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Original scientific paper

PARENT RECOLLECTIONS OF THE CHILD'S HOME FOOD ENVIRONMENT AND IMPACT ON THE HEALTH OF COLLEGE STUDENTS

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Abstract

Few studies have observed the longitudinal impact of the child's home food environment on later eating behaviors, diet quality, and body composition. This study aimed to explore this potential relationship while expanding on constructs of the child's home food environment retrospectively in college students. Dietary information and body composition measures were obtained using a 24-hour diet recall, food frequency questionnaire, and the InBody520. A mailed, retrospective survey on the child's home food environment was obtained from caregivers. Child control was negatively associated with percent body fat (p=0.047), waist circumference (p=0.046), and perceived healthy food barriers (p=0.008), and positively associated with consumption of green vegetables and beans (p=0.045) and dairy (p=0.016). The use of negative feeding practices yielded mixed results. Body mass index was positively associated with using food as a reward (p=0.003) and restriction for weight (p=0.013) but negatively associated with emotional regulation (p=0.027) and pressure to eat (p=0.030). Waist circumference was positively associated with using food as a reward (p=0.001) but negatively associated with emotional regulation (p=0.021), pressuring to eat (p=0.025) and restriction for the weight (p=0.020). These findings indicate that the child's home food environment provides both positive and negative influences which transcend into early adulthood.

Keywords: Body Composition, Body Mass Index, Child Home Food Environment, Diet Quality, Parental Feeding Practices

1. Introduction

The most recent National Health and Nutrition Examination Survey (NHANES) documented the highest-ever obesity rates within the United States. Between 2017-2018, the prevalence of obesity was 19.3% and affected about 14.4 million children and adolescents (Fryar, Carroll & Afful, 2020). Specifically, the obesity preference among 2- to 5-year-olds was 13.4%, 20.3% among 6- to 11-year-olds, and 21.2% among 12- to 19-year-olds (Fryar, et al., 2020). This is a significant increase from 1999-2000 when 13.9% of children had obesity (Fryar, et al., 2020). In addition, from 2007–2010, 60% of children aged 1–18 years did not meet U.S. Department of Agriculture (USDA) Food Patterns fruit intake recommendations, and 93% did not meet vegetable recommendations (Kim, et al., 2014). Poor dietary choices, paired with obesity, have both immediate and long-term effects on health and well-being. Children and adolescents who are obese are more likely to have obesity as adults, therefore putting them at risk of developing problems such as heart disease, type 2 diabetes, stroke, and osteoarthritis, among others (Freedman, et al., 2005).

Obesity in childhood is thought to be the result of multiple influences, including genetic and environmental risk factors. The role of parents and caregivers within a child’s home food environment is of particular interest, given that parents and caregivers not only determine a child’s direct physical and social environment, but also serve as indirect role models for children in forming behaviors (Cromley, Neumark-Sztainer, Story, & Boutelle, 2010). Research suggests that a parent’s specific feeding style, often reflective of their overall parenting style, plays an important role in the development of a child’s taste preferences, eating habits, and by extension, their overall health and nutrition status (Gerards & Kremers, 2015; Hughes, Power, Orlet, Mueller & Nicklas, 2005). More specifically, parental preference for unhealthy foods, as well as a lack of availability

and accessibility of healthy foods within the home, has been associated with lower fruit and vegetable intake, as well as higher intake of high-fat foods and sugar-sweetened beverages in children (Stang, 2011; Van der Horst et al., 2006; Couch, Glanz, Zhou, Sallis & Saelens, 2014; Pearson, Biddle & Gorely, 2009; Rasmussen et al., 2006). These foods tend to be identified most often as issues during family mealtimes, and are frequently the targets of child obesity interventions. Increased fruit and vegetable consumption have been correlated to improved diet quality and lower body weight in children (Jennings, Welch, van Sluijs, Griffin & Cassidy, 2011). This demonstrates one pathway through which the child's home food environment can help combat the rise in childhood obesity.

