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RESEARCH ARTICLE

Curvilinear Associations between Weight Status and Diet Variety in Children Referred for Eating Problems

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Abstract

Background: Past research has found positive linear associations between weight status and the variety of grains, proteins, and snack foods accepted by children and adults, but with negative linear associations for vegetables. To date, the literature has only examined linear associations between these variables. With their broad range of body mass index (BMI) z-scores in comparison to same-aged peers, children referred to clinics for the treatment of eating problems provide a unique opportunity to examine both linear and curvilinear associations between children's BMI z-scores and the number of foods accepted.

Methods: Participants included 587 children with various problems with eating, such as poor weight gain, selective eating, and/or overweight with autism spectrum disorder, other special needs, and no special needs. Clinic staff measured children's height and weight to calculate BMI z-scores and parents completed surveys to report children's acceptance of 77 common foods from six food groups.

Results: ANCOVAs found greater diet variety accepted by children who were older, female, without special needs, and with higher BMI z-scores. Hierarchical multiple regression revealed the expected positive linear associations, but also J-shaped curvilinear associations between BMI z-scores and diet variety for fruits, vegetables, proteins, grains, and dairy foods with upswings in diet variety for both underweight children (BMI z-scores < -2.00) and especially for children with severe obesity (BMI z-scores > +2.00).

Conclusion: These results suggest that only encouraging children to eat a variety of foods will not be a successful weight management strategy. The willingness of underweight children to eat a variety of foods may also help promote weight gain through offering a variety of foods at meals and snacks to decrease satiation and increase intake.

Keywords: Diet variety; Diet diversity; Child weight status; Pediatric obesity; Feeding problems; Under weight

Introduction

When children are referred to hospital-based clinics for the treatment of various eating problems, clinicians must set behavioral goals for each child's food consumption (such as increased food variety, increased food amount). Setting these goals depends on accurate research findings about how children's weight status is associated with their diet variety. Children's weight status is typically measured by clinicians as body mass index scores in comparison to same-aged peers (BMI z-score), and children's diet variety is often measured by giving parents a long list of foods and asking them to report which items their children are willing to eat. In general, past research has found positive linear associations between weight status and the variety of grains, proteins, and snack foods accepted by children and adults, but with negative linear associations for vegetables [1-3]. These results suggest increasing the variety of fruits and vegetables while decreasing the variety of carbohydrates such as grains and snack foods.

Recent research involving a large sample of adults showed a great food count was associated with greater intake of both healthy and unhealthy foods, suggesting interventions limited to increasing overall diet diversity may not be helpful [4]. Another recent study found a positive linear association found between weights gained and the variety of foods consumed, including fruits and vegetables [5]. One possible explanation for the inconsistency in past results would be if curvilinear associations between weight and diet variety are obscured by consideration only of linear associations. Examining such curvilinear associations requires large samples of children with an extremely wide range of BMI z-scores. Children referred for eating problems can provide this range, with its inclusion of children with severe obesity having BMI z-scores above +2.00 (or two standard deviations above the mean for same-aged peers) to underweight children having BMI z-scores below -2.00 (or two standard deviations below

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the mean). Their eating problems may include poor weight gain, food refusal, selective feeding, disruptive mealtime behavior, and/or overeating. Thus, samples of such clinic-referred children provide a unique opportunity to consider both linear and curvilinear associations between children's BMI z-scores and diet variety accepted. Results of linear and/or curvilinear associations found may be useful for clinicians in determining goals they might emphasize for these children's food consumption (such as increased food variety, or increased food amount). One possible curvilinear association between BMI z-scores and diet variety could be an "inverted U-shaped" relationship, in which the highest diet variety occurred for children with mid-range weight status (BMI z-scores close to 0), with both extremely underweight children and children with severe obesity showing "picky eating" and low diet variety (most likely for fruits and vegetables). Alternatively, the curvilinear association between BMI z-scores and diet variety could be a "U-shaped" relationship with upswings in diet variety for both children with severe obesity and underweight children or a "J-shaped" relationship with upswings in diet variety for both underweight and severe obesity, but especially for the children with severe obesity.

