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Ethnic Differences in BMI, Weight Concerns, and Eating Behaviors: Comparison of Native American, White, and Hispanic Adolescents

Wesley C. Lynch and Daniel P. Heil

Montana State University – Bozeman

Elise Wagner, M.A. and Michael D. Havens, Ph.D.

Montana State University – Billings

Abstract

Evidence suggests that substantial proportions of adolescents, regardless of ethnicity or gender, are engaged in excessive weight control behaviors. Crago and Shisslak (2003), however, have noted that small samples and poorly validated instruments have limited the value of previous ethnic difference studies. Using the McKnight Risk Factor Survey, we compared Native American, White, and Hispanic adolescents. Native students were divided into groups with one (NA-mixed) or two (NA) Native American biological parents. Surveys were completed by 5th through 10th grade students. BMI z-scores were significantly higher for boys and girls in the NA group, and boys in this group were significantly more engaged in weight control behaviors, including purging. A higher percentage of Native and Hispanic girls preferred a larger body size. BMI was positively correlated with weight and shape concerns and with weight control behaviors, regardless of ethnicity or gender. Overweight among Native adolescents may put them at greater risk for eating problems than their White peers.

Keywords

BMI; body image; weight concern; eating disorders; risk factors; weight control behaviors; size preference; McKnight Risk Factor Survey

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Body dissatisfaction, fear of weight gain, appearance concerns, weight and shape concerns, and higher BMIs among adolescents are associated with increased risk for eating disorders (Killen et al., 1994; Shisslak et al., Stice, 1998;1998;Story et al., 1991;Striegel-Moore, Silberstein, & Rodin, 1986). In addition, recent studies suggest that substantial proportions of most ethnic groups and both genders are engaged in sometimes-excessive weight control behaviors (e.g., Croll, Neumark-Sztainer, Story, & Ireland, 2002;Taylor et al., 2003). In a recent review, however, Crago et al. (2003) noted that small sample sizes and poorly validated

Correspondence to: Wesley C. Lynch, Ph.D., Department of Psychology, Montana State University, Bozeman, MT 59717-3440, Phone: 406-994-3803, FAX: 406-994-3804, E-mail: wlynch@montana.edu.

Wesley C. Lynch, Department of Psychology, Montana State University - Bozeman; Daniel P. Heil, Health & Human Development, Montana State University – Bozeman; Michael D. Havens, Department of Psychology, Montana State University – Billings; Elise Wagner, Department of Psychology, Montana State University – Billings.

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assessment instruments have limited the usefulness of many studies of ethnic differences. In one of the few studies of Native American eating problems using validated behavioral measures, Smith and Krejci (1991) studied Native adolescents (~15 years old) from Pueblos in Southwestern USA and found that, compared to their Caucasian peers, a greater percentage of Native participants reported binge eating, vomiting and fear of gaining weight. In a recent large-scale survey of several adolescents groups, including Native Americans, Croll and colleagues (2002) found that Native American and Hispanic girls had the highest prevalence of weight control behaviors, including fasting or skipping meals, binge eating, vomiting intentionally, using diet pills and laxatives, or smoking cigarettes. Similarly, in a small sample of adolescent girls living in Montana, we found that Native girls (~14 years old) scored significantly higher than their White peers on both the restricting/purging and social pressure/oral control factors of the children's eating attitudes test (Lynch, Eppers, & Sherrodd, 2004).

Why Native American adolescents may be at such high risk for eating problems remains unclear. Despite a surge of recent interest in ethnic and cultural differences in eating problems, there is little consensus regarding underlying mechanisms. In an early report, Bulik (1987) described the cases of two Russian immigrants who developed anorexic symptoms shortly after arriving in the US. She suggested that rapid acculturation to the thin ideal of beauty in the US or disruption of traditional family roles might be involved. Around this same time, Nasser (1988) argued that anorexia and bulimia should be considered "culture-bound" syndromes because they appeared to be linked to "...a recent change in Western values in relation to female shape with more emphasis on thinness..." (p. 574).

More recently, reviewers have offered a plethora of tentative hypotheses about the sources of these culture-bound differences, including differences in self-esteem or identification with the White middle-class (Crago, Shisslak, & Estes, 1996), differences in "...coping with various traumas..." (Thompson, 1992, p.76), cultural differences in dietary habits, family structures or parent-child relationships (Pate, Pumariega, Hester, & Garner, 1992; Yates, 1990), variations in attitudes toward eating, the meaning of food and meals, culturally related eating behaviors, or cultural influences on individuation, maintenance of control, or emotional expression (Cummins, Simmons, & Zane, 2005). Others have implicated the changing social, economic, and professional status of women in non-western cultures or ethnic groups (Crago et al., 2003), unique cultural beliefs, values, and practices regarding food, or unique perceptions about health (Markey, 2004). Unfortunately, systematic cross-cultural studies of these variables are not currently available.

The idea that cultural conflict associated with affiliation with more than one culture – the so-called "two-world hypothesis" (Katzman & Lee, 1997) – may lead to an increased risk of eating disorders (EDs) has been supported by studies showing that Black girls who accepted White values and beliefs were significantly more likely to have a higher drive for thinness and engage in restrictive eating behaviors than those who did not accept these White values (Abrams, Allen, & Gray (1993). However, despite such evidence, a recent meta-analysis by Wildes, Emery, and Simons (2001) found little support for this differential acculturation hypothesis.