Parent-feeding practices, which are situation-specific behaviors or strategies to manage how much, when, and what children eat (Stang, 2011), have also been explored in current research. Controlling feeding practices, including restriction, pressure to eat, and monitoring, have been related to poor diet quality, as well as increased body mass index (BMI) in children (Ventura & Birch, 2008; Faith, Scanlon, Birch, Francis & Sherry, 2004; Clark, Goyder, Bissell, Blank & Peters, 2007; Birch, Fisher & Davison, 2003; Jansen et al., 2012). Restriction of either the amount of food or types of food can lead to the "forbidden food effect," which manifests as an increase in preference, poor self-regulation, and over-consumption of the restricted foods, often resulting in weight gain (Faith et al., 2004, Clar et al., 2007; Birch et al., 2003). Pressuring a child to eat takes two different forms. First, pressure to eat more food in general (ie. to "clean their plate"), has been shown to override a child's internal cues of hunger, which can lead to overeating (Birch & Fisher, 1998). Secondly, pressure to eat specific foods (typically low-energy-density foods such as fruits and vegetables) increased a child's dislike for those foods (Birch et al., 1998; Batsell, Brown, Ansfield & Paschall, 2002). Pressuring feeding practices have been shown to have mixed results on BMI and weight status in children (Clark et al., 2007; Birch et al., 2003; Jansen et al., 2012; Birch et al., 1998). Other caregiver feeding practices evaluated in current research include using food as a reward or for a child's emotional regulation. Overweight children have been shown to perceive food as being more reinforcing (Temple, Legierski, Giacomelli, Salvy, Epstein, et al., 2008). This means that they are willing to do more to gain access to food, and because of this, will consume more calories in ad-lib situations than their non-overweight peers (Temple et al., 2008). More positive feeding practices, such as teaching children about healthy eating, parental modeling of healthy habits, involvement in mealtime decisions, and allowing children control over feeding, have been less studied, but have shown to be equally as influential in the development of healthy eating behaviors, fruit, and vegetable consumption, and weight status (Entin, Kaufman-Shriqui, Naggan, Vardi & Shahar, 2014; the Chu et al., 2013; Van der Horst, Ferrage & Rytz, 2014; Chu, Storey & Veugelers, 2014; Hurley, Cross & Hughes, 2011).

Despite the many developmental, social, and environmental changes as children grow older, research has suggested that many food habits formed during childhood persist into adolescence and young adulthood (Branen & Fletcher, 1999; Galloway, Farrow & Martz, 2010; De Backer, 2013). Further, certain eating behaviors in college students were shown to be dependent on the individual having been fed that way as a child (Branen, 1999; Galloway, 2010; De Backer, 2013), demonstrating the lasting impact this early period can have. Therefore, a more complete understanding of the factors that influence child eating behaviors within the home may provide information that is useful in the treatment of childhood obesity and ultimately the prevention of adult obesity.

Much of previous research that has examined the child's home food environment has been limited by the small number of home factors examined, narrowly focusing on controlling feeding practices, and failing to consider other relevant constructs such as food availability and accessibility, parental modeling, education, and child involvement. In addition, while the longitudinal influence on eating behaviors has been demonstrated in young adults, specific measures of diet quality and body composition have yet to be examined in this population. The purpose of this study was to expand on the current literature to include a more comprehensive definition of the child's home food environment and to examine its impact on these measures. We hypothesized that: i) parent recollections of the child's home food environment are associated with the diet quality of college students) the

child's home food environment will impact the body composition and BMI of college students.

2. Methods

The study included a convenience sample of 105 randomly selected college students. In addition, because parent reports of their use of child-feeding practices are more related to students' current eating behaviors and BMI (Galloway et al., 2010), students' childhood caregivers were also recruited. 96 caregivers were contacted by mail or email through consenting students participating in the study.

Students were recruited through campus fliers, mass emails, and student organization announcements. Interested students were asked for their email and were contacted to schedule a time to complete the study. The email included guidelines for participants to follow to obtain the most accurate body composition measurements on the day of their analysis. During the appointment, students were first asked to complete two consent documents; 1) provided more information on the study and solicited their participation, and 2) asked for permission to contact their childhood caregivers. Student responses and documents were all assigned a randomly generated number to ensure confidentiality.

To obtain information on diet quality, a 24-hour diet recall and food frequency questionnaire (FFQ) was utilized. Extensive evidence has demonstrated that 24-hour dietary recalls provide the highest quality and least biased dietary data. Trained nutrition students conducted the recalls using the USDA Automated Multiple-Pass Method (AMPM) (Moshfegh et al., 2008). This five-step dietary interview includes multiple passes through the 24 hours of the previous day, during which respondents receive cues to help them remember and describe the foods and drinks they consumed. The use of measuring utensils and the Automated Self-Administered 24-Hour Recall (ASA24) system's Portion Size Image Database were used to aid in gathering more exact quantities and portions (Islam et al., 2013). The National Institutes of Health (NIH) All-Day Screener, an FFQ, was also used to capture students' current fruit and vegetable intake. The use of FFQs in population-based studies has been well established, as they minimize the high intra-variability in nutrient and food intake (Subar et al., 2001).