Purpose of the Present Study

The purpose of the present study was to add to the research literature an examination of both linear and curvilinear associations between children's weight status and diet variety (for fruits, vegetables, proteins, grains, snack foods). The children included in our planned sample had been referred for treatment of a wide variety of eating problems and they had an extremely wide range of BMI z-scores, from children with severe obesity (BMI z-scores > +2.00) to extremely underweight children (BMI z-scores < -2.00). Results from our linear and curvilinear analyses may provide new insights for clinicians treating children with eating problems, allowing clinicians to provide recommendations concerning children's food consumption as specific and appropriate for their weight condition as possible.

Key Messages

- A curvilinear association between diet variety and weight showed children at both ends of the weight spectrum accepted a greater variety.
- Consumption of a wide variety of foods alone is not sufficient to manage weight.
- The increased diet variety found among underweight children could be used in the development of interventions to increase intake.

Method

Participants

Study participants included 587 children referred for treatment at two hospitals in Pennsylvania and New York, having various eating problems including poor weight gain, food refusal, selective feeding, disruptive mealtime behavior, and obesity (60.9% male; mean age = 81.05 months, SD = 47.67; mean BMI z-score = .46, SD = 1.65; 29.4% with ASD, 30.2% with other special needs, 40.4% with no special needs). Children's weight status was determined by clinic staff who measured the child's weight in kg and height in cm, then calculated the child's body mass index (BMI = kg^2/m) percentile and z-scores in comparison to children of their age and gender using data files from the Centers for Disease Control or the Children's Hospital of Philadelphia online software (http://stokes.chop.edu/web/zscore) for children over 24 months and Pedi Tools (http://www.peditools.org/growthinfant/) for children under 24 months. While all of the children with ASD were diagnosed prior to referral for their eating problems, ASD status was confirmed by a psychologist who reviewed patient records and interviewed caregivers during an initial evaluation with one or more of the following team members: a speech-language pathologist, an occupational therapist, a dietician, a psychologist, a pediatric nurse practitioner, and a physician (either a pediatric gastroenterologist or weight management specialist). This study was approved by the IRB at each hospital and informed consent was obtained for participants.

Procedures and Measurement

Parents used a pre-intervention survey to report children's demographic information and their food acceptance or willingness to eat (not food amounts or frequency consumed) for a list of 77 common foods that included six food groups: 20 fruits, 17 vegetables, 16 proteins and substitutes, 9 grain foods, 6 dairy foods, and 9 sweet and salty snack foods. For each child, the diet variety acceptance score for each food group was the number of foods from that group the child would eat, with higher scores indicating greater diet variety. Table 1 shows the percentage of the 587 clinic children who accepted each of the 77 common foods.

Data Analysis

One preliminary set of analyses examined how children's demographics (special needs status, gender, age, BMI z-score) were associated with diet variety for each food group (20 fruits, 17 vegetables, 16 proteins, 9 grains, 6 dairy, 9 snacks). For each food group, SPSS 24 software was used to conduct 3 X 2 ANCOVAs that compared diet variety across three special needs status groups (ASD, other, none), across two genders (male, female), with age and BMI z-scores as covariates (Table 2). (NOTE: Samples sizes were slightly smaller for analyses of some of the six food groups if parents did not endorse any of the responses regarding acceptance for a particular food.)

The primary goal for data analysis in the present study was to examine the possible presence of both linear and curvilinear associations between the 587 children's weight status (BMI z-score) and diet variety scores for the six food groups (fruits, vegetables, proteins, grains, dairy, snacks). For each food group, SPSS 24 software was used to conduct hierarchical multiple regression analyses for the diet variety score (number of foods eaten) served as the outcome variable, with BMI z-score entered in the first step of the regression to evaluate

