Published in final edited form as:

J Acad Nutr Diet. 2012 February ; 112(2): 271–275. doi:10.1016/j.jada.2011.10.021.

Children Who Are Pressured to Eat at Home Consume Fewer High-Fat Foods in Laboratory Test Meals

HEEWON LEE, PhD, RD [Research associate] and

Department of Health and Behavior, Teacher's College, Columbia University, New York, NY

KATHLEEN L. KELLER, PhD [Research associate and an assistant professor]

Department of Research Medicine, New York Obesity Research Center, St Luke's-Roosevelt Hospital Center, Institute of Human Nutrition, Columbia University College of Physicians & Surgeons, New York, NY

Abstract

Parents use greater pressure to eat with children who weigh less, but the impact of this practice is unclear. The purpose of this cross-sectional study was to determine the association between parental reports of eating pressure and children's actual intake across four identical ad libitum meals. Sixty-eight ethnically diverse, 4- to 6-year-old children from New York, NY, participated in this study from 2005 to 2007. Eating pressure was measured by the Child Feeding Questionnaire. Height and weight were measured and converted to body mass index *z* scores. Meals consisted of macaroni and cheese, string beans, carrots, grapes, graham crackers, cheese sticks, milk, pudding, and a sugar-sweetened beverage. Multiple regressions were performed to determine the extent to which pressure to eat predicted food intake after adjusting for BMI *z* score and child weight concern. Pressure to eat was negatively associated with child BMI *z* score ($r = -0.37$; $P < 0.01$), energy intake ($\beta = -.30$; $P < 0.05$), and energy density ($\beta = -.28$; $P < 0.05$). In addition, pressure was negatively associated with intake of macaroni and cheese ($\beta = -.26$; $P < 0.05$), whole milk ($\beta = -.27$; $P < 0.05$), and pudding ($\beta = -.33$; $P < 0.01$), but positively associated with vegetable intake ($\beta = .43$; $P < 0.01$). However, both vegetable and milk consumption were low, so results should be interpreted with caution. These findings suggest that greater pressure to eat is associated with lower intake of some high-fat foods in the laboratory, where no pressure is applied.

Parents often pressure their children to eat as a way to encourage intake of certain foods (1), but the consequences can be unintended (2). Increased use of pressure is commonly associated with lower body mass index (BMI; calculated as kg/m^2) (2–7) and lower energy intake in children (2,8). In addition, pressuring children to eat can be associated with lower fruit and vegetable intake (9) and higher pickiness (2). During longer-term studies, increased pressure has been associated with the emergence of disordered eating among girls (10). In addition, eating pressure can impair a child's ability to self-regulate energy intake, which could potentially promote overeating (3).

Findings from the studies mentioned suggest that excessive pressure to eat can negatively impact development of childhood eating behaviors. Few studies have looked at these

relationships in ethnically diverse cohorts. Because differences in the effectiveness of parenting styles exist across ethnic groups (11), these studies are warranted.

The objective of this study was to investigate the relationship between parental reports of pressure to eat and actual food intake across four identical test meals in a multi-ethnic sample of young children. It was hypothesized that greater pressure would be associated with lower intake of high-fat foods at the meal.

METHODS

Participants and Study Design

Sixty-eight 4- to 6-year-old children (mean age=5.3±0.8 years) completed this cross-sectional study that took place from 2005 to 2007. Children were eligible to participate if they were healthy and not on any medications, had been to school, and had no food allergies. In addition, children also had to like at least six of nine foods served at the meals, according to parent report during screening. Families received modest compensation for participating. Parents, the majority (~95%) of which was mothers, provided written consent for their children, and children verbally agreed to participate. This study was approved by the Institutional Review Board of St Luke's Roosevelt Hospital.

These data are part of a larger cross-sectional study designed to investigate the relationship between genetic taste factors and obesity (data presented elsewhere) (12). As part of this study, children attended the laboratory for four, 1-hour sessions that started anywhere from 4:30 to 6:30 PM. The first 30 minutes were used to complete study questionnaires, followed by consumption of an ad libitum dinner. Children were requested to fast for 3 hours before their session. All sessions took place within 2 weeks of each other, and each session was separated by at least 1 day to avoid fatigue with the meal. On the first session, parents also completed a series of demographic and feeding-behavior questionnaires.