In the case of Native Americans, Doane (1992) has suggested that cultural pressures to eat at family and tribal gatherings, coupled with high-fat diets, due in part to government commodities supplanting traditional foods and a sedentary life-style, may contribute to the high levels of obesity and diabetes in many contemporary Native communities. Perhaps such cultural pressures and dietary conditions combined with media images of thinness coming from the majority White culture, increase weight and shape concerns among Native adolescents.

Despite the lack of consensus on the source of cultural or ethnic differences in eating problems, there is clear evidence of a link between BMI, body concerns, and eating disorders risk across

widely diverse cultural and ethnic groups. For example, Mumford and Choudry (2000) found that White and south Asian women living in London, as well as south Asian women living in Pakistan, all showed strong associations between BMI, body dissatisfaction, and total scores on the Eating Attitudes Test. Such evidence suggests that despite cultural and geographic differences, increases in BMI can lead to increases in body dissatisfaction and to increases in the risk for eating problems. The association of BMI with ED risk may be particularly relevant for the present study given the serious obesity problem among Native Americans of both sexes and all ages (Broussard et al., 1991) and the fact that obesity prevalence in Native communities has increased rapidly in the past half century to near-epidemic proportions (Story et al., 1999). Consistent with this idea, Stevens et al. (1999) noted that "...a risk factor for weight dissatisfaction, dieting, and unhealthy weight control practices among American Indian adolescents is being or feeling overweight" (p. 35). The association between BMI and body dissatisfaction appears to be a common finding across ethnic groups, although the strength of this association may vary substantially from one ethnic group to another (Yates, Edman, & Aruguete, 2004). Other studies support the idea that differences in body dissatisfaction may account, at least in part, for ethnic differences in eating disturbances (e.g., Caradas, Lambert, & Charlton, 2001; Neumark-Sztainer et al., 2002; Stice, 2003).

The present study began as an attempt to understand the risk factors for eating disturbance among several adolescent ethnic groups with substantial representation in south-central Montana, USA. We assessed several putative risk factors for eating disorders including BMI-for-age (and gender), body size preference, weight and shape concerns, and several high-risk eating behaviors among male and female adolescents. Based on available research, we predicted that BMI would be positively correlated with measures of weight and shape concern and with high-risk eating behaviors among all ethnic groups. Further, based on the few available studies of Native Americans (e.g., Croll et al., 2002; Lynch et al., 2004; Smith et al., 1991), we predicted that Native participants would show higher levels of BMI, more weight and shape concerns, and more bingeing and purging behaviors than their White peers. Based on the work of Yates and colleagues (2004) we predicted that correlations between BMI and weight concerns would vary from one ethnic group to another. However, existing data did not allow us to predict which ethnic groups would show the strongest associations or whether such differences would be statistically significant. Finally, in accord with the "two-world" hypothesis mentioned above, we expected that Native American females who were more acculturated to the White norms of thinness, would report more weight and shape concerns and more risky eating behaviors than their more traditional, less acculturated, peers.

Method

Participants

Students from 13 public schools in south-central Montana participated in the study ($n = 2558$). Schools were selected on the basis of their historically high enrollment of Native American students. Eight schools were located in the Billings, MT school district, four in the Hardin, MT school district, and one (St. Labre High) was a private parochial school located in Ashland, MT. All students in grades 5–10 were eligible to participate. Parental consent was obtained using a passive consent method approved by the Institutional Review Board (IRB) at Montana State University, Bozeman, MT and by the school board (Billings School District) or by individual school administrators (Hardin and St. Labre Schools). Among the Native American and Native-mixed ethnic groups, the tribes represented were those of the central plains, primarily Crow and Northern Cheyenne.

Ethnic group and gender distributions of participants in the study were as follows: 59.4% were White, 19.1% had two biological parents who were Native American (NA), 7.7% had one Native American biological parent (NA-mixed), 7.3% were Hispanic, and 6.5% were of other

or mixed ethnic backgrounds (Other). The “Other” group consisted of Black ($n = 23$), Asian ($n = 24$), and mixed-parent ethnic groups, other than NA–mixed ($n = 119$). Participants in the Other group were combined because of their small numbers. Of the total sample, 48.0% were female.

Instruments

The following items and instruments were included in the survey packet which was completed over a two-day period.

Demographic—Age (based on date of birth), gender, ethnicity, number of biological parents in household, number of adults in household who act as parents, and primary language spoken at home, were self-reported. Table 1 summarizes these statistics.

Native American cultural identity—NA and NA-mixed participants were asked to indicate which one of the following four descriptions about their beliefs and behaviors best described them: a) Traditional: “I maintain the beliefs and behaviors that have persisted for generations.” b) Transitional: “I maintain some of the beliefs and behaviors that have persisted for generations but I’ve also developed some new beliefs and behaviors that are consistent with the current ways of life.” c) Modern: “I’ve mainly developed new beliefs and behaviors that are consistent with the current ways of life.” d) Unsure: “I’m undecided at present.”

