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Sibling eating behaviours and parental feeding practices with siblings: similar or different?

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Abstract

Objective: Little is known about whether siblings have similar or different eating behaviours or whether parents tailor their feeding practices to different siblings. The main objectives of the present study were to examine similarities and differences in child eating behaviours and parental feeding practices with siblings and to determine whether child eating behaviours and parental feeding practices differ depending on sibling concordant (i.e. both siblings overweight or healthy weight) or discordant (i.e. one sibling overweight and one sibling healthy weight) weight status.

Design: Cross-sectional, mixed-methods study.

Setting: In-home visits were conducted by research staff. Surveys were conducted with parents and anthropometry was collected on parents and siblings.

Subjects: Children (*n* 88) aged 6–12 years (mean age 9 (SD 2) years), their parents (mean age 34 (SD 7) years) and near-age siblings (mean age 9 (SD 4) years) from diverse racial/ethnic and low-income households participated.

Results: Results indicated that siblings with higher BMI engaged in higher levels of emotional eating compared with siblings with lower BMI. Additionally, results indicated that when families had sibling dyads discordant on weight status, the sibling who was overweight had higher food enjoyment and lower levels of food satiety. Additionally, within siblings with discordant weight status, parents were more likely to use restrictive feeding practices with the overweight sibling and pressure-to-eat and encouragement-to-eat feeding practices with the healthy-weight sibling.

Conclusions: Family-based childhood obesity interventions may need to assess for sibling weight status when researching the home environment and intervene with parents to avoid using restriction or pressure-to-eat feeding practices when siblings are discordant on weight status.

Keywords
Parental feeding practices
Child eating behaviours
Siblings
Weight status
Childhood obesity

It is common for American children aged 6–12 years old to have at least one sibling[1]. However, very little is known about whether siblings have similar or different eating behaviours or whether parents use similar or different feeding practices with siblings. This is important to investigate because previous research conducted with one child has shown that parental feeding practices, including restriction and pressure-to-eat, are associated with more harmful weight and weight-related behaviours such as overweight/obesity, disordered eating behaviours, eating in the absence of hunger and unhealthy dietary intake[2–7], although not all findings have been consistent[8]. Additionally, child eating behaviours such as restrained eating (i.e. picky eating) have been found to be associated with higher BMI in children over time[9].

Given that parental feeding practices (i.e. restriction, pressure-to-eat, monitoring) and child eating behaviours (e.g. picky eating) have been associated with more unhealthy weight and weight-related behaviours in research conducted with one child[2–7], examining whether parents adapt their feeding practices to accommodate siblings' eating behaviours in the same household or whether parents use similar feeding practices with both siblings is important to investigate. In addition, it is

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unknown if parents adapt their feeding practices depending on the status of sibling dyads (i.e. one child is overweight and the other child is healthy weight *v.* two siblings of similar weight status)[10]. Answers to these important questions have been missing in the field of childhood obesity and are highly relevant for designing effective family-based obesity prevention interventions for families who have more than one child in their household.

Previous research examining parental feeding practices with siblings (i.e. sibling dyads) within the same household is limited and has shown inconsistent findings[11,12]. For example, studies have shown that parents report using greater restrictive feeding practices with children who exhibit more food fussiness (i.e. picky) than their siblings and more pressure-to-eat feeding practices with children who were slower to eat, enjoyed food less or who were thinner than their siblings[13,14]. Other studies have found no significant differences between maternal control over feeding and child and sibling weight status[15–17] or that mothers used restrictive feeding practices with both siblings regardless of weight status[18]. Many of these studies have been conducted with homogeneous samples (e.g. white, middle class), thus it is unclear if these findings would generalize to racially/ethnically and socio-economically diverse populations. Additionally, none of these studies have examined both parental feeding practices and child eating behaviours with siblings in the same study. More research is needed to address these important unanswered questions regarding parental response to sibling dyads in the home environment and to address inconsistencies and study limitations in previous research.

