Chronic dieting and the belief that smoking controls body weight in a biracial, population-based adolescent sample

Robert C Klesges, Vanessa E Elliott, Leslie A Robinson

Abstract
Objective—To evaluate the prevalence of weight concerns and smoking for body weight reasons as a function of race and gender.

Design—A questionnaire measuring a number of factors thought to be predictive of smoking was administered.

Setting—The Memphis (Tennessee) school system.

Participants—Participants were 6961 seventh-grade students (mean age 13 years). This population consisted of 80.8% black children, 16.5% white children, and 2.7% of other ethnic origins.

Main outcome measures—Weight concerns were assessed using items from a restraint scale. Students were questioned regarding their smoking status, beliefs that smoking controls body weight, and their own weight-control smoking behavior.

Results—Dietary restraint interacted with race in that, whereas white girls scored the highest on dietary restraint, black boys scored higher on dietary restraint than white boys. Almost 40% of subjects at this school level believed that smoking controls their body weight. Of the regular smokers, 12% indicated they have smoked to control their weight, with white girls endorsing this belief significantly more than other respondents.

Conclusions—The propensity to smoke for weight control reasons, previously described by other researchers among white females of college and high-school age, was also found among this sample of students of junior high school age.

(Tobacco Control 1997;6:89–94)

Keywords: dieting; body weight and smoking; adolescence

Introduction
Cigarette smoking is the primary preventable cause of premature disease and death in the United States. Smoking has been causally linked to lung cancer and other fatal malignancies, atherosclerosis and coronary heart disease, chronic obstructive pulmonary disease, and other conditions that constitute a wide array of serious health consequences.

Although smoking is responsible for more than one of every six deaths in the United States, more than 50 million adult Americans continue to smoke.

Tobacco use primarily begins in early adolescence, typically by age 16 with almost all first use occurring before the time of high school graduation (age 18). It has been estimated that over two thirds of all children and adolescents have tried at least one cigarette—this is important for three reasons. First, the earlier in life one begins to smoke, the more likely it is for that individual to continue smoking as an adult. Second, earlier onset of cigarette smoking provides more life-years in which to use tobacco and thereby increases the potential duration of use and the risk of a range of more serious health consequences. Third, earlier onset is also associated with heavier use; those who begin to use tobacco as younger adolescents are among the heaviest users in adolescence and adulthood.

It has been estimated that 3.1 million adolescents and 25% of 17- and 18-year-olds currently smoke cigarettes. Smoking prevalence among American adolescents declined sharply in the 1970s, but this decline slowed significantly in the 1980s, particularly among white males who have shown no decline in recent years. Female and male adolescents are now equally likely to smoke, while white adolescents are more likely to smoke than are black adolescents. These trends may reflect differing rates of smoking initiation among the subgroups.

Several social, psychological, and physiological factors have been associated with smoking initiation and maintenance in teenagers. One factor that has emerged is the use of smoking for weight control. Weight control does appear to be an issue for many adolescents, particularly for females. Rosen and Gross found that more than two thirds of the girls and half of the boys in a sample of primarily white high-school adolescents were trying to modify their weight. A large percentage of girls was either losing or trying to lose weight, even though they were already in the normal weight range. Whereas girls tended to show a bias towards thinness, boys generally revealed a bias toward larger figures. They typically have the reverse pattern of weight modification: trying to gain weight even when...
they were already in the normal weight range.14
Contrary to these and other similar findings, Emmons15 reported that, in a sample of
high-school students, more than 40% of the
males were dieting to lose weight.

The research also demonstrates racial differ-
ences in the perception of weight and
body-figure preferences. Although a large
number of white girls were found to be dieting
unnecessarily for weight control,16 black girls
tended to be more satisfied with their weight
and engaged in dieting behaviour less fre-
quently.17-20 These findings are generally
consistent despite the fact that blacks tend to
weigh more that whites on average.21

In terms of the relationships between dieting
consciousness and smoking status, numerous cross-
 sectional studies have linked dieting, weight
concerns, and the belief that smoking controls
body weight with increased risk for adolescent
smoking. For example, in a survey of 16 000
adolescent students, the heaviest regular smok-
ers were the most likely to agree that smoking
controls weight (42.2%) compared with students
who never smoked (16.6%).22 In a study of
high-school students (n = 1705),
females concerned about their body weight
were twice as likely as other young women to
be current smokers.23 These variables,
however, were generally unrelated to smoking
status in males.24 A study of 33 393 young
people in the seventh to 12th grades found that
dieting frequency was associated with greater
likelihood of regular tobacco use in females,
but not in males.25 The findings that smoking
adolescents were more likely to report the use
of diet pills and, for female smokers, the use of
amphetamine for weight loss, are further evidence
of a relationship between weight concerns
and smoking, at least in young women.26

