Parent-Rated Behavior Problems Associated with Overweight

After Controlling for Sleep Disordered Breathing: A Prospective Study

Shelagh A. Mulvaney, PhD
Center for Evaluation & Program Improvement and Department of Pediatrics, Vanderbilt University, Nashville, Tennessee, shelagh.mulvaney@vanderbilt.edu

Kristine L. Kaemingk, PhD
Department of Pediatrics, University of Arizona, College of Medicine, Tucson, Arizona, kaemingk@peds.arizona.edu

James L. Goodwin, PhD
Arizona Respiratory Center, University of Arizona, College of Medicine, Tucson, Arizona, jamieg@arc.arizona.edu

Stuart F. Quan, MD
Arizona Respiratory Center, University of Arizona, College of Medicine, Tucson, Arizona, sfquan@arc.arizona.edu

Correspondence: Shelagh Mulvaney, PhD, Center for Evaluation & Program Improvement, Vanderbilt University, 230 Appleton Place, Peabody #151, Nashville, TN 37203, Tel 615-322-4875, Fax 615-322-7049; shelagh.mulvaney@vanderbilt.edu

Running Head: Behaviors Associated with Childhood Overweight
ABSTRACT

Background: Researchers and clinicians are seeking to develop efficacious behavioral interventions to treat children with overweight. However, few studies have documented the behavioral correlates of overweight in children in community samples. The goal of this study was to determine the nature and prevalence of behavior problems for overweight school-aged children versus normally weighted peers.

Methods: Hispanic and Caucasian children were invited to participate in a study of sleep through public elementary school classrooms. Anthropometric evaluation and behavioral ratings were collected for 402 normal children aged 6-11 years. Overweight was calculated using the Centers for Disease Control age- and gender-specific guidelines. Children were classified as overweight if they were at or above the 95th percentile for their age and gender group. Behavior problems were measured using the Conners' Parent Rating Scales-Revised and the Child Behavior Checklist.

Results: Approximately 15% (59/402) of the sample was classified as overweight. Simple odds ratios indicated that overweight children were more likely to have clinically relevant levels of internalizing symptoms (OR 2.23, CI 1.05-4.72), psychosomatic complaints (OR 2.15, CI 1.02-4.54), withdrawal (OR 4.69, CI 2.05-10.73), and social problems (3.18, 1.53-6.60). When odds ratios were adjusted for level of sleep disordered breathing, withdrawal (OR 3.83 CI 1.59-9.22) and social problems (OR 2.49 CI 1.14-5.44) remained significantly higher for overweight subjects.

Conclusions: Behaviors associated with overweight, such as withdrawal and social problems, need to be taken into account in the design of interventions and services as they may act to moderate the efficacy of behavioral treatments.
BACKGROUND

The prevalence of childhood overweight has been reported frequently in the research literature and popular media. Recent epidemiological studies estimate that pediatric overweight has increased dramatically in the last generation, that as of 2000 approximately 15% of children aged 6-11 are overweight [1], and that 25-31% of children and adolescents in the U.S. are overweight or at risk of being overweight [2-5]. The health consequences related to childhood overweight include insulin resistance, type 2 diabetes, hypertension, and heart disease later in life [6, 7].

Psychological or behavioral problems in childhood have been examined as both causes and effects of overweight. That is, overweight has been hypothesized as a possible result of psychological symptoms and psychological symptoms have been hypothesized to be a result of overweight [8, 9, 10, 11]. Further evidence for the relationship between overweight and behavioral problems is provided by treatment studies that have shown decreased levels of psychological and behavioral problems in children subsequent to treatment for overweight [12, 13, 14].

Clinical, referred, or screened samples have found relationships between overweight and depression [15, 16] as well as between overweight and social problems and withdrawal [15] or both internalizing and externalizing behaviors [16]. One longitudinal study found relationships between chronic overweight and oppositional defiant disorder for boys and girls and with depression for boys [10]. Alternatively, an epidemiological study of adolescents and young adults found a relationship between body mass index (BMI) and depression only in girls [16]. Mixed samples have found lowered social and physical perceived self-competence and well-being compared to normal weighted peers [17]. Community-based studies have found depression
and overweight related in girls and non-specific patterns of behavior problems associated with overweight [8]. In overweight children and adolescents, quality of life measures indicate a lower overall quality of life as well as lower self-esteem and physical functioning [19,20].

