Correlates of Overweight and Obesity in American Indian Children*

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Objective To identify risk factors that may contribute to the development and/or maintenance of overweight and obesity in American Indian children. **Methods** The sample consisted of 291 tribally enrolled American Indian children. Body mass index (BMI) was measured by a tribal program and children completed self-report measures during health class. Hierarchical multiple regression analyses were conducted for 232 children and included three blocks of predictor variables (diet and physical activity, weight-related attitudes, and psychosocial variables). **Results** Thirty-three percent of children were obese and 20% were overweight. Diet and physical activity (7.6%) and weight-related attitudes (31.9%) made significant contributions, explaining 39.5% of the variance in BMI. **Conclusions** Greater BMI scores were related to healthier food choice intentions, more hours of television viewing, greater body dissatisfaction, higher negative attitudes toward body size, and more weight loss attempts.

Key words American Indian; childhood; obesity; overweight.

Introduction

Overweight and obesity rates are higher than national prevalence in several American Indian tribes including the Mescalero (Hauck, 1992), Southwest US tribes (Broussard et al., 1991), Navajo (Gilbert, Percy, Sugarman, Benson, & Percy, 1992), Pueblo (Davis, Gomez, Lambert, & Skipper, 1993), and tribes from the Northern Plains (Zephier, Himes, & Story, 1999). Ethnic minority children, including those of American Indian descent, are at high risk for becoming overweight and obese (Kumanyika, 1993; Story et al., 1999). In a study of children attending seven American Indian elementary schools, Caballero et al. (2003) found that over 30.5% of girls and 26.8% of boys were overweight [body mass index (BMI >95th percentile)] and 21% of girls and 19.6% of boys were at risk for becoming overweight (BMI between 85 and 95th percentile).

Diet and Physical Activity

Although insufficient physical activity (Dietz & Gortmaker, 1985; Epstein, Smith, Vara, & Rodefer, 1991; Gordon-Larsen, Adair, & Popkin, 2002) and unhealthy eating patterns (Bronner, 1996) are important predictors of increased risk for obesity in all children, several researchers have suggested additional explanations for the high rates of overweight and obesity in American Indian children. Relevant theories suggest that American Indians may have a genetic predisposition for obesity (Crawford, Story, Wang, Ritchie, & Sabry, 2001). Others have suggested the importance of recent exposure to westernized foods (Gittelsohn et al., 1996; Knowler, Pettitt, Savage, & Bennett., 1981); insufficient availability of healthy foods (Story et al., 1999), in part, due to lower socioeconomic levels (Crawford et al., 2001); and physical inactivity (Stevens et al., 2004) that may be associated with environmental barriers (Fontvieille, Kriska, & Ravussin, 1993; King et al., 2000; Thompson et al., 2001).

Weight-related Attitudes

Data from *Pathways*, a large, 8-year school-based obesity prevention project with 41 schools (1,704 students) in seven American Indian tribes from Arizona, South Dakota, Utah, and New Mexico, suggest important relationships between weight-related attitudes, body image, and dieting in American Indian children (Davis & Lamber, 2000; Stevens, Cornell et al., 1999; Stevens, Story, et al., 1999; Story et al., 2001). These data show that many American Indian children are dissatisfied with their body size and are practicing weight modification techniques such as following restrictive diets, skipping meals, and increasing

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exercise. Alarmingly, recent studies report that dieting may contribute to the development of increased fat mass in children (Tanofsky-Kraff et al., 2006) and increased BMI in adolescents (Neumark-Sztainer, Wall, Haines, Story, & Eisenberg, 2007). Even though it is recommended to interpret youth ''dieting'' reports cautiously (Neumark-Sztainer & Story, 1998), these data are concerning considering that 56% of 1,441 American Indian students (grade 3–5) endorse a history of dieting for weight loss, and dieting was more common among heavier children (Story et al., 2001). Story et al. (2001) is the only study examining weight-related attitudes (i.e., attitudes toward body size, dieting, and body dissatisfaction) in relation to BMI in American Indian children.