The purpose of this study was to evaluate
the prevalence of weight concerns and smoking for
body weight reasons as a function of race and
gender. Our study addressed these issues using
a large sample heavily representing black
subjects, a group previously underrepresented
in the growing body of literature on adolescent
smoking and weight concerns. Specifically,
this study was designed to address some of the
inconsistencies in the literature on the weight
concerns of black adolescents, consequently
allowing for important ethnic comparisons of
the degree to which adolescents are concerned
about controlling their weight. Finally, we were
interested in whether children in the seventh
grade (junior high school) have begun to
describe the belief that smoking can help
control weight, and whether they have actually
engaged in this behaviour for weight-
controlling purposes.

Methods
SUBJECTS
Participants were 6961 students in the seventh
grade of the Memphis city schools (mean age
13 years). Subjects were participants in the first
phase of the Memphis Health Project, a longi-
dudal investigation of the correlates of smok-
ing onset in black vs white adolescents. This
population consisted of 80.8% black children,
16.5% white children, and 2.7% of other
ethnic origins. Boys and girls were
approximately equally represented (49.5% and
50.5%, respectively).

OVERVIEW OF THE MEMPHIS HEALTH PROJECT
The Memphis Health Project is a longitudinal,
prospective evaluation of the predictors of
smoking onset among black vs white girls. With
additional support from the University of
Memphis, the researchers were able to collect
data on boys as well. The study was designed to
be the first comprehensive assessment of
gender and race models of smoking onset. All
children in the seventh grade of this major,
mid-south metropolitan school system were
invited to participate. This particular school
system is among the largest in the nation and
has a principally (81%) black student body.
For the larger study, a questionnaire measuring
a number of factors thought to be predictive of
smoking was administered to all students who
agreed to participate (see Results for participa-
tion rate data). These students will be surveyed
prospectively for several years, allowing us to
identify which factors accurately predict smok-
ing onset for the students. Among other items,
weight concerns and the belief that smoking
controls body weight were included.

QUESTIONNAIRE/MEASURES
Six items from a restraint scale27 were
embedded in the Memphis Health Project
Survey to assess weight-control concerns. This
scale is widely used and is a reliable and valid
measure of dietary restraint.28 The entire scale
was not used because it is now known to mea-
sure more than one dimension of restraint.29
Two distinct factors, representing separate
dimensions, constitute the restraint scale: con-
cern with dieting (CD), which reflects
heightened attention to and emotional associa-
tion with eating, and weight fluctuation (WF),
which reflects extent of previously experienced
weight gain and loss.30 The CD items were
considered more appropriate for this investiga-
tion for several reasons. First, the CD items are
an assessment of food intake inhibition, rather
than varying body weights. Second, the WF
items require specific information about
weight variation that might not be answerable
by most subjects in this study population. Fur-
thermore, adolescence is a period when weight
and body size are expected to fluctuate
normally. Thus, only the CD items were used.
With the CD subscale, higher scores on this
scale reflect greater dietary concern.
Body mass indices (BMI = kg/m²) were
calculated for each subject, based on his or her
self-reported height and weight. Evidence
seems to suggest that self-reported weights are
quite accurate for both normal and overweight
persons.31 Although there may be a tendency
to underestimate weight and overestimate height,
group means reported for weight and height
are considered valid enough measures of actual
weight and height for adolescents in large-scale
epidemiological studies.32 So that implausible
values and outliers would not contaminate the
data, the top and bottom 1% of these values
were dropped from the analyses. Only values between 11.00 and 36.00 were used.

One item on the questionnaire asked subjects whether they endorsed the belief that smoking cigarettes helps people control their weight. A follow-up question asked respondents if they have ever smoked to control or lose weight. These questions were included because, although there may be a relationship between smoking and weight concerns, it would still not be clear if adolescents were actually using smoking as a dieting strategy.