McKnight Risk Factor Survey (MRFS, 67)—The MRFS is a self-report questionnaire originally designed to assess risk factors for the development of eating disorders among pre- and post-adolescents girls (Shisslak et al., 1999). An earlier version of the MRFS (version III) has been psychometrically validated with individuals ranging in age from 8–18 (grades 4–12). Although three forms of the MRFS-IV were available at the time of this study (Shisslak, personal communication), only the form designed for grades 6–12 was used. Items included in the complete survey packet were those covering the following putative risk domains: Eating behaviors and attitudes (e.g., dieting, exercising, bingeing, purging, social eating, appearance appraisal, and self-reported ED risk), social influences on eating behavior (e.g., weight teasing by adults or peers, adult support/sharing, sexual pressure, media modeling, and sports pressure), and personal attributes (e.g., self-confidence, attributes for success, and maturity level). Items such as, “In the past year, how often have you worried about having fat on your body?” were rated on 5-point Likert scales ranging from never (1) to always (5). An unweighted score for each participant and each domain was calculated as the mean of all items making up that domain. For the purpose of the present study, only selected domains were used (McKnight Risk Factor Survey, 2006)¹. Because our main interest was in ethnic differences in the relationships among body size, body image, and potentially risky eating behaviors, the present paper focuses on those domains directly related to these issues. The specific MRFS-IV domains included were: Domain 2, appearance appraisal (AA, 3 items), domain 4, binge eating (BE, 2 items), domain 15, overconcern with weight and shape (OWS, 5 items), domain 18, purging behavior (PB, 3 items), and domain 24, weight control behaviors (WCB, 7 items). Moderate to excellent internal reliability has been reported previously for all five of these domains. One of the three items making up appearance appraisal (Q31) was modified for males as follows: Males: “In the past year, how often have you felt attractive or handsome?” Females: “In the past year, how often have you felt attractive or pretty?” Convergent validity, internal reliability, and test-retest reliability have been reported for the OWS domain for girls (Shisslak et al.,

¹Individual items making up specific domains from the McKnight Risk Factor Survey (version 4 for grades 6–12), were used to assess body image concerns and eating behaviors, can be seen by accessing the link to the appropriate “survey” and the “scoring guide” at the Stanford University, Laboratory for the Study of Behavioral Medicine website: <http://bml.stanford.edu/mcknight/>. To correct the scoring guide, Appearance Appraisal items should be Q19 reverse scored, Q31, and Q54.

1999). Previous studies employing the WCB domain have shown it to correlate significantly with various measures of ED risk (Sherwood, et al., 2004; Shisslak et al., 1998).

Figure Rating Scale (FRS)—The FRS was originally designed to measure body shape satisfaction (Stunkard, Sorenson, & Schulsinger, 1983). In the present study we used the FRS to assess size preference by asking participants to circle one of nine gender-specific body shape figures perceived to be “most similar” to her or him self and then, using a second set of figures, to circle the figure that she or he “most preferred” to look like. A difference score (most similar minus most preferred) indicated the preference for a smaller (positive difference) or larger size (negative difference). Although numerous concerns have previously been raised regarding the psychometric properties of the FRS (e.g., Gardner, Friedman, & Jackson, 1998), especially for assessing body dissatisfaction among adolescents (e.g., Sherman, Iacono, & Donnelly, 1995) and males (Cafri, Thompson, & Barbau, 2004), our data revealed significant correlations between FRS difference scores and OWS scores both for males ($r = .368, p < .01$) and for females ($r = .507, p < .01$).

Anthropometric measures—Height and weight measurements were derived from front- and side-view photos of each participant taken while the student stood barefoot on a digital balance. Each photo included the image of a calibrated meter stick, which was subsequently used to determine height. ImageJ software, available from the National Institute of Mental Health, Research Services Branch (2006), was used to derive height measurements from the photos. Weight was read directly from the digital balance (Tanita BWB-800S). Body mass index was calculated from measured values of body weight (kilograms) and body height (meters) as kg/m^2 . We employed this photographic method in order to facilitate rapid and efficient non-subjective data collection within the restricted time schedule of students and schools. To our knowledge this method of calculating BMI has not previously been reported². BMI is generally considered the only practical noninvasive measure of relative body size for survey methods and thus is generally preferred over measures of body composition. For the purpose of ethnic group and gender comparisons, each participant’s BMI was transformed to an age- and gender-specific z-score according to the CDC’s BMI-for-age and –gender growth charts. For the purpose of comparison with the CDC norms, data from the current participants were sorted into one of three established BMI categories: Normal ($\leq 85^{\text{th}}$ percentile), At risk for overweight ($> 85^{\text{th}}$ and $< 95^{\text{th}}$ percentile), or Overweight ($\geq 95^{\text{th}}$ percentile).

Procedure

Prior to the start of data collection trained graduate research assistants met with Health Enhancement (HE) teachers in each of the targeted schools to discuss logistics and distribute parental information sheets along with copies of the survey materials to be used for parental review. A brief letter explaining the goals of the project and requesting parental cooperation accompanied these materials. Passive consent or “opt-out” forms were sent to all parents by school administrators at least two weeks prior to the beginning of data collection. Completed “opt-out” forms were returned by parents to each school and forwarded by the school to HE teachers, who were responsible for re-assigning these students to alternative locations and activities prior to the beginning of data collection.