Psychosocial Variables

Cultural Identity

Studies with American Indians suggest that high cultural identification is associated with overweight and obesity through social acceptance of heavier body types (Ravussin, Valencia, Esparza, Bennett, & Schulz, 1994; Stevens, Story et al., 1999; White et al., 1997). However, others postulate that living and maintaining a traditional lifestyle (i.e., eating traditional foods and being physically active) may prevent obesity (Ravussin et al., 1994). Although these studies suggest a possible relationship between weight and acculturation, only one study, Stevens, Story, et al. (1999), has examined this issue in American Indian children. Findings indicate that compared to children with weaker cultural identity, children with strong cultural identity viewed heavier body types as healthier.

Self-Esteem

It has been suggested that social stigma associated with obesity significantly contributes to lower self-esteem in obese children (Kimm, Sweeney, & Janosky, 1991; Sheslow, Hassink, Wallace, & DeLancey, 1993). However, some older studies have failed to find significant differences in self-esteem between obese and normal-weight children (Mendelson & White, 1982; Wadden, Foster, Brownell, & Finley, 1984). This issue has not been examined in American Indian children, but Story et al. (2001) recommends including self-esteem measures in future American Indian weight-related research.

Emotional Eating

Research indicates that some obese or overweight children tend to ''emotional eat,'' or eat as a way of coping with negative affect, and/or binge eat (Caccialanza et al., 2004; Shapiro et al., 2007; Tanofsky-Kraff et al., 2007). Emotional eating has recently been described in obese pediatric samples (Goossens, Braet, & Decaluwé, 2007), and emotional eating's concomitant binge eating has been associated with increased body mass in children (Tanofsky-Kraff et al., 2006). Other studies, however, have not found relationships between emotional eating and size or weight (Caccialanza et al., 2004; Tanofsky-Kraff et al., 2007); yet to our knowledge, there are no studies examining the potential relationship between emotional eating and overweight and obesity in American Indian children.

Present Study

The purpose of this study was to examine relationships between American Indian children's BMI and diet and physical activity, weight-related attitudes, cultural identity, self-esteem, and emotional eating. Identification of predictors of overweight and obesity could assist in the design and development of primary and/or secondary prevention programs for American Indian youth.

Research Methods

Participants

All third- through fifth-grade students enrolled in an elementary school located on an American Indian reservation in the Northern Plains of the US were eligible to participate in this study ($N = 384$). Informed consent was received for 301 students, and data for all children identifying themselves as American Indian ($N = 291$; 153 girls, 137 boys, 1 child did not report gender) were included in this article's analyses (analyses with fewer participants resulted from missing data on individual measures). Participants ranged in age from 8- to 12-years old. The majority of participants (53%) reported living with their mother and father, while 25% reported living with mother only, 8% reported living with their father only, 8% reported living with grandparents, and 3% reported living with foster parents.

Measures

BMI

Weight and height were directly measured by staff from the Tribal Diabetes Prevention Program (TDPP). The TDPP sent home a letter instructing students to wear light-weight clothes on the day of assessment. Weight and height were measured during a regularly scheduled physical education class and those students who were not present that day were not included in the assessment. Students were instructed to remove their shoes and jackets/heavy sweatshirts prior to being weighed. The TDPP conducts annual assessments of weight and height for the purpose of

obtaining BMI and are well trained in this assessment protocol. The following weight status classifications were used to describe this sample: obese (BMI >95th percentile); overweight (BMI between the 85th and 95th percentile); healthy weight (BMI between the 5th and 84th percentile); and underweight (BMI <5th percentile) (Expert Committee Recommendations for Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity, January 2007).

Diet and Physical Activity

Diet (i.e., food choice intentions, knowledge of fatty foods, and food self-efficacy) was assessed using the following three measures abstracted from the Knowledge, Attitudes, and Behaviors questionnaire (KAB: Stevens, Cornell et al., 1999).

