

## ORIGINAL ARTICLE

# Characteristics of Vegetarian Adolescents in a Multiethnic Urban Population

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**Purpose:** To examine the prevalence of adolescents' vegetarianism in a multiethnic, urban population, and its correlates with demographic, personal, weight-related, and behavioral factors.

**Methods:** Self-report and anthropometric data were collected from a representative sample of 4746 adolescents from 31 public middle schools and high schools in the Twin Cities area of Minnesota. Students answered questions concerning vegetarianism, food and weight, and health behaviors. Height and weight were directly measured. Comparisons were made between self-reported vegetarians and nonvegetarians; these analyses also assessed gender and race/ethnicity interactions. In the second set of analyses, demographic and behavioral characteristics of more restricted and semi-vegetarians were examined. Analyses were done by logistic regression.

**Results:** Teenage vegetarians comprise about 6% of the sample. The vegetarians were more likely than nonvegetarians to be female, not black, weight- and body-conscious, dissatisfied with their bodies, and involved in a variety of healthy and unhealthy weight control behaviors. Vegetarians more often reported having been told by a physician that they had an eating disorder and were more likely to have contemplated and attempted suicide. Vegetarian males were found to be an especially high risk group for unhealthy weight control practices. Few ethnic group differences among vegetarians were noted.

Adolescents who did not eat chicken and fish were at lower risk than those who also ate chicken and fish.

**Conclusions:** Adolescent vegetarians are at greater risk than others for involvement in unhealthy and extreme weight control behaviors. Vegetarian males are at particularly high risk. Vegetarianism among adolescents may therefore be a signal for preventive intervention. Adolescents who choose to become vegetarians may also need to learn how to healthfully do so. © Society for Adolescent Medicine, 2001

**KEY WORDS:**

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Vegetarianism is a dietary pattern that is characterized by the consumption of plant foods and the avoidance of some or all animal products [1-3]. Vegetarianism is normative in some parts of the world, such as India where it is estimated that 80% of India's 1 billion people are vegetarian [4]. It is also espoused among some religions, such as Hinduism, Buddhism, and Christianity [4,5]. Since about 500 B.C., vegetarianism has been maintained as a dietary pattern for large groups of people for familial, cultural, ethical, and religious reasons [6]. It is mainly since the 19th century that vegetarianism has been promoted because of its contribution to health [7].

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Recent studies of adult vegetarians vs. nonvegetarians have suggested that adhering to a vegetarian diet may have health-related benefits. Vegetarians live longer and are less likely to acquire chronic diseases such as cardiovascular disease and some cancers [2,8–13]. In addition, vegetarians tend to be leaner than nonvegetarians, and are able to maintain their dietary pattern longer than those on more traditional weight-loss diets [14–16]. It is not surprising that 82% of a sample of adult vegetarians in the United States, reported that they choose this diet owing to health reasons, and that that was the most important reason for their interest in vegetarianism [17].

It might be assumed that adolescent vegetarians are simply younger versions of their adult counterparts and follow a vegetarian diet because of familial, cultural, or health reasons. However, adolescents tend to adopt and maintain behaviors for a variety of reasons that are unique to their developmental stage, such as to assert their independence, establish an identity, become more intimate with others, or to rebel [18–20]. Vegetarianism may be a way to express these developmental needs, which has been noted for other behaviors such as cigarette smoking and alcohol use [21]. Adolescents also put a great deal of emphasis on their appearance, an emphasis that appears to increase over the course of adolescence [22]. This preoccupation with appearance puts them at greater risk for adopting a variety of dietary patterns in an attempt to look attractive and thin, according to the current vogue. Vegetarianism among adolescents may therefore be a healthy dietary choice, a way to accomplish developmental tasks, and/or a way to maintain or lose weight.

Teenage vegetarians are more likely to be female, with more negative beliefs about meat-eating and animal cruelty, and more importance placed on their health, appearance, and the environment than their nonvegetarian peers [7,23,24]. Adolescent vegetarians may be at greater risk than their peers for unhealthy weight control behaviors (e.g. frequent dieting, binge eating, and laxative use) [24,25]. There has also been some concern that there might be nutritional inadequacies of iron and zinc among vegetarian adolescents [1,26]. Yet, adolescent vegetarians also report higher intakes of fruits, vegetables, and legumes, and lower intakes of sweet and salty snack foods than their nonvegetarian peers [25]. Adolescent vegetarians appear to weigh less than their nonvegetarian peers, which may reinforce the adoption of this dietary pattern among young people