Findings related to eating behaviours among siblings have also been limited[19]. The majority of studies examining sibling eating behaviours have been conducted with twins[20–22]. These studies have shown that among discordant weight status twin siblings, twins who are overweight have higher food responsiveness, more enjoyment of eating, more slowness of eating and lower food satiety compared with twins who are healthy weight[20–22]. Additionally, twin siblings with restrained eating (i.e. picky eating) as infants had higher BMI at 2 years of age compared with siblings without restrained eating[9]. Thus, given the limited studies conducted on non-twin siblings, it is important to examine eating behaviours between siblings.

Based on the limited and inconsistent findings from previous research on child eating behaviours and parental feeding practices with sibling dyads and because it is common for children to have a sibling, it is critical to understand whether parents are tailoring their feeding practices with siblings. Examining differences by sibling weight status is also important, given previous research conducted with parents with one child that shows parents restrict more often with children who are overweight and pressure more with children who are healthy weight[2,4–6,10]. Ultimately, if parental differential treatment exists by sibling weight status it may lead to more overweight or disordered eating over time in the sibling experiencing restrictive feeding practices[23–27]. Furthermore, because the limited research to date has been with homogeneous (i.e. white) and mid- to higher-income status samples, it is important to examine parental feeding practices with siblings and sibling eating behaviours in racially/ethnically and socio-economically diverse populations.

The main research questions being addressed in the current study are:

1. Do sibling dyads have similar or different eating behaviours and do parents engage in similar or different parental feeding practices with siblings with different weight status?
2. Between concordant (i.e. both siblings overweight or both siblings healthy weight) and discordant (i.e. one sibling overweight and one sibling healthy weight) weight status sibling dyads, do siblings have similar or different eating behaviours and do parents report similar or different parental feeding practices?
3. Among discordant weight status siblings only, do siblings have similar or different eating behaviours and do parents report similar or different parental feeding practices with siblings?

The primary hypothesis guiding the study is that siblings will have different eating behaviours, and parents will use different feeding practices with siblings, when siblings are discordant on weight status (i.e. one child is overweight and one child is healthy weight). Results from the current study will inform further research on siblings and set the stage for informing interventions regarding how to intervene on parental feeding practices and child eating behaviours when there are multiple children in the home.

Methods

Study design and population

Data for the current analysis were drawn from an ancillary study called Family Meals, LIVE!: Sibling Edition (henceforth 'Sibling Edition'), which is linked to a larger study called Family Meals, LIVE![28]. The original study (i.e. Family Meals, LIVE!) is a mixed-methods, cross-sectional study designed to identify key family home environment factors related to child eating behaviours that increase or decrease the risk for childhood obesity. The Family Meals, LIVE! population (120 families) consisted of low-income and racially/ethnically diverse 6–12-year-olds (n 120) and their families. Eligible children and their families lived in the Minneapolis/St. Paul area of Minnesota, USA and were recruited from four primary-care clinics that serve low-income and diverse populations. Families were eligible to participate if all members could read and speak English and if they ate at least three family meals per week

together. Additionally, in order to examine similarities and differences between households with and without an overweight/obese child, recruitment was stratified so that half of the 6–12-year-olds were overweight/obese (≥85th BMI percentile) and half were healthy weight (>5th BMI percentile and <85th BMI percentile). Comprehensive study procedures have been previously documented elsewhere[28].

The Sibling Edition ancillary study aimed to examine whether and how parents tailor their feeding practices in response to the eating behaviours of two siblings in the same household. The main eligibility criterion for participating in the Sibling Edition study was that families had to have at least one sibling between the ages of 2 and 18 years living in the same home (100 % of the time) as the original target child from Family Meals, LIVE!. If a family had more than one eligible sibling aged 2–18 years living in the same home, the child closest in age to the target child was classified as the participating sibling. Not all families in Family Meals, LIVE! had two children living in the same household and, therefore, were not eligible to participate in Sibling Edition. Of the original 120 families who participated in Family Meals, LIVE!, ninety-eight families were eligible to participate in Sibling Edition. Of the ninety-eight families, ten were either unable to be reached or declined to participate; thus eighty-eight eligible families consented to participate (90 % participation rate). Data collection occurred during a home visit lasting 2–3 h. Trained research staff consented/assented all family members to participate in the study and gathered heights and weights on all participating family members. The parent/primary caregiver completed an online survey using a study iPad and a qualitative interview conducted by a trained research staff in their home. The online survey measured parental feeding practices, parental feeding style and child eating behaviours. The qualitative interview focused on parents' perceptions of family meals, parental feeding practices and weight-related conversations with more than one child in the home[28]. All study protocols were approved by the University of Minnesota's Institutional Review Board.