This investigation relied on self-reports of smoking. The use of biochemical measures of smoking status is not feasible for survey research due to cost and its inability to detect low levels of cigarette consumption. "Bogus pipelines", in which subjects are led to believe that a "breath test" or "saliva samples" will be used to corroborate their reports of smoking, have produced mixed results and have increased refusal rates. The best predictor of accurate reporting appears to be assured confidentiality, which was used carefully in this study.

**PROCEDURE**
The principal of each school assigned a coordinator who was responsible for overseeing survey administration. School coordinators attended a training session where they learned about the project, their roles, and procedures for the administration of the survey. Two weeks before survey administration, letters informing the parents about the nature and planned administration of the survey were sent home with the students. Parents did not have to sign or return the letters if they agreed to allow their child to participate. If the parent objected, he/she was instructed to notify the researchers. Students also signed consent forms on the survey day.

On the survey day, each student received: a student consent form which the student signed agreeing or declining to participate, a student identification/information sheet, the survey, and a large envelope in which the student was to place materials upon completion. The teachers read from a prepared script a description of the materials and instructions to the students. After the students had completed the materials and sealed their envelopes, the teacher collected the envelopes in a large box, which was then sealed.

**APPROACH TO ANALYSIS**
In this investigation, we were interested in evaluating varieties in adolescent weight concerns by race and sex. These data were analysed using ANOVA unique sums of squares to account for the non-orthogonal nature of the design. This same approach was applied in analysing respondents' endorsement of the belief that smoking could help control one's weight. To follow up on significant interactions, the Newman-Keuls test was employed.

In some cases, we were interested in the relationship between variables. Pearson product moment correlations were employed to assess the direction and strength of the relationship between BMI and restraint. In other cases, we were interested in the relationship between dichotomous dependent and predictor variables. In these cases, analyses were performed.

Because increasing age is sometimes associated with increases in concerns related to dieting, age was considered as an independent variable in the analysis. However, because all participants were in the same grade (seventh), age was severely truncated. Age correlated with BMI 0.06, while age and restraint correlated 0.02. As such, age was not included.

In all analyses, the following definitions of smoking status were always employed: (1) never-smoker, never smoked a cigarette; (2) experimental smoker, currently smoking fewer than one cigarette per week; and (3) regular smoker, smoking weekly or daily.

**Results**
**DESCRIPTIVE RESULTS**
Participation rates among available students were excellent. Only 3% of the students refused to complete the survey. Another 2% of the children had to be withdrawn from the study due to parental refusal or our inability to notify the parents of the research project. Although gender and ethnicity comparisons of non-responders could not be assessed, our resultant sample's ethnic and gender breakdown was virtually identical to the city-wide statistics in the Memphis city schools.

Table 1 contains means and standard deviations of demographic variables by sex and race. As can be seen, black boys and girls were older than their white counterparts. Within both races, boys were older than girls. Smoking status varied greatly by ethnicity. A full 10% of white boys (total n = 550) and 6.4% of white girls (total n = 517) in the seventh grade reported daily smoking. In contrast, only 1.3% of black boys (total n = 2066) and 0.9% of black girls (total n = 2531) reported daily smoking. Thus, compared with white students, black children were significantly less likely to be regular smokers than never-smokers, \( \chi^2(1) = 221.9, P < 0.001 \).
Table 2  Endorsement of the belief that smoking can help people control their weight, by race and sex

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys (n = 2578)</td>
<td>0.60</td>
<td>0.78</td>
</tr>
<tr>
<td>Girls (n = 2768)</td>
<td>0.54</td>
<td>0.75</td>
</tr>
<tr>
<td>Whites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys (n = 585)</td>
<td>0.42</td>
<td>0.65</td>
</tr>
<tr>
<td>Girls (n = 528)</td>
<td>0.64</td>
<td>0.71</td>
</tr>
</tbody>
</table>

BODY WEIGHT CONCERNS
A 2 × 2 factorial analysis of variance was performed on restrained eating scores (RES); table 1 shows the results. Because smoking status did not interact with race and gender (F = 0.01, P = 0.92), data are not split by smoking status. The main effect for race was not significant, F (1,6300) = 0.57, P = 0.45. The main effect for sex was significant, F (1,6300) = 134.93, P < 0.0001. However, this was moderated by a significant sex-by-race interaction, F (1, 6300) = 68.71, P < 0.0001.