20 FRUITS	%	17 VEG	%	16 PROTEINS	%	9 GRAINS	%	6 DAIRY	%	9 SNACKS	%
Banana	64.70%	Potato fries	73.10%	Peanut butter	80.90%	Crackers	69.30%	Yogurt	60.00%	Potato chips	71.10%
Applesauce	56.00%	Corn	45.70%	Nuts/seeds	69.90%	Pizza	66.10%	Cottage cheese	53.50%	Chocolate	67.10%
Apple	55.50%	Carrot	45.30%	Bacon	63.00%	Bread/pita	62.70%	Cheese	50.80%	Pretzels	60.30%
Grapes	49.60%	Peas	36.80%	Beef steak	54.30%	Cold cereal	62.20%	Ice cream	33.40%	Cheese puffs	58.30%
Orange	45.10%	Broccoli	34.80%	Ground beef	48.20%	Pasta	60.10%	Milk	25.00%	Other candy	57.00%
Watermelon	42.20%	Tomato	32.90%	Beans	47.10%	Muffin/ bagel	55.50%	Pudding	21.30%	Corn chips	56.70%
Strawberries	41.10%	Lettuce	29.30%	Chicken nuggets	47.00%	Rice	53.00%			Donuts	53.20%
Peach	35.40%	Zucchini squash	26.10%	Chicken/ turkey	41.90%	Hot cereal	44.60%			Cake	49.30%
Other berries	34.80%	Onion	23.90%	Shellfish	40.70%	Stuffing	17.20%			Pie	49.30%
Pear	34.10%	Green pepper	21.80%	Hot dogs	37.40%						
Pineapple	32.40%	Cucumber	21.50%	Pork/ham	37.20%						
Raisins	29.80%	Cauliflower	18.70%	Tuna/fish	30.90%						
Other melon	24.40%	Celery	18.10%	Sausage	30.50%						
Plum	19.80%	Leafy greens	12.60%	Lunch meat	26.10%						
Mango	17.20%	Cabbage	12.10%	Eggs	22.50%						
Nectarine	15.40%	Brussel sprouts	7.50%	Tofu	18.30%						
Kiwi	13.30%	Eggplant	5.30%								
Apricot	9.00%										
Cranberry sauce	7.70%										
Grapefruit	6.70%										

Table 1: Percentage of Acceptance for Each Food for the Sample of 587 Children.

linear associations between weight and diet variety, and then with BMI z-score^2 entered in the second step of the regression to evaluate curvilinear (quadratic) association between weight and diet variety (Table 3). Finally, SPSS 24 software was used to make graphs showing scatterplots and best-fit lines (both linear and curvilinear) for associations between children's weight and diet variety for each of the six food groups evaluated (Figure 1)

Results

Child Demographics Associated with Diet Variety

The 3 X 2 ANCOVAs found that children's demographics of age, gender, BMI z-score, and special needs status were each significantly associated with children's diet variety at least five of the six food groups evaluated (Table 2**).** Specifically, older age was associated with more acceptance of all six food groups: fruits (r = .14, p = .001), vegetables (r = .34, p = .000), proteins (r = .43, p = .000), grains (r = .39, p = .000), dairy (r = .39, p = .000), snacks (r = .34, p = .000). Female gender was associated with more acceptance of all food groups except snacks: fruits (mean scores: female = 7.7, male = 5.4), vegetables (mean scores: female = 6.0, male = 3.8), proteins (mean scores: female = 8.2, male = 6.1), grains (mean scores: female = 4.6, male = 4.5), and dairy (mean scores: female = 2.9, male = 2.1). Children with ASD or other special needs accepted less variety than children with no special needs for all six food groups: fruits (mean scores: ASD = 4.6, other = 6.5, none = 7.5), vegetables (mean scores: ASD = 3.6, other = 4.7, none = 5.4), proteins (mean scores: ASD = 5.8, other = 6.5, none = 8.1), grains (mean scores: ASD = 4.3, other = 4.5, none = 5.7), dairy (mean scores: ASD = 1.9, other = 2.4, none = 2.9), snacks (mean scores: ASD = 4.4, other = 4.2, none = 5.9). Higher BMI z-score was associated with more acceptances of all food groups: fruits (r = .19, p = .000), vegetables (r = .21, p = .000), proteins (r = .33, p = .000), grains (r = .24, p = .000), dairy (r = .32, p = .000), and snacks (r = .24, p = .000). No significant gender X special needs interactions were found in diet variety accepted for any of the six foods.