Student body composition and BMI were measured using the InBody 520 body composition machine (InBody USA), which uses bioelectrical impedance analysis (BIA) to generate a detailed breakdown of an individual's weight in terms of muscle, fat, and water. According to the American College of Sports Medicine, BIA measures body fat with the same accuracy as skin-fold calipers, trailing only hydrostatic weighing for accuracy (Esmat, 2012). Of the results provided, BMI, which was automatically calculated based on weight, and percent body fat results were utilized. Body fat percentage is the percentage of body fat to total body weight. It is generally accepted that a range of 10-22% for men and 20-32% for women is considered satisfactory for good health (Gallagher et al., 2000).

Waist circumference provides an independent prediction of risk over and above that of BMI. A trained nutrition student obtained this by placing a non-stretchable tape measure around the participant's bare stomach just above the hip bone. The tape was kept snug to the body and measurements were taken to the nearest quarter of an inch. Waist circumference was categorized according to standard clinical guidelines for men and women. Waist circumference measures >102 centimeters for men and >89 centimeters for women corresponds to increased disease risks (National Heart, Lung, and Blood Institute, 2015).

Student level of physical activity was analyzed retrospectively after the original portion of the study was completed. Students were asked to rate their level of physical activity at the time of the study on a scale of 1-3, with 1) corresponding to exercise 2 or fewer days per week, 2) corresponding to 2-5 days per week, and 3) corresponding to 5+ days of exercise per week.

Following students' completion of the diet and body composition analyses, their caregivers were contacted via email and prompted to participate in the study. Qualtrics, an online survey software, was utilized to format and distribute the survey electronically. Informed consent and further information about the study were also included. For caregivers who were not accessible through email, hard copies of the consent form and survey

were mailed to the address provided by the consented students, and instructions were provided on how to return their responses in a pre-addressed and stamped envelope. These were assigned a unique identification number to ensure their confidentiality and to associate their responses with their student's data.

A more comprehensive and relatively new instrument called the Comprehensive Feeding Practices Questionnaire (CFPQ) was used for the caregiver survey. The CFPQ broadens the commonly used Child Feeding Questionnaire (Musher-Eizenman & Holub, 2007) and covers a wider range of behaviors that are related to feeding practices. The CFPQ consists of 49 total questions and examines 12 subscale constructs. The questions are scored using a 5-point Likert scale. The developers tested the validity and reliability of the 12-factor feeding practices instrument among American parents of children who were mostly Caucasian (>90%). The final 12-subscale model for the samples showed a good fit with $\chi 2(1061) = 1580$, RMSEA = 0.057, and CFI = 0.98 (Harris & Ramsey, 2015). The questionnaire has since been validated in multiple populations, making it a valid assessment tool to measure aspects of the child feeding environment (Harris et al., 2015; Haszard, Williams, Dawson, Skidmore & Taylor, 2013; Doaei, Kalantari, Gholamalizadeh & Rashidkhani, 2013; Melbye, Øgaard & Øverby, 2011; Shohaimi, Yoke & Mohd, 2014). In addition, it has also been approved for computer-based distribution (Musher-Eizenman et al., 2007; Shohaimi et al., 2014).

The survey was formatted retrospectively and asked caregivers to think back to when their child was 3-6 years old, as indicated in the original Comprehensive Feeding Practices Questionnaire (Harris et al., 2015). Items numbered 1–13 utilized a 5-point response scale: ''never, rarely, sometimes, mostly, always.'' Items numbered 14–49 utilized a 5-point scale with different anchors: ''disagree, slightly disagree, neutral, slightly agree, agree.'' Question 16, "I kept a lot of snack foods in my house"; question 37, "I kept a lot of sweets in my house"; and question 42, "I told my child what to eat and what not to eat without explanation," were reverse coded. The higher the value of the response scale for each question, the more the caregiver reported using those feeding styles when their child was younger. Caregiver feeding practices were labeled as either positive or negative and grouped as the independent variables. Positive feeding practice categories included child control, balance, variety, environment, involvement, modeling, and teaching about nutrition. Negative feeding practice categories included emotion regulation, food as a reward, monitoring, pressuring, restriction for health, and restriction for weight.

Approval from the Institutional Review Board of Northern Illinois University was obtained before conducting this cross-sectional study.

3. Data Analysis

Statistical tests were executed through the Statistical Package for the Social Sciences (SPSS) version 22.0 software. Descriptive statistics and frequencies were used for demographics and other food practice questions. To examine the contribution of caregiver feeding practices in explaining the variance in current student diet quality and body composition, multiple regression analyses were conducted with BMI, waist circumference, percent body fat, and healthy eating index scores as dependent variables. Positive and negative caregiver feeding practice scores were analyzed separately as independent variables.