Food Choice Intentions

This is an eight-item (Cronbach's $\alpha = .76$; Stevens, Cornell et al., 1999) self-report questionnaire assessing healthy food choice intentions. Healthy food choices were presented in an eight-item pictorial dichotomous format. Healthy food choices were awarded a score of one and unhealthy selections a score of zero. Scores were summed and totaled as described previously in Story et al. (2001).

Knowledge of Fatty Foods

This scale consists of six-items (Cronbach's $\alpha = .56$; Stevens, Cornell et al., 1999) assessing knowledge of fatty foods. Children were instructed to identify which of two foods presented in a pictorial format contained more ''fat.'' One point was awarded for correct responses and zero points for incorrect and ''don't know'' responses. Scores were summed and total scores were used in analyses.

Food Self-efficacy

This scale consists of 12 likert-type items (Cronbach's $\alpha = .76$; Stevens, Cornell, et al., 1999); four items assessing children's perceived ability to participate in physical activity and eight items assessing their perceived ability to select healthy food items. The eight items associated with food self-efficacy were used in this study with higher scores indicating higher food self-efficacy.

Physical Activity

Three items assessing physical activity were extracted from the Youth Risk Behavior Surveillance System (YRBSS) to examine activity level in participants within the past 7 days (how many days did you exercise or participate in physical activity for at least 20 min that made you sweat and breathe hard; how many days did you participate in physical activity for at least 30 min; how many days did you do exercise to strengthen or tone your muscles) (Centers for Disease Control and Prevention [CDC], 1999). Students were also asked to report their most common barrier to physical activity from the following options: (a) there are none here for me to do; (b) I'm too tired; (c) I don't like my body; (d) I don't have a ride to the fitness center; and (e) I don't feel safe because there are no leash laws. Barriers to physical activity were included for descriptive purposes and were not included in the regression analyses.

Television Viewing

One item from the YRBSS (On a regular day after school, how many hours do you watch television?) was used to assess inactivity.

Weight-related Attitudes

Body Dissatisfaction

Body contours included in the KAB questionnaire (Stevens, Cornell, et al., 1999) were used to assess participant's perceptions of healthy body image and body image dissatisfaction. This scale consisted of eight contour drawings that have been adapted to resemble American Indian children and range from very underweight to very overweight. Children were instructed to answer the following questions pertaining to body image: (a) which image shows the size that you think you are; (b) which image would you most like to look like?

Healthy Body Perception

An additional question was included in the body dissatisfaction measurement (Stevens, Cornell, et al., 1999) to assess healthy body perception. Children were asked to circle the body image that appeared most healthy.

Attitudes Toward Body Size

As in previous studies (Stevens, Story, et al., 1999), attitudes toward body size were measured using three questions from the original five-item Body Image subscale of the KAB (Cronbach's $\alpha = .57$; Stevens, Cornell, et al., 1999). These questions ask whether they believe they are (a) too skinny; (b) about right; or (c) too fat.

Attempted Weight Loss

To assess experiences with dieting or other weight loss attempts, six dichotomous items (e.g., have you ever tried to lose weight, are you now trying to lose weight, I exercised more to lose weight) were selected from the Weight-related Attitudes sections of the KAB questionnaire (Cronbach's $\alpha = .67$; Stevens, Cornell, et al., 1999), as used previously by Story, et al. (2001).

Psychosocial Variables

Emotional Eating

The four-item emotional eating subscale (Cronbach's $\alpha = .86$; Van Strien, Frijters, Bergers, & Defares, 1986) of the Dutch Eating Behaviors Questionnaire (DEBQ) (Van Strien et al., 1986) was used to measure emotional eating.

Self-esteem

Self-esteem was measured with the six-item Global Self-Worth subscale (Cronbach's $\alpha = .78$; Harter, 1985) of the Self-Perception Profile for Children (SPPC) (Harter, 1985). Each item received a score between one and four, with four representing the most adequate self-judgment and one representing the least adequate self-judgment.