The Sibling Edition online survey assessed parental feeding practices with siblings. Valid and reliable standardized measures assessing parental feeding practices, parental feeding style, child eating behaviours, dietary intake, weight-control behaviours and psychosocial constructs were identified by an in-depth literature review. In addition to the research team, a team of experts in the fields of nutrition, child eating behaviours, parental feeding practices, family functioning and psychology/child development reviewed the survey for content validity. In order to try to ensure that parents would answer questions thinking of each sibling individually, parents filled out separate surveys for each sibling, and were reminded throughout the survey if the survey was for the target child or the target child's sibling.

Parent participants in Sibling Edition were mostly female (94 %) and were racially diverse: 64 % African American, 18 % white, 5 % Asian, 3 % American Indian/Alaskan Native and 10 % mixed or other race/ethnicity (Table 1). Target child and sibling participants were well split between sex (target child = 47 % girls, 53 % boys; sibling = 56 % girls, 44 % boys) and were racially/ethnically diverse (target child = 68 % African American, 9 % white, 5 % Asian, 5 % Native American and 14 % mixed/other; sibling = 69 % African American, 9 % white, 5 % Asian, 5 % Native American and 13 % mixed/other). Mean parental age was 34·0 (SD 6·6) years and target children and sibling mean age was 9·0 years (target child SD = 2·1 years; sibling SD = 4·2 years). Parent work status included 28 % full time, 21 % part time, 11 % stay-at-home caregivers by choice, 18 % unemployed and seeking work, and 22 % not working and not seeking work. Socio-economic status characterized in terms of household income was low, with slightly more than half of the sample (52 %) reporting annual household income of less than $US 20 000, and a quarter of households reporting annual income of at least $US 35 000. Fifty per cent of the sample was characterized as living below the federal poverty line.

Measures

Child eating behaviours

Child eating behaviours were measured using questions taken from the Child Eating Behaviour Questionnaire (CEBQ)[29]. Parents were asked to report about child emotional overeating (two items), food responsiveness (two items), satiety responsiveness (two items), food fussiness (two items), enjoyment of food (two items) and slowness of eating (two items). Values of the subscale component items (i.e. 1 = 'never', 2 = 'seldom', 3 = 'sometimes', 4 = 'often', 5 = 'always') were summed and then divided by the number of component items to create each subscale index.

Parental feeding practices

Questions were drawn from two reliable and valid questionnaires to assess parental feeding practices, the Child Feeding Questionnaire (CFQ)[30] and the Parental Feeding Style Questionnaire (PFSQ)[15]. The full parental restriction subscale (eight items), pressure-to-eat subscale (four items) and monitoring subscale (three items) of the CFQ were used to assess parental feeding practices[30]. In order to reduce participant burden in taking the survey, partial subscales from the PFSQ were chosen based on their high factor loadings[15]. Specifically, parental control (two items), emotional feeding (two items), encouragement (two items) and instrumental feeding (two items) were assessed from the PFSQ to measure parental feeding style[15]. Values from the CFQ (1 = 'disagree', 2 = 'slightly disagree', 3 = 'neutral', 4 = 'slightly agree', 5 = 'agree') and the PSFQ (i.e. 1 = 'never', 2 = 'seldom',

Table 1 Demographic characteristics of parents and 6–12-year-old siblings from diverse racial/ethnic and low-income households, Minneapolis/St. Paul area, Minnesota, USA (Family Meals, LIVE!: Sibling Edition)