All dietary data were analyzed using the McGraw-Hill Nutrition Calc Plus database (NutriCalc Plus). Reports were generated which included a participant's total caloric, macronutrient, and micronutrient intake as well as a percentage of recommended consumption of these categories. FFQ data were scored according to NIH guidelines to generate a daily average of MyPlate servings for each of the food groups (National Cancer Institute [NCIa], 2016).

Healthy Eating Index (HEI) scores were calculated for each participant. When calculating the score, information on foods consumed by individuals on a day can be collected using a variety of methods (National Cancer Institute [NCIb], 2016), thus foods recorded from the 24-hour diet recall were considered. Relevant dietary constituents included fruit (total and whole), vegetables (total, beans, peas, and dark green leafy), whole grains, dairy, protein (total, seafood, nuts, and seeds) fatty acids (saturated, polyunsaturated and

monounsaturated), sodium, calories from added sugars, solid fat, and alcohol, as well as total calories. Pertinent ratios were then derived and each HEI component was scored using the relevant standard. The HEI-2010 SAS macro program was used to calculate the HEI-2010 component and total scores.

List-wise deletion was applied for all model analyses. Thus, only dyads with complete data sets for the student and their caregiver were included in the analyses. Multiple linear regressions were used to model the relationship between the constructs of caregiver feeding practices and the child's home food environment and aspects of diet quality and body composition in college students. This allowed for a better interpretation of the results and for making more accurate predictions based on the hypotheses. The significance for all analyses was set at $p<0.05$.

4. Results

As illustrated in Table 1, student participants were between the ages of 18 and 50, with a majority falling between the ages of 18 and 22 (mean age 22.07 ± 4.25). Participants were also primarily female, Caucasian and upperclassmen. Thirty-seven out of a total of sixty-five different academic majors were reported, indicating representation from across campus.

Of the 96 caregivers whose students consented to participate, 68 completed the online Qualtrics survey, and seven completed and mailed in a hard copy of the consent form and survey. One submitted survey was incomplete, leaving a final sample of 74 caregivers obtained for this study. Caregivers were between the ages of 37 and 74, with an average age of 51 years old. Participants were primarily Caucasian (81%) and female (85%).

5. Diet Quality

To assess the first hypothesis, 24-hour diet recalls and FFQ results were first compared to national guidelines. MyPlate, the current nutrition guide published by the USDA is a visual representation of the five food groups that make up the building blocks of a healthy diet. More specific recommendations are based on age, sex, height, weight, and physical activity level. Based on the diet recall, when comparing students' intake to their personalized recommendations, participants on average met about 84% of their recommended grain servings, 83% of their vegetable target, and 62% of their fruit target. The results of the Fruit and Vegetable FFQ revealed similar findings. Students on average consumed less than the recommended amounts of fruits and vegetables, with an average of 1.24 servings and 1.90 servings, respectively. The sub-category of "other vegetables," which included raw, cooked, canned, or frozen, saw the highest average servings (0.99 ± 1.51), as compared to the daily recommended standard of 0.60 servings. Alternatively, the sub-category of beans was consumed the least by students (0.10 ± 0.18), as compared to the recommended daily standard of 0.25 servings.

Total and component HEI-2010 scores were calculated for each student to assess their overall diet quality. The maximum HEI-2010 score is 100, with the individual components having separate sub-scores. The total HEI-2010 score for students participating in this study was 52 ± 16.13. The lowest score was 21 and the highest total score was 93. Figure 1 compares the component scores of the U.S. population based on the National Health and Nutrition Examination Survey (NHANES) data to the scores of the student participants in this study (Center for Disease Control [CDC], 2015).

The univariate model was utilized to assess for possible associations between caregiver feeding practices and overall diet quality. Food as a reward ($p=0.034$), restriction for health ($p=0.005$), and restriction for the weight ($p=0.009$) were all negatively associated with overall diet quality, as measured by total HEI-2010 scores. However, in the presence of other variables within the multivariate model, these factors were no longer significant and multiple regressions showed no significant association between caregiver feeding practices and overall diet quality. When assessing individual HEI components, the positive practices of granting child control were a positive predictor of green leafy vegetables and beans consumption ($p=0.045$) as well as dairy

consumption (p=0.016).