[27]. The limited research to date supports the notion that vegetarianism among adolescents may be adopted and maintained for different reasons than among adults, and may be part of a cluster of weight control behaviors, both healthy and unhealthy, that might be related to eating disorders in youth. Alternatively, in some youth, this dietary pattern may have positive outcomes both in the short-term, such as higher intakes of fruits and vegetables, and in the long-term, such as lower rates of chronic disease. Thus, it is important to better understand the phenomenon of adolescent vegetarianism to help guide young people's quest for a healthy dietary pattern that can be sustained into adulthood, while protecting them from harm during adolescence. To date, studies of adolescent vegetarianism have been limited in number and focused primarily on white populations. There are few population-based studies that have examined the prevalence of adolescent vegetarianism and its correlates with demographic, personal, and behavioral factors. Clearly more research on adolescent vegetarians in varied racial/ethnic groups is needed to more fully understand this dietary pattern.

We hypothesized that vegetarian adolescents compared with their nonvegetarian peers, would more likely be: female (as has been seen in other studies of vegetarians [25]; high school age (vs. middle school age, since the importance of appearance increases with age [22]; non-African-American (since African-American teenagers have been shown to have more acceptance of their body type and weight) [28]; health- and weight-conscious, with greater involvement in both healthy and weight-related attitudes [24]; and similar in their rates of other health-related behaviors [25].

Within the vegetarian population, it was hypothesized that adolescent vegetarians will have primarily weight-related reasons for their dietary pattern, and these would be more endorsed than health, moral, familial or religious reasons. We also hypothesized that there would be significant differences between racial/ethnic and gender groups in the degree of involvement with health- and weight-related attitudes and behaviors. Finally, in comparing types of vegetarians, it was hypothesized that more restricted vegetarians (such as vegans, lacto- and lacto-ovo vegetarians) would exhibit more of the health- and weight-related attitudes and behaviors outlined above than those who also eat chicken and/or fish.

## Methods

### Sample and Study Design

The study population included 4746 adolescents from 31 public middle schools and high schools in the Twin Cities area of Minnesota. Participants were equally divided by gender (50.2% males, 49.8% females). The mean age of the study population was 14.9 years (range 11 – 18 years); 34.3% were in junior high school and 65.7% in high school. The racial/ethnic backgrounds of the participants were as follows: 48.5% Caucasian, 19.0% African-American, 19.2% Asian-American, 5.8% Hispanic, 3.5% Native American and 3.9% mixed/other. The majority of the Asian-American population was from Southeast Asia.

Data for this study were collected via self-report surveys and anthropometric assessments in the 1998 – 1999 school year. The data were collected in schools within Health, Physical Education, and Science classrooms in one 90-minute period or two 50-minute periods. Trained research staff administered the surveys in the classrooms and measured height and weight in a private area. Study procedures were approved by the University of Minnesota Human Subjects' committee and by research boards of the participating school districts. Consent procedures also followed the requirements of the participating school districts. In some schools passive consent procedures were utilized, while in others active consent procedures were required. The response rate for student participation was 77.1%. The main reasons for lack of participation were absenteeism and failure to return consent forms within schools requiring active consent.

### Measures

*Vegetarian items.* To identify vegetarians, all students were asked on the survey to respond to the question "Are you a vegetarian? . . . 1) Yes; 2) No." Of those who answered "yes," they were also asked to respond to additional questions. The first was "As a vegetarian, do you eat any of the following? . . . 1) Eggs; 2) Dairy food (such as milk, cheese); 3) Chicken; 4) Fish." Students who checked "no" to all four were categorized as vegan; while those who checked "yes" that they ate dairy foods were considered lacto-vegetarian, and those who checked "yes" that they ate eggs and dairy products were considered lacto-ovo vegetarian. Students who checked "yes" to either chicken or fish were considered semi-vegetarians [24]. Self-reported vegetarians were also asked to answer "What are your main reason(s) for eating

a vegetarian diet? . . . 1) To lose weight or keep from gaining weight; 2) Want a healthier diet; 3) To help the environment; 4) Religious reasons; 5) Do not want to kill animals; 6) A family member is a vegetarian; 7) I don't like the taste of meat." They could choose any number of reasons that applied to them. Finally, vegetarians were asked how long they had been vegetarians and were thus divided into those who had been vegetarians for greater than 2 years, and those who had been vegetarians for 2 years or less.

*Sociodemographic items.* Demographic factors, including gender, ethnicity/race, socio-economic status (SES), and school level, were based on self-report. The highest level of education of either parent primarily determined SES. Other variables used to assess SES included: family eligibility for public assistance, eligibility for free or reduced-cost school meals, and employment status of mother and father. An algorithm was developed to avoid classifying youth as high SES, based on parental education levels, if they were on public assistance, eligible for free/reduced school meals, or had two unemployed parents. A five-level classification of SES was constructed with 1=lowest SES, 5=highest SES. School level was divided into middle school (7th – 8th grades) and high school (9th – 12th grades).