Graduate and advanced undergraduate research assistants administered the surveys and gathered all other required data. Research assistants administered the surveys during two class periods in all HE classes at each school during the fall 2002 and spring 2003 semesters. Individual participant data were coded to maintain confidentiality. All data collection

²An unpublished manuscript describing the procedures used to validate the photographic method used to assess height and weight in the present study, and comparing the results to standard anthropometric methods, is available from the corresponding author upon request.

procedures were approved by the IRB of Montana State University-Bozeman and by the Billings District School Board or individual school administrators in Hardin and Ashland, MT.

The surveys were administered within HE classes at each school at a pre-arranged date convenient to teachers in that school. On the designated date research assistants (two males to work with boys and two females to work with girls in each classroom) brought paper-and-pencil survey materials to the schools in advance of scheduled HE classes. At the beginning of class, following a brief introduction by the teacher, students were divided by gender and males were moved temporarily to a vacant classroom or other area with seating and writing surfaces (e.g., cafeteria or gymnasium). This separation was necessary because some materials were gender-specific. Demographic and MRFS data were collected on Day 1. FRS and anthropometric data were collected on Day 2.

Results

Analysis of the demographic data revealed no significant age differences among ethnic groups or between genders. There was a significant difference in gender distribution across ethnic groups when all five groups were considered; however, the degree of association of gender with ethnicity was small ($\chi^2(4) = 14.90, p < .005$, *Cramér's V* = .077). As can be seen in Table 1, this group difference was largely due to the lower percentage of females in the Hispanic group. When only the three groups of primary interest were included (W, NA, and NA-mixed) there were significant differences in terms of the percent of households with two biological parents ($\chi^2(2) = 80.78, p < .001$, *Cramér's V* = .193) and the percent of households with two adults acting as parents ($\chi^2(2) = 39.67, p < .001$, *Cramér's V* = .136). Both these latter differences were due to the smaller percentage of two parent families (biological or otherwise) among the NA and NA-mixed groups. Not surprisingly, when asked to indicate the main language spoken at home, there were significant differences between ethnic groups, with the lowest percentage speaking English at home among the NA and Hispanic groups ($\chi^2(12) = 382.65, p < .001$, *Cramér's V* = .332). When only the NA and NA-mixed groups were compared, 12.2% (40 of 327) of NA participants reported speaking mainly their native language at home, while only 0.8% (1 in 127) of the NA-mixed group did so.

Table 2 shows internal reliability scores (Cronbach's α) for each of the five MRFS domains. Reliability measures were calculated first for all males and all females and then separately for each of the eight main subgroups. In the following analyses only comparisons for which the Cronbach's α was at least 0.65 are reported. As Table 2 shows, OWS and WBC had good internal reliability for both genders and for all subgroups. However, the AA domain had poor reliability for most of the male subgroups and for the NA female group. The PB domain was only reliable for the NA male group and the NA-mixed and Hispanic female groups. The BE domain was reliable for all female groups except Hispanic females, but only for the NA-mixed and Hispanic males.

Table 3 shows the number and percentage of male and female participants, by ethnic group, within each of three BMI ranges based on BMI-for-age (and gender) charts of the Centers for Disease Control (2006). Based on these data it is clear that NA boys had substantially higher BMIs than boys of all other ethnic groups, with 43.0% in the overweight category (95th percentile), compared to 24.9% of White boys, and 27.8% of all boys. This difference was similar for female groups in which 31.5% of NA girls were in the overweight category compared to 15.7% of White girls and less than 20% of all girls. As suggested by these results, chi-square analyses confirmed highly significant ethnic group differences among both male ($\chi^2(8) = 31.52, p < .001$, *Cramér's V* = .121) and female ($\chi^2(8) = 27.63, p = .001$, *Cramér's V* = .119) groups.

Table 4 shows the percentage distribution of preferences for smaller, same, or larger body sizes based on FRS difference scores for each of the ethnicity and gender subgroups. Chi-square analyses based on the data in Table 4 revealed no ethnic group differences in preferred body size for males ($\chi^2(8) = 8.57, p = .380, \text{Cramér's } V = .088$), but a significant difference for females ($\chi^2(8) = 19.38, p = .013, \text{Cramér's } V = .103$), which was mainly due to the much smaller percentage of White girls (4.6%) who reported wanting to be larger, compared to NA (9.6%), NA-mixed (14.1%), and Hispanic girls (15.0%). Regardless of ethnicity, boys consistently reported wanting to be larger more often than girls.

Group differences

Table 5 shows ethnic group and gender differences in the means and standard deviations of the five MRFS domain scores as well as BMI-for-age (and gender) z -scores. To test for ethnic group and gender difference in the magnitude of each of these dependent variables, univariate ANOVAs were carried out for BMI z -scores (BMI) as well as each of the five MRFS domain scores with gender and ethnic group as independent variables. Post-hoc multiple comparisons (Bonferroni-adjusted Student's t) assessed differences among individual ethnic groups. For BMI there were no significant gender differences nor ethnic group by gender interactions, but there were significant ethnic group differences ($F(4, 2054) = 13.55, p < .001$). Post-hoc tests confirmed that Native Americans as a group had significantly higher mean BMI z -scores than all other ethnic groups (Table 5, $p < .001$ for each pair-wise comparison). None of the other ethnic group differences was statistically significant.