Anthropometric Measures

Anthropometric measures (weight and height) were performed by a trained researcher. Children were weighed and measured in stocking feet and light clothing on a balance scale (Model 437, Detecto, Webb City, MO) and stadiometer (Model 202 Wall Mounted Stadiometer, Seca, Chino, CA), respectively. Height and weight were converted to BMI and BMI z scores were calculated using the Centers for Disease Control and Prevention's conversion program.

Test Meals

Children ate ad libitum from a test meal of foods that were chosen because they are familiar, palatable, and have been used in past studies with this age group (12,13). The same meal was served on all occasions. Dinner consisted of the following foods (energy density appears in parentheses): macaroni and cheese (3.2 kcal/g), baby carrots (0.38 kcal/g), string beans (0.27 kcal/g), cheese sticks (2.9 kcal/g), grapes (0.71 kcal/g), graham crackers (4.2 kcal/g), chocolate pudding (1.1 kcal/g), whole milk (0.62 kcal/g), fruit punch (0.47 kcal/g), and a choice of sugar-sweetened beverage (ie, chocolate milk [0.81 kcal/g], apple juice [0.43 kcal/g], and caffeine-free cola [0.42 kcal/g]). A choice of sugar-sweetened beverages was given because an additional aim of the study was to examine the relationships among milk intake, sugar-sweetened beverages, and obesity (14). Serving sizes of each food were determined by selecting the average portion size consumed of each food or beverage for children ages 6 to 11 years from the Continuing Survey of Food Intakes by Individuals (1994–1996) (15). All items were provided on trays, with main entrées served on plates. A consistent presentation was used across all meals. If children finished a portion, they were

asked whether they wanted more. However, children were not pressured to try or finish any of the foods. Researchers read to children during the meal to avoid the awkwardness of having the child eat alone. Children were allowed 30 minutes to eat as much as they liked.

Parents were instructed to avoid making eating-related prompts and were seated in an adjacent waiting room during the meals. They were unable to hear or see the child while they ate, but they could check on their child at any time if they needed.

Total energy and energy density for the meals were computed by calculating the difference between the pre and post weight in grams of all foods and beverages eaten. Nutrition Facts label information was used to calculate calorie content of each item.

Parental Feeding Practices

The Child Feeding Questionnaire from Birch and colleagues (16) was used to assess pressure to eat. This is a self-report instrument that measures three feeding attitudes (ie, perceived responsibility, perceived overweight, and concern for child weight) and three feeding practices (ie, restriction, monitoring, and pressure). The relationship between other Child Feeding Questionnaire sub-scales and ad libitum meal intake has been reported elsewhere (17). The Child Feeding Questionnaire has not been validated on an inner-city, multi-ethnic population.

Pressure to eat is a feeding practice defined by the extent to which parents use pressure to encourage their child to eat more. It consists of four items: 1) "My child should always eat all of the food on his/her plate;" 2) "I have to be especially careful to ensure my child eats enough;" 3) "If my child says 'I'm not hungry,' I try to get him/her to eat anyway;" and 4) "If I did not guide or regulate my child's eating, she/he would eat much less than she/he should." Parents responded to each question using a 5-point scale. A mean value of all four items was calculated to determine the pressure-to-eat score.

Statistical Analysis

Descriptive statistics were performed to determine means and standard deviations for continuous variables and frequencies for categorical variables. Pearson's correlations were used to test associations among key variables. Multiple regressions were done to determine the relationships between pressure, total energy intake (kcal), and intake from each food item, independently. Dependent variables were energy intake of the meal and each individual item (kcal) and energy density (kcal/g). Pressure to eat was considered an independent variable in each model. In addition, child ethnicity, BMI z score, and weight concern were included as covariates. Ethnicity was dummy-coded in initial regression models, but because it was not a significant predictor in any model, it was dropped from the final analyses. Independent sample *t* tests were used to compare food intake among children who had high vs low eating-pressure scores. A median split was used to categorize low (score ≤ 3) vs high (score > 3) pressure for these analyses.