*Food-related items.* Food-related personal factors were also examined using the self-report survey. All students were asked about their values on different aspects of health using the question "How much to you care about? . . . 1) Eating healthy food; 2) Controlling your weight; 3) Being healthy." Student responses for each item were dichotomized as "not at all/a little bit" vs. "somewhat/very much." Since these items did not form a scale, they were analyzed individually, assessing the percentage of students who reported "somewhat" or "very much." Students were also asked about eating-related outcome expectations and indicated whether they agreed or disagreed with the statements: "The types of food I eat affects. . . 1) My health; 2) How I look; 3) My weight; 4) How well I do in sports; 4) How well I do in school." This formed an Eating Outcomes Scale ( $\alpha = .82$ ); the scale was split at the median for analyses. Finally, students were asked about their confidence (self-efficacy) in eating healthy foods by indicating how sure they were that they could eat healthy foods when they were in nine different social, emotional, and neutral situations [29]. These items formed a

Self-Efficacy Scale ( $\alpha = .83$ ), which was split at the median for analyses.

*Weight-related items.* Weight-related personal factors were examined using four questions. The first assessed frequency of weighing and asked students whether they agreed or disagreed with the statement "I weigh myself often." The second addressed eating disorders and asked "Has a doctor ever told you that you have an eating disorder such as anorexia nervosa, bulimia nervosa, or binge eating disorder? . . . 1) Yes; 2) No." The third question addressed body satisfaction, and asked them to rate how satisfied (vs. dissatisfied) they were with ten different aspects of their body, such as their height, shape, face, and build. This formed a Body Satisfaction Scale ( $\alpha = .92$ ); which was split at the median for analyses. The fourth question addressed weight control methods including exercise, fasting, taking diet pills, skipping meals, etc. These were scored by indicating whether they had engaged in at least one healthy weight control behavior in the past year ( $\alpha = .81$ ) or unhealthy weight control practice in the past year ( $\alpha = .70$ ). The healthy weight control behaviors included exercise, eating more fruits and vegetables, eating less high fat foods, and eating less sweets. The unhealthy weight control behaviors included fasting, eating little, using food substitutes, skipping meals, and smoking cigarettes. In addition, adolescents were asked if they had vomited or took diet pills or laxatives during the previous week for weight control purposes ("yes," "no").

*Health behavior items.* A range of health-related behaviors were assessed to examine the relationships of these behaviors to being on a vegetarian diet. Students were asked if they had used: (a) cigarettes; (b) beer, wine, hard liquors; (c) marijuana; and (d) drugs other than marijuana (acid, cocaine, crack, etc.) in the past year. The frequencies of using these substances were summed to form a Substance Use Scale ( $\alpha = .79$ ). For these analyses, the scale was dichotomized into "never using any substance" vs. "using at least one substance over the past year." They were also asked if they had ever thought about killing themselves or had ever tried to kill themselves ("yes," "no"). Depressive symptoms were also assessed, using a 7-item standardized scale [30]. The depression scale was split at the median for analyses. Students also reported how many hours of vigorous and moderate physical activity they engaged in during a typical week [31]. These physical activity measures were each dichotomized into two levels —

those having greater than 2 hours of activity per week, and those having 2 hours or fewer.

*Anthropometric assessments.* Students' heights and weights were measured by trained research staff in a private area at the schools using standardized equipment and procedures. Body mass index (BMI) values were calculated according to the formula:  $\text{wt (kg)}/\text{ht (m}^2\text{)}$ . Using gender- and age-specific cut-off points based on reference data from the Centers for Disease Control and Prevention (2000) growth tables [32], respondents were classified as underweight (<15th percentile), average weight (>15th to <85th percentile), at risk for overweight (>85th to <95th percentile), and overweight (BMI > 95th percentile).

### Data Analysis

The present study assessed demographic, personal, and behavioral factors associated with adolescent vegetarians. In the first set of analyses, self-reported vegetarians were compared to nonvegetarians; these analyses also assessed whether the relationships between demographic and behavioral factors, and vegetarianism were moderated by gender and race/ethnicity (white, black, Asian). In the second set of analyses, demographic and behavioral factors between vegetarian groups were compared. For these analyses, lacto-, lacto-ovo, and vegans were combined into one category, restricted vegetarians, and compared to semi-vegetarians. The dependent variables used in all of the analyses were dichotomous; thus, Proc GLIMMIX in SAS 6.12 was used for all analyses. Proc GLIMMIX is a program that runs logistic regression analyses but enables the program to control for variables with random effects. The estimates presented in the present manuscript are unadjusted; however, the odds ratios and 95% confidence intervals are controlled for the random effect of school and the fixed effect of gender.