6. Body Composition

BMI, waist circumference, and percent body fat results were used to assess the second hypothesis. The mean BMI of female students was 25.2 ± 5.44 and of the males was 25.5 ± 2.4, both within the overweight range. These values were not skewed when the muscular build of participants was controlled for. While most students fell within the normal weight range with a BMI of 18.5-24.9 kg/m2 (54%), the second-largest majority was in the overweight range of 25-29.9 kg/m2 (34%). The mean waist circumference for male participants was 33.4 ± 2.75; while the mean waist circumference for female students was 32.16 ± 5.1, both falling below at-risk guidelines. Finally, among male students participating, the average percent body fat was 17.13 ± 5.61, and for women, this average was 30.71 ± 8.17, again falling within satisfactory ranges.

Multiple regressions revealed that six out of twelve measured feeding practices were significantly associated with later student body composition. As illustrated in Figure 2, granting a child control over eating was negatively associated with percent body fat (p=0.047). Additionally, as seen in Figure 3, involving children in food preparation and decisions was also negatively associated with waist circumference (p=0.046). Negative feeding practices illustrated some mixed results (see Table 2). According to the univariate model, caregiver use of restriction for health was positively associated with a student's current BMI (p=0.006) as well as waist circumference (p=0.002). In addition, using food as a reward was also positively correlated with BMI (p=0.020) and a student's percent body fat (p=0.049). When all variables were run together in the multivariate model, food as a reward remained a significant predictor; however, the use of restriction for health was not. Caregivers who reported using food as a reward was positively associated with both BMI (p=0.003) and waist circumference (p=0.001). Childhood restriction of food for weight control was positively associated with BMI (p=0.013) and percent body fat (p=0.014) but was negatively associated with waist circumference (p=0.021). Emotional regulation was shown to negatively impact later BMI (p=0.027) and waist circumference (p=0.021). Caregiver pressuring was also negatively associated with BMI (p=0.030) and waist circumference (p=0.025).

7. Discussion & conclusions

This study indicated no significant associations between childhood experiences and overall diet quality in college students, as assessed by HEI-2010 total scores. However, it is noted that the reported use of child control by caregivers was positively associated with the consumption of green leafy vegetables, beans, and dairy HEI scores. In this instance, students who were granted more control when they were younger to select what and how much they ate, consumed these healthier options more than their previously restricted counterparts. This mirrors studies that have shown significant correlations between positive caregiver feeding practices and fruit and vegetable consumption in children and adolescents (Entin et al., 2014; Chu et al., 2013; Van der Horst et al., 2014; Chu et al., 2014). Alternatively, the results indicate negative associations between using food as a reward, restriction for health, and restriction for weight on overall diet quality. This supports similar findings that have illustrated that parental control through restricting the intake of "bad" foods can lead to an increase in preference and later consumption of the restricted foods (Faith et al., 2004; Clark et al., 2007; Birch et al., 2003). These results further expand upon previous research on college students which found that specific food habits, such as eating dessert or cleaning one's plate were dependent on the individual having been fed that way as a child (Branen, 1999). Specifically, these aspects of the control exerted by caregivers are of concern, given that they may result in children eating according to external, rather than internal cues, which can in turn increase the risk of overeating and subsequent weight gain.

The results of this study did indicate significant associations between aspects of the child's home food environment and BMI and body composition in college students. Positive constructs of granting child control and involvement were negative predictors of body fat percentage and waist circumference in college students.

These findings are supported by previous research in children, which found that involvement in the cooking process was associated with lower BMI and waist circumference (Entin, et al., 2014). Furthermore, it was shown that negative home food environment exposures, such as using food as a reward and restricting foods for weight control, can predict negative outcomes in BMI and body fat mass in adulthood. These findings substantiate previous research that has illustrated that restrictive feeding practices, or an inability to allow for child control, can lead to weight gain (Ventura et al., 2008; Jansen et al., 2012).

Findings from this study suggest a need for continued research in understanding how early caregiver-child interactions concerning food might influence the development of eating behaviors and overall health later in life. The approach in this research was unique in that retrospective reports from the perspective of the caregivers were utilized to examine relationships between the early childhood home food environment and current diet quality and body composition in an adult population. Another strength of this study was the detail in which the food environment was measured. Previous studies analyzing the "child home food environment" have narrowly focused on specific mealtime behaviors, emphasizing the presence of parental control (i.e, through pressure or restriction) in the mealtime environment. This ignores other constructs such as availability, involvement, modeling, and education, which have been shown to play a significant role in the developing child. It is difficult to capture the complexity of the child's home food environment through a questionnaire; however, using a more comprehensive tool, such as the CFPQ, may give greater confidence in future research findings.

