The role of family and maternal factors in childhood obesity

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ABSTRACT

Objective: To investigate the relationship between a child's weight and a broad range of family and maternal factors.

Design, setting and participants: Cross-sectional data from a population-based prospective study, collected between January 2004 and December 2005, for 329 children aged 6–13 years (192 healthy weight, 97 overweight and 40 obese) and their mothers ($n = 265$) recruited from a paediatric hospital endocrinology department and eight randomly selected primary schools in Perth, Western Australia.

Main outcome measures: Height, weight and body mass index (BMI) of children and mothers; demographic information; maternal depression, anxiety, stress and self-esteem; general family functioning; parenting style; and negative life events.

Results: In a multilevel model, maternal BMI and family structure (single-parent v two-parent families) were the only significant predictors of child BMI *z* scores.

Conclusion: Childhood obesity is not associated with adverse maternal or family characteristics such as maternal depression, negative life events, poor general family functioning or ineffective parenting style. However, having an overweight mother and a single-parent (single-mother) family increases the likelihood of a child being overweight or obese.

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In 1973, Hilde Bruch observed that obese children tended to belong to families characterised by a domineering, over-protective mother, a weak father, and a lack of responsiveness, warmth, and support towards the obese child.[1] Later, studies also suggested that childhood obesity may be associated with some specific family characteristics, such as family cohesion, conflict, disorganisation, a lack of interest in social and cultural activities,[2,3] and parental neglect.[4] Other studies, however, have failed to support the hypothesis that obese children come from families displaying such dysfunctional traits.[5,6] Thus, no clear pattern of family dynamics has consistently been associated with obesity.

Previous studies examining the role of family and parental factors in childhood obesity have often been limited by small sample sizes, and a single measure of family function/dysfunction. Moreover, most previous studies have been based on the assumption that poor family functioning will be associated with inadequate parental monitoring and/or regulation of children's eating and activity patterns. However, no specific underlying theory or mechanisms have been hypothesised to explain any role of family factors in childhood obesity.

The role of the family has implications for the treatment of obese children — family-based treatment programs for obese children are based on the theory that parenting style, family functioning, and the home environment are key factors.[7-9] There is evidence of the long-term effectiveness of this approach.[7]

We aimed to examine the relationship between a child's weight and a broad range of family and maternal factors. Our hypothesis was that increasing adiposity in children would be associated with poor general family functioning (eg, poor communication, inadequate support towards other family members, poor problem-solving skills), lower socioeconomic status, inappropriate parenting style (eg, too lax or too controlling), the experience of negative life events in the family, and maternal psychopathology.

METHODS

Design

We investigated cross-sectional data from the Childhood Growth and Development (GAD) Study, a prospective, enriched cohort study being conducted in Western Australia. The GAD Study aims to identify the origins and consequences of the development and persistence of childhood obesity by studying healthy weight, overweight and obese children. The children are followed up twice a year for at least 3 years. One parent of each child is also taking part in the study. Families recruited during the first 2 years (January 2004 – December 2005) of the GAD Study provided the data for our analyses.

The protocol for the GAD Study was approved by the Ethics Committee of the Women's and Children's Health Service, Perth.