There are several limitations to the studies currently available linking overweight to behavior in otherwise healthy children. Studies using non-referred samples have been screened for specific psychological disorders [10], are conducted within other cultures [17] or have used overweight categorizations that are not age- and gender-specific [15, 16]. While cognitive problems, hyperactivity, and externalizing behaviors, have been linked to SDB and snoring [21-23], no specific pattern of behavioral problems have been consistently associated with SDB. Additionally, research to date indicates an unclear relationship between SDB and overweight in community samples of children [24, 25]. Understanding what behaviors may be more related to SDB and what may be relatively more related to obesity per se is important for the development of interventions and services for this population. The goal of the current research was to provide a description of the nature and prevalence rate of behavior problems in a general population cohort for overweight and normal weight school children after controlling for the presence of sleep disordered breathing.

**METHODS**

Participants

Subjects in the current analyses were enrolled in a study of sleep in children, the Tucson Children’s Assessment of Sleep Apnea [23, 24, 26]. This study recruited 6 through 11 year old Hispanic and Caucasian children to undergo home polysomnography, a sleep questionnaire, and neurocognitive testing. A detailed description of recruitment procedures has been previously published [23, 24, 26]. Briefly, recruitment was accomplished by soliciting the cooperation of
selected elementary schools in the Tucson Unified School District (TUSD). TUSD is a large
district with an elementary school population that is representative of children living in southern
Arizona. A short sleep-habits screening questionnaire was sent home with all children in a "notes
home" folder. Parents were asked to complete the questionnaire and to provide contact
information if they agreed to allow study personnel to call and schedule a polysomnogram and
neurocognitive testing for their child. Sleep and demographic questionnaire data, child weight
and height measures were acquired in the family home at the time of the polysomnogram.
Behavioral questionnaire data were collected from parents within the Department of Pediatrics
when the child subsequently underwent neurocognitive testing. The TUSD Research Committee
and the University of Arizona Institutional Review Board approved the study protocol. Parents or
guardians completed approved consent forms and children completed assent forms before
participating in the study.

Children were excluded from the study if there was a history of head injury,
tonsillectomy, mental retardation, or asthma. Families were paid $25 for completing the sleep
study and $25 to complete the behavioral evaluation.

Measurement

Children were classified as overweight if their BMI was at or over the 95th percentile for
age- and gender-specific normative values [27].

The Conners' Parent Rating Scale – Revised (CPRS-R) is a well validated 80-item
behavior rating scale that measures symptoms of ADHD (hyperactivity, impulsivity, and
inattention) as well as comorbid behaviors such as oppositional behavior, anxiety, and somatic
complaints [28]. All CPRS-R scales focus on behaviors central to a diagnosis of ADHD such as
Cognitive Problems and Hyperactivity or measure behaviors that are commonly comorbid with inattention and hyperactivity. Three scales on the CPRS-R are considered internalizing correlates of ADHD (Anxious-Shy, Perfectionism, and Psychosomatic Complaints). Behaviors are rated on a 4-point scale that ranges from ‘Very True’ to ‘Not True’. Seven of the scales on the CPRS-R are derived directly from the Diagnostic and Statistical Manual-IV criteria for ADHD [29]. A t-score is derived for each scale, based on a large age and gender specific normative sample. A t-score (M=50, SD=10) over 65 is considered to indicate moderate to severe clinical impairment.

The Child Behavior Checklist (CDCL) [30] allows assessment of 118 parent-reported behavioral and emotional problems of children ages 4-18. Parents rate their child’s behavior on a 3-point scale (Not True, Somewhat True, or Very/Often True). The CBCL includes 8 syndrome scales, a Total problem score, and higher order Internalizing and Externalizing scales. Internalizing scales include Anxious/Depressed, Withdrawn, and Somatic Complaints. Externalizing scales include Aggressive Behavior and Delinquent Behavior. Three syndrome scales, Social Problems, Thought Problems, and Attention Problems, are not part of the internalizing/externalizing dimensions. A t-score over 65 is considered to indicate moderate to severe clinical impairment.

Data were analyzed using SPSS version 13 for Windows (SPSS, Inc., Chicago, IL). Simple odds ratios and adjusted odds ratios were calculated. Adjusted odds ratios controlled for the level of sleep disordered breathing using the respiratory disturbance index (RDI). The RDI is a continuous variable that indicates the number of respiratory "events" per hour of sleep. Breathing "events" were scored during sleep if total inspiratory volume went below 50% of baseline and was associated with a 3% decrease in blood oxygen levels [26, 31, 32].
RESULTS

Of the 7055 initial surveys distributed throughout the schools, 2327 (33%) were returned. Of the 1219 (52.4%) who gave permission to be contacted further, 503 (41.3%) met inclusion criteria and agreed to participate. Of the 480 sleep studies completed, 402 (83.7%) had complete anthropometric and behavioral data.