Despite these strengths, multiple limitations are acknowledged. First, it is possible that caregivers' and children's perceptions and understanding of the child's home food environment are dynamic for childhood and into late adolescence. Because this study asks caregivers to recall the time when their child was 3-6 years of age, it does not necessarily consider diet and nutrition knowledge acquired after childhood and if that has an impact on college-student diet quality and BMI. While a student's current area of study was considered and controlled for, we could not account for the myriad of other influences that could impact a college student's diet and overall health. In addition, administering the CFPQ retrospective version has not previously been validated and should therefore be considered when interpreting the results of this study. Also, due to the retrospective design of the study, caregivers' reports of various child home food environment constructs are not precise. Moreover, they may be biased by their adult child's current diet and eating behavior or weight status.

Because an individual's diet is in large part a culmination of not only their upbringing but also their current situation and environment, it is essential to consider these results in the context of a college student population. Issues of food availability, accessibility, and social conditions can influence the types of food a student has access to and ultimately consumes. In addition, this research was cross-sectional by design, so it only measured attitudes and diet at one point in time. Following diet trends over time and the impact of advancement in both education and independence could have affected the outcomes of this study.

Finally, the use of a single 24-hour dietary recall to analyze diet quality is subject to several inherent limitations. Three 24-hour dietary recalls are considered the most robust measure of diet (Burrows, Martin, Collins, 2010). Therefore, a single 24-hour diet recall may not always be representative of habitual diet at an individual level, making it difficult to make more generalized statements about the impact caregiver feeding practices have on a student's overall diet quality. Secondly, recall forces a student to depend on memory to accurately report specific details of their diet, which can be prone to unintentional error. Furthermore, both under-reporting and over-reporting could bias the associations between the child's home food environment and diet quality.

Parents and caregivers are important in the development of food preferences and eating patterns, through both direct and indirect influences, from controlling a child's diet, to passively modeling a healthy or unhealthy diet. The possibility of a longitudinal influence that lasts into young adulthood has yet to be extensively covered in previous research. This study examined the relationship between the child's home food environment

and later diet quality and body composition in college students. In particular, positive parenting practices of granting child control and involvement were shown to be negative predictors of body fat percentage and waist circumference. Child control was also a positive predictor of certain aspects of diet quality. In contrast, negative parenting practices such as using food as a reward and restricting foods for weight control were linked to negative outcomes in BMI, body fat mass, and diet quality in this adult population. These findings, in conjunction with previous research, suggest that the child's home food environment, while complex, plays an important role in shaping the dietary intake and weight status in childhood through early adulthood. It also presents a possible modifiable area for nutrition educators to influence and improve dietary patterns and overall health in young U.S. adults.

Table 1. Demographics of Student Participants

Variables	Frequency n (%)	Mean ± SD
Age (years)	105 (100)	22.07 ± 4.25
Gender		
Female	67 (63.8)	NA
Male	38 (36.2)	
Body Mass Index Categories		
Underweight (<18.5 kg/m2)	2 (1.9)	17.45 ± 1.06
Normal (18.5-24.9 kg/m2)	57 (54.3)	22.53 ± 1.61
Overweight (25-29.9 kg/m2)	36 (34.3)	27.11 ± 1.31
Obese (30+ kg/m2)	10 (9.5)	35.83 ± 4.29
Body Fat Percentage	105 (100)	25.78 ± 9.82
Physical Activity Frequency	55 (52)	1.78 ± 0.66
Ethnicity		
Caucasian	74 (70.5)	NA
American Indian	2 (1.9)	
African American	13 (12.4)	
Asian/Pacific Islander	8 (7.6)	
Hispanic	8 (7.6)	
Year in School		
Freshman	15 (14.3)	NA
Sophomore	13 (12.4)	
Junior	41 (39)	
Senior	35 (33.3)	
Graduate	1 (1)	
Place of Residence ≥5 days per week.		
Dorm	37 (35.2)	
Apartment/House	52 (49.5)	NA
With Parents	12 (11.4)	
Fraternity/Sorority	2 (1.9)	
Other	1 (1)	
‘Where do you eat the majority of your meals?’		
Campus Dining Hall	45 (42.9)	NA
Cook for Yourself	58 (55.2)	
Fast Food/Convenience Meals	15 (14.3)	

Parent's Home	7 (6.7)	
'Have you ever taken any nutrition or health classes in the following settings?'		
High School	78 (74.3)	
College	57 (54.3)	
Health Services	1 (1)	NA
Doctor's Office	2 (1.9)	
Other	5 (4.8)	
'Have you ever utilized any nutrition services on campus?'		
Yes	7 (6.7)	
No	98 (93.3)	NA

Table 2. Associations Between Measures of Body Mass or Fat Mass (Defined by BMI, Waist Circumference or Percent Body Fat) and Negative Caregiver Feeding Practices*