Selection and recruitment

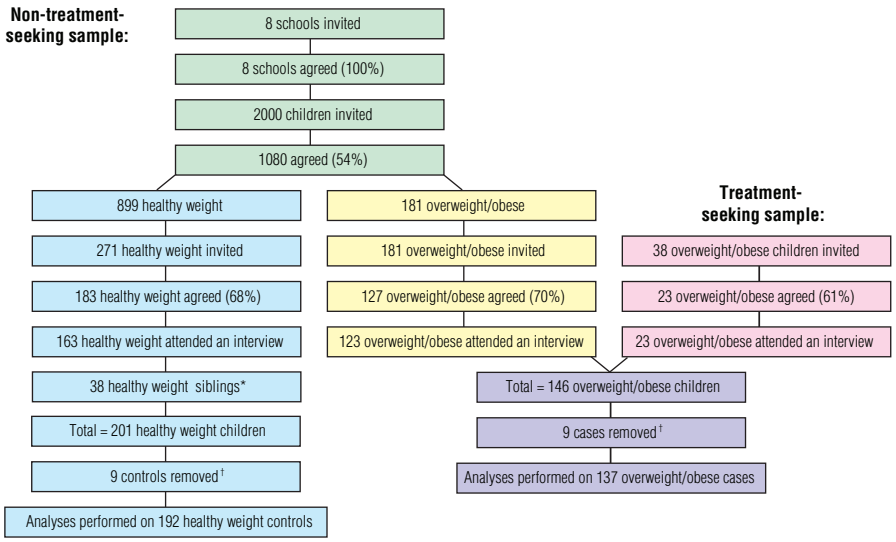
Participants for the GAD Study were recruited in two ways (Box 1).

A *treatment-seeking sample* of overweight and obese children was recruited from a paediatric hospital endocrinology department. All children aged 6–13 years seeking treatment for overweight, obesity, or related conditions ($n = 38$) and their parent(s) were invited to participate; 23 (61%) agreed.

A *non-treatment-seeking sample* of overweight and obese children was recruited from eight randomly selected primary schools in the Perth metropolitan area. All children at these schools took home an information sheet inviting them to be weighed and measured at school. All children with parental consent ($n = 1080$; 54%) who were present at the schools during the site visit were weighed in light clothing and without shoes with regularly calibrated digital medical scales (Tanita, Chicago, Ill, USA), and had their height measured with a regularly calibrated portable Harpenden stadiometer (Holtain Ltd, Crymych, UK) using the stretch technique (to the nearest millimetre). All measures were assessed twice, with the mean score recorded. Body mass index (BMI = weight [kg]/height [m]^2) was calculated for each child. Children were classified as healthy weight, overweight or obese using Cole and colleagues' age- and sex-specific overweight and obese BMI cut-offs for children.[10] All children classified as overweight or obese ($n = 181$) were invited to participate in the prospective phase of the GAD Study (regardless of whether they were siblings of others in that group), and 127 (70%) agreed to participate; 123 of these attended the assessment interview.

With the aim of recruiting 1.5 healthy weight controls for each target subject, a random sample of healthy weight children ($n = 271$) matched to the overweight/obese group by school grade were also invited to participate. One hundred and eighty-three

1 Flow chart of the participant recruitment and selection process



* If a child was selected as a target subject or as a healthy weight control and his/her healthy weight siblings were not selected, then the siblings were also invited to participate (if they were within the 6–13-year age range). † Cases with data available from fathers only (analyses were only performed on data from mothers). ◆

(68%) agreed, and 163 of these attended the assessment interview. If a child was selected as a target subject or as a healthy weight control and his/her healthy weight siblings were not selected, then the siblings were also invited to participate (if they were within the 6–13-year age range). In this way, 38 siblings were invited to participate, and all agreed.

Data from children who only had their fathers participate, for both the treatment-seeking ($n = 9$) and non-treatment-seeking ($n = 9$) groups, were removed before analysis.

Measures

Participating children and their mothers attended separate assessment interviews.

Anthropometry

All children and their mothers were (re)weighed and (re)measured. Age- and sex-specific BMI z scores were calculated for the children using the United States Centers for Disease Control and Prevention 2000 reference data.[11] Child BMI z scores were used in all analyses.

Socioeconomic status

The family's socioeconomic status was measured by maternal education level and total family income. Codes from the Socio-Economic Indexes for Areas (SEIFA), which includes an Index of Advantage/Disadvantage,[12] were also obtained, based on residential address.

Family structure

The number of children in the family, the number of residing parents, and parental marital status were recorded.

Family functioning and maternal factors

Maternal responses on a range of scales were used to assess family functioning, parenting style and maternal psychopathology. All scales have been shown to have good validity.