In contrast to BMI, there were no significant ethnic group differences or ethnic group by gender interactions for AA, OWS, or BE. However, there were significant gender differences for both body image variables (AA and OWS) and for all three eating-related behaviors (BE, PB, and WCB ($p < .001$)). In all cases, females were significantly more dissatisfied with appearance, more concerned about weight and shape, and more engaged in risky eating behaviors than males. In the case of PB, there were also significant ethnic group differences. Post-hoc comparisons showed that the both the NA and NA-mixed groups had significantly higher PB scores than their White peers. Finally, there were significant ethnic group differences, as well as a significant ethnicity by gender interaction in the case of WCB scores ($p < .001$). Group differences in WCB scores are shown in Figure 1, which illustrates that girls uniformly had significantly higher WCB scores than males and that NA males had significantly higher scores, on average, than their peers.

Correlations among BMI and MRFS domain scores

In order to assess the degree of association among BMI z -scores and the five MRFS domain scores, bivariate (Pearson's) correlations were calculated separately for each ethnicity and gender subgroup as well as for all males and all females. The following correlations were considered significant if $p < .01$.

Considering females first, BMI was significantly correlated with OWS and WCB for all five female groups. BMI was also significantly correlated with AA for four of the five female groups, with the exception of Hispanic girls. BMI was not significantly correlated with BE for any of the female groups. OWS and AA were significantly positively correlated for all girls combined and for four of the five female subgroups, with the exception of the NA girls (for whom the AA domain was not reliable). It may be noteworthy that bingeing (BE) and purging (PB) were positively correlated with each other only for the White girls, although the PB, in this case, had only moderate internal reliability ($r = .616$). BE was significantly correlated with WCB scores among females in general ($p < .001$) and among the White and NA-mixed but not the NA female groups. Finally, OWS was significantly correlated with PB for females in general and for each of the individual female subgroups. Although there were many differences

between groups in the magnitudes of the above correlations, none of these differences were statistically significant.

Among males, regardless of ethnicity, BMI was significantly correlated with the OWS and WCB. In this regard males were similar to females. Somewhat more surprising was the fact that among the NA boys BMI was significantly positively correlated with purging behavior (PB) and that purging was significantly positively correlated both with weight and shape concerns (OWS) and with weight control behaviors (WCB).

Native American cultural identity

A number of previous studies have suggested that individuals who identify more with the White cultural ideal of thinness may be at greater risk for body dissatisfaction and eating disorders than individuals who maintain more traditional cultural values. Perhaps differences in cultural identity between the NA and NA-mixed groups might account, at least in part, for the differences between these groups in BMI and ED risk. As noted above, a much smaller percentage of participants in the NA-mixed group reported speaking English as their main language at home. This might suggest a greater level of acculturation to the White, English-speaking culture among members of this group. Consistent with this idea, when we compared these two groups in terms of their Native American Cultural Identity (NACI), we found a highly significant difference ($\chi^2(3) = 14.62, p = .002$, *Cramér's V* = .152) with a smaller percentage of the NA-mixed group holding traditional Native cultural values. To determine whether NACI significantly predicted differences in ED risk, we carried out additional analyses (ANOVAs) using data from the NA and NA-mixed groups, with NACI and gender as independent variables and each of the MRFS domain scores and BMI as dependent variables. In the case of BMI, there were marginally significant main effects both of NACI ($F(1, 499) = 3.10, p = .026$) and gender ($F(1, 499) = 5.12, p = .024$), but no significant interaction. In general, males and those who reported more traditional Native American values tended to have higher BMI *z*-scores. There were also highly significant main effects of NACI on WCB scores ($F(1, 627) = 4.34, p < .005$) and gender ($F(1, 627) = 8.14, p = .004$) but no NACI-by-gender interaction. In this case, girls and those reporting more traditional values had higher average WCB scores. In the case of weight and shape concerns (OWS), the effect of NACI was not significant ($F(3, 627) = 2.52, p = .057$). There were no significant effects of NACI on either binge eating (BE) or purging behaviors (PB).

Discussion

BMI-related differences

Based on previous research we expected Native American students, irrespective of gender, to have significantly higher BMI *z*-scores than their peers. To our surprise the rates of overweight among the NA participants in the present study exceeded even those reported in previous large-scale studies. Zephier, Himes, and Story (1999), for instance, surveyed more than 12,000 Native American children and adolescents from 16 tribes in Iowa, Nebraska, North, and South Dakota and found that 38% of girls and 39% of boys were above the 85th percentile for age and gender, while 18% of girls and 22% of boys were above the 95th percentile. By comparison we found that 51% of NA girls and 54% of NA boys were above the 85th percentile, while 31% of NA girls and 43% of NA boys were above the 95th percentile. Remarkably, nearly twice as many students in the NA group were at or above the 95th percentile of BMI-for-age and gender compared to all other groups, including the NA-mixed group (Table 3).