Linear and Curvilinear Associations between Weight and Diet Variety

The hierarchical multiple regression analyses found significant linear associations between children's BMI z-score and diet variety for all six food groups evaluated (fruits, vegetables,

20 FRUITS				
Effect	F	(df)	p	effect size
Age	2.87	(1, 575)	.091	.005
BMI z-score	9.84	(1, 575)	.002	.017
Special needs	10.82	(2, 575)	.000	.036
Gender	13.33	(1, 575)	.000	.023
Special needs X Gender	0.36	(2, 575)	.697 (ns)	.001
17 VEGETABLES				
Effect	F	(df)	p	effect size
Age	51.51	(1, 575)	.000	.082
BMI z-score	4.26	(1, 575)	.040	.007
Special needs	5.03	(2, 575)	.007	.017
Gender	20.14	(1, 575)	.000	.034
Special needs X Gender	1.36	(2, 575)	.258 (ns)	.005
16 PROTEINS				
Effect	F	(df)	p	effect size
Age	82.52	(1, 573)	.000	.126
BMI z-score	21.08	(1, 573)	.000	.035
Special needs	12.04	(2, 573)	.000	.040
Gender	10.35	(1, 573)	.000	.018
Special needs X Gender	0.9	(2, 573)	.406 (ns)	.003
9 GRAINS				
Effect	F	(df)	p	effect size
Age	71.39	(1, 575)	.000	.110
BMI z-score	4.57	(1, 575)	.033	.008
Special needs	13.99	(2, 575)	.000	.046
Gender	6.85	(1, 575)	.009	.012
Special needs X Gender	1.09	(2, 575)	.337 (ns)	.004
6 DAIRY				
Effect	F	(df)	p	effect size
Age	61	(1, 576)	.000	.096
BMI z-score	19.97	(1, 576)	.000	.034
Special needs	14.81	(2, 576)	.000	.049
Gender	10.24	(1, 576)	.001	.017
Special needs X Gender	1.09	(2, 576)	.336 (ns)	.004
9 SNACKS				
Effect	F	(df)	p	effect size
Age	44.07	(1, 573)	.096	.071
BMI z-score	6.43	(1, 573)	.034	.011
Special needs	17.11	(2, 573)	.049	.056
Gender	2.12	(1, 573)	.017	.004
Special needs X Gender	2.53	(2, 573)	.004	.009

Table 2: Results from 3 X 2 ANCOVAs to Examine Demographics Associated with Diet Variety Eaten from Six Food Groups for 587 Clinic Children, Comparing Three Special Needs Groups (ASD, Other, None), Two Genders, with Age and BMI Z-Score as Covariates.

proteins, grains, dairy, snacks), and significant curvilinear associations between BMI z-score and diet variety for all food groups except snacks (Table 3 and Figure 1)

Conclusion

Results from the present study's examination of demographics associated with diet variety of children referred to hospital-based clinics were generally similar to those of past research, with greater variety accepted by children who were older, without special needs, females, and elevated BMI z-score. For example, food neophobia has been found most prevalent between two and six years of age [6], so younger children

20 FRUITS	R2 change	beta	t	p	17 VEGETABLES	R2 change	beta	t	p
Entered first: BMI z-score	.035	.186	4.58	.000	Entered first: BMI z-score	.044	.211	5.21	.000
Entered second: BMI z-score^2	.017	.144	3.25	.001	Entered second: BMI z-score2	.032	.195	4.46	.000
Total R2 = .052					Total R2 = .076				
F(2, 583) = 15.91					F(2, 583) = 23.94				
p = .000					p = .000				
16 PROTEINS	**R2 change**	**beta**	**t**	**p**	**9 GRAINS**	**R2 change**	**beta**	**t**	**p**
Entered first: BMI z-score	.107	.327	8.36	.000	Entered first: BMI z-score	.058	.241	6.01	.000
Entered second: BMI z-score2	.038	.213	5.05	.000	Entered second: BMI z-score2	.038	.215	4.97	.000
Total R2 = .145					Total R2 = .097				
F(2, 581) = 49.11					F(2, 583) = 31.15				
p = .000					p = .000				
6 DAIRY	**R2 change**	**beta**	**t**	**p**	**9 SNACKS**	**R2 change**	**beta**	**t**	**p**
Entered first: BMI z-score	.099	.315	8.04	.000	Entered first: BMI z-score	.058	.240	5.97	.000
Entered second: BMI z-score2	.028	.183	4.31	.000	Entered second: BMI z-score2	.003	.062	1.41	.140 (ns)
Total R2 = .127					Total R2 = .061				
F(2, 584) = 42.52					F(2, 581) = 18.86				
p = .000					p = .000				