Depression Anxiety Stress Scales (DASS): The DASS is a set of three self-report scales designed to measure depression (dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia), anxiety (autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect) and stress (difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/overreactive and impatient).[13] Mothers rated the extent to which they had experienced each state over the previous week.

McMaster Family Assessment Device (FAD): The General Functioning Scale (12 items) of the FAD[14] was administered to all mothers. This subscale assesses the overall health/pathology of the family. Mothers rated their agreement or disagreement with how well items described their family (eg, "We don't get along well together").

Parenting Scale: The 30-item Parenting Scale is designed to measure dysfunctional discipline practices.[15] Paired extremes of discipline strategies form the anchors for a seven-point scale (eg, "When my child misbehaves, I raise my voice or yell" versus "When my child misbehaves, I speak to my child calmly").

Three factor scores can be derived from the Parenting Scale — Laxness, Overreactivity and Verbosity. The Laxness factor includes 11 items related to permissive discipline (ie, a parent's tendency to give in or allow rules to go unenforced). The Overreactivity factor consists of 10 items reflecting displays of anger, meanness, and irritability. The Verbosity factor consists of seven items reflecting lengthy verbal responses and a reliance on talking even when it is ineffective.

Life events scale: Mothers assessed recent negative life events using the List of Threatening Experiences,[16] which includes 12 categories of negative life events (eg, illness, death of a close friend or relative, unemployment).

Rosenberg Self-Esteem Scale: This brief unidimensional measure of global self-esteem consists of 10 statements related to overall feelings of self-worth or acceptance.[17] Items are summed to derive an overall score ranging between 10 and 40, with higher scores indicating higher maternal self-esteem.

Statistical analysis

The data were analysed using univariate and multivariate linear regression models incorporating a random intercept for within-family clustering. A series of univariate models were used to examine the relationships between child BMI z score, the primary independent variable, and each predictor variable. Age group and sex were considered as possible confounders.

In secondary analyses, the associations with family and maternal factors in treatment-seeking and in non-treatment-seeking overweight and obese children were compared. Because the distribution of child BMI z scores differed in the two groups, these comparisons were made both before and after adjusting for child BMI z score.

All data analyses were performed using SPSS, version 12.0 (SPSS Inc, Chicago, Ill, USA).

RESULTS

Participants

There were 329 children (mean age, 9.51 years; SD, 1.84) and 265 mothers from 265 families; 192 children were classified as healthy weight, 97 overweight, and 40 obese.

Relationships between family factors and child BMI *z* scores

In univariate models, increasing child BMI *z* score was found to be significantly associated with higher maternal BMI, an increasing likelihood of belonging to a single-parent family, fewer people living in the home, increasing social disadvantage (all $P < 0.01$), lower annual family income and fewer years of maternal education (both $P < 0.05$) (Box 2).

In a multivariate model, maternal BMI and family structure (single- or two-parent family) were the only factors significantly associated with child BMI *z* score ($P < 0.01$ and $P < 0.05$, respectively) (Box 2). There were no significant main or interaction effects of age group or sex.

These analyses were rerun after removing the 23 treatment-seeking overweight and obese children, and the results remained the same.

Treatment-seeking versus non-treatment-seeking overweight and obese children

Box 3 shows the results stratified by treatment-seeking ($n = 23$) and non-treatment-seeking ($n = 114$) overweight and obese children, both before and after adjusting for child BMI *z* score. Compared with mothers of non-treatment-seeking children, mothers of treatment-seeking children had significantly higher BMIs and reported significantly lower annual family incomes. Families of treatment-seeking children were more socially disadvantaged, according to the SEIFA index. However, after controlling for child BMI *z* score, these differences disappeared. There was also a trend for mothers of the treatment-seeking children to report higher levels of depression than mothers of the non-treatment-seeking children. This difference remained after adjusting for child BMI *z* score.