### Results

There were 262 self-reported adolescent vegetarians in the study or 5.8% of the sample. Among the vegetarians, nearly three-fourths (73.7%) were female. Nearly half (47.5%) of the vegetarians were white, 26.8% were Asian, 11.1% were black, 5.8% were Hispanic, 5.0% were American Indian, and the remaining 4% were Hawaiian/Pacific Islander or Other. Because there were so few Hispanic, American Indian, and Mixed/Other vegetarians, race/

**Table 1.** Demographic, Personal, Weight-Related, and Behavioral Factors of Adolescent Subjects<sup>‡</sup>

	Vegetarians N = 262	Nonvegetarians <sup>a</sup> N = 4258	OR <sup>b</sup>	95% CI
	% (n)	% (n)		
<b>Demographic Factors</b>				
Females	73.7 (193)	48.4 (2062)	2.95	2.23, 3.92***
Race: White	47.5 (124)	49.8 (2094)		
Asian	26.8 (70)	18.7 (787)	1.32	0.98, 1.78
Black	11.1 (29)	18.2 (767)	0.53	0.35, 0.79**
High school	61.4 (159)	65.2 (2750)	0.51	0.32, 0.81**
SES (mean ± SD)	3.1 ± 1.4	2.9 ± 1.3	1.10	0.99, 1.22
<b>Personal Factors</b>				
How much do you care about:				
Eating healthy	85.5 (224)	78.4 (3321)	1.43	1.00, 2.04*
Controlling weight	77.3 (198)	72.0 (3032)	1.17	0.86, 1.59
Being healthy	83.7 (215)	89.9 (3790)	0.55	0.39, 0.78***
Eating Outcomes Scale <sup>c</sup>	51.9 (136)	44.3 (1887)	1.22	0.95, 1.57
Self-Efficacy Scale <sup>c</sup>	56.1 (147)	46.3 (1971)	1.50	1.16, 1.94**
<b>Weight-Related Factors</b>				
I weigh myself often	40.0 (102)	31.3 (1317)	1.34	1.03, 1.74*
Diagnosed eating disorder	8.5 (22)	3.1 (131)	2.72	1.71, 4.34***
Body Satisfaction Scale <sup>c</sup>	41.2 (108)	53.2 (2265)	0.74	0.57, 0.96*
Healthy weight control practice in the past year	87.7 (228)	76.9 (3249)	1.75	1.19, 2.57**
Unhealthy weight control practice in the past year	68.5 (178)	43.7 (1848)	2.33	1.77, 3.08***
Vomited in the past week	8.3 (21)	2.5 (106)	2.99	1.86, 4.79***
Diet pills in the past week	5.6 (14)	2.0 (83)	2.37	1.35, 4.17***
Laxatives in the past week	5.6 (14)	0.7 (30)	7.52	4.11, 13.8***
<b>Behavioral Factors</b>				
Substance Use Scale	47.9 (234)	46.3 (1863)	1.19	0.90, 1.57
Thought about killing yourself	34.7 (82)	24.9 (1009)	1.37	1.03, 1.82*
Ever tried to kill yourself	18.3 (44)	8.6 (348)	2.04	1.53, 2.88***
Depression Scale <sup>c</sup>	58.8 (154)	48.4 (2060)	1.25	0.96, 1.62
Physical activity				
Vigorous (>2 hrs/week)	45.4 (119)	54.4 (2317)	0.86	0.66, 1.12
Moderate (>2 hrs/week)	42.7 (112)	50.4 (2145)	0.81	0.63, 1.04
BMI				
85th–95th percentile <sup>d</sup>	14.3 (32)	15.8 (623)	0.83	0.60, 1.15
≥95th percentile	8.1 (18)	10.4 (408)	0.79	0.49, 1.30

<sup>a</sup> reference group<sup>b</sup> controlled for gender and school<sup>c</sup> median split for analyses<sup>d</sup> odds ratio is for ≥85th percentile\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .<sup>‡</sup> Unadjusted percentages, adjusted odds ratios and 95% confidence intervals

ethnicity analyses were confined to Whites, Blacks, and Asians. Over half of the vegetarians (53%) reported eating chicken, 41.6% ate fish, 76.4% ate eggs, and 78.7% ate dairy products. Reasons for vegetarianism were: (a) to lose/not gain weight (35.1%); (b) not to kill animals (28.2%); (c) taste of meat (27.1%); (d) a healthy diet (25.2%); (e) help environment (16.8%); (f) family (13.7%); and (g) religion (9.9%). (Students could endorse multiple reasons.) Overall,

the length of time being a vegetarian was: greater than 2 years (43.4%) and less than or equal to 2 years (56.6%).