Table 3: Hierarchical Multiple Regression to Examine Linear and Curvilinear Associations between Weight Status (BMI z-score) and Diet Variety Accepted by 587 Clinic Children for Six Food Groups.

would be expected to accept fewer foods. Also, limited diet variety has been found more prevalent in children with special needs, especially children with ASD [7-9], so present findings of children with special needs having more limited diet variety for all six food groups was expected. Additionally, while some past research suggests no gender differences in diet variety [10], 29.4% of the present sample had ASD which is more prevalent in boys, and may explain the reduced diet variety found for boys in the present sample. Finally, past research examining only linear associations between weight status and diet variety suggests that individuals with higher BMI percentiles usually eat a greater variety of grains, proteins, and snack foods [2, 3].

However, in addition to the present study's findings of positive linear associations between children's weight and diet variety for six food groups (fruits, vegetables, proteins, grains, dairy, snacks), present results also uncovered "J-shaped" curvilinear associations between BMI z-scores and diet variety for five of these food groups (fruits, vegetables, proteins, grains, dairy). More specifically, upswings in diet variety eaten were seen for both children who were extremely underweight (BMI z-scores < -2.00) and severely obese (with BMI z-scores $> +2.00$), but especially for children with severe obesity. (Figure 1)

Biological factors, including gut hormones and genetic influences, have been shown to be related to obesity [11, 12]. One interpretation for the dramatic upswing in variety seen for children with severe obesity may be these biological factors that contribute to excessive adiposity also metabolically prompt excessive hunger and willingness to taste more of the foods available. Children willing to taste foods repeatedly, possibly including those with severe obesity will learn to develop taste preferences for newly introduced foods, and thus producing a lasting increase in diet variety [13]. It may also be the case that some children who are more willing to try novel foods will become overweight because they develop a range of food preferences which increases food availability as there are few foods they do not eat. Conversely, another interpretation is that children with severe obesity are more likely to engage in emotional eating, increasing the likelihood of eating all varieties of food [14]. Future research is needed to assess the reasons for diet variety in children with severe obesity.

The modest upswings in variety for the most severely underweight children may be due to the composition of the sample. The underweight children tended to be younger and consisted of fewer with ASD. The children with ASD, who ate fewer foods than either child with other special needs or without special needs, do not tend to get referred for their selective eating habits until they are at least preschoolers, often when they are school-aged.

Possible Applications of Present Results

Present results suggest the recommendation of eating a wide variety of foods from all food groups is inadequate as a weight management strategy. These results also suggest clinicians encourage children with severe obesity to limit the variety of some food types, such as snack foods, as this may increase their ability to reach satiation and stop over-eating [15, 16]. It has also