2 Predicted effects of family and maternal factors on child body mass index (BMI) *z* scores

Independent variable	Univariate coefficient (95% CI)	Multivariate coefficient (95% CI)*
Maternal BMI†	0.06‡ (0.04, 0.08)	0.06‡ (0.04, 0.08)
Family structure: single-parent family (v two-parent family)	0.76‡ (0.45, 1.07)	0.56§ (0.14, 0.99)
Family income†	−0.09‡ (−0.13, −0.05)	−0.003 (−0.06, 0.05)
Number of people living in the home†	−0.29‡ (−0.41, −0.18)	−0.16 (−0.29, 0.03)
Maternal education level (v completed Year 12)¶		
Never attended primary school	2.09 (−0.04, 4.23)	0.75 (−1.22, 2.73)
Completed primary school	1.13 (−0.12, 2.37)	1.56 (−0.38, 3.50)
Completed Year 10	0.25 (−0.02, 0.52)	−0.04 (−0.32, 0.24)
SEIFA advantage/ disadvantage index†	−0.004‡ (−0.07, −0.001)	−0.01 (−0.01, 0.00)
Child's age group: 6–10 years (v 11–13 years)	0.58‡ (0.39, 0.76)	0.23 (−0.01, 0.47)
Child's sex: males (v females)	0.67 (−0.21, 0.75)	0.11 (−0.12, 0.34)
Maternal DASS		
Depression†	0.01 (−0.02, 0.04)	
Anxiety†	0.02 (−0.06, 0.06)	
Stress†	0.01 (−0.01, 0.03)	
Maternal self-esteem†	0.01 (−0.03, 0.03)	
Parenting Scale		
Mean score†	0.07 (−0.18, 0.32)	
Laxness†	0.06 (−0.10, 0.22)	
Overreactivity†	0.01 (−0.19, 0.20)	
Verbosity†	0.08 (−0.10, 0.25)	
Life events scale†	0.07 (−0.01, 0.14)	
McMaster FAD†	0.07 (−0.30, 0.15)	

* Multivariate model includes all variables significant ($P < 0.05$) in univariate models, plus sex of child. † Coefficients indicate the predicted change in child BMI *z* score per unit change in the independent variable. Maternal and family factor variables were assessed by validated scales. ‡ $P < 0.01$. § $P < 0.05$. ¶ Significant ($P < 0.05$) only in the univariate model.
SEIFA = Socio-Economic Indexes for Areas.[12] DASS = Depression Anxiety Stress Scales. FAD = Family Assessment Device. ◆

DISCUSSION

Using a range of well known and replicable measures of specific maternal and family characteristics, we found that having an overweight mother and coming from a single-parent (single-mother) family increased the likelihood of a child being overweight or obese. These findings are consistent with the results of a previous study conducted with a random sample of 1581 Australian school children aged 7–15 years,[18] which found that having parents, especially mothers, who were overweight increased the risk of children being overweight.

However, some early research suggested that obese children tend to come from dysfunctional families,[2,3] where "dysfunctional" described traits such as family conflict, disorganisation and parental neglect.

The discrepancy between the earlier studies and more recent studies of family functioning in relation to childhood obesity may reflect a temporal change. In developed countries, the prevalence of obesity among young people has increased dramatically over the past 10 years.[19] Twenty to 30 years ago, when childhood obesity was significantly less prevalent, it may have been that obese children did come from relatively unsupportive family environments. Now that childhood obesity is more widespread, the problem is not confined to families with these problems.

Moreover, previous indications of a link between poor family functioning and childhood obesity were based on studies without population-based data and without observations across a range of theoretically important factors that may confound conclusions. Specifically, the link between poor family functioning and childhood obesity may reflect structural variations in family composition set against a backdrop of diminished human capital, as evidenced by lower education and lower income. Children from single-parent families, particularly when there is a family history of obesity, may struggle to maintain a healthy weight in an obesogenic environment with restricted access to less energy-dense foods (eg, fruits, vegetables and wholegrain cereals, which tend to be more expensive) and adequate facilities for recreational exercise.