	Parent (*n* 88)		Target child (*n* 88)		Sibling (*n* 88)	
	n or Mean	% or SD	*n* or Mean	% or SD	*n* or Mean	% or SD
Sex						
Female	83	94	41	47	49	56
Male	5	6	47	53	39	44
Age (years), mean and SD	34	7	9	2	9	4
Weight status						
Overweight (BMI: adult ≥25 kg/m^2, children ≥85th percentile)	72	82	46	52	36	42
Healthy weight (BMI: adult <25 kg/m^2, children <85th percentile)	15	17	42	48	50	58
Race						
Black/African American	56	64	60	68	61	69
White	16	18	8	9	8	9
American Indian or Alaskan Native	3	3	4	4·5	4	4·5
Asian	4	5	4	4·5	4	4·5
Mixed/other	9	10	12	14	11	13
Primary caregiver relationship status						
Married	24	27	–		–	
Not married, living with significant other	18	20	–		–	
Dating, not living together	12	14	–		–	
Separated	4	5	–		–	
Divorced	4	5	–		–	
Widowed	1	1	–		–	
Single/never married	25	28	–		–	
Same-sex domestic partner	0	0	–		–	
Number of household members						
2–4	47	54	–		–	
5–7	40	45	–		–	
8–10	1	1	–		–	
Employment status						
Full time	25	28	–		–	
Part time	18	21	–		–	
Stay-at-home caregiver (intentional)	10	11	–		–	
Unemployed, seeking work	16	18	–		–	
Not working	9	22	–		–	
Annual household income ($US)						
<20 000	45	52	–		–	
20 000–35 000	22	25	–		–	
35 000–50 000	9	9	–		–	
50 000–75 000	9	9	–		–	
75 000+	3	5	–		–	

Weight status is missing for two siblings and one parent.

3 = 'sometimes', 4 = 'often', 5 = 'always') were summed and then divided by the number of component items to create each subscale index.

Weight status

All anthropometric measurements were completed following standardized procedures[31]. Height was assessed to the nearest 0·1 cm using a stadiometer and weight to the nearest 0·1 kg using a calibrated scale. To ensure inter-rater reliability, both measures were taken twice, and agreement of less than 1 cm for height and 0·5 kg for weight was required. BMI percentiles, which are appropriate for measuring youth weight, were calculated using the Centers for Disease Control and Prevention guidelines[32]. Average BMI percentile for the sample was 77·0 (SD 23·2), ranging from 7 to 99. Girls had an average BMI percentile of 77·8 (SD 21·3) ranging from 23 to 99, and boys had an average BMI percentile of 76·3 (SD 25·0) ranging from 7 to 99. Children were then grouped into three weight status categories: overweight concordance (i.e. both siblings ≥85 percentile), healthy weight concordance (i.e. both siblings <85 percentile) or discordant weight status (one sibling overweight and one sibling healthy weight).

Covariates

Children's and parent's race/ethnicity were assessed by parent report. Race/ethnicity was assessed with the item, 'Do you think of yourself as: (i) white, (ii) black or African-American, (iii) Hispanic or Latino, (iv) Asian-American, (v) American Indian or Alaskan Native, or (vi) Mixed?' and respondents were asked to check all that applied. Participants who checked two race options were included in the 'mixed' category. Parent and child age were calculated using parent-reported birth dates and the survey completion date.

Table 2 Adjusted mean parent report of child eating behaviours, parental feeding practices and parental feeding style scales according to higher and lower child BMI percentile; parents and 6–12-year-old siblings from diverse racial/ethnic and low-income households, Minneapolis/St. Paul area, Minnesota, USA (Family Meals, LIVE!: Sibling Edition)

	Mean scale response				
	Higher BMI sibling (*n* 86)	Lower BMI sibling (*n* 86)	Mean difference	95 % CI	*P* value
Child Eating Behaviour Questionnaire[29]; scale range = 1–5 ('never'–'always')					
Emotional eating	**1·9**	**1·5**	**0·4**	**0·1, 0·7**	**0·01**
Food responsiveness	2·7	2·5	0·2	–0·1, 0·5	0·25
Satiety responsiveness	2·8	2·9	–0·1	–0·3, 0·2	0·69
Food fussiness	2·7	2·8	–0·1	–0·4, 0·2	0·62
Enjoyment of food	3·6	3·5	0·1	–0·1, 0·3	0·28
Slowness in eating	3·1	3·1	0·0	–0·3, 0·3	0·92
Child Feeding Questionnaire–parental feeding practices[30]; scale range = 1–5 ('disagree'–'agree')					
Restriction	3·2	3·1	0·1	–0·2, 0·3	0·54
Pressure-to-eat	2·8	3·0	–0·2	–0·4, 0·0	0·06
Monitoring	3·6	3·6	0·0	–0·3, 0·3	0·93
Parental Feeding Style Questionnaire[15]; scale range = 1–5 ('never'–'always')					
Control	3·3	3·2	0·1	–0·0, 0·2	0·07
Emotional feeding	1·6	1·7	–0·1	–0·3, 0·1	0·15
Encouragement-to-eat	**2·4**	**2·7**	**–0·3**	**–0·5, –0·1**	**0·01**
Instrumental feeding	1·8	1·8	0·0	–0·2, 0·1	0·39