Statistical Package for the Social Sciences (version 18.0, 2006, SPSS Inc, Chicago, IL) was used for analyses, all tests were two-tailed, and the cut-off for significance was $P < 0.05$. All descriptive data are presented as mean $\pm$ standard deviation (SD). The term *predictor* is used to describe statistical relationships and is not meant to imply causality.

RESULTS AND DISCUSSION

Seventy-five children were recruited, but because of scheduling conflicts, only 68 completed all visits and are described here. Children's characteristics are summarized in Table 1. Twenty-six of 68 children had BMIs in the overweight or obese range (≥ 85 th percentile

BMI-forage), and mean BMI *z* score was 1.08 ± 1.09 . Parents' BMIs were self-reported and averaged 27.9 ± 6.1 , with mothers (mean $\pm$ SD= 27.0 ± 6.1) having lower BMIs than fathers (mean $\pm$ SD= 32.2 ± 4.7) ($P < 0.05$). Parental BMI was positively associated with child BMI *z* score ($r = 0.27$; $P < 0.05$), but this correlation was stronger when considering mothers only ($r = 0.41$; $P < 0.005$), a finding consistent with previous literature (18). Seventeen of 68 (25%) families reported incomes $\leq \$20,000$ per year. Of the 17 families who reported that they earned $\leq \$20,000$ per year, 15 (90%) reported high eating pressure, and only 29 of 51 (56%) higher-income families reported high eating pressure ($\chi^2 = 4.0$; $P = 0.05$).

Pressure-to-eat scores ranged from 1 to 5 (mean $\pm$ SD= 3.03 ± 1.11). Scores on this subscale were normally distributed and had acceptable reliability (Cronbach $\alpha = .81$). Pressure to eat was not associated with child age, sex, or ethnicity. Similar to other studies (3,4,6,7,9), pressure to eat was negatively associated with child BMI *z* score ($r = -0.37$; $P < 0.01$).

Mean energy intake for the meals across all children was 545 ± 266.25 kcal and was positively associated with child BMI *z* score ($r = 0.27$; $P < 0.05$). Pearson correlations demonstrated that child BMI *z* score was positively associated with mean intake of milk ($r = 0.27$; $P < 0.05$) and chocolate pudding ($r = 0.42$; $P < 0.001$), but not with the other meal items.

The primary hypothesis was that higher eating pressure would be associated with reduced intake of higher-fat meal items. After adjusting for BMI *z* score and child weight concern, pressure was negatively associated with average calories ($\beta = -.30$; $P < 0.05$), energy density ($\beta = -.28$; $P < 0.05$), and with intake of some higher-fat meal items, including macaroni and cheese ($\beta = -.26$; $P < 0.05$), chocolate pudding ($\beta = -.33$; $P < 0.01$), and whole milk ($\beta = -.27$; $P < 0.05$). These findings are further supported by independent *t* tests, presented in Table 2. Children who received high pressure consumed fewer calories ($P < 0.05$), less whole milk ($P < 0.05$), and less chocolate pudding ($P < 0.001$), compared with low-pressured children. However, total milk intake among all children was low, with highly pressured children consuming only about 1 fluid ounce. These findings are consistent with past reports that have identified negative associations between pressuring children to eat and dietary intake (8,9), and they are not surprising, given the nature of this feeding practice. Parents perceive a greater need to pressure their child to eat if he or she is not a "big eater." The fact that, in the present study, the relationship between pressure and these meal variables was significant after adjusting for both child BMI *z* score and weight concern suggests that parents might be pressuring children to eat in response to factors other than weight status.

