Research Journal of Food and Nutrition
Volume 2, Issue 2, 2018, PP 14-22

Adolescent Weight Perceptions and Snack Food Portion Estimation

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ABSTRACT

PURPOSE: *The purpose of this study was to examine the effects of weight perception on weight intention, and portion estimation.*

METHODS: *Seventy-four middle school students poured themselves single servings of chips and cereal and estimated servings in three different sized chips bags. Measured portions were compared to accuracy within 25% of a standard serving. Associations between composite portion estimation, weight intentions, participant characteristics, and weight perceptions were identified by using Pearson's correlations. Further analysis included factorial ANOVA and post hoc Bonferroni's tests.*

RESULTS: *Significantly more girls intended to lose weight than boys ($r = -.362$, $p < .01$). Weight intention was correlated with composite portion estimation ($r = -317$, $p < .01$) where intention to lose weight was correlated with a smaller portion estimation.*

CONCLUSIONS: *Participants who intended to lose weight were often girls and were more accurate when pouring portions of chips. This study demonstrates the relationship between sex, weight intention and portion size accuracy. Future studies should focus on education strategies to promote healthy perceptions of weight and help improve accuracy of serving sizes.*

Keywords: *adolescent, portions, weight, snacks, servings*

ABBREVIATIONS: *body mass index (BMI)*

INTRODUCTION

It is clear that dramatic increases in the prevalence of obesity in the United States population have led to an "obesity epidemic".[1,2] Exact cause of the obesity trend remains unknown, however increased food consumption and decreased physical activity are undeniably strong influences. Increased food consumption may be influenced by environmental factors such as cost of food, food labeling, food marketing, meal patterns, and portion sizes. Food advertisements often feature large portion sizes as a tool to attract customers and increase profits; however, social marketers and public health agencies have become concerned as the large portion sizes advertised and consumed may be a contributing factor to the excessive obesity rates.[3,4]

Food portion sizes have increased exponentially in grocery stores, vending machines, restaurants, as well as in the home; continually larger than recommended portion sizes outlined in the Dietary Guidelines for Americans.[5–8] Portion size assessment tools such as food photography, interactive portion size assessment system, and food models have been developed to assist adults and youth in portion size estimates, however, validation of their use is very weak.[9] When portion size measurement aids were used to examine food portion size estimation accuracy in 7 to 18 year olds, a high range of error of 33-54% continued to occur. Significant differences in accuracy were also found between amorphous food pieces such as grapes and amorphous food masses which lack a predefined shape and form into the structure of the serving container such as mashed potatoes. There are

qualitative differences when foods portions, particularly amorphous foods, are estimated.[10]

Food portion sizes are used as a guide for consumption, thus encouraging consumers to eat and drink more from larger portion sizes. Simply doubling portion size can lead up to a 35% increase in consumption on average; however, it is suggested developmental factors may be involved in a child's response to portion size.[11,12] For example, when children were allowed to pour and serve their own entrée they consumed 25% less compared to when served a large portioned entrée.[13]As young children develop eating behaviors they naturally regulate their energy intake by listening to internal hunger and satiety.[14] However, parents or adults may disrupt these self-control practices as they assume children need assistance in determining when and how much to eat.[14]

When determining long term total energy intake changes, increased portion size had one of the largest influences when compared to several intake variables including energy density of a food, increased portion size had one of the larges influences.[15,16] Children as young as 2 years of age are affected by these obesity promoting eating behaviors as increased energy intake is a result of over consuming large portion sizes.[12] It is expected that chronic exposure to large portioned meals and an increase in consumption would eventually lead to significant weight gain if increases in energy expenditure do not occur.[17] The unnecessary and significant weight gain continues to contribute to the current obesity epidemic where 36.5% of adults and 17% of youth are classified as obese.[18]

The positive association between children's body weight and their portion sizes and energy intake identifies early childhood as a critical period to develop appropriate food intake patterns.[19] It is clear that large portion sizes and overconsumption tend to be the primary concern for most individuals, however those with body dissatisfaction or disordered eating patterns may have a fear of eating excessive portions of food.[20] Adolescents diagnosed with Anorexia Nervosa have reported significantly smaller maximum tolerated portion sizes and higher food induced anxiety when compared to those not diagnosed with disordered eating.[21]Individuals with Anorexia Nervosa have also been known to measure a significantly smaller typical or ideal portion size when compared to a control group.[22,23]