The fact that participants in the NA-mixed group, despite identifying themselves as Native American, had BMI *z*-scores similar to their non-Native peers, suggests that these individuals differ substantially from their peers with two Native parents. The failure to separate participants

according to the number of Native American parents may, in part, account for the lower reported BMI *z*-scores for Native Americans in previous large-scale surveys (e.g., Zephier et al., 1999). However, the greater overweight in our study may also reflect true differences among tribal groups or across geographic locations. Clearly there is a crucial need for additional data on this issue derived from representative national samples that are assessed periodically over time.

Although the BMI differences associated with differences in Native American Cultural Identity suggest that Native adolescents holding more “traditional” values have significantly higher BMI *z*-scores, these differences were rather small – on the order of about 0.3 *z*-score units compared to the CDC norms – and probably cannot account for the large BMI differences between the NA and NA-mixed groups. Clearly, acculturation is only one of many potentially important differences between NA and NA-mixed groups that may account for some part of this BMI difference. Other factors such as degree of Native inheritance, socioeconomic status, family cohesion, strength of social support networks, and other factors may also contribute to this difference. Sorting out the relative contributions of these factors will require a great deal more careful research.

Body Size Preference

Although we made no *a priori* predictions, we found significant ethnic group and gender differences in terms of body size preference as indicated by FRS difference scores (Table 4). Most striking was the difference among female groups in the percentages who reported wanting a larger body size. While only 4.6% of White girls reported wanting to be larger, more than twice this percentage of NA girls (9.6%), and more than three times as many NA-mixed (14.1%) and Hispanic (15%) girls said they wanted to be larger. Differences in size preference among male groups were less pronounced and it is particularly notable that fewer NA males indicated a desire to be larger compared to all other male groups. This is probably related to the fact that, on average, NA boys were already substantially larger than their non-Native peers (Table 3). Consistent with previous research (Rinderknecht & Smith, 2002), a significantly larger percentage of boys than girls reported wanting to be a larger size and nearly 60% of both genders reported a preference for a size different than their current body size.

BMI and ED Risk

One of the main purposes of the present study was to investigate the relationships among BMI, body concerns, and potentially risky eating behaviors. As noted in the introduction, previous research has suggested that the relationship between BMI and body dissatisfaction may vary among ethnicity and gender groups. For instance, Yates et al., (2004) found that BMI was strongly correlated with body dissatisfaction among some groups, including White females and Filipino males, but less strongly correlated among others, including White males and Japanese females. Similarly, Caradas et al. (2001) in a study of Black and White South African girls, reported that although Black girls had significantly higher BMIs than White girls, White girls had significantly more body shape concerns than Black girls.

Based on such evidence, we predicted that BMI would be positively correlated with weight and shape concerns and with risky eating behaviors for all ethnic groups and both genders and, further, that the strength of this association would vary among groups. Our data revealed a more complex picture than predicted with many similarities but also some notable differences among ethnicity and gender subgroups. As expected, BMI was strongly positively correlated with weight and shape concerns (OWS) and with dieting and exercising to control weight (WCB) among all ethnic groups and both genders. Among females BMI was also significantly correlated with negative appearance appraisal (AA) for all but the Hispanic girls. In contrast to dieting and exercising behaviors (assessed by WCB), BMI was not associated with binge

eating or purging behaviors among most male or female groups. One exception was the surprising finding that BMI was significantly positively correlated with purging behavior (PB) among the NA boys. Further research will be needed to confirm (and begin to understand) this unexpected result for NA boys. Also unexpected was the finding that binge eating and purging were significantly positively correlated with each other only among White girls. The fact that a strong binge-purge association was not found for Native American girls, may suggest that Native girls are less likely to develop bulimic symptoms. However this is merely speculation at present, since no studies of prevalence rates for clinical eating disorders among Native Americans are currently available.

Within female groups we found ethnic group differences similar to those reported previously by others (e.g., Caradas et al., 2001; Stevens et al., 1999; Yates et al., 2004). Thus, it appears that although they are thinner than other female groups in this study, White females are less likely to want to be larger, are equally or more dissatisfied with their current body size, and are equally likely to be engaging in risky weight control behaviors than their non-White peers. Finally, consistent with previous research, we found many ethnic and gender differences in the strength of association between BMI and measures of ED risk; however, none of these differences reached the level of statistical significance.

Ethnic and Gender Differences in ED Risk

As expected, significant gender differences were found for all of the MRFS risk domains, with females at higher apparent risk than males. However, there were also two notable ethnic group differences. In the first instance, a significant gender difference and a significant ethnicity by gender interaction was found in the case of the WCB variable. Figure 1 shows that the interaction was due mainly to Native American males engaging in more weight control efforts than all other male groups. Another potentially important ethnicity difference was the finding that NA and NA-mixed groups had significantly higher mean purging (PB) scores than their White counterparts. This difference together with the finding of a significant positive correlation between BMI and purging among NA boys, suggests that purging behavior may be a serious problem for Native adolescents, particularly for overweight boys. This may foreshadow even greater future problems if the obesity epidemic in Native American communities continues to grow.