Cultural Identification

This seven-item survey included in the KAB questionnaire (Stevens, Cornell, et al., 1999; Stevens, Story, et al., 1999) was used to assess level of ethnic identity. Each response was scored zero or one, and responses were then summed with higher scores indicating greater cultural identity. Adequate internal validity (Cronbach's $\alpha = .60$) and test–retest correlation ($r = .70$) has been reported by Stevens, Story, et al. (1999).

Procedures

This study was approved by the Institutional Review Board and tribal officials. Active consent was obtained from parents and children signed assent forms. Collection of BMI scores was completed in collaboration with the TDPP. Prior to administration of survey packets, a small sample of elementary teachers ($n = 4$) reviewed questionnaires to assess the readability and appropriateness of material for children in grades three through five. The content of the questionnaires was not altered, and only minor modifications (e.g., adding detailed instructions to the SPPC self-esteem scale) were recommended by teaching staff. Children were asked to complete a survey packet (~60 min) during a regularly scheduled health period. Teaching staff presented the material orally item-by-item for the entire class, while students were responsible for filling in the questionnaires.

Data Analyses

SPSS 14.0 was utilized to analyze the data. Descriptive statistics were conducted to examine the nature and characteristics of the sample. Pearson correlation analyses were used to determine the strength and direction of relationships between groups of selected variables. Finally, the primary analyses consisted of a series of multiple regressions conducted to examine predictors of children's BMI. These analyses were structured hierarchically to investigate the contributions of the following three blocks of predictor variables: (a) diet and physical activity (i.e., food choice intentions, knowledge of fatty foods, food self-efficacy, physical activity, and television viewing); (b) weight-related attitudes (i.e., body dissatisfaction, healthy body perception, attitudes toward body size, and attempted weight loss); and (c) psychosocial variables (i.e., self-esteem, emotional eating, and cultural identity). This hierarchical structure was based on the extent of supporting literature with variables in the first block having the most support and variables in the third block representing more exploratory avenues toward understanding obesity in American Indian children.

Results

Physical Characteristics

BMI scores and categories, as assessed by measuring heights and weights, were collected for 259 students. BMI scores ranged from 14.20 to 41.20 (m/kg^2) with a mean of 21.68 and a *SD* of 4.75. BMI scores were used to classify the percentage of participants as underweight (<1%), normal or healthy weight (47.1%), overweight (19.7%), or obese (32.8%) using recent standards developed by the Expert Committee Recommendations (http://www.ama-assn.org/ama1/pub/upload/mm/433/ped_obesity_recs.pdf).

Diet and Physical Activity

The majority of participants selected the healthier food item for five of the eight food pairs presented. The three exceptions were choosing corn with butter (95%) over corn without, regular pop (52%) over diet pop, and ice cream (56%) over popsicles. Children also demonstrated high knowledge of fatty foods, selecting the correct item for five out of six food pairs. The one exception was the fry bread/tortilla comparison when 25% believed that the tortilla had more fat than the fry bread and 32% did not know whether a fry bread or tortilla contained more fat.

Students reported engaging in some type of physical activity at least 4 days per week. Barriers to engaging in physical activity included not having a ride to the community fitness center (21%); not feeling safe on the bike path because there are no leash laws (18%); not having activities to do (14%); being too tired (10%); and not liking my body (3%). As for television viewing, 12% of children reported watching television ≥5 hr a day, 8% 4 hr per day, 12% 3 hr per day, 19% 2 hr per day, 23% 1 hr per day, 19% <1 hr per day, and 8% did not watch television at all.

Table I. BMI with Diet and Physical Activity Correlational Matrix

Item	BMI	FCI	KFF	FSE	PA	TV
BMI	–					
FCI	.18**	–				
KFF	.11	.17**	–			
FSE	.08	.35**	.14*	–		
PA	−.04	.04	.09	.24**	–	
TV	.14*	−.24**	.03	−.05	−.12*	–

FCI, food choice intentions; KFF, knowledge of fatty foods; FSE, food self-efficacy; PA, physical activity; TV, television viewing.
*$p < .05$; **$p < .01$.