Self-image and body image satisfaction in adolescents may be adversely influenced by body weight status expressed as body mass index (BMI).Male and female adolescents with an overweight or obese (>25) BMI have experienced a constant trend of lower body satisfaction scores when compared to those with an underweight (<18.5) BMI.[24,25] In a large sample of adolescents (n=1168), 69% were dissatisfied with their body image, 83% of underweight participants wanted to gain body weight, and 91% of obese participants wanted to lose body weight. Females had the tendency to want to lose weight while males wanted to gain weight.[24] The resulting body dissatisfaction tendencies correspond to the impact idealized mass media exposure has on adolescents and their perceived body image.[26] Body image distortion also continues to be a concern in all BMI classifications as 35% of underweight adolescents did not consider themselves thin and 62% of obese adolescents did not see themselves in the correct classification.[24] Lower body satisfaction scores in male and female adolescents predicted higher levels of dieting, unhealthy weight control behaviors, binge eating, lower levels of physical activity, smoking and lower fruit and vegetable intake. Due to these findings, health messages promoting body satisfaction have been encouraged.[27]

BACKGROUND

Previous research has pointed to the Socio-cultural Theory to explain the unrealistic standard of body image that many adolescent females strive for.[28] Girls are susceptible to cultural influences particularly through media outlets that increase feelings of body dissatisfaction, even at a young age.[29] In the interest of relating portion sizes to weight status, previous research has demonstrated that underweight eaters who engaged in restrained eating often over-estimated potions.[30] Based on these previous findings, we hypothesize that girls will tend to measure portions as smaller than standard sizes relative to boys, as girls as often unequally affected by poor body image.[29]

Given the increases in societal definitions of proper portions, prevalence of obesity and influence of poor body satisfaction on eating behaviors, the present study seeks to explore the relationship between weight perceptions, weight intention, and portion estimation of two common snack foods: chips and cereal. Based on previous literature, we hypothesize that more

females will indicate an intention to lose weight than males and those trying to lose weight will under- or accurately measure portion sizes. We also hypothesize that, in general, most participants will over-estimate portion sizes.

METHODS

Participants

Students enrolled in physical education courses for grades 6-8 in a private southern United States school were recruited to participate. These students were enrolled in the fall semester of physical education and accounted for 21% of the middle school population. Students completed the surveys and accompanying portion estimation activities during three physical education class periods, each with approximately 25 students, over two days, each session lasting approximately 45 minutes. Other activities and questions regarding snack foods were asked and results published elsewhere.[31] All activities were guided by trained researchers. Student responses to survey questions and portion estimations were recorded using survey software on an online interface accessed on participant computers (RedJade® Sensory Software Suite, 2016). Adolescents were selected for this study as they are beginning to make more independent food choices compared to elementary school students.[32] Students completed a series of surveys which included age and sex. Student participation was voluntary. Parental consent was obtained prior to the study. All study instruments and protocol were reviewed and approved by The University of Mississippi Institutional Review Board.

Weight Perception and Intentions

Students' perception of weight was assessed by using two items from the Centers for Disease Control and Prevention Youth Risk Behavior Survey: "how do you describe your weight?" and "which of the following are you trying to do about your weight?".[33] These questions have also been used in similar body image studies.[34,35] Students were given the following choices for the former question "very overweight, slightly overweight, about the right weight, slightly underweight, and very overweight" and the following choices for the latter question "I am not trying to do anything about my weight, stay the same weight, gain weight, lose weight".

Snack Portions

Participants were tested on portion size accuracy in two ways using food items commonly sold in schools.[36] Participants were asked to pour themselves, on a 10 inch paper plate, the amount of each snack that they would ordinarily consume in one serving. Two different snacks were used: fruit flavored cereal and flavored snack chips. Packages used had 12 servings (cereal) and 10 servings (chips) within. Packages were full for each participant. Poured portions were weighed using a food scale and compared to actual standardized serving sizes of the products.

