Relationships among Body Mass Index, Parental Perceptions, Birthweight and Parental Weight after Referral to a Weight Clinic

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Objective: We sought to determine whether, in a specialty referral clinic, parental perceptions of their child's obesity were commensurate with the child's body mass index z score. Secondarily, we examined the impact of birth weight and parental body mass index on their child's body mass index z score and review results of an intake questionnaire.

Design: Cross-sectional study

Setting: University of Michigan from March 21, 2003 through June 30, 2004

Participants: Eighty-two children ages 1–20.2 years of age

Intervention: Body mass index z score for all participants was calculated. An intake questionnaire was completed by caregivers in which they were asked to describe their child as little overweight, overweight, very overweight or obese.

Outcome Measures: Mean body mass index z score was compared to each parental descriptor. Regression analysis related body mass index z score to birthweight and parental body mass index.

Results: Body mass index z score was not related to parental descriptors. Maternal body mass index and child birthweight were predictors of the child's body mass index z score (r^2=0.15, $p<0.05$; and r^2=0.11, $p<0.05$, respectively). Both together produced a better model than either alone (r^2=0.23, $p<0.05$). There was no relationship between paternal and child body mass index z score ($p>0.05$).

Conclusions: There is a divergence between the parental perception of childhood obesity and the clinical definition that persists even in the context of an explicit referral. Given the significant impact of maternal weight on childhood overweight, education for prevention of overweight youth should encompass prenatal, early childhood and adolescent health maintenance.

Key words: body mass index ■ children/adolescents ■ obesity ■ overweight

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INTRODUCTION

Childhood and adolescent obesity in the United States is now deemed to be the most prevalent nutritional disease and has been propelled to the forefront of attention by the media, schools, national and local governments.[1-3] Over the past three decades, the rate of childhood overweight has increased nearly three-fold in both children and adolescents.[2] Despite this, parents often fail to recognize their own child(ren) as overweight. Only one in five mothers who identify themselves as overweight correctly identifies their overweight child(ren) as overweight.[4] Determining the presence of overweight is an effective screening tool for potential cardiovascular risk factors. Among overweight 5–10-year-olds, 61% have ≥1 risk factor, and the corresponding positive predictive value among teenagers is 60%.[5] Parental recognition of childhood overweight and obesity is the first critical step in lifestyle changes, as the success of any intervention is dependent on the degree of parental involvement.[6,7] Primary care physicians are at the frontline of the obesity epidemic. In clinical pediatric practices, 20% of the children and adolescents have been diagnosed as overweight.[8] Only a portion of these patients identified in a primary care setting are referred to a subspecialty clinic. In a population of caregivers told to take their child to a specialist explicitly due to excess weight, little is known about how those caregivers may then perceive the child's weight. We sought to determine the degree of concordance between parental perception of their child's weight and the child's degree of obesity as determined by their body mass index (BMI) z score,

after they had been referred to a subspecialty clinic. The setting of the study was in a referral-only specialized weight clinic. Additionally, we related BMI z scores to parental characteristics from an intake questionnaire.

DESIGN

This cross-sectional study was approved by the institutional review board of the University of Michigan. Eighty-two consecutive children were evaluated from March 21, 2003 through June 30, 2004 at the Pediatric Weight Assessment Clinic at the University of Michigan, a clinic staffed by pediatric endocrinologists to assess metabolic morbidity from abnormal weight gain. All participants had been referred by a broad range of community private practitioners. BMI z scores were calculated using Centers for Disease Control criteria. Parental body mass indices were determined from self-reported height and weight. Parents were asked to assign to their child one of the following descriptors: LOV=little overweight, OV=overweight, VOV=very overweight or OB=obese. These were arranged on the questionnaire from left to right to reflect the ascending severity of the descriptors in relationship to the child's obesity. The term "obesity" was used to echo lay terms used in the common articles in the media targeting the general population.[9-11] Patients and families were mailed an intake questionnaire prior to the visit that was either mailed back to the clinic or brought at the time of consultation. The questionnaire was divided into the following categories:

Concern for child's weight (meaning who was concerned about the child's weight)
- Primary care physician
- Parent
- Family (meaning extended family members)
- Child

Perceived cause (as perceived by primary care giver)
- Genetic (runs in the family)
- Eats too much
- Stress
- Low energy
- Low metabolism
- Lifestyle