To follow up on the significant interaction, the analysis of simple effects employed the Newman-Keuls test (P = 0.01). Girls in the sample produced scores (mean = 6.78 (SD 3.46)) on the RES that were higher than boys (mean = 6.09 (SD 3.20)). White girls indicated more restraint than black girls. However, among boys, the reverse pattern emerged, with black boys scoring higher than white boys. Pearson product moment correlations were employed to assess the direction and strength of the relationship between RES scores and BMI. For the entire sample, RES scores were not strongly, but nevertheless significantly, correlated with BMI, r (5728) = 0.21, P < 0.0001. Among the four subgroups, the correlation between these two variables was highest among white girls and boys (r = 0.31 and 0.30, respectively), followed by black girls (r = 0.25), and was not significant among black boys (r = 0.14).

PREVALENCE OF WEIGHT-RELATED BELIEFS ABOUT SMOKING
Of the 6462 respondents, 39.4% (n = 2547) endorsed the belief that smoking could help control one’s weight. Table 2 contains a breakdown of the degree of endorsement by sex and race. A 2 × 2 factorial analysis of variance was performed. The main effect for race was not significant, F (1,6455) = 2.65, P = 0.10. The main effect for sex was significant, F (1,6455) = 10.66, P < 0.01. However, this was moderated by a significant sex by race interaction, F (1, 6455) = 29.52, P < 0.0001. Follow-up analyses employed the Newman-Keuls test (P = 0.01). White girls endorsed this belief significantly more than any other subgroup. White boys were the least likely to endorse this belief. There was a significant difference between black girls and boys at a 0.01 significance level with black boys reporting a more weight concerns than black girls.

The pattern of endorsement was also analysed by smoking status (table 3). One-way analysis of variance revealed that never-smokers, experimental smokers, and regular smokers differed significantly from each other in their endorsement of the belief, F (3,1007) = 10.95, P < 0.0001. In general, endorsement of smoking for weight control increased as smoking exposure increased. Never-smokers (mean = 0.51) were the least likely to endorse this belief followed by experimental (mean = 0.66), regular (mean = 0.70), and daily (mean = 0.79) smokers.

Table 3  Endorsement of the belief that smoking can help people control their weight, by smoking status

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>0.51</td>
<td>0.74</td>
</tr>
<tr>
<td>Experimental</td>
<td>0.66</td>
<td>0.75</td>
</tr>
<tr>
<td>Regular</td>
<td>0.70</td>
<td>0.81</td>
</tr>
<tr>
<td>Daily</td>
<td>0.79</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Note: item is coded to reflect the extent of belief in the weight-control effects of smoking, with 0 = no weight-control benefits, 1 = a fair amount, and 2 = quite a bit of weight-control benefit.

Table 4  Percentage of regular smokers, by sex and race, who reported having smoked to control their weight

<table>
<thead>
<tr>
<th></th>
<th>Blacks (%)</th>
<th>Whites (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Girls</td>
<td>11</td>
<td>27</td>
</tr>
</tbody>
</table>

Note: total n = 233; black boys = 58; black girls = 45; white boys = 86; white girls = 44. A regular smoker is defined as one who smokes weekly or daily.

USE OF SMOKING FOR WEIGHT CONTROL
A follow-up question of the regular smokers asked whether they had actually used smoking to control their weight. Of the 240 respondents with an active smoking history, approximately 12% (n = 29) indicated that they did smoke to control their body weight. Among female smokers, 18% (n = 17) endorsed this behaviour, whereas only 8% (n = 12) of male smokers reported using smoking as a weight control strategy, and this difference was significant, χ²(1) = 6.52, P < 0.05. Although black children were less likely than white children to endorse smoking for weight control (9%, n = 9; 15%, n = 19, respectively), this difference did not achieve conventional levels of statistical significance. Table 3 presents the percentages of regular smokers, by sex and race, who endorsed this behaviour. Consistent with the data on dietary restraint, white girls were the most likely to endorse smoking for weight control, nearly three times as likely as the other groups.

Discussion
Results of this study indicate that girls expressed more concern for dieting than boys. White girls reported more concerns than any other group. Additionally, a sizable percentage endorsed the belief that smoking could help control one’s weight. As the level of previous smoking exposure increased, endorsement of this belief also went up. Analyses further revealed that, of the regular smokers, 12% indicated that they have smoked to control their weight, with white girls endorsing this behaviour significantly more than other respondents.