Participants were also given three different sized bags of chips and were asked to estimate the number of portions within. The packages of flavored tortilla chips used were common package sizes sold in grocery stores, schools, and convenience stores. These included a 28.3 g package (1 serving), 88.5 g package (3 servings), and 283.5g package (10 servings). Participants were shown each package in a random order generated by RedJade software.

Statistical Analysis

Descriptive analysis for all variables was completed (version 24.0.0, SPSS Statistics, IBM Corporation, Armonk, NY, 2013).

Weight perception responses were collapsed into the following categories for analysis: underweight, about right weight, or overweight. Similarly, weight intention was also collapsed: lose, stay the same, or gain. Weight perceptions were dummy coded to perceived overweight and perceived underweight as the reference group of perceived about right weight. Weight intention was also dummy coded to intention to lose weight and intention to gain weight as the reference group of intention to maintain.

Accuracy within 25% for portion size was chosen based on previous literature on portion size estimation.[37] Similar to previous research, measured portions poured by participants were divided by the standard serving size to give a number referred to as the standardized portion, where 1 is equal to the standard serving size. A standardized portion over 1.25 was over-pouring, whereas under .75 was under-pouring. Standardized portions between .75 and 1.25 were considered accurate for the present study. Accuracy of portions for pouring and estimation

activities were determined using a chi-square test for independence.

A composite score of portion estimation was created from the mode value of five different portion data: portion estimations made by pouring chips and cereals, and portion estimations made from three different sizes of bagged chips. Composite scores were used as it is an inclusive representation of a participant's portion estimation tendency. Each set of portion estimation data was categorized into under, correct, or over. Each individual case mode value represented the individual's tendency toward the portion estimation, yielding 74 total participants as not all students completed both the pouring and visual estimation activities.

The associations between composite portion estimation, weight intentions, participant characteristics, and weight perceptions were identified using Pearson's correlations. These relationships were further explained using factorial ANOVA and post hoc Bonferroni's tests.

RESULTS

Participants

Seventy-nine middle school students participated in the study, 41.8% of which were girls. Seventy-four students completed all aspects of the study. Average age of participants was 12.6 years old (SD = 0.99).

Weight Perceptions and Weight Intentions

Of all participants, 21.5% described themselves as underweight and 17.7% as overweight. The remaining 60.8% believed themselves to be "about the right weight".

When asked "which of the following are you trying to do about your weight?". Many (48.1%) participants indicated they desired to maintain or were not trying to change their weight. More participants wanted to lose weight (30.4%) than those who wanted to gain weight (21.5%). Overall more boys wanted to gain weight than girls, and more girls wanted to lose weight than boys. Though most girls believed themselves to be the right weight, 45.5% of all girls indicated that they intended to lose weight (Table 1).

Table 1: *Weight intention and weight perception by sex in middle school adolescents*

	Boys (n=46)			Girls (n=33)		
	Lose weight	Stay the same/maintain	Gain weight	Lose weight	Stay the same/maintain	Gain weight
Underweight	0.0%	10.9%	8.7%	3.0%	18.2%	3.0%
About right	10.9%	23.9%	23.9%	33.3%	30.3%	0.0%
Overweight	8.7%	13.0%	0.0%	9.1%	0.0%	3.0%

Table 2: *Correlations between sex, weight perception, weight intention and portion estimation.*[a]

	Sex	Perceived Weight	Weight Intention	Portion Estimation
Sex	1.00			
Perceived Weight	-.113	1.00		
Weight Intention	-.362**	-.291**	1.00	
Portion Estimation	-.140	.024	-.317**	1.00

[a]*Two-tailed correlation test,* $^{*}p < .05$, $^{**}p < .01$.