Family history
- Type-2 diabetes
- Sleep apnea
- Heart disease
- Depression
- Obesity

Perceived activity level
- Not very active
- Less than most
- Average
- More than most
- Very active

Estimated daily time spent with TV/video games
- 1–2 hours
- 2–4 hours
- 4–6 hours
- 6–8 hours

Reported family eating habits
- Eat what they want, when they want
- There are some off-limit foods
- Too busy to eat together
- Arguments about food
- Parents control portion sizes
- May have second and third portions
- Everyone eats meals together

Data Analysis

Mean BMI z score was compared for each parental description of their child's weight using a one-way ANOVA. Regression analysis related BMI z score to birthweight and parental BMI. Statistical analyses were performed using SAS® release 9.1.3. Significance for these analyses was set at $p \leq 0.05$.

RESULTS

Description of Overall Clinic Population

Patients and parental characteristics are summarized in Table 1. The study population was comprised of 82 participants (32 boys, 50 girls). Caucasians represented the majority of the population at 56 (68%), followed

Table 1. Patient characteristics

	Mean (SD*)	Range
Age (years)	11.4 (4.5)	1.0–20.2
Birthweight (kg)	3.3 (0.7)	1.4–5.1
BMI z score	2.63 (0.6)	1.6–5.4
Paternal BMI (kg/m^2)	30.0 (7.1)	20.7–50.3
Maternal BMI (kg/m^2)	33.0 (9.4)	20.0–58.4

* SD: standard deviation

by African Americans at 16 (20%) and Hispanics at two (2%). BMI z scores using CDC criteria were calculated for 74 subjects. Exclusion criteria for regression analysis were: age of <2 years, nonambulatory status, and underlying diagnosis associated with obesity and/or abnormal growth patterns. Eight subjects were excluded. For all 82 subjects, sex was unevenly distributed, with 61% girls and 39% boys, and children had a mean age of 11.4 ± 4.5 years. Single-parent households represented 48% of the patient population, of which 54% listed Medicaid as their primary insurance. Among African-American households, 75% were single, 50% of which were on Medicaid. The intake questionnaire was completed by the parent(s) of 61 (26 boys, 35 girls) of the 82 participants. When the intake questionnaire was completed, 98% were completed by the mothers alone. The remaining 2% were either completed by fathers alone or both parents. Paternal BMI (n=54) ranged from 20.7–50.3 kg/m^2 with a mean of 30 kg/m^2 and maternal BMI (n=63) ranged from 20–58.4 kg/m^2 with a mean of 33 kg/m^2 with a standard deviation of 7.1 and 9.4, respectively.

Relationships between Parental BMI and Birthweight on Child's Weight at Referral

BMI z score was not related to parental perception of the degree of obesity (p=0.36). Maternal BMI and child birthweight were significant predictors of the child's BMI z score (r^2=0.15, p=0.002; and r^2=0.11, p=0.004, respectively). Both together produced a better model than either alone (r^2=0.23, p=0.01). There was no significant relationship between paternal BMI and the child's BMI z score (p=0.28).

Relationships between Parental Descriptors and BMI Z Scores

Table 2 describes the relationship between parental descriptors and child BMI z scores. The descriptors that were the most selected were OV and VOV, and yet for all categories, there was no significant difference for average BMI z score. As a result, there was no relationship between the severity of obesity and the severity of the descriptor chosen by the parent in the process of referral to a specialized weight clinic.

Patterns for Family Beliefs and Rules Related to Lifestyle

Table 3 describes the results of the questionnaire at the time of referral. Although all families were referred, concern for obesity was reported as initiated by the primary care physician by 54–100% of caregivers, depending on the descriptor subgroup. Genetics were perceived as a cause for obesity in over 30% across categories of parental descriptors. More than half of children referred had a family history of type-2 diabetes. There was no definite pattern of level of perceived activity or of reported television viewing. None of the families selected "0 to 1 hours" of television viewing. Therefore, this option is not reported on the table. Two-thirds of the families allowed second and third portions.