Descriptive summary statistics for the sample are in Table 1. There were approximately equal numbers of boys and girls, and more Caucasians than Hispanics. Overweight was present in 14.7% of the total sample. There were significantly more Hispanic subjects in the overweight (56%) group compared to the non-overweight group (35.6%). Descriptive statistics are provided separately for the overweight and normal weight subjects in Table 2. The overweight subjects tended to be slightly older than the normal weight subjects. There were no significant differences between the groups on gender or parent education.

Table 3 shows percentages of overweight and normal weight subjects who were classified as having clinically relevant levels of behavioral problems (moderate to severe) for the Conners' Parent Rating Scale-Revised (CPRS-R). It also includes simple odds ratios indicating the probability of overweight children being classified with clinically relevant levels of behavior problems given that they were overweight. Additionally, odds ratios were calculated controlling for sleep disordered breathing (SDB). The adjusted odds ratios and confidence intervals are shown in Table 3. Although odds ratios were greater than one for several CPRS-R scales, confidence intervals were wide and only the Psychosomatic scale was statistically significant. Twice as many children were classified as having psychosomatic complaints in the overweight versus normal weight groups. When odds ratios were adjusted for level of SDB, psychosomatic complaints were no longer significant across the groups.
Table 4 shows percentages of overweight and normal weight subjects who were classified as having clinically relevant levels of behavioral problems (moderate to severe) for the Child Behavior Checklist (CBCL), simple odds ratios, and adjusted odds ratios controlling for SDB. Significant unadjusted odds ratios were observed for the Withdrawn, Social Problems and Internalizing scales. When SDB was controlled, the Withdrawn (3.83, CI 1.59-9.22) and Social Problems (2.49, CI 1.14-5.44) odds ratios remained significant.

CONCLUSIONS

Current findings suggest that overweight school-aged children show elevated levels of several behavior problems. Within this sample, 15% of the subjects were overweight. Overweight was more prevalent in Hispanic and male subjects. This sample had increased parent reports of psychosomatic complaints, social problems, withdrawal, and general internalizing behaviors. When SDB was taken into account, overweight was no longer associated with psychosomatic complaints and general internalizing symptoms. However, levels of withdrawal for the overweight subjects were still almost 4 times higher and social problems were 2.5 times higher than that of normal weight subjects. Attention problems, hyperactivity, oppositional, and externalizing behaviors were not elevated in the overweight group.

The Conners' psychosomatic complaints scale included items related to headaches, stomach aches in general, stomach aches before school, vague complaints that are not supported by physical illness, and fatigue. While these behaviors may be related to avoidance of school or other social situations, vague bodily pain, malaise and fatigue could also be related to sleep disordered breathing.

The most prevalent problem behaviors reported by parents were those related to withdrawal. The CBCL withdrawal scales includes items related to shyness, preference for being
alone, secretiveness, sulking, underactive, sadness, withdrawal, and not talking. Although overweight has been hypothesized as a result of some psychiatric symptoms, such as depression, these behavioral problems could result from living with overweight. Social problems are related to immaturity, not being liked by peers, teased by peers, overweight, and clumsiness. Social problems on the CBCL were reported much more frequently by parents of overweight children than by parents of normal weight children. Children who are overweight may be subject to bullying or face functional limitations [33]. They may be ostracized by their peers or feel less physically competent compared to their peers [17]. Withdrawal is a natural and predictable reaction to judgment by peers or other social problems.

Oppositional behavior has been linked to chronic overweight, when it is present from childhood through adolescence [11]. The current results do not support the idea that oppositional or externalizing behaviors, such as aggression, are salient at this developmental stage in the context of overweight. Another large cross-sectional study that found an overall relationship between overweight and behavior problems did not find specific patterns that fit externalizing (nor internalizing) problems [8]. It may be that the current sample was not chronic enough to be at risk for externalizing behaviors. It is unclear whether childhood overweight has long term psychological correlates unless it persists into adolescence.