Table II. BMI with Weight-related Attitudes Correlational Matrix

Item	BMI	BD	HBP	ATBS	AWL
BMI	–				
BD	.44**	–			
HBP	−.07	−.20**	–		
ATBS	.46**	.40**	−.09	–	
AWL	.51**	.32**	−.15*	.47**	–

BD, body dissatisfaction; HBP, healthy body perception; ATBS, attitude toward body size; AWL, attempted weight loss.
*$p < .05$, **$p < .01$.

Weight-related Attitudes

Attitudes toward body size revealed that the majority of participants (70%) believed that their body was ''just right,'' while 23% believed they were ''too fat,'' and 7% believed they were ''too skinny.'' Similarly, 68% reported that they were happy with their weight or never think about it, while 32% reported being unhappy with their current weight. Despite these attitudes, 51% of participants reported that they would like to be skinnier than they are now and only 49% reported being satisfied with their current weight. Similarly, 58% of participants reported trying to lose weight in the past, and 41% reported currently trying to lose weight. The following weight loss methods were reported by participants: changed diet (54%), exercised more (61%), skipped a whole meal (26%), and skipped meals for entire day (15%).

Bivariate Correlations Between BMI and Diet and Physical Activity

Correlations between BMI, diet, and physical activity measures showed that BMI was positively correlated with food choice intentions ($r = .18$, $p < .01$) and television viewing ($r = .14$, $p < .05$). These and other correlations between BMI, diet, and physical activity measure can be found in Table I.

Bivariate Correlations between BMI and Weight-related Attitudes

BMI also correlated positively with body dissatisfaction ($r = .44$, $p < .01$), attitudes toward body size ($r = .46$, $p < .01$), and attempted weight loss ($r = .51$, $p < .01$). These and other correlations between BMI and weight-related attitude variables can be found in Table II.

Table III. Hierarchical Multiple Regression for Model 3: Significant Predictor Variables

Variables	β	SE
Block 1		
FCI	.213	0.189
TV	.189	0.179
$\Delta R^2 = .076$*		
F (5, 226) = 3.718*		
Block 2		
TV	.132	0.147
BD	.254	0.196
ATBS	.202	0.251
AWL	.314	0.153
$\Delta R^2 = .319$**		
F (4, 222) = 29.262**		

Only significant predictors that are retained at each step are presented.
*$p < .01$, **$p < .001$.

Bivariate Correlations Between BMI and Psychosocial Variables

Correlations between BMI and psychosocial variables only revealed one significant correlation. BMI was negatively correlated with emotional eating ($r = -.18$, $p < .05$).

Multiple Regression Analyses

A set of hierarchical multiple regression analyses were conducted to examine how well various sets of predictors accounted for the variance in participants' BMI scores. In the first block, diet and physical activity variables (i.e., food choice intentions, knowledge of fatty foods, food self-efficacy, physical activity, and television viewing) were entered into the model, resulting in a significant amount of explained variance (7.6%). Food choice intentions ($\beta = .213$, $p < .01$) and television viewing ($\beta = .189$, $p < .01$) made significant contributions to the model. Higher BMI scores were related to healthier food choice intentions and more television viewing. In the second block, weight-related attitudes (i.e., body dissatisfaction, healthy body perception, attitudes toward body size, and attempted weight loss) were entered into the model, resulting in a significant increase (31.9%) in variance explained in BMI scores. In this analysis, television viewing ($\beta = .132$, $p < .05$), body dissatisfaction ($\beta = .254$, $p < .001$), attitudes toward body size ($\beta = .202$, $p < .001$), and attempted weight loss ($\beta = .314$, $p < .001$) all made significant unique contributions (Table III). In the third block, psychosocial variables (self-esteem, emotional eating, and cultural identity) were

entered into the model, resulting in a nonsignificant increase in the amount of variance explained (0.9%).