Comments

Overweight or obese children and adolescents are 5–20 times more likely to become overweight adults, and the presence of an elevated BMI in childhood is also predictive of hypertension in early adulthood.[12] Parental recognition of their child's overweight or obese status is a critical step in establishing preventative strategies against further weight gain and reduction of obesity-related comorbidities. Intuitively, one might presume that parental characterization of their child's weight may relate with their true degree of obesity, especially after being referred to a pediatric weight assessment clinic. However, in our study, there is a divergence between the parental perception of degree of overweight and the clinical definition of obesity that persists even in the context of an explicit referral for obesity. Even though all of the children in this study had body mass indices of >95th percentile, the BMI z score was not related to the parental description. The majority of the parents recognize their children are overweight. However, they did not recognize the severity of their children's condition, since all had surpassed the threshold of obesity. This is a significant concern, as it has been previously described that parents who thought their child's weight was an issue were more likely to be prepared to take corrective measures.[13] Our study echoes results of others wherein parents do not easily discern fatness in their children. Even among medical professionals, proper categorization of weight status in young children is problematic.[14]

The majority of parents present at the time of the

Table 2. Comparison between BMI z score and parental descriptors

Characteristics	LOV (n=4)	OV (n=24)	VOV (n=24)	OB (n=9)
Males/females	3/1	8/16	13/11	2/7
Age, mean (SD), years	7 (4.7)	10.8 (4.5)	12.9 (3.7)	11.7 (5.3)
BMI z score, mean (SD)	3.12 (1.26)	2.61 (0.82)	2.68 (0.33)	2.92 (0.59)

P=0.36, data presented as mean; SD: standard deviation; LOV: little overweight; OV: overweight; VOV: very overweight; OB: obese

consultation in each group did not perceive that overeating and sedentary lifestyles contributed to the causation of obesity. One can infer from this observation that these parents might not be responsive to campaigns targeting childhood obesity since they do not view their own children as obese. Adding to this complexity are recent calls for the substitution of the term "obese" for less pejorative terms such as "overweight."[15] As long as there will be discrepancies in vocabulary designating children who are morbidly obese, the effectiveness of public awareness campaigns in the media is in doubt.[16,17]

A prior study suggests that when mothers refer to their child with colorful euphemisms such as "big-boned" or "strong," these descriptors are not intended as metaphors for obesity. Some mothers may feel that being "chubby" or "plump" is an indication of overall good health and may be viewed as being attractive.[18] Children whose parents have a greater knowledge about nutrition and a more accurate assessment of their own weight status are less likely to be overweight.[19] Children of low socioeconomic status and two-parent households are more likely to be overweight.[20] However, overweight has been found to be higher in single-mother families.[21] To be more effective, interventions should address these misperceptions and work within different cultural frameworks to help parents become ready to make behavior changes.[22] In our study, parental perception discrepancy is present in very young children. In both preschool- and school-aged children, our study echoes other reports and suggests that early-onset childhood obesity continues to be overlooked.[23,24] Across the groups, genetics was indicated as an underlying cause of obesity in 30–100% of

Table 3. Responses to intake questionnaire by parental descriptor*

	LOV (n=4)	OV (n=24)	VOV (n=24)	OB (n=9)
Concerned about Child's Weight				
Primary care physician	4 (100)	13 (54)	18 (75)	8 (89)
Parent	1 (25)	17 (71)	19 (79)	6 (67)
Family	3 (75)	13 (54)	16 (67)	5 (56)
Child	1 (25)	12 (50)	11 (46)	3 (33)
Perceived Cause				
Genetic	4 (100)	9 (38)	10 (42)	3 (33)
Eats too much	0	6 (25)	11 (46)	3 (33)
Stress	0	3 (13)	3 (13)	2 (22)
Low energy	0	8 (33)	8 (33)	5 (55)
Low metabolism	0	5 (21)	2 (8)	2 (22)
Lifestyle	0	1 (4)	3 (13)	3 (33)
Family History				
Type-2 diabetes	2 (50)	16 (67)	12 (50)	5 (55)
Sleep apnea	0	7 (29)	8 (33)	4 (44)
Heart disease	1 (25)	13 (54)	10 (42)	5 (55)
Depression	0	12 (50)	8 (33)	5 (55)
Obesity	1 (25)	12 (50)	10 (42)	5 (55)
Perceived Activity Level				
Not active	0	5 (21)	5 (21)	3 (33)
Less than most	0	8 (33)	6 (25)	3 (33)
Average	2 (50)	5 (21)	7 (29)	2 (22)
More than most	0	1 (4)	0	0
Very active	0	2 (8)	2 (8)	0
Estimated Daily Time Spent with TV/Video Games				
1–2 hours	1 (25)	3 (13)	6 (25)	3 (33)
2–4 hours	2 (50)	9 (38)	4 (17)	2 (22)
4–6 hours	0	5 (21)	6 (25)	1 (11)
6–8 hours	1 (25)	2 (8)	4 (17)	2 (22)
Reported Family Eating Habits				
Eat what they want, when they want	0	7 (29)	7 (29)	2 (22)
There are some off-limit foods	0	3 (13)	5 (21)	1 (11)
Too busy to eat together	1 (25)	8 (4)	4 (17)	1 (11)
Arguments about food	0	4 (17)	6 (25)	0
Parents control portion sizes	2 (50)	11 (46)	7 (29)	3 (33)
May have 2nd and 3rd portions	3 (75)	14 (58)	14 (58)	4 (44)
Everyone eats meal together	3 (75)	12 (50)	11 (46)	5 (55)