Table3. *Differences in weight perception, weight intention and portion estimation***.**

		Portion composite score		
		≤ 25% of standard serving, % (n)	Accurate within 25% of standard serving, % (n)	≥ 25% of standard serving, % (n)
Weight Perception	Underweight	1.4% (1)	10.8% (8)	8.1% (6)
	About right	13.5% (10)	25.7% (19)	24.3% (18)
	Overweight	0.0% (0)	9.5% (7)	6.8% (5)
Weight Intention	Lose weight[a]	6.8% (5)	18.9% (14)	5.4% (4)
	Stay the same/maintain	6.8% (5)	20.3% (15)	20.3% (15)
	Gain weight[a]	1.4% (1)	6.8% (5)	13.5% (10)

[a]*Significant differences using ANOVA test with Bonferroni post hoc tests, p<0.05*

Snack Portions and Weight

The initial correlations between sex, age, perceived weight, weight intention, and portion estimation displayed significant relations between variables. Weight intention correlated significantly with sex and perceived weight, as well as with portion estimation as presented on the Table 2.

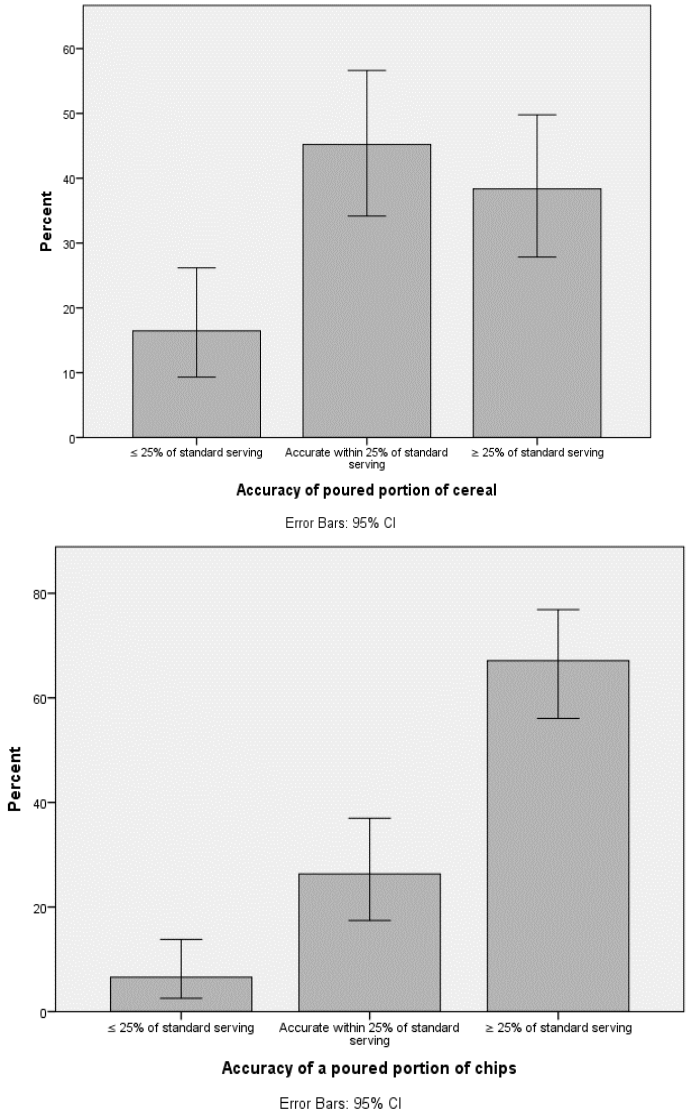
According to Levene's test of equality of error variances, the test met the assumption of the homogeneity of variances (p = .544). Based on the initial factorial ANOVA, perceived weight did not have a significant effect on their portion estimation, $F(2, 74)$ .883, p = .418. Weight intention did not have a significant effect on their portion estimation either, $F(2, 65)$ = 1.659, p = .198. Additionally, there was no statistically significant interaction between perceived weight and weight intention, $F(2, 65)$ = .046, p = .996.

However, the Bonferroni's *post hoc test* discovered significant differences between those who intended to lose weight and those who intended to gain weight and portion estimation (*Mean Differences* = .606, p< .05) as shown in Table 3. Participants who intended to lose weight estimated portions to be smaller than standard sizes relative to those who intended to gain weight.

Snack Portions

Fewer participants over-poured on cereal portions (38.4%) compared to chips portions (67.1%), see Figure 1.