	BMI			Waist Circumference			Percent Body Fat		
	β	SE	P	β	SE	P	β	SE	P
Emotion Regulation	-2.024	.898	.0271	-1.992	.842	.0211	-1.993	2.092	.344
Food as Reward	2.331	.745	.0031	2.518	.698	.0011	2.966	1.735	.092
Monitoring	-.285	.529	.592	-.027	.496	.957	-1.197	1.233	.335
Pressuring	-1.257	.569	.0301	-1.226	.533	.0251	-1.285	1.325	.335
Restriction for Health	.585	.483	.229	.633	.452	.167	.328	1.124	.771
Restriction for Weight	1.921	.751	.0131	-1.992	.705	.0211	4.426	1.751	.0141

**Data adjusted for gender, age, academic major, and physical activity*
Data are presented as β, standard error (SE), and P-value.
1Statistically significant at p<0.05.

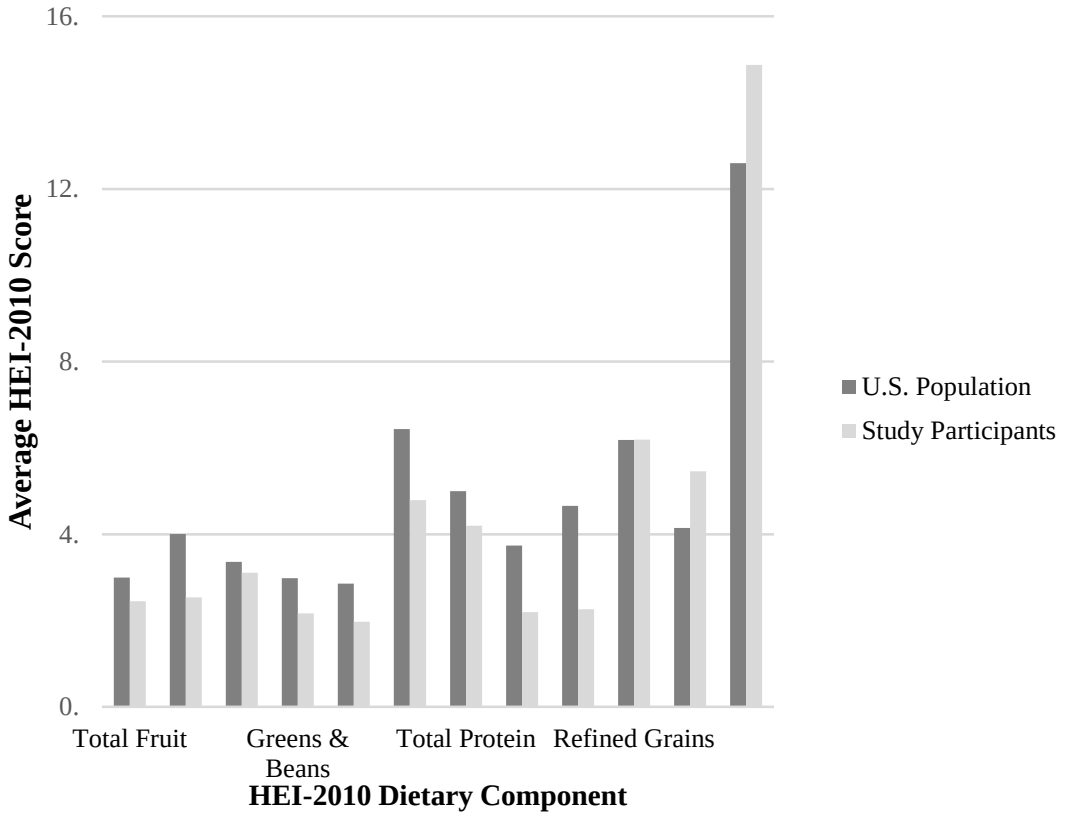

Fig1. Comparison of HEI-2010 between the U.S. population and study participants.