Data are presented as n (%); * Caregivers allowed to respond to >1 descriptor so sum of percentages may be greater than 100

respondents, despite the observation that only five of the 82 children (6%) had identified genetic disorders. One probable explanation for this is that the term "genetic" may simply mean that the parents themselves were overweight in youth or reflect their perception that obesity "runs in the family." This view may further contribute to a lack of parental recognition of obesity as a true morbid condition.

This report adds to a growing body of evidence that there is a significant link between maternal BMI and the child's BMI z score, whereas a link between paternal weight and BMI is weak[25]—or, as in our study, fails to exist. The role of the mother in determining lifestyle at home may also explain why maternal BMI is linked to child BMI. In our study, mothers completed the majority of the questionnaires, suggesting mothers in our study provide the bulk of child-rearing guidance. If mothers are obese, their lifestyle practices could easily contribute to promotion of obesity in their children, especially if they are unaware of the degree to which they are overweight. Our data indicate that mothers, as the principle contributors to our survey data, were unaware of their own obesity and/or the family's predisposition to obesity.

Our study has several limitations. Our sample size was small and was underpowered to stratify results by age (of which the range was wide) or ethnicity. Although no discrepancies between self-reported height and weight versus general observation by the investigator were noted, parental obesity may have underestimated, as adults who are overweight tend to underestimate their weight. Information pertaining to paternal height and weight was based primarily the mothers' observations, as very few fathers accompanied the child to the clinic. Information regarding early feeding practices during infancy was not obtained. Selection biases that reflect primary care physicians' referral patterns were possibly embedded in the data since there were more girls than boys referred. In addition, the parents kept their appointment with the weight assessment clinic, which implies that they were motivated to do so. While these parents may have been motivated by the referring physician, it was beyond the scope of the study to ascertain whether referring physicians' comments may have influenced parental perception.

Our observations have significant implications for how we deal with childhood obesity issues. Current guidelines for the prevention of pediatric overweight and obesity as set forth by the American Academy of Pediatrics are primarily targeted toward the child.[26] Doctors and other healthcare providers may have a strong influence on whether parents understand the health risks associated with childhood overweight.[22]

If maternal lifestyle choices for child rearing contribute significantly to childhood obesity, professional recommendations regarding dietary and lifestyle modifications should be more generalized to include the whole family and perhaps should be included in prenatal counseling in anticipation of early weight gain in infants and toddlers. This need is further substantiated by data on prenatal programming of obesity in infants born to obese mothers.[27,28]

There are now emerging trends of the use of bariatric surgery as treatment for obesity in the pediatric population. In the United States, the rates of bariatric surgery among youth aged <20 years have increased from 0.23 per 100,000 to 0.73.[29] As more aggressive treatments are sought for children, it will be critical to develop assessment tools relating parental perceptions of obesity, as they could impact the long-term results of these interventions.

In conclusion, our study underscores that parental lack of recognition of childhood obesity continues to be a major contributing factor to the increasing incidence of childhood obesity. This has implications for further increases in obesity-related morbidities, particularly for the youngest children, who are most likely to go unrecognized as obese or overweight. Assessment tools regarding parental perceptions of obesity which take culture and ethnicity into account are lacking. Our results suggest that parental misperceptions regarding their child's obesity and contributing factors are present during the early years of the child's life. Preventative strategies to rectify embedded misperceptions and reinforce recognition of obesity would need to include young women of reproductive age, the mother–child unit during pregnancy and the entire family during the early preschool years to effectively communicate health concepts related to obesity.

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