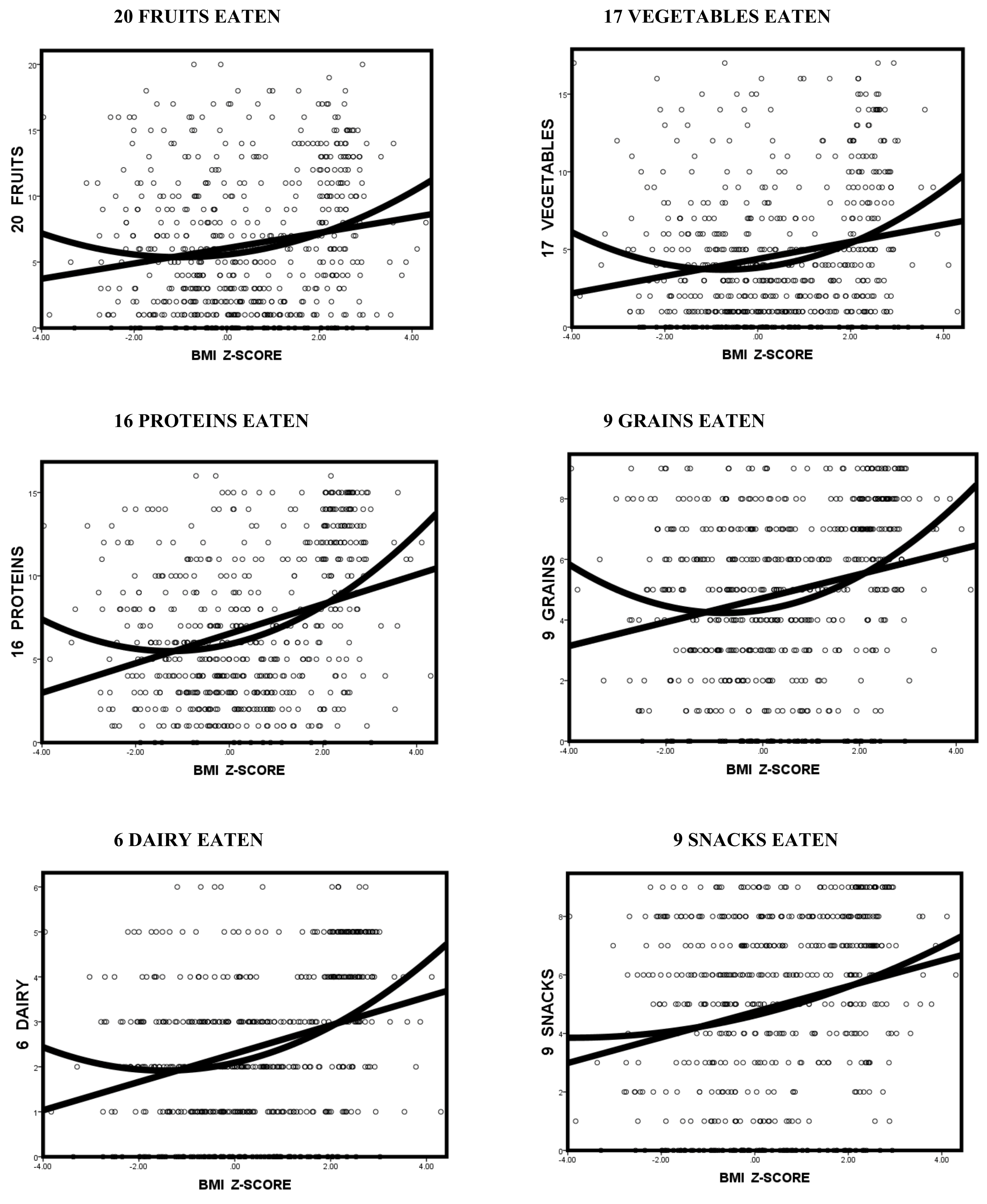

Figure 1: Linear and Curvilinear Associations between BMI Z-Scores and Diet Variety for 587 Children. Significant Linear Associations were found for All Six Food Groups, Curvilinear for All except Snacks.

been suggested that changing the diet composition to include more low-calorie, high-nutrient foods such as vegetables while decreasing the intake of high-calorie, low nutrient foods such as snack foods, is an effective method for both prevention of and intervention for obesity [17]. Present results suggest children with severe obesity might be particularly amendable to this type of diet change because their acceptance of wide diet variety would make them more likely to eat vegetables.

The finding that extremely underweight children eat a wider variety than some of their heavier peers may present a method of increasing their overall intake. Numerous studies with children and adults have demonstrated increased food variety at single eating episode, such as a meal or snack, results in increased intake [18, 19]. These past findings may be readily applied to the underweight children found to accept a variety of foods by serving them a greater number of foods at meals to decrease sensory specific satiety and increase intake.

Study Limitations and Further Research

One limitation of the present study was that its measure of children's diet variety relied upon parent report. Future research should include independent corroboration of children's diet variety such as from medical staff, from the child's other parent, from food presentations made to children with their responses recorded. Also, the present study measure only children's willingness to accept foods, rather than actual frequency or amount consumed. Actual consumption using daily food diaries, either written or electronic, or perhaps other forms of technology to record intake in real or near-real time would provide better estimates of consumption. Additionally, while we were interested in possible curvilinear associations between children's weight and diet variety allowed by the broad spectrum of BMI z-scores found in a clinical sample of children with a range of eating issues, additional research should be conducted with non-clinic populations to confirm the inverted U-shaped patterns found in the present study.

Another limitation of the present study was that its survey methodology allows only conclusions about correlations, rather than cause-effect directions between children's weight status and diet variety. For example, one interpretation for the positive linear associations found between children's BMI z-scores and diet variety could be the causal sequence that children with severe obesity have hormonal and/or hypothalamic dysregulation (for whatever reason) which leads to increased feelings of hunger and consumption of a variety of available foods. Alternatively, the causal sequence could be reversed so that once children have learned to consume a wide variety of foods satiation is harder to achieve. Future research could use more experimental approaches to examine whether interventions that maintain limits for the number of foods children with obesity have available to them (even from "healthy" foods such as fruits, vegetables, proteins, and whole grains) are effective for increasing their perceived "satiety" for available foods, for decreasing total calories they consume, and reducing their weight status.