The association between eating pressure and intake of low energy-dense items, namely vegetables, was also tested. Because of previous findings (19), it was predicted that this association would also be negative. This was not the case. After adjusting for child BMI *z* score and weight concern, pressure was positively associated with intake of carrots ($\beta = .34$; $P < 0.05$), string beans ($\beta = .35$; $P < 0.01$), and both vegetables combined ($\beta = .43$; $P < 0.01$). In Table 2, high-pressure children consumed more carrots ($P < 0.05$), string beans ($P < 0.05$), and both vegetables combined ($P < 0.01$), compared with low-pressured children. However, vegetable consumption overall was extremely low. This is not surprising, considering the current dietary trends among children (20). It is possible that these results could be due to the fact that children who were pressured were also given rules related to meal time that carried over to the laboratory (eg, "You must try everything on your plate"). However, because of the cross-sectional nature of this study, the causal pathways cannot be determined.

Parents often use pressure to get their children to eat certain foods, but previous studies have suggested that this practice is largely maladaptive (2,3,9,10). Because of these studies, it is

not advisable to interpret the present findings from the perspective that pressuring children to eat might be protective. These data are cross-sectional, and it is not possible to disentangle cause from effect. However, in light of previous studies, the current findings demonstrate that, in the laboratory environment where no pressure is administered, higher pressure to eat was associated with fewer total calories and lower intake of several palatable, high-fat foods. The fact that higher pressure was associated with an overall healthier food-selection pattern suggests that the reasons parents are pressuring children at home need to be more closely examined.

The present cohort was ethnically diverse. Most studies have been done in white populations of higher socioeconomic status (9,21–23). However, African-American parents report higher use of pressure (24,25) than white parents. In addition, several studies have found that African-American and Hispanic parents tend to perceive their children as thinner than they actually are (26). Consequently, parents might be pressuring children to eat because they perceive them to be underweight. In the present study, ethnicity did not substantially affect the relationships between meal intake and eating pressure, but the cohort might have been too small to detect these effects.

This study had several limitations. First, the validity of a single meal to predict a broader spectrum of eating behaviors is unknown. Another limitation is that parental eating habits, such as fruit and vegetable intake, were not measured, and previous studies have identified parental modeling as an important predictor of child eating behavior (19). The sample size was small, so it was not possible to adjust for other covariates that could have impacted the primary relationships. In addition, the test meal included nine items and several beverages that could have reduced intake of less palatable items, such as vegetables. Finally, children were not allowed to serve themselves food items, and previous research has demonstrated that this can impact consumption (27).

CONCLUSIONS

This cross-sectional study demonstrates an association between parental reports of eating pressure and lower intake of some high-fat foods in the laboratory among children. These relationships were independent of child BMI *z* score, which suggests that parents might be pressuring children in response to cues other than body weight, such as low intake of energy-dense foods. Longitudinal studies in larger cohorts are needed to determine the causal pathway by which pressure affects eating behavior and obesity.

Acknowledgments

FUNDING/SUPPORT: This research was supported by National Institutes of Health (NIH) grant K01DK068008 (K.L.K.). Also, the work was made possible by the Obesity Research Center Grant (NIH grant 5P30DK026687-27).

References

1. Francis LA, Hofer SM, Birch LL. Predictors of maternal child-feeding style: Maternal and child characteristics. *Appetite*. 2001; 37(3):231–243. [PubMed: 11895324]
2. Galloway AT, Fiorito LM, Francis LA, Birch LL. ‘Finish your soup’: Counterproductive effects of pressuring children to eat on intake and affect. *Appetite*. 2006; 46(3):318–323. [PubMed: 16626838]
3. Birch LL, Fisher JO. Mothers’ child-feeding practices influence daughters’ eating and weight. *Am J Clin Nutr*. 2000; 71(5):1054–1061. [PubMed: 10799366]
4. Brann LS, Skinner JD. More controlling child-feeding practices are found among parents of boys with an average body mass index compared with parents of boys with a high body mass index. *J Am Diet Assoc*. 2005; 105(9):1411–1416. [PubMed: 16129082]