Table 1 presents the differences between vegetarians ( $n = 262$ ) and nonvegetarians ( $n = 4258$ ) on demographic, personal, weight-related, and behavioral factors. The table presents unadjusted means, and odds ratios and 95% confidence intervals adjusted for the effects of school and gender. Vegetar-

ians were nearly 3 times more likely to be female than were nonvegetarians. There was a significantly lower percentage of Blacks among the vegetarians than among nonvegetarians. Vegetarians were less likely to be in high school rather than in junior high/middle school than nonvegetarians.

Vegetarians were significantly more likely to care about eating healthy food, and less likely to care about being healthy. They had greater self-efficacy to be able to eat healthy foods in a variety of situations than did nonvegetarians. Differences in weight-related characteristics were also found between the groups. Vegetarians were more likely to weigh themselves often, to have been told by a doctor that they had an eating disorder, to be dissatisfied with their bodies, and to practice healthy and unhealthy weight control behaviors. Finally, vegetarians were more likely than nonvegetarians to have thought about or actually tried to kill themselves. Other measures of substance use, depression, physical activity, and all levels of BMI were not different between groups (Table 1).

We examined the interaction of vegetarian status and gender and found four significant interactions with main effects for both vegetarian status and gender. These interactions are shown in Figure 1, with the comparisons discussed below all statistically significant ( $p < .01$ ). As shown in Figure 1a, vegetarian males weigh themselves more frequently than nonvegetarian males. Figure 1b shows the results for engaging in healthy weight control behaviors. Among males, vegetarians engage in healthy weight control behaviors more than nonvegetarians. Figure 1c shows results for engaging in unhealthy weight control behaviors. Among both males and females, vegetarians engage in more unhealthy weight control behaviors than their nonvegetarian counterparts. Figure 1d shows results for vomiting in the past week. Among males and females, vegetarians are more likely to vomit than their nonvegetarian counterparts.

We also examined the interaction of vegetarian status and race/ethnicity and found that only two of the interactions were significant with main effects for both vegetarian status and race/ethnicity. The first interaction concerned being previously diagnosed by a physician as having an eating disorder. Among Asians and Blacks, vegetarians were more likely to report having been diagnosed with an eating disorder than nonvegetarian Asian and Blacks. Among vegetarians, Asians and Blacks reported higher rates of being diagnosed with an eating disorder than whites. The second interaction concerned depressive

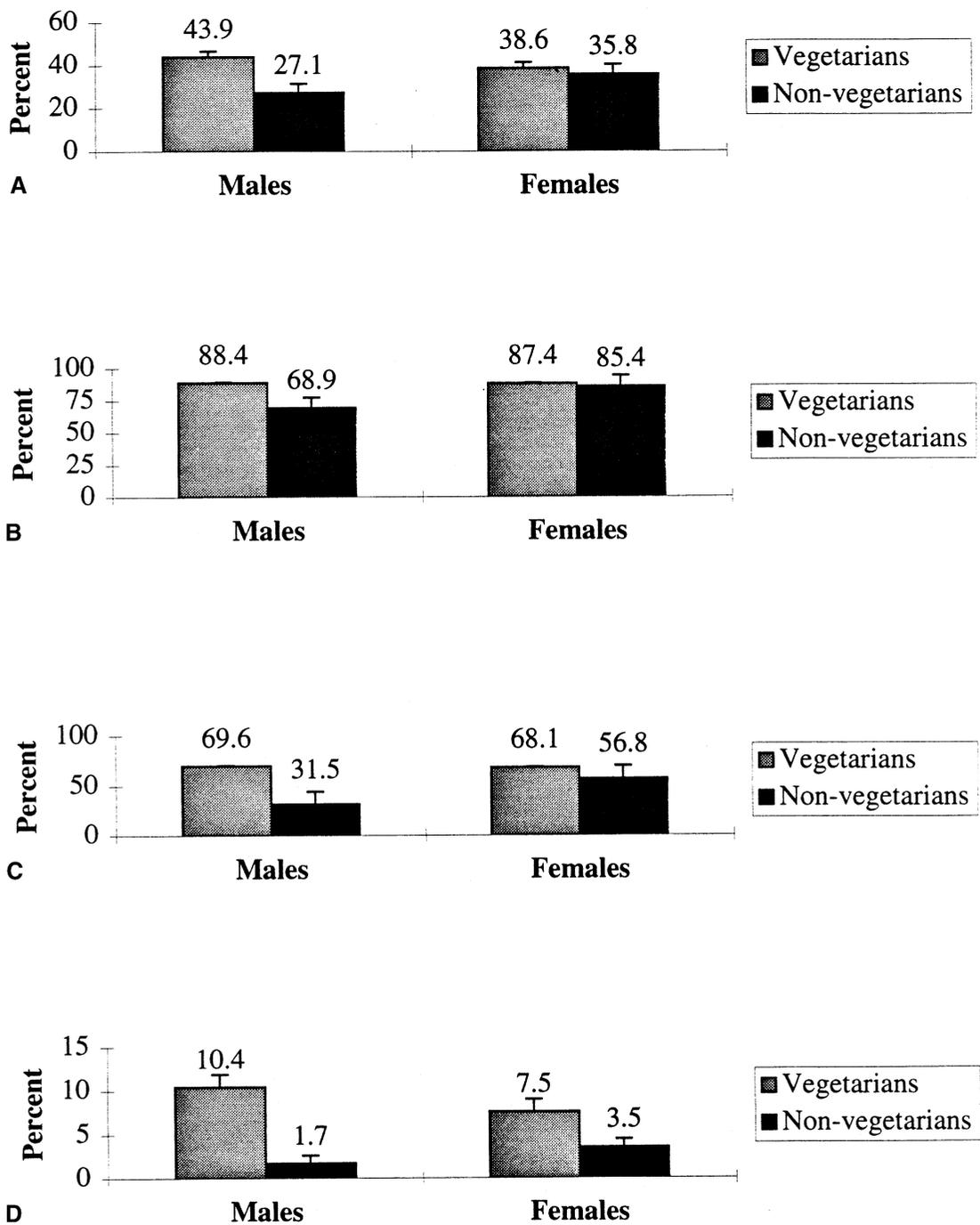
symptomatology. Among nonvegetarians, Asians reported more, and Blacks reported less, depressive symptomatology than whites. This was not found among vegetarians.