Native American Cultural Identity

Many factors associated with cultural or ethnic differences have been proposed as possible sources of differences in eating problems or ED risk. Although the current study was not specifically designed to investigate such factors, we expected that Native Americans, especially girls, who were more acculturated to the White norms and values, might show more weight concerns and more risky eating behaviors than their more traditional peers. Although Native American Cultural Identity significantly associated with two ED risk factors, the direction of these associations was not as predicted. In the first case, we found a small but significant difference in BMI *z*-scores with higher scores among individuals holding more traditional Native values. This may reflect an acceptance of larger body sizes by more traditional Native participants. In addition, participants holding more traditional Native values reported significantly higher WCB scores. Thus, contrary to the “two-world” hypothesis, it appears that greater ED risk is associated with *less*, rather than more, acceptance of modern or White majority values among Native adolescents.

Summary of Results

Regardless of ethnicity or gender, BMI was positively correlated with body concerns and weight control behaviors. The current study found a much higher percentage of Native American adolescents of both genders who were overweight than in previous studies. Further,

more than twice as many Native American and Hispanic girls, as White girls, reported wanting a larger body size. Boys with two Native parents were more likely than other boys to be engaged in weight control behaviors, including purging behaviors, to control their weight. Although girls reported more body concerns and more risky behaviors than boys, regardless of ethnicity, boys indicated substantial weight and shape concerns and were only slightly less likely than girls to engage in risky weight control behaviors. A particularly notable and robust finding was that Native participants from families with only one Native parent were much *less likely* to be overweight, to have weight and shape concerns, or to engage in risky eating behaviors than their peers with two Native American parents. Finally, Native participants who were more acculturated to White majority values (i.e., held less traditional values) were significantly *less likely* to be overweight, to express body weight concerns, or be engaged in risky eating behaviors.

Strengths and Limitations

One of the major strengths of the present study is the size of the Native American sample. Although some large school-based surveys have previously obtained measures of BMI and weight control behaviors in multiethnic samples including Native adolescents (e.g., French et al., 1997; Neumark-Sztainer et al., 2002), none to our knowledge, have carefully examined the relationships among BMI, weight and shape concerns and weight control behaviors. In this sense, the present results confirm and extend previous findings suggesting that Native American adolescents may be at particularly high risk of eating-related problems.

A serious limitation of this study was the poor reliability of some MRFS measures for some ethnicity or gender subgroups. We chose the McKnight Risk Factor Survey because it had been used previously in multiethnic adolescent studies and covered a broad range of potential risk factor domains (Taylor et al., 2003). Unfortunately, some of these domains proved unreliable with our sample. Given the multifaceted nature of the body image concept (Thompson, 2004), future research will be needed to further clarify the most important cognitive and behavioral dimensions of body image and how best to assess them given the apparent diversity of ethnicity and gender differences. This is particularly important when non-English speakers are involved. In addition, more robust measures of restrictive eating, exercising to control weight, as well as binge eating and purging may be needed for future cross-cultural and cross-gender research. Another limitation is that we were not able to explore a larger range of the many potentially important determinants of ethnic differences in ED risk. Although our data suggest that Native Americans with one versus two Native parents are quite different in term of BMI and some measures of ED risk, much more needs to be done to determine the relative roles of genetics and environment. Aside from genetic heritage, environmental factors such as socioeconomic status, family dynamics, acceptance of Western values, and availability of social support systems need to be examined in much more detail.

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Figure 1.

Group mean Weight Control Behavior (WCB) scores (± 1 SD) for each of five ethnicity and gender subgroups. Analysis of variance confirmed significant main effects for ethnic group and gender as well as a significant interaction, as illustrated mainly by male group differences (all $p < .001$).

Table 1

Sample descriptive statistics for five ethnic groups

Ethnic group	<i>n</i>	Age <i>M (sd)</i>	% Female	% 2-biological	% 2-adult	% English
White	1520	13.8 (1.7)	46.6	55.6	77.8	99.1
NA	489	13.6 (1.8)	51.7	39.8	65.7	80.4
NA-mixed	197	13.3 (1.8)	54.3	34.7	62.9	92.9
Hispanic	186	13.5 (1.7)	39.2	43.6	66.3	82.9
Other	166	13.5 (1.6)	51.8	38.7	64.4	88.4

Note. NA= Native American; NA-mixed = One biological parent is Native American. Participants in the “Other” group included those who indicating ethnicity as Black, Asian, or mixed (other than NA-mixed). % 2-biological parents = Percentage within each ethnic group who are from households with two biological parents. % 2-adults parents = Percentage within each ethnic group who are from households with two adults who act as parents. % English = Percentage within ethnic group who are from households in which English is the primary language spoken.

Table 2
Internal reliability scores (Cronbach's Alpha) for five domains of the McKnight Risk Factor Survey, version 4, by ethnic group

Gender	Ethnic group	Cronbach's α for selected MRFS domains				
		AA (Dom2)	BE (Dom4)	OWS (Dom15)	PB (Dom18)	WCB (Dom24)
Male	White	.607	.585	.801	.573	.878
	NA	.335	.580	.744	.692	.874
	NA-mixed	.384	.706	.792	.423	.877
	Hispanic	.487	.691	.788	.281	.891
	All males	.531	.611	.790	.646	.876
Female	White	.747	.717	.891	.616	.905
	NA	.565	.673	.850	.505	.885
	NA-mixed	.664	.708	.863	.752	.892
	Hispanic	.717	.580	.838	.711	.890
	All females	.690	.696	.873	.625	.898

Note. AA = MRFS appearance appraisal domain 2 score; BE = MRFS binge eating domain 4 score; OWS = MRFS overconcern with weight and shape domain 15 score; PB = MRFS purging behavior domain 18 score; WCB = MRFS weight control behavior domain 24 score. Ethnic groups are the same as in Table 1.