5. Carnell S, Wardle J. Associations between multiple measures of parental feeding and children's adiposity in United Kingdom preschoolers. *Obesity*. 2007; 15(1):137–144. [PubMed: 17228041]
6. Farrow CV, Blissett J. Controlling feeding practices: Cause or consequence of early child weight? *Pediatrics*. 2008; 121(1):e164–e169. [PubMed: 18166535]
7. Spruijt-Metz D, Li C, Cohen E, Birch L, Goran M. Longitudinal influence of mother's child-feeding practices on adiposity in children. *J Pediatr*. 2006; 148(3):314–320. [PubMed: 16615957]
8. Goldstein GL, Daun H, Tepper BJ. Influence of PROP taster status and maternal variables on energy intake and body weight of pre-adolescents. *Physiol Behav*. 2007; 90(5):809–817. [PubMed: 17313965]
9. Galloway AT, Fiorito L, Lee Y, Birch LL. Parental pressure, dietary patterns, and weight status among girls who are "picky eaters". *J Am Diet Assoc*. 2005; 105(4):541–548. [PubMed: 15800554]
10. Carper JL, Orlet FJ, Birch LL. Young girls' emerging dietary restraint and disinhibition are related to parental control in child feeding. *Appetite*. 2000; 35(2):121–129. [PubMed: 10986105]
11. Hughes SO, Power TG, Orlet FJ, Mueller S, Nicklas TA. Revisiting a neglected construct: Parenting styles in a child-feeding context. *Appetite*. 2005; 44(1):83–92. [PubMed: 15604035]
12. Keller KL, Reid AR, MacDougall M, et al. Sex differences in the effects of bitter thiourea sensitivity on body weight in 4–6 year-old children. *Obesity*. 2010; 18(6):1194–1200. [PubMed: 19779476]
13. Faith MS, Keller KL, Johnson SL, et al. Familial aggregation of energy intake in children. *Am J Clin Nutr*. 2004; 79(5):844–850. [PubMed: 15113724]
14. Keller KL, Kirzner J, Pietrobelli A, St-Onge MP, Faith MS. Increased sweetened beverage intake is associated with reduced milk and calcium intake in 3- to 7-year-old children at multi-item laboratory lunches. *J Am Diet Assoc*. 2009; 109(3):497–501. [PubMed: 19248869]
15. Smiciklas-Wright, H.; Mitchell, D.; Mickle, S.; Cook, A.; Goldman, J. *Foods Commonly Eaten in the United States: Quantities Consumed per Eating Occasion and in a Day, 1994–96*. Beltsville, MD: US Department of Agriculture; 2002.
16. Birch LL, Fisher JO, Grimm-Thomas K, et al. Confirmatory factor analysis of the child feeding questionnaire: A measure of parental attitudes, beliefs and practices about child feeding and obesity proneness. *Appetite*. 2001; 36(3):201–210. [PubMed: 11358344]
17. Sud S, Tamayo NC, Faith MS, Keller KL. Increased restrictive feeding practices are associated with reduced energy density in 4–6 year-old multi-ethnic children at *ad libitum* laboratory test meals. *Appetite*. 2011; 55(2):201–207. [PubMed: 20594990]
18. Lake JK, Power C, Cole TJ. Child to adult body mass index in the 1958 British birth cohort: Associations with parental obesity. *Arch Dis Child*. 1997; 77(5):376–381. [PubMed: 9487953]
19. Fisher JO, Mitchell DC, Smiciklas-Wright H, Birch LL. Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *J Am Diet Assoc*. 2002; 102(1):58–64. [PubMed: 11794503]
20. Guenther PM, Dodd KW, Reedy J, Krebs-Smith SM. Most Americans eat much less than recommended amounts of fruits and vegetables. *J Am Diet Assoc*. 2006; 106(9):1371–1379. [PubMed: 16963342]
21. Fisher JO, Birch LL. Restricting access to palatable foods affects children's behavioral response, food selection, and intake. *Am J Clin Nutr*. 1999; 69(6):1264–1272. [PubMed: 10357749]
22. Fisher JO, Birch LL. Eating in the absence of hunger and overweight in girls from 5 to 7 years of age. *Am J Clin Nutr*. 2002; 76(1):226–231. [PubMed: 12081839]
23. Fisher JO, Birch LL. Restricting access to foods and children's eating. *Appetite*. 1999; 32(3):405–419. [PubMed: 10336797]
24. Brown KA, Ogden J, Voge C, Gibson EL. The role of parental control practices in explaining children's diet and BMI. *Appetite*. 2008; 50(2–3):252–259. [PubMed: 17804116]
25. Reid AR, Faith MS, Keller KL. Ethnic variations in reported parental feeding strategies as measured by the Child Feeding Questionnaire. *Obesity*. 2007; 15(suppl):A171.
26. Killion L, Hughes SO, Wendt JC, Pease D, Nicklas TA. Minority mothers' perceptions of children's body size. *Int J Pediatr Obes*. 2006; 1(2):96–102. [PubMed: 17907321]