Differences in types of vegetarians were examined by comparing more restricted vegetarians (vegans, lacto vegetarians, and lacto-ovo vegetarians) with semi-vegetarians (those who reported to eat chicken or fish). These comparisons are shown in Table 2 with the unadjusted means, and odds ratios and 95% confidence intervals adjusted for school and gender. Semi-vegetarians were less likely to be female, and more likely to be Asian and black than the more restricted vegetarians. The semi-vegetarians were more likely to be in high school, come from a lower SES, and been vegetarians for a shorter period of time. Semi-vegetarians were much less likely to be vegetarians because they did not want to kill animals. The semi-vegetarians were more likely to engage in healthy and unhealthy weight control practices and less likely to be physically active. Finally, the semi-vegetarians were much less likely to be at risk for overweight than the more restricted vegetarians.

## Discussion

Vegetarians comprise about 6% of our urban, multi-ethnic group sample of adolescents. The vegetarians were, as hypothesized, more likely than nonvegetarians to be female, not black, weight- and body-conscious, dissatisfied with their bodies, and involved in a variety of healthy and unhealthy weight control behaviors. Vegetarians, contrary to our hypotheses, were less likely to be in high school and less health conscious than nonvegetarians. In fact, they reported caring less about being healthy, despite caring more about eating healthy foods. In addition, vegetarians more often reported having been told by a physician that they had an eating disorder and were more likely to have contemplated and attempted suicide. As hypothesized, other behaviors such as substance use and physical activity were not different between vegetarians and nonvegetarians.

What emerges from these data on vegetarians is a group of mostly female adolescents who are quite concerned about their weight, have used a variety of methods to control their weight, perceive they are in control of their eating (as evidenced by their greater self-efficacy to eat healthy foods in a variety of situations), and yet have a greater likelihood than nonvegetarians to be engaging in extreme weight



**Figure 1.** Weight-Related Behaviors by Gender Among Vegetarian and Nonvegetarian Adolescents: (a) Percent Who Weigh Themselves Frequently; (b) Percent Who Reported Using at Least One Healthy Weight Control Behavior in the Past Year; (c) Percent Who Reported Using at Least One Unhealthy Weight Control Behavior in the Past Year; (d) Percent Who Reported Vomiting for Weight Reasons in the Past Week.

control behaviors such as the use of diet pills, laxatives, vomiting to lose weight, and contemplating suicide. The association between extreme weight control behaviors and suicidal ideation has been noted previously [33,34]; this study is the first to

show that adolescent vegetarianism may also be associated with suicidal thoughts and attempts (although a trend in this direction was previously observed) [25]. Thus, although adult vegetarianism has demonstrated healthful outcome [2,10], adoles-