Analyses adjusted for child race/ethnicity, age and sex. Bold indicates that effects are significant at $P < 0·05$.
Weight status was not available for two families with sibling children (eighty-six families and 172 children were available for analysis).
Interpretation example: 'Restriction'. Parents reported 'neutral' to using restrictive feeding practices with higher and lower BMI children. The higher BMI child was not statistically different on restriction compared with the lower BMI child ($P = 0·54$).

Statistical analysis

General linear models and generalized estimating equation models were used to examine differences in parent-reported child eating behaviours and parent-reported feeding practices by sibling weight status. Child eating behaviours and parental feeding practices were used as continuous outcomes for the higher BMI percentile sibling and the lower BMI percentile sibling in the total sample population (Tables 2–4) and for siblings who were discordant on overweight status (Table 4). Exchangeable correlation structure was assigned to the generalized estimating equation model. Pairwise post-estimation was performed to detect differences in the mean scale response between the three weight status concordance groups in the generalized estimating equation model. Sampling weights were computed to reflect the sampling design and were calculated as percentages of the overall sample based on target child BMI, sex, age, and recruitment location. The inverse of these sampling fractions was applied as a weight in each model to allow for estimates reflective of the clinic-level population from which the sample was recruited. Statistical adjustment was performed for child race/ethnicity, age and sex by including these covariates in all analytic models. All statistical analyses were performed using the statistical software package Stata/SE 13·1.

Results

Research question #1: Do sibling dyads have similar or different eating behaviours and do parents engage in similar or different parental feeding practices with siblings with different weight status?

Results showed some significant ($P < 0·05$) and some marginally significant ($P < 0·10$) findings related to eating behaviours and parental feeding practices between siblings with higher and lower BMI (Table 2). Parents reported higher levels of emotional eating behaviours (mean difference = 0·4; 95 % CI 0·1, 0·7; $P = 0·01$) in higher BMI siblings compared with lower BMI siblings. Parents reported lower levels of pressure-to-eat feeding practices with higher BMI siblings compared with lower BMI siblings (mean difference = – 0·2; 95 % CI –0·4, 0·0; $P = 0·06$). Parents reported higher levels of food control with higher BMI siblings compared with lower BMI siblings (mean difference = 0·1; 95 % CI –0·0, 0·2; $P = 0·07$). Additionally, parents reported lower levels of encouragement-to-eat in higher BMI siblings compared with lower BMI siblings (mean difference = – 0·3; 95 % CI –0·5, –0·1; $P = 0·01$). No other child eating behaviours or parental feeding practices were significantly different between higher and lower BMI siblings.

Research question #2: Between concordant (i.e. both siblings healthy weight or both siblings overweight) and discordant (i.e. one sibling overweight and one sibling healthy weight) sibling dyads, do siblings have similar or different eating behaviours and do parents report similar or different parental feeding practices?

Results showed some significant ($P < 0·05$) and some marginally significant ($P < 0·10$) findings across concordant and discordant sibling weight status categories related to

Table 3 Adjusted mean parent report of child eating behaviours, parental feeding practices and parental feeding style scales according to weight status concordance groups; parents and 6–12-year-old siblings from diverse racial/ethnic and low-income households, Minneapolis/St. Paul area, Minnesota, USA (Family Meals, LIVE!: Sibling Edition)