27. Fisher JO. Super-size me: Portion size effects on young children's eating. *Physiol Behav.* 2008; 94(1):39–47. [PubMed: 18155736]

Table 1

Descriptive characteristics of young children enrolled in a study investigating the relationship between eating pressure and laboratory food intake (n=68)

Variable	
Age (y), mean±SD ^a	5.3±0.8
BMI ^b z score, mean±SD	1.08±1.09
Sex, n (%)	
Male	34 (50.0)
Female	34 (50.0)
Ethnicity, n (%)	
African American	23 (33.8)
Hispanic	20 (29.4)
White	14 (20.6)
Asian/East Asian	2 (2.9)
Other	9 (13.2)
BMI classification-children, n (%)	
Underweight (<5th % BMI-for-age)	2 (2.9)
Normal weight (5–85th % BMI-for-age)	40 (38.8)
Overweight (85–95th % BMI-for-age)	8 (11.8)
Obese (≥95th % BMI-for-age)	18 (26.5)
Parental BMI, ^c n (%)	
Underweight (BMI <18.5)	0 (0)
Normal weight (BMI 18.5–24.9)	17 (34.0)
Overweight (BMI 25–29.9)	17 (34.0)
Obese (BMI ≥30)	16 (32.0)

^aSD=standard deviation.

^bBMI=body mass index; calculated as kg/m².

^cParent-reported BMI for the parent who completed the questionnaire (n=50), the majority of which were mothers (~95%).

Table 2

Total and individual food item intake (kcal) across four test meals in 4- to-6-year-old children classified as low pressure (score ≤3) or high pressure (score >3)

Meal variable	Low pressure (n=24)	High pressure (n=44)	P value ^a
Individuals foods ← mean±standard deviation →			
Macaroni and cheese (kcal)	33.36±19.31	23.16±20.28	0.06
Carrots (kcal)	0.54±0.11	2.47±0.38	0.02 ^a
String beans (kcal)	0.13±0.04	0.54±0.16	0.02 ^a
Grapes (kcal)	11.61±13.44	10.86±12.67	0.82
String cheese (kcal)	7.62±13.10	10.11±15.95	0.53
Graham crackers (kcal)	11.94±15.17	15.53±23.07	0.53
Whole milk (kcal)	8.72±15.63	2.66±7.58	0.046 ^a
Chocolate pudding (kcal)	23.53±22.57	7.16±10.50	0.003 ^b
Fruit punch (kcal)	8.70±13.17	7.27±9.21	0.89
Additional SSB ^c (kcal)	48.10±44.64	34.99±30.40	0.46
Summary meal characteristics			
Energy density of meal (kcal/g)	1.96±0.77	1.70±0.57	0.12
Total vegetables (kcal)	0.66±0.76	2.83±4.36	0.02 ^a
Total calories (kcal)	648.5±301.3	477.7±278.2	0.03 ^a

^aMeans are significantly different at $P<0.05$ (two-tailed).

^bMeans are significantly different at $P<0.005$ (two-tailed).

^cSSB=sugar-sweetened beverage; children were offered a choice of SSBs (eg, juice, fruit punch, cola, and chocolate milk).