**Table 2.** Comparisons of Restricted Vegetarians and Semi-Vegetarians on Demographic, Personal, Weight-Related, and Behavioral Factors<sup>‡</sup>

	Restricted Vegetarians <sup>a</sup> N = 94	Semi-Vegetarians <sup>b</sup> N = 158	OR <sup>c</sup>	95% CI
	% (n)	% (n)		
<b>Demographic factors</b>				
Females	80.9 (76)	68.9 (109)	1.91	1.03, 3.54*
Race: White	60.6 (57)	40.8 (64)		
Asian	18.1 (17)	32.5 (51)	0.46	0.24, 0.89*
Black	4.3 (4)	14.0 (22)	0.23	0.07, 0.72*
High school	58.5 (55)	62.6 (97)	0.45	0.23, 0.88*
SES (mean ± SD)	3.5 ± 1.4	2.7 ± 1.4	1.41	1.15, 1.73**
Years of vegetarianism (>2)	52.1 (49)	38.8 (61)	1.90	1.12, 3.25*
Reasons why vegetarian:				
Weight control	27.7 (26)	39.9 (63)	0.57	0.32, 1.00
Healthier diet	31.9 (30)	20.9 (33)	1.78	0.98, 3.23
Religious	12.8 (12)	8.2 (13)	1.85	0.78, 4.36
Not kill animals	45.7 (43)	18.9 (30)	3.19	1.79, 5.71**
<b>Personal factors</b>				
How much do you care about:				
Eating healthy	85.1 (80)	84.8 (134)	0.91	0.44, 1.90
Controlling weight	79.8 (75)	76.5 (117)	1.02	0.55, 1.94
Being healthy	89.4 (84)	79.9 (123)	1.94	0.89, 4.19
Eating Outcomes Scale <sup>d</sup>	51.1 (48)	51.9 (82)	0.98	0.58, 1.65
Self-Efficacy Scale <sup>d</sup>	59.6 (56)	52.5 (83)	1.32	0.78, 2.21
<b>Weight-related factors</b>				
I weigh myself often	36.2 (34)	44.1 (67)	0.73	0.43, 1.25
Diagnosed eating disorder	4.3 (4)	10.9 (17)	0.35	0.11, 1.11
Body Satisfaction Scale <sup>d</sup>	44.7 (42)	37.9 (60)	1.55	0.89, 2.68
Healthy weight control practice in the past year	80.8 (76)	92.9 (146)	0.32	0.14, 0.71**
Unhealthy weight control practice in the past year	57.4 (54)	75.2 (118)	0.44	0.25, 0.77**
Vomited in past week	2.2 (2)	10.5 (16)	—	—
Diet pills in past week	4.4 (4)	5.9 (9)	0.67	0.19, 2.31
Laxatives in past week	3.3 (3)	6.0 (9)	—	—
<b>Behavioral factors</b>				
Substance Use scale	47.8 (43)	49.6 (68)	0.88	0.50, 1.54
Thought about killing yourself	30.7 (27)	37.4 (52)	0.67	0.37, 1.21
Ever tried to kill yourself	18.7 (17)	17.9 (25)	1.01	0.50, 2.02
Depression Scale <sup>d</sup>	55.3 (52)	60.1 (95)	0.75	0.44, 1.28
Physical activity				
Vigorous (>2 hrs/week)	57.4 (54)	37.3 (59)	2.38	1.38, 4.06**
Moderate (>2 hrs/week)	52.1 (49)	37.9 (60)	1.82	1.07, 3.07*
BMI				
85th–95th percentile <sup>e</sup>	21.8 (19)	9.2 (12)	2.03	1.05, 3.91*
≥95th percentile	8.0 (7)	8.5 (11)	0.96	0.35, 2.63

<sup>a</sup> vegans, lacto- and lacto-ovo vegetarians<sup>b</sup> reference group; vegetarians who also eat chicken/fish<sup>c</sup> controlled for gender and school<sup>d</sup> median split for analyses<sup>e</sup> odds ratio is for ≥85th percentile\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < .001$ ; -- too few cases; test would not converge.<sup>‡</sup> Unadjusted percentages, adjusted odds ratios and 95% confidence intervals

cent vegetarianism may be a signal that other, health-compromising attitudes and behaviors may also be adopted, particularly those related to unhealthy weight control.

Adolescent vegetarians reported being vegetarian for a number of reasons. Over one-fourth of the adolescent vegetarians reported that wanting to lose or not gain weight, not kill animals, not liking the taste of meat, and a healthy diet were among their reasons for being vegetarian. As hypothesized, adolescents indicated that they wanted to lose or not gain weight as the most frequent reason for their vegetarianism, a notable difference from adult vegetarians [17]. It is also interesting that their second ranked reason for being vegetarians was out of compassion for animals; this is consistent with adolescent cognitive development and their sense of idealism and need to conceptualize a world that is perfect [35,36]. Thus, vegetarianism may be one way an adolescent chooses to act to create a more ideal and less cruel world.