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Conflicts of Interest

None.

References

1. Fletcher S, Wright C Jones A, Parkinson K, Adamson A (2017) Tracking of toddler fruit and vegetable preferences to intake and adiposity later in childhood. *Matern Child Nutr* 13:e12290. [View Article]
2. McCrory MA, Fuss PJ, McCallum JE, Yao M, Vinken AG, et al. (1999) Dietary variety within food groups: Association with energy intake and body fatness in men and women. *Am J Clin Nutr* 69:440-447. [View Article]
3. Vadiveloo M, Dixon LB, Mijanovich T, Elbel B, Parekh N (2015) Dietary variety is inversely association with body adiposity among U.S. adults using a Novel Food Diversity Index. *J Nutr* 145:555-563. [View Article]
4. De Oliveira Otto MC, Padhye NS, Bertoni AG, Jacobs DR, Mozaffarian D (2015) Everything in moderation-dietary diversity and quality, central obesity and risk of diabetes. *PLoS One* 10:e0141341. [View Article]
5. Fernandez C, Kasper NM, Miller AL, Lumeng JC, Peterson KE (2016) Association of dietary variety and diversity with body mass index in US preschool children. *Pediatrics* 137:e20152307. [View Article]
6. Kral VET (2018) Food neophobia and its association with diet quality and weight status in children. In S. Reilly (ed.) Food neophobia: Behavioral and biological influences. *Woodhead Publishing*. P. 287-303. [View Article]
7. Budd KS, McGraw TE, Farbisz R, Murphy TB, Hawkins D, et al. (1992) Psychosocial concomitants of children's feeding disorders. *J Pediatr Psychol* 17:81-94. [View Article]
8. Field D, Garland M, Williams K (2003) Correlates of specific childhood feeding problems. *J Paediatr Child Health* 39:299-304. [View Article]
9. Schreck KA, Williams K, Smith AF (2004) A comparison of eating behaviors between children with and without autism. *J Autism Dev Disord* 34:433-438. [View Article]
10. Lytle LA, Seifert S, Greenstein J, McGovern P (2000). How do children's eating patterns and food choices change over time? Results from a cohort study. *Am J Health Promot* 14:222-8. [View Article]
11. Mishra AK, Dubey V, Ghosh AR (2016) Obesity: an overview of possible role (s) of gut hormones, lipid sensing and gut microbiota. *Metabolism* 65:48-65. [View Article]
12. Farooqi IS, O'Rahilly S (2007) Genetic factors in human obesity. *Obes Rev* 1:37-40. [View Article]
13. Cooke L (2007) The importance of exposure for healthy eating in childhood: a review. *J Hum Nutr Diet* 20:294-301. [View Article]
14. Aparicio E, Canals J, Arija V, De Henauw S, Michels N (2016) The role of emotion regulation in childhood obesity: implications for prevention and treatment. *Nutr Res Rev* 29:17-29. [View Article]
15. Raynor HA, Wing RR (2006) Effect of limiting snack food variety across days on hedonics and consumption. *Appetite* 46:168-176. [View Article]
16. Temple JL, Giacomelli AM, Roemmich JN, Epstein LH (2007) Overweight children habituate slower than non-overweight children to food. *Physiol Behav* 91:250-254. [View Article]
17. Rolls BJ (2010) Plenary Lecture 1: Dietary strategies for the prevention and treatment of obesity. *Proc Nutr Soc* 69:70-79. [View Article]

18. Brondel L, Romer M, Van Wymelbeke V, Pineau N, Jiang T, et al. (2009) Variety enhances food intake in humans: role of sensory-specific satiety. *Physiol Behav* 97:44-51. [View Article]

19. Sørensen LB, Møller P, Flint A, Martens M, Raben A (2003) Effect of sensory perception of foods on appetite and food intake: a review of studies on humans. *Int J Obesity Relat Metab Disord* 27:1152. [View Article]

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