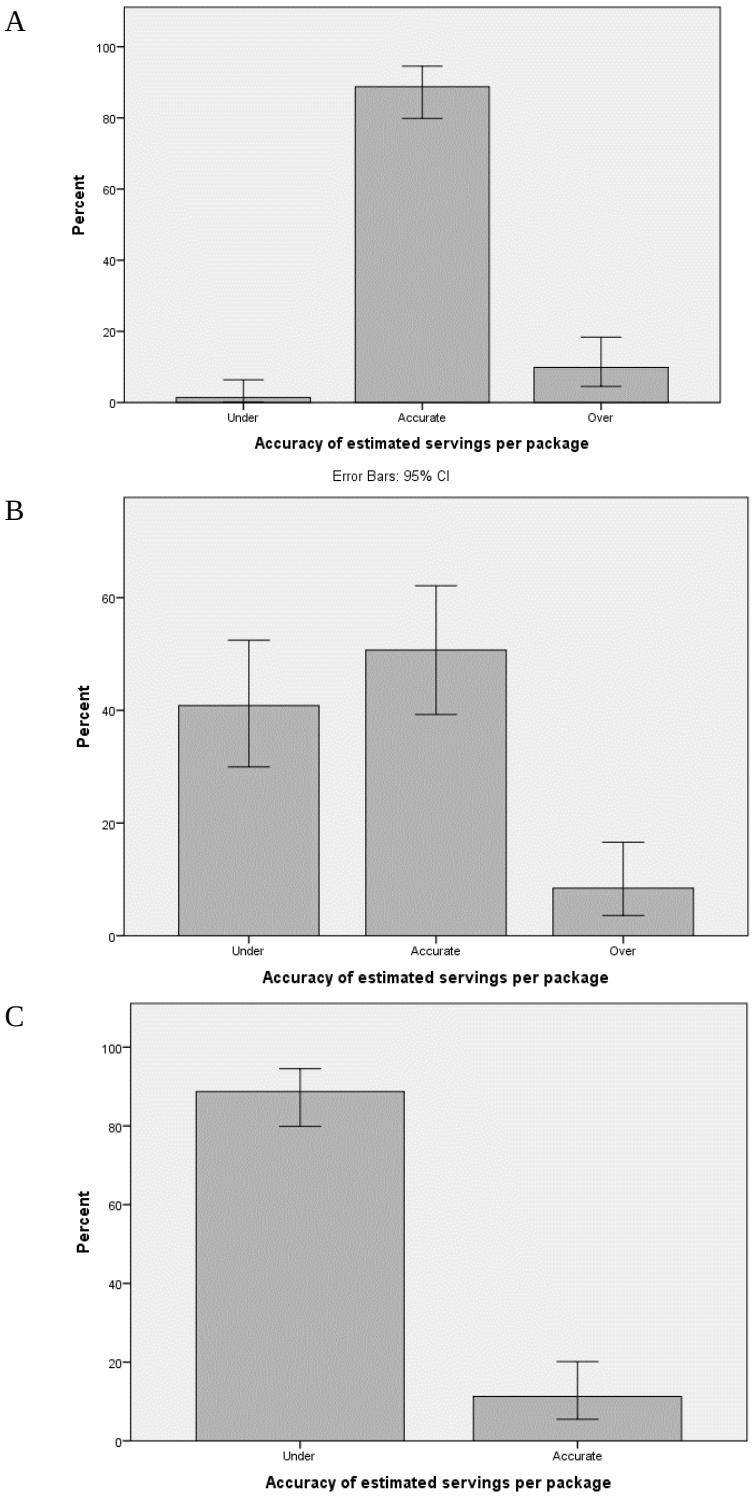
Figure1. *Accuracy of poured servings of cereal and flavored tortilla chips*



When participants were given various sized packages of chips, significantly more participants guessed fewer servings were enclosed in the package than the accurate number of servings (Figure 2). More participants were accurate when guessing the

number of portions inside a single serving bag (88.7%), yet not as many accurately guessed the number of servings in the three serving bag (50.7%). Very few participants guessed neither more servings than were accurate for either the single serving bag (9.9%) nor the three serving bag (8.5%).