Table 3
Number and percentage (%) of participants in each of three BMI ranges by ethnic group

Gender	Ethnic group	BMI range (percentile)					Total
		Normal ($\leq 85^{\text{th}}$)	%	At-risk ($> 85^{\text{th}}$)	%	Over ($\leq 95^{\text{th}}$)	
Male	White	379	56.2	127	18.8	168	674
	NA	67	36.0	39	21.0	80	186
	NA-mixed	44	56.4	16	20.5	18	78
	Hispanic	49	52.7	20	21.5	24	93
	Other	30	58.8	10	19.6	11	51
	All Boys	569	52.6	212	19.6	301	1082
Female	White	350	60.2	140	24.1	91	581
	NA	96	48.7	39	19.8	62	197
	NA-mixed	40	48.8	24	29.3	18	82
	Hispanic	35	66.0	9	17.0	9	53
	Other	33	55.0	14	23.3	13	60
	All Girls	554	56.9	226	23.2	193	973

Note. Normal = normal weight, At-risk = at risk of overweight, and Over = overweight. BMI = body mass index z-score based on CDC BMI-for-age and –gender tables. Ethnic groups are the same as in previous tables.

Table 4
Size preference percentages based on Figure Rating Scale (FRS) difference scores

Gender	Ethnic group	Percent within gender		
		Smaller	Same	Larger
Male	White	34.3	40.3	25.4
	NA	39.8	44.5	15.7
	NA-mixed	31.7	42.7	25.6
	Hispanic	36.0	40.0	24.0
	Other	32.7	41.8	25.5
	Mean %	35.2	41.3	23.6
Female	White	50.8	44.6	4.6
	NA	51.8	38.6	9.6
	NA-mixed	48.7	37.2	14.1
	Hispanic	47.5	37.5	15.0
	Other	47.1	49.0	3.9
	Mean %	50.5	42.6	6.9

Note. Smaller = preference for smaller size (positive FRS difference); Same = preference for same size (no FRS difference); and Larger = preference for larger size (negative FRS difference). Ethnic groups are the same as in previous tables.

Table 5
Group mean and standard deviations of BMI z-scores and McKnight Risk Factor Survey (MRFS) domain scores

Gender	Ethnic group	BMI <i>M</i> (<i>SD</i>)	AA <i>M</i> (<i>SD</i>)	BE <i>M</i> (<i>SD</i>)	OVS <i>M</i> (<i>SD</i>)	PB <i>M</i> (<i>SD</i>)	WCB <i>M</i> (<i>SD</i>)
Male	White	0.79 (1.10)	3.66 (0.88)	1.86 (0.91)	1.70 (0.79)	1.06 (0.30)	1.59 (0.72)
	NA	1.33 (0.99)	3.56 (0.82)	1.77 (0.87)	1.90 (0.81)	1.14 (0.39)	1.92 (0.84)
	NA-mixed	0.77 (1.09)	3.47 (0.80)	1.74 (0.90)	1.80 (0.83)	1.13 (0.43)	1.74 (0.80)
	Hispanic	0.87 (1.05)	3.86 (0.91)	2.05 (1.11)	1.83 (0.89)	1.13 (0.38)	1.68 (0.83)
	Other	0.71 (1.37)	3.81 (0.84)	1.85 (1.05)	1.70 (0.88)	1.10 (0.55)	1.58 (0.72)
	All Boys	0.89 (1.11)	3.65 (0.87)	1.85 (0.93)	1.75 (0.81)	1.09 (0.35)	1.66 (0.77)
Female	White	0.74 (0.88)	3.26 (0.92)	1.94 (0.91)	2.53 (1.09)	1.13 (0.40)	2.09 (0.89)
	NA	1.05 (0.93)	3.23 (0.87)	1.94 (0.94)	2.51 (1.01)	1.17 (0.40)	2.12 (0.87)
	NA-mixed	0.81 (1.01)	3.19 (0.99)	1.95 (0.97)	2.58 (1.10)	1.23 (0.63)	2.08 (0.94)
	Hispanic	0.61 (1.01)	3.21 (1.01)	2.05 (0.97)	2.55 (1.08)	1.17 (0.49)	2.07 (0.93)
	Other	0.86 (0.93)	3.16 (1.02)	1.82 (0.82)	2.46 (1.04)	1.19 (0.51)	2.10 (0.89)
	All Girls	0.81 (0.92)	3.24 (0.93)	1.94 (0.92)	2.53 (1.07)	1.16 (0.44)	2.10 (0.89)

Note. Mean (*M*) and standard deviation (*SD*) of BMI and MRFS domain scores. BMI = body mass index z-score based on CDC BMI-for-age and –gender tables; AA = MRFS appearance appraisal domain 2 score; BE = MRFS binge eating domain 4 score; OVS = MRFS overconcern with weight and shape domain 15 score; PB = MRFS purging behavior domain 18 score; WCB = MRFS weight control behavior domain 24 score. Ethnic groups are the same as in previous tables.