The finding that the white students in the sample reported more concern for dieting and...
body weight than all other groups is consistent with previous research in this area.\textsuperscript{14, 15} The finding that white girls expressed a much greater concern than black girls is also consistent.\textsuperscript{16, 20} That the reverse pattern emerged among boys is a new finding, in that previous studies have suggested that white males were more likely to have more dietary/weight concerns than black males,\textsuperscript{14, 20} or that there was no difference in these concerns between the two groups.\textsuperscript{16} Perhaps having a large representative sample of black adolescents (n = 5346) allowed this difference to emerge. Still, it is quite curious that black boys were more restrained and more likely to believe that smoking reduces body weight than white boys. Perhaps these youths and their weight concerns are related to an increased emphasis on athleticism in this sample. Future research should further study this relative higher level of weight concern in black boys and relate these concerns to other interests.

Approximately 39\% of our sample endorsed the belief that smoking can help control one’s weight. This percentage is consistent with the observance of Camp et al.\textsuperscript{17} that approximately 40\% of a sample of high school students endorsed this belief. What should be highlighted is the fact that respondents in the our sample are much younger (seventh grade) than the respondents in the investigation by Camp et al.\textsuperscript{17} Furthermore, it has previously been reported that smoking youths under the age of 13 were not likely to endorse the belief that smoking would control a person’s weight.\textsuperscript{22} Our study, with very young subjects, suggests that a surprising number of young adolescents endorse this belief, with current and regular smokers the most likely. Like Camp et al.\textsuperscript{17} we found that white girls were markedly more likely than any other ethnic/gender group to endorse this belief.

The finding that a notable percentage (12\%) of adolescent regular smokers, primarily white girls, reported smoking for weight-control reasons is consistent with a growing literature\textsuperscript{23, 24, 26, 27} that suggests that white females are more susceptible to smoking for weight control. It appears that white females are at high risk of smoking for weight control across a wide age range. The active use of cigarettes as a weight-control strategy was not exclusively race dependent as found in the investigation by Camp et al.\textsuperscript{17} Although comprising only a small proportion of the sample, there were some black students (of both sexes) who endorsed this behaviour. Future studies should evaluate whether the incidence of smoking for weight control is increasing among black males and females.

Our investigation of the relationship between body weight concerns and smoking in adolescence was conducted using one of the largest sample sizes known to date. This study was unique in that these concerns were assessed using a sample with a majority representation of black children, thus adding to the literature investigating these concerns and behaviours among this population. However, certain limitations should be noted.

First, the data for this study were obtained from students dwelling in one mid-South urban city who attended public schools. Results might have differed if the study had been based on a suburban or more rural population or in other urban locations with different ethnic populations.

Second, white students in this sample may not be representative of the whole community, because many attend private schools. For these reasons, one should be particularly cautious in making generalisations to other samples of white subjects.

Third, although there are arguments both for and against biochemical and “bogus pipeline” procedures,\textsuperscript{28} the lack of these procedures in the current study may have led to an underestimate of smoking behaviour, potentially biasing the results. Nonetheless, the rates of smoking obtained in this age group was very close to national estimates.\textsuperscript{2}

Fourth, because substance users may have a pattern of behaviour that includes delinquent behaviour,\textsuperscript{2} there may have been an underrepresentation of these students because of their absence from school and their failure to fill out items on the questionnaire. A different pattern of results might have been obtained if these students could have been included in the survey. Finally, one must be cautious regarding cross-sectional data, even with large sample sizes. Only prospective studies can determine whether the rate of new smoking (incidence) is related to dieting concerns, as cross-sectional studies must typically rely on those subjects who have recently converted to smoking, as well as those who have been smoking for longer periods of time (prevalence).

In summary, a significant proportion of children in the seventh grade have concerns about smoking and believe that smoking controls body weight. White girls are more concerned with dieting and more likely to believe that smoking controls body weight. Among boys, the opposite is true: black boys are more likely to express concern about diet and to endorse the belief that smoking has weight-suppressing effects. Future research should address the relationship between these concerns and the initiation of health risk factors, such as smoking or restrictive eating.

This study was supported by a grant (HL50723) from the National Heart, Lung, and Blood Institute (NHLBI) as well as a minority supplement from NHLBI (HL50723-BI). Support was also received from the Centers of Excellence awarded by the State of Tennessee to the Department of Psychology at the University of Memphis. The authors would like to thank Dr Andrew Meyers and Dr Thomas Fagan for their support of this project. The authors also thank Dr Jerry House, Superintendents, and all other individuals of the Memphis City School System who helped support this project.