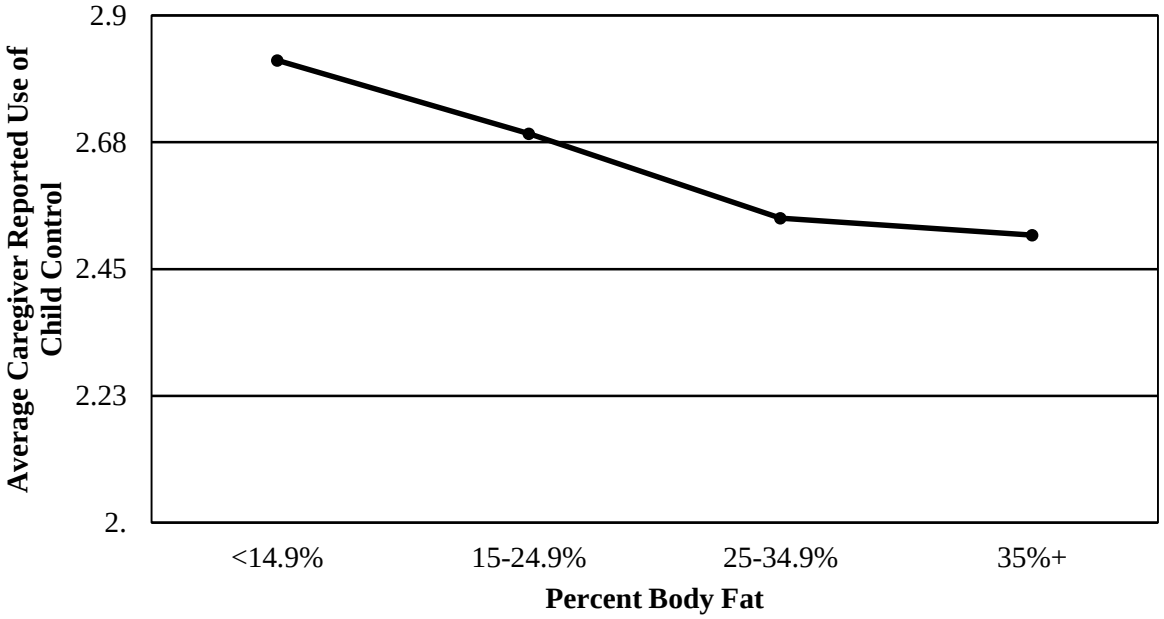

Fig2. Association between caregiver use of child control and percent body fat of students

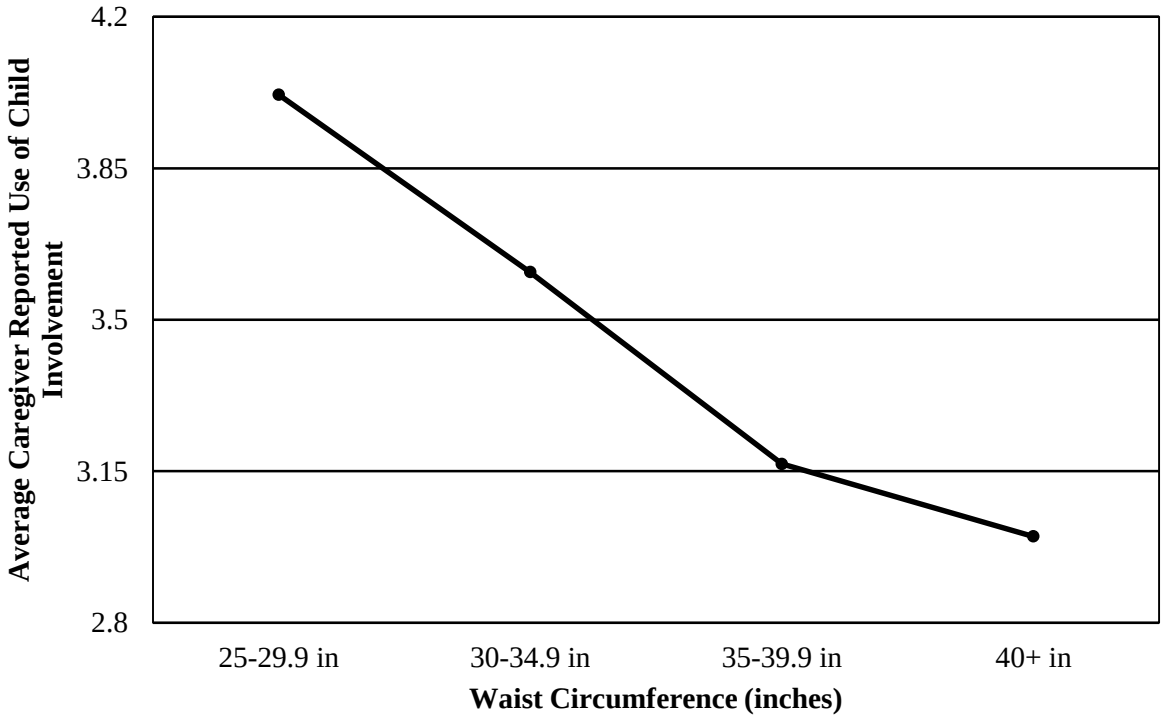

Fig3. Association between caregiver use of child involvement and waist circumference of students

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