	Mean scale response		Condcordant overweight *v.* ref group		Mean scale response	Discordant weight *v.* ref. group		
	Concordant healthy weight (*n* 64) (ref. group)	Concordant overweight (*n* 50)	Mean difference	95 % CI	Discordant weight (*n* 58)	Mean difference	95 % CI	Overall *P* value
Child Eating Behaviour Questionnaire[29]; scale range = 1–5 ('never'–'always')								
Emotional eating	1·5[a]	2·0[a]	0·5	–0·1, 1·0	1·7[a]	0·2	–0·3, 0·6	0·26
Food responsiveness	2·4[a]	2·8[a]	0·4	–0·1, 0·8	2·6[a]	0·2	–0·1, 0·5	0·23
Satiety responsiveness	3·0[b]	2·6[a]	–0·4	–0·7, –0·1	3·0[a,b]	0·0	–0·3, 0·3	0·06
Food fussiness	2·6[a]	2·6[a]	0·0	–0·5, 0·4	2·9[a]	0·3	–0·1, 0·7	0·22
Enjoyment of food	3·2[b]	4·0[a]	0·8	0·1, 1·5	3·7[a,b]	0·5	–0·1, 1·2	0·07
Slowness in eating	3·1[a]	3·1[a]	0·0	–0·4, 0·3	3·2[a]	0·1	–0·3, 0·4	0·89
Child Feeding Questionnaire–parental feeding practices[30]; scale range = 1–5 ('disagree'–'agree')								
Restriction	**2·9**[b]	**3·3**[a]	**0·4**	**0·0**, **0·8**	**3·3**[a]	**0·4**	**0·1**, **0·8**	**0·04**
Pressure-to-eat	2·8[a]	2·6[a]	–0·3	–0·9, 0·3	3·1[a]	0·2	–0·3, 0·7	0·29
Monitoring	3·1[b]	4·0[a]	0·9	0·1, 1·7	3·7[a,b]	0·6	–0·2, 1·3	0·06
Parental Feeding Style Questionnaire[15]; scale range = 1–5 ('never'–'always')								
Control	3·2[a]	3·2[a]	0·0	–0·4, 0·3	3·2[a]	0·0	–0·3, 0·3	0·98
Emotional feeding	1·6[a]	1·7[a]	0·1	–0·4, 0·6	1·7[a]	0·1	–0·3, 0·5	0·81
Encouragement-to-eat	2·3[a]	2·7[a]	0·4	–0·4, 1·2	2·8[a]	0·5	–0·2, 1·2	0·31
Instrumental feeding	1·8[a]	1·6[a]	–0·2	–0·7, 0·3	1·8[a]	0·0	–0·5, 0·5	0·62

Analyses adjusted for child race/ethnicity, age and sex. Bold indicates that effects are significant at $P < 0·05$.
Weight status was not available for two families with sibling children (eighty-six families and 172 children were available for analysis).
Interpretation example: 'Restriction'. There was statistical evidence that parent use of restrictive feeding practices was overall different by weight concordance group ($P = 0·04$). Differences between the three weight status groups indicate that parents reported higher mean restriction in concordant overweight sibling families compared with concordant healthy-weight sibling families (mean difference = 0·4; 95 % CI: 0·0, 0·8; $P < 0·05$). Mean restriction was also higher in discordant weight sibling families compared with concordant healthy-weight sibling families (mean difference = 0·4; 95 % CI 0·1, 0·8; $P < 0·05$).
[a,b,c]Mean scale responses within a row with unlike superscript letters were significantly different ($P < 0·05$). For example, satiety responsiveness was significantly different between the concordant overweight and concordant healthy weight groups as indicated by the different superscript letters. However, the two concordant groups were not significantly different from the discordant weight status group as they share superscript letters.

eating behaviours and parental feeding practices. Specifically, parents reported that concordant overweight siblings had the lowest food satiety levels compared with concordant healthy-weight siblings and discordant weight siblings ($P = 0·06$; see Table 3 for 95 % CI comparisons across groups). Parents reported that concordant overweight siblings had the highest levels of food enjoyment compared with concordant healthy weight or discordant weight siblings ($P = 0·07$). In addition, parents reported significantly higher levels of food restriction feeding behaviours with concordant overweight siblings and discordant siblings compared with concordant healthy weight status siblings ($P = 0·04$). Parents reported the highest levels of monitoring feeding practices with concordant overweight status siblings compared with concordant healthy weight or discordant weight siblings ($P = 0·06$). No other child eating behaviours or parental feeding practices were significantly different between sibling dyads by weight status concordance and discordance.