Figure 2. *Accuracy of estimated servings per (A) one serving, (B) three serving, and (C) ten serving bag of flavored tortilla chips*



DISCUSSION

Our study aimed to explore the effects of body weight perception and weight intention on food portion estimation in middle school girls and boys and to investigate the accuracy of participants' ability to determine appropriate portion sizes of commonly consumed snack items. In the present total population, body dissatisfaction was apparent as a large percentage (48.1%) of participants reported

wanting to lose weight even though only 17.7% described themselves as overweight. When exploring this desire by sex, 45.5% of girls and 19.6% of boys wanted to lose weight while 48.5% of girls and 47.8% of boys wanted to stay the same weight and 6.1% of girls and 32.6% of boys wanted to gain weight. These finding are in agreement with previous studies and the study hypothesis that more females will indicate an intention to lose weight than males.[24,25,35]

The data from the present study is in contrast to state data. In the state level data for Tennessee from the Youth Risk Behavior Survey, the total percentage of adolescents in the sample who described themselves as overweight was less than in our study, 24.8% and 17.7% respectively.[38] In stark contrast to state level data, fewer girls described themselves as overweight in the present study yet the percentage of boys who believed themselves to be overweight (21.7%) was similar to state level data (23.1%). In the current study, 80.4% of boys were not trying to lose weight which is higher than the state level data at 63.9%. Of the girls in this study, 54.5% were not trying to lose weight which is higher than the state level data at 45.8%. Of all students surveyed, 69.6% were not trying to lose weight compared to 55.0% state wide. It is possible these discrepancies could be due to the higher socioeconomic status of the current study's population, as low socioeconomic status has been tied to overweight and obesity.[39]

The hypothesis that girls will tend to estimate portion sizes as smaller than standard sizes relative to boys was rejected. However, those who intended to lose weight estimated portion sizes as smaller than standard sizes compared to those who intended to gain weight, confirming the study's hypothesis. Further, the hypothesis that generally portion sizes would be too large and inaccurate was confirmed.

When participants were asked to pour a portion of chips, a larger percent of those who intended to gain weight (75%) and maintain weight (48%) over-poured versus 43.5% of those trying to lose weight. Similarly, the composite scores revealed that students who intended to gain weight compared to those who wanted to lose weight poured portions differently, as those who wanted to lose weight often under-estimated an accurate serving size. This finding suggests that those adolescents reporting an attempt to lose weight may be more inclined to look at food labels or just critically evaluate the amount of an item that they are consuming. Previous finding have reported that individuals with Anorexia Nervosa measure significantly smaller than typical or ideal portions when compared to a control group; however, the literature does not present this for the general population.[22,23]

Unlike the chips servings, fewer participants over-poured cereal. This could be a result of students' consumption of chips outside of school more so than cereal, or perhaps their preference for chips. Additionally, because cereal is commonly served in bowl and chips directly from the bag, we postulate that this finding could be influenced by participants' visual perceptions of serving sizes. Ready to eat cereal, unlike chips, has been associated with healthier eating patterns which could also factor into the difference in poured portions.[40]

Most participants were able to guess one serving in the single serving package of chips, though many students guess fewer servings in the three serving package, suggesting that adolescents would eat the package in one or two sittings rather than the intended three. Even fewer participants were able to accurately guess that there were ten servings in the largest chip package, with the majority (88.7%) guessing well below the accurate ten servings and an average guess of 5.68 servings per package.

The findings in this study suggest that recent changes by the Food and Drug Administration (FDA) to the Nutrition Facts related to portion sizes are decisions in improving Americans knowledge of portions. Per the FDA, "serving sizes must be based on the amounts of food and drink that people typically consume, not on how much they should consume."[41]

LIMITATIONS

While this study adds to the larger body of portion size data and provides a unique study design that incorporates perceptions of weight, and estimation of serving size using two different methods, the sample is from a private school and results cannot be generalized. Additionally, the sample is in the southern US only. Future studies should be done using larger, more ethnically diverse samples, and in various regions of the US. The current study lacks objectively measured anthropometric data, which would greatly strengthen the study conclusions. This study also uses only one question to account for participant's sentiments towards their weight in comparison to measures

that use images to identify a personal standard for ideal body size.

Unlike previous studies, two methods of portion estimation were used to create an overall composite score. Despite the limitations, this study uniquely highlights adolescent estimations of portion sizes through the lens of weight perception.

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