There were several gender/vegetarian-status interactions, which all provided evidence that vegetarian males are an especially high risk group for unhealthy weight control practices. Vegetarian males were significantly more likely than nonvegetarian males to weigh themselves frequently, to engage in healthy and unhealthy weight control behaviors, and to report vomiting in the past week as a weight control method. Vegetarian males were as likely to engage in all of these behaviors as vegetarian females, whereas nonvegetarian males were less likely than nonvegetarian females to do so. This is an important finding, since females generally are considered at greater risk for eating disturbances [37–39]. Being an adolescent male vegetarian may serve an important marker for other unhealthy weight control behaviors. Male vegetarians might need added information, screening or counseling to assure a healthful diet. To our knowledge, ours is the first study to have demonstrated this increased risk among adolescent male vegetarians, most likely because other studies focused on females or had too small a sample size of males to observe these interactions.

To our surprise, there were very few significant race/ethnicity interactions found. There were differences between racial/ethnic groups among the vegetarians, but most of those differences were also found among nonvegetarians, so that the main influence was not vegetarianism but rather race/ethnicity. Thus it appears that the patterns of factors associated with vegetarianism found among adolescents summarized above hold true for Whites, Blacks

and Asians. Unfortunately, there were too few Hispanic, American Indian, and other ethnic groups to perform meaningful analyses with these subgroups, so our findings cannot be generalized to those groups. Still, it is interesting that involvement with vegetarianism would be associated with changes in attitudes and behaviors that are independent of race/ethnicity, and perhaps thereby reflecting the centrality of the issue of diet among all adolescents in our urban settings.

Finally, we examined the differences between semi-vegetarians (who eat fish and chicken) and more restricted vegetarians. Contrary to our hypothesis, the restricted vegetarians were less likely to engage in healthy and unhealthy weight control practices and more likely to be physically active. The restricted vegetarians were more likely than the semi-vegetarians to be female, in junior high/middle school, from a higher SES group, have been vegetarian longer, and endorse not wanting to kill animals as a reason for their dietary pattern. They were also less likely to be Asian or black. Thus, the restricted vegetarians (e.g. vegans, lacto- and lacto-ovo vegetarians) appear to be more "stable" and healthy adolescent vegetarians, with over half having been vegetarian for over 2 years, and with less involvement in unhealthy weight control behaviors. Semi-vegetarians (63% of the vegetarians) may be a group who are more likely to be experimenting with vegetarianism as another form of weight control practice, and therefore are an important group to consider when planning intervention programs to prevent unhealthy weight control behaviors and eating disorders. It may also be that semi-vegetarian adolescents are a separate group of vegetarians with different reasons for their eating patterns, and those are primarily weight-related. For example, semi-vegetarians were less likely to be vegetarians because of not wanting to kill animals than restricted vegetarians. It may also be that semi-vegetarianism, for some, is the first step toward a more stable, restricted vegetarianism, and that once the transition is made or the vegetarianism is maintained for over 2 years, there might be fewer health-compromising weight control behaviors exhibited. It is interesting to note that despite their relative lack of involvement with weight control practices, the restricted vegetarians were over twice as likely to be at risk for overweight (>85th percentile).

This study had several strengths and limitations. The questions on vegetarianism and associated factors were more comprehensive than prior population-based studies. We chose a representative sample

of adolescents from the major urban school districts in Minnesota and thus had sufficient data to examine ethnic group and gender differences. The study was limited by the self-reporting of vegetarianism and the cross-sectional design of the study.

Our findings are similar to those previously reported [25,26] who also found that adolescent vegetarians were at greater risk for involvement in unhealthy weight control behaviors. Our study underscores these findings and extends them to adolescents of multiple racial/ethnic groups and noting the particularly high-risk status of vegetarian males. Additionally, our study points to semi-vegetarians as less stable and more at risk for involvement in weight control practices than the restricted vegetarians. Because of the interest in vegetarianism, particularly among adolescent females, this may be an opportunity for preventive intervention, by regarding vegetarianism as a signal for more extreme weight control behaviors and providing early counseling. Another approach may be to consider the choice of vegetarianism as an opportunity, and recruit adolescents to programs focussing on how to become a healthy vegetarian. Since adult vegetarians appear to be leaner and healthier than their nonvegetarian counterparts, learning how to become a "healthy" adolescent vegetarian may be one avenue for long-term and healthful changes in dietary patterns for adolescents [16].

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