	7.5 (1.6)	**6.9 (1.3)**	**16.5 (2.9)**	**41.7 (6.0)**	**22.9 (3.7)**	**22.6 (3.2)**
Native American/Asian	2.7 (0.7)	**6.0 (1.3)**	**6.0 (1.7)**	**4.0 (1.4)**	**3.2 (1.3)**	**4.5 (1.1)**
Hispanic	6.1 (1.2)	**12.6 (2.3)**	**12.5 (2.3)**	**9.4 (2.5)**	**9.6 (2.1)**	**8.1 (1.8)**
Parental education						
<HS	7.7 (1.4)	11.7 (1.8)	14.4 (2.5)	**20.3 (3.9)**	**14.9 (2.2)**	**15.4 (2.5)**
HS/GED	27.9 (2.2)	30.6 (2.1)	29.8 (2.6)	**41.1 (4.0)**	**39.3 (2.5)**	**40.8 (3.0)**
Some college	32.5 (2.4)	26.2 (1.9)	28.0 (2.3)	**22.8 (2.9)**	**27.4 (2.0)**	**28.7 (2.4)**
College or greater	32.0 (2.3)	31.6 (2.3)	27.8 (2.5)	**15.9 (2.9)**	**18.4 (1.9)**	**15.1 (2.1)**
Household Income Tertile*						
1	20.9 (2.7)	25.3 (2.6)	**31.9 (2.9)**	**50.6 (4.7)**	**37.4 (3.0)**	**38.3 (3.1)**
2	35.6 (2.5)	38.7 (2.2)	**37.3 (3.0)**	**34.5 (4.1)**	**36.4 (2.5)**	**37.4 (2.1)**
3	43.6 (2.8)	36.0 (2.9)	**30.8 (2.9)**	**14.9 (2.7)**	**26.3 (2.4)**	**24.3 (2.5)**
Age group						
<=15 years	65.1 (4.6)	**46.1 (4.6)**	63.6 (4.5)	55.4 (6.3)	**31.4 (4.0)**	**39.3 (5.3)**
16–17 years	28.7 (3.5)	**38.5 (3.0)**	29.8 (3.4)	33.5 (5.0)	**51.0 (3.2)**	**45.4 (4.4)**
>=18 years	6.2 (1.5)	**15.4 (2.6)**	6.7 (1.5)	11.2 (3.2)	**17.7 (1.8)**	**15.2 (2.0)**
Region						
West	13.2 (2.0)	17.4 (2.1)	16.4 (2.7)	**11.2 (2.6)**	**14.2 (2.6)**	13.1 (2.2)
Midwest	35.2 (4.3)	32.1 (4.5)	27.4 (3.7)	**21.3 (5.6)**	**26.7 (3.4)**	33.4 (4.2)
South	33.0 (3.5)	33.1 (3.0)	40.4 (3.5)	**57.1 (5.5)**	**50.1 (3.4)**	39.6 (3.6)
Northeast	18.7 (2.5)	17.5 (2.2)	15.8 (2.6)	**10.4 (2.7)**	**9.0 (1.4)**	13.9 (1.6)
Season						
Spring	55.6 (4.2)	62.8 (4.2)	**65.8 (4.1)**	52.5 (5.5)	61.8 (3.0)	59.4 (3.1)
Summer/Fall	44.4 (4.2)	37.2 (4.2)	**34.2 (4.1)**	47.5 (5.5)	38.2 (3.0)	40.6 (3.1)
Obesity[c]						
Obese	5.7 (1.0)	**12.4 (1.9)**	**11.8 (1.9)**	**16.4 (2.8)**	**9.7 (1.2)**	**14.4 (1.6)**

[a] Means and proportions are weighted for national representation. **Bold** font represents statistical significance compared to the School & Sports Cluster ($p<0.05$ with Bonferroni correction using the design-based F-test).

[b] The National Longitudinal Study of Adolescent Health (Waves I and II)

[c] Obesity defined as BMI≥age- and sex-specific Centers for Disease Control (CDC) 95^{th} percentile or BMI ≥ 30 kg/m^2