In sum, the overall model explained 39.5% of variance in BMI with higher BMI being associated with more hours of television viewing, greater body dissatisfaction, higher negative attitudes toward body size, and more weight loss attempts.

Discussion

This study suggests that overweight and obesity are prevalent for American Indian children in the Northern Plains, and that weight-related attitudes and television viewing are associated with BMI in this group. Approximately 33% of this sample was obese and another 20% were overweight. These findings are consistent with prevalence rates for American Indian children reported in previous studies (Broussard et al., 1991; Story et al., 2001). Despite the high prevalence of overweight and obesity, children in this sample demonstrated high knowledge of fatty foods and indicated mostly healthy food choice intentions. Over half of the children were sedentary between 2 and 5 hr per day, with heavier children reporting more inactivity, body dissatisfaction, and dieting. Fontvieille et al. (1993) also found that Pima Indian children reported less active leisure time and more sedentary behavior than their Caucasian peers, and obesity was positively correlated with time spent watching television.

Diet and physical activity variables (i.e., food choice intention, knowledge of fatty foods, food self-efficacy, physical activity, and television viewing) in the first model explained a statistically significant amount of variance; however, the predictors only accounted for a small portion of variance in children's BMI (7.6%). Examination of the individual predictors revealed that only two variables, healthy food choice intentions and television viewing, made statistically significant contributions. Consistent with Story et al. (2001), healthy food choice intentions were related to greater BMI. This finding is intriguingly counter-intuitive in that many people likely believe that overweight and obese children make unhealthy food choices. These results must be interpreted with caution, as measuring healthy food intention is not the same as measuring actual intake. It is possible that heavier children's food choice intentions are healthier than their actual food choices. Weight loss attempts among this group may also play a role. A large percentage of children (41%) reported that they were currently trying to lose weight by changing their diet. Therefore, heavier children may have been dieting during the time of the study and thus may have been sensitized to healthier food choices. Another explanation may be the unavailability of healthy foods, which might hinder their ability to follow through with their intentions (Bronner, 1996). A previous study found that parents of Ojibway-Cree descent demonstrated knowledge regarding ''unhealthy'' food, yet consistently purchased ''junk food'' items such as pop, candy, and chips (Gittelsohn et al., 1996). Therefore, children in this sample may have healthy intentions and the perceived ability to select healthier foods, but such foods may not be available in their home environments.

Television viewing was also a statistically significant predictor of children's BMI. Children with higher levels of television viewing had greater BMI. These findings were consistent with existing literature citing television viewing as a contributing variable to the obesity epidemic in children (Dietz & Gortmaker, 1985; Fontvieille et al., 1993; Gordon-Larsen et al., 2002). These findings further support the importance of developing intervention programs for obese children that target decreasing television viewing as well as increasing physical activity. Epstein et al. (1991) report that inactivity may be very reinforcing for overweight children and interventions must first identify the reinforcing properties of being sedentary before introducing equally reinforcing physically active alternatives. Future programs might also benefit from considering the barriers to physical activity noted in this sample.

Barriers to physical activity are cited as influential variables to consider when designing obesity prevention programs in American Indian communities (King et al. 2000; Thompson et al., 2001). Some children in this sample (18%) reported not feeling safe when using their community bike path because of the absence of leash laws for dogs, and over one-third of children reported that the resources needed to engage in various physical activities were not available within their community. Increasing physical activity is a common treatment approach for obesity and these findings suggest that when implementing such an approach in rural reservation communities, one must also attempt to remove barriers that hinder physical activity.