One of the strengths of our study is that it involved community-based samples of overweight, obese and healthy weight children as well as a treatment-seeking sample of overweight and obese children. Initial comparisons suggested that the treatment-seek-

ing children came from families with a lower annual income and had mothers with higher BMIs than the non-treatment-seeking children. However, these differences were accounted for by the children in the treatment-seeking sample being significantly more overweight than the non-treatment-seeking sample. Interestingly, even after controlling for child BMI *z* score, mothers of treatment-seeking children were found to be significantly more depressed than mothers of equally overweight non-treatment-seeking children, although the origin of this association cannot be determined from our cross-sectional data. Nevertheless, this suggests that maternal mental health may be one factor that influences whether or not parents seek treatment for their overweight child.

Another strength of our study is the involvement of mothers, allowing us to gather information about maternal mental health and parenting style — factors seldom considered in studies of childhood obesity. We found that parenting style was not associated with childhood obesity. Nevertheless, it remains possible that parenting practices regarding children's food and exercise behaviour may play a role in managing children's weight problems.

Limitations of our study include its cross-sectional nature and omission of some aspects of family functioning, such as family communication patterns or the child's perceived level of parental support. We are also unable to comment on the relationship between family functioning and obesity in single-father families, as there were too few of these for statistical analysis. In addition, it is important to acknowledge the possibility of a non-response bias. Families experiencing high levels of stress, maternal psychopathology or poor general functioning may have been less likely to participate in the study, thereby restricting the range of values on our measure of family functioning. However, our distribution of FAD scores suggested that the range of values was comparable to that reported in previous studies.[20]

3 Comparison of treatment-seeking and non-treatment-seeking overweight and obese children by family and maternal factors

Variable	Treatment-seeking children ($n = 23$)	Non-treatment-seeking children ($n = 114$)	*P*	*P* adj*
Child BMI *z* score	2.37 ± 0.38	1.58 ± 0.36	0.001‡	
Maternal BMI (kg/m^2)	33.72 ± 10.72	28.16 ± 6.43	0.002‡	0.152
Children living in a single-parent family†	46%	29%	0.110	0.637
Annual family income (mean range)	$35 001–$40 000	$50 001–$60 000	0.008‡	0.902
Number of people living in the home	3.62 ± 1.06	4.10 ± 1.07	0.053	0.950
Mothers completing high school (Year 12)†	38%	59%	0.063	0.223
SEIFA advantage/ disadvantage index	1005.80 ± 53.69	1042.07 ± 51.65	0.003‡	0.148
Maternal DASS				
Depression	6.53 ± 9.95	3.09 ± 5.10	0.057	0.050
Anxiety	4.18 ± 5.62	2.67 ± 4.46	0.186	0.693
Stress	10.82 ± 9.96	8.76 ± 7.40	0.281	0.116
Parenting Scale				
Mean score	3.10 ± 0.66	3.12 ± 0.55	0.882	0.636
Laxness	2.62 ± 0.97	2.67 ± 0.91	0.825	0.726
Overreactivity	2.93 ± 0.83	2.89 ± 0.73	0.824	0.540
Verbosity	4.04 ± 0.96	4.12 ± 0.71	0.674	0.375
Life events scale	2.04 ± 2.30	1.78 ± 1.91	0.587	0.975
McMaster FAD	1.65 ± 0.48	1.77 ± 0.59	0.391	0.341

Values are mean ± SD, unless otherwise indicated.
* *P* adjusted for child BMI *z* score. † All comparisons were conducted using univariate analysis of variance, except family structure and maternal education, which were analysed using binary logistic regression. ‡ $P < 0.05$.
BMI = Body mass index. SEIFA = Socio-Economic Indexes for Areas.[12]
DASS = Depression Anxiety Stress Scales. FAD = Family Assessment Device. ◆

Our findings suggest that childhood obesity is not associated with adverse maternal or family characteristics such as maternal depression, negative life events, poor general family functioning, or ineffective parenting style. However, the association between children's weight, maternal BMI and family structure confirms the need to find ways of targeting prevention and intervention efforts for childhood obesity at families with overweight parents, particularly under-resourced single-parent (single-mother) families.

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COMPETING INTERESTS

None identified.

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