Research question #3: Among discordant weight status siblings, do siblings have similar or different eating behaviours and do parents report similar or different parental feeding practices with siblings?

Results indicated that within discordant weight status sibling dyads, parents reported some significant ($P < 0·05$) differences on child eating behaviours and several significant differences on parental feeding practices (Table 4). Regarding child eating behaviours, parents reported significantly lower food satiety (mean difference $= -0·6$; 95 % CI –0·9, –0·3; $P < 0·001$) and greater food enjoyment (mean difference = 0·5; 95 % CI 0·2, 0·8, $P = 0·01$) for siblings who were overweight compared with siblings who were healthy weight. Parents also reported significantly more restrictive parental feeding practices with siblings who were overweight compared with siblings who were healthy weight (mean difference = 0·4; 95 % CI 0·1, 0·7; $P = 0·01$) and significantly more pressure-to-eat feeding practices with siblings who were healthy weight compared to siblings who were overweight (mean difference $= -0·5$; 95 % CI –0·8, –0·1; $P = 0·01$). Similarly, parents reported significantly more encouragement-to-eat feeding practices (e.g. encouragement to try new foods, encouragement to eat food that was prepared for them) with healthy-weight siblings compared with overweight

Table 4 Adjusted mean parent report of child eating behaviours, parental feeding practices and parental feeding style scales according to discordant weight status; parents and 6–12-year-old siblings from diverse racial/ethnic and low-income households, Minneapolis/St. Paul area, Minnesota, USA (Family Meals, LIVE!: Sibling Edition)

	Mean scale response				
	Overweight sibling (*n* 29)	Healthy-weight sibling (*n* 29)	Mean difference	95 % CI	*P* value
Child Eating Behaviour Questionnaire[29]; scale range = 1–5 ('never'–'always')					
Emotional eating	1·9	1·6	0·3	–0·1, 0·8	0·16
Food responsiveness	2·7	2·4	0·3	–0·2, 0·8	0·18
Satiety responsiveness	**2·7**	**3·3**	**–0·6**	**–0·9**, **–0·3**	**<0·001**
Food fussiness	2·8	3·0	–0·2	–0·6, 0·2	0·39
Enjoyment of food	**3·9**	**3·4**	**0·5**	**0·2**, **0·8**	**0·01**
Slowness in eating	3·1	3·2	–0·1	–0·5, 0·3	0·64
Child Feeding Questionnaire–parental feeding practices[30]; scale range = 1–5 ('disagree'–'agree')					
Restriction	**3·5**	**3·1**	**0·4**	**0·1**, **0·7**	**0·01**
Pressure-to-eat	**2·8**	**3·3**	**–0·5**	**–0·8**, **–0·1**	**0·01**
Monitoring	3·8	3·6	0·2	–0·3, 0·7	0·48
Parental Feeding Style Questionnaire[15]; scale range = 1–5 ('never'–'always')					
Control	3·3	3·1	0·2	–0·1, 0·5	0·14
Emotional feeding	1·6	1·7	–0·1	–0·4, 0·2	0·54
Encouragement-to-eat	**2·6**	**2·8**	**–0·2**	**–0·4**, **–0·0**	**0·04**
Instrumental feeding	1·7	1·9	–0·2	–0·4, 0·1	0·22

Analyses adjusted for child race/ethnicity, age and sex. Bold indicates that effects are significant at $P < 0·05$.
Interpretation example: 'Satiety responsiveness'. Within discordant weight status families, parents reported that the overweight target child exhibited statistically significantly less food satiety when eating than the healthy-weight child (mean difference = –0·6; 95 % CI –0·9, –0·3; $P < 0·001$).

siblings (mean difference = – 0·2; 95 % CI –0·4, –0·0; $P = 0·04$).

Discussion

Overall, results suggested that some sibling eating behaviours were significantly different and several parental feeding practices were significantly different when sibling dyads were discordant on weight status (i.e. one sibling overweight and one sibling healthy weight). Specifically, results indicated that in families with discordant weight status siblings, parents reported that overweight siblings had higher food enjoyment and lower levels of food satiety compared with healthy-weight siblings. Additionally, parents reported using more restrictive feeding practices with siblings who were overweight compared with siblings who were healthy weight and more pressure-to-eat and encouragement-to-eat feeding practices with siblings who were healthy weight compared with siblings who were overweight.