The introduction of weight-related variables (i.e., body dissatisfaction, healthy body perceptions, attitudes toward body size, and attempted weight loss) in the second block resulted in a statistically significant increase (31.9%) in variance explained in children's BMI score, with television continuing to make a significant contribution. These findings reflect a strong relationship between body

dissatisfaction, negative attitudes toward body size, weight loss attempts, more television viewing, and increased BMI, a finding consistent with those of previous studies with American Indian children (Fontvieille et al. 1993; Stevens, Story, et al., 1999; Story et al., 2001). Surprisingly, the majority of children reported having tried to lose weight in the past, and a large portion indicated they were currently trying to lose weight. Common weight loss methods were exercising more and changing diet, which is consistent with findings from studies involving other tribal communities (Stevens, Story, et al., 1999; Story et al., 2001). The results of a recent study by Neumark-Sztainer et al. (2007) highlight the importance of addressing dieting in young people, since it may relate to future weight gain. The results of the present study show that educating American Indian children about the possible counterproductive effects of dieting on weight may be a critical prevention/intervention component for these children.

The inclusion of psychosocial variables (i.e., self-esteem, emotional eating, and cultural identity) in the third block of the regression model did not significantly contribute to the variance explained in BMI. Some research shows increasing rates of stigmatization (Latner & Stunkard, 2003) and higher rates of depression and lowered self-esteem in obese children, yet others have revealed normal levels self-esteem (Mendelson & White 1982; Wadden et al., 1984) as reported in this study. Other studies with American Indians show that a heavier body type may be acceptable (Ravussin et al., 1994; Stevens, Story et al., 1999; White et al., 1997); therefore, stigmatization associated with overweight status may not be as common. The present study is one of the first examining self-esteem and BMI in American Indian children. Further research in this area seems justified given our finding that overweight and obese American Indian children had normal levels of self-esteem despite also reporting body dissatisfaction.

In terms of emotional eating, our findings are consistent with other studies on emotional eating in children (Caccialanza et al., 2004; Tanofsky-Kraff et al., 2007) that have not found a strong relationship between emotional eating and body size or weight. However, Goossens et al. (2007) did report more depression and emotional eating among obese children who reported losing control of their eating compared to those not reporting such a loss of control. The present study did not include a measure of binge eating or loss of control of eating behavior; the addition of such measures might be a useful avenue to further explore emotional eating issues in future studies with American Indian children.

Cultural identity also failed to significantly contribute to the variance explained in children's BMI. It has been suggested that a stronger cultural identity may serve as a protective factor against obesity, while identifying more with westernized culture may increase the risk for obesity in American Indian communities (Knowler et al., 1981; Ravussin et al., 1994). Although no association between cultural identity and BMI was found in this study, it is possible that many of the children were too young to have developed a strong cultural identity. Support for this hypothesis can be drawn from the confusion many of the students reported regarding what to call themselves (i.e., they knew they were American Indian but did not know tribal names or affiliations).

The current study provides information related to possible predictor variables associated with BMI in young American Indian children. However, findings from this study are cross-sectional and the relationship among BMI and weight-related variables and other psychosocial variables are complex. This sample was almost exclusively of Chippewa descent, and caution should be used when generalizing these results to members of other American Indian tribes. Future studies should consider including physiological and/or observational measures to provide more accurate assessment of variables such as diet and physical activity. Second, a qualitative examination of dieting, as seen in Neumark-Sztainer and Story (1998), in young American Indian children may provide insight into its possible relationship with obesity. Neumark-Sztainer and Story suggest interpreting self-report data on adolescent dieting with caution (i.e., not all weight control behaviors reported by this group are unhealthy). Weight loss attempts were relatively common among children in this sample and exploring in more detail young children's understanding of ''dieting'' would help define how such practices might be contributing to the obesity epidemic in American Indian communities. Third, emotional eating, although described in other studies as being a potential predictor of binge eating (Goossens et al., 2007) and therefore, increased body weight, was not predictive of increased BMI in this sample of American Indian children. Future studies should continue to explore the role of emotional eating using a more suitable measure designed for use with children such as introduced in Tanofsky-Kraff et al. (2007).

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