Results from the current study showed that siblings with discordant weight status had some differing eating behaviours. Specifically, parents reported that siblings who were overweight had less food satiety and higher food enjoyment than siblings who were healthy weight. This is a new finding in the field and suggests that siblings who are overweight engage in more unhealthy eating behaviours than the siblings who are healthy weight. These differing eating behaviours may be associated with parents' use of feeding practices that promote or sustain overweight siblings' weight status. For example, parents may perceive their healthy-weight children as having higher levels of satiety responsiveness than their overweight siblings, which may influence parents to use more pressure-to-eat and encouragement-to-eat parenting styles with the child who is healthy weight. Current study results also confirm prior studies conducted on siblings in twin studies[33]. Overall, twin studies have shown that environment, more than heredity, shapes a child's behaviour; thus current study results would include eating behaviours as part of the 'environment'.

Results from the current study corroborate and expand previous findings in the field examining the association between parental feeding practices and child weight status conducted with one child[2–7]. Specifically, results: (i) confirm prior studies showing parents tend to use restrictive feeding practices with children who are overweight and pressure-to-eat feeding practices with children who are healthy weight[2–7]; and (ii) extend prior findings by suggesting that, to some extent, parents tailor their feeding practices to different siblings depending on whether the sibling is overweight (restrictive feeding practices) or healthy weight (i.e. pressure-to-eat feeding practices).

Strengths of the current study include assessment of a population at high risk for obesity (i.e. African-American children from low-income households), measurement of eating behaviours and feeding practices with two siblings in the home (which has rarely been done) and the inclusion of objective measures of parent and siblings' weight and height. There were also limitations of the study. One limitation of the study was using self-report surveys, which may have increased the likelihood of parents answering in socially desirable ways regarding their parental feeding practices. A second limitation of the current study is that

findings were cross-sectional and, thus, temporality of associations cannot be implied. Furthermore, while the study sample size (n 88) was larger than many previous sibling studies, larger samples are needed to corroborate results of the current study and to examine plausible risk and protective factors which the study was underpowered to detect – especially with regard to the small number of discordant weight status siblings. Lastly, the number of statistical tests that were performed may have inflated the type I error rate.

Findings from the current study offer implications for family-based interventions and for future research. Specifically, findings provide insight into parents' and sibling dyads' parental feeding practices and child eating behaviours that may be important for public health interventions. For example, it may be important for family-based obesity prevention studies to include assessment of sibling weight status concordance or discordance for all children living in the home in order to tailor parental feeding practice interventions to current household composition and specific parent/sibling needs. This could include educating parents about the tendency to restrict with siblings who are overweight, the tendency to use pressure-to-eat feeding practices with siblings who are healthy weight and, based on prior research[2–7], the importance of doing neither with their children.

In addition, future studies are necessary to confirm these cross-sectional results. It would be important to use a longitudinal research design that allows for examining whether and how differential parental feeding practices used with discordant weight status siblings influence each sibling's weight and weight-related behaviours over time. For example, if an overweight sibling receives more restrictive feeding practices from his/her parent compared with his/her healthy-weight sibling, would this impact the overweight sibling's dietary intake, weight status, unhealthy weight-control behaviours and body satisfaction over time? Future studies may also want to consider the role of older siblings in the household who may be preparing snacks and meals for their younger siblings; older sibling eating behaviours may also serve as role models for younger sibling eating patterns.

Conclusion

Results indicated that siblings who were discordant on weight status (one sibling overweight and one sibling healthy weight) had different eating behaviours, with siblings who were overweight having higher food enjoyment and lower satiety responsiveness compared with siblings who were healthy weight. Additionally, parents of discordant weight status siblings used more restrictive feeding practices with siblings who were overweight and more pressure-to-eat and encouragement-to-eat feeding practices with siblings who were healthy weight. Thus, family-based obesity prevention interventions and future research may need to consider intervening with parents and families with discordant weight status siblings differently from concordant weight status siblings.

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