A limitation to this study is that only one informant was used to measure behavioral problems. Although cross-informant behavioral agreement is generally low [34], it does provide contextual perspectives on behavior and may be used to generate alternate explanations for results. Additionally, this study is descriptive and the data do not allow for strong inferences regarding the etiology of the behaviors reported by parents. Finally, more socio-economic data on these families would have been helpful to determine if socioeconomic status related to
behavior problems. However, this study did examine a broad variety of problem behaviors derived from a population-based sample of school children. Overweight was defined as age- and gender-specific, however, the overweight group was predominantly Hispanic. Epidemiological studies have documented the relatively high rate of overweight in young Hispanic males found here [3]. The high rates of overweight in minority groups may indicate a need to use ethnically derived normative indices of overweight.

Overweight may contribute to behavior problems independent of SDB. It is possible that the behaviors for which overweight adds predictive value above SDB are those that are influenced by social factors such as teasing or other peer behaviors. Overweight children do face discrimination and stigmatization and this may impact their global self-worth [35, 36, 37]. Further research with larger samples should examine the extent to which emotional response to overweight is moderated by environmental and social pressures such as exclusion or individual differences in the need for relatedness or social acceptance.

Behavioral correlates, such as those documented here, need to be taken into account in the development and evaluation of interventions for childhood overweight. Although emotional and behavioral problems may act as moderators of interventions, most trials to date have not measured or examined behavioral status in such a manner. Psychologists and health administrators seeking to create services responsive to the current problems in U.S. childhood overweight could benefit from further information regarding the psychosocial mechanisms of withdrawal and social problems. Alternatively, individual differences in the predisposition toward behavioral problems in the context of childhood overweight may be moderated by attitudes surrounding overweight and the extent of obesity within the extended family. As Freidman & Brownell [38] pointed out in the adult obesity literature, many important questions
about etiology and treatment may only be answered through longitudinal research that allows for an examination of risk factors and causal modeling.

ABBREVIATIONS

SDB, sleep disordered breathing; CBCL Child Behavior Checklist; CPRS-R, Conners' Parent Rating Scale – Revised.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

SM conceived the manuscript, performed statistical analyses, helped with behavioral data collection, and drafted the manuscript. KK participated in the design and funding of the study, supervised behavioral data collection, and helped edit the manuscript. JG supervised PSG data collection, and edited the manuscript. SQ obtained funding for the project, designed the sleep study, and helped draft the manuscript. All authors read and approved the final manuscript.
REFERENCES


Table 1. Descriptive statistics for the sample (N=402).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD) or Percent</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>8.8 (1.61)</td>
<td>6.0 - 11.9</td>
</tr>
<tr>
<td>Gender (% Female)</td>
<td>48.3 %</td>
<td></td>
</tr>
<tr>
<td>Hispanic %</td>
<td>38.6 %</td>
<td></td>
</tr>
<tr>
<td>Caucasian %</td>
<td>61.4 %</td>
<td></td>
</tr>
<tr>
<td>Obese %</td>
<td>14.7 % (59/402)</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>18.0 (4.48)</td>
<td>10.9 - 48.1</td>
</tr>
<tr>
<td>Parent Education (N=287)</td>
<td>13.6 (3.24)</td>
<td>1-21</td>
</tr>
</tbody>
</table>
Table 2. Descriptive statistics and tests of differences between typical weight versus overweight subjects.

<table>
<thead>
<tr>
<th></th>
<th>Normal Weight</th>
<th>Overweight</th>
<th>F (sig) or Chi² (sig)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD) or Percent (N=343)</td>
<td>Mean (SD) or Percent (N=59)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>8.7 (1.6)</td>
<td>9.2 (1.5)</td>
<td>F 4.42 (.036)</td>
</tr>
<tr>
<td>Gender (% Female)</td>
<td>50.1%</td>
<td>37.3%</td>
<td>Chi 3.33 (.068)</td>
</tr>
<tr>
<td>Hispanic %</td>
<td>35.6%</td>
<td>55.9%</td>
<td>Chi 8.81 (.003)</td>
</tr>
<tr>
<td>Parent Education</td>
<td>13.7 (3.3)</td>
<td>13.2 (2.8)</td>
<td>F .901 (.343)</td>
</tr>
</tbody>
</table>
Table 3. Odds ratios and percentages for probability that a subject who is overweight will be classified within the clinical range for each problem behavior on the Conners’.

<table>
<thead>
<tr>
<th>Scale name</th>
<th>% Normal Weight in Clinical Range</th>
<th>% Overweight in Clinical Range</th>
<th>Unadjusted Odds Ratio</th>
<th>Adjusted Odds Ratio*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oppositional</td>
<td>9.4</td>
<td>16.7</td>
<td>1.69 (0.76-3.74)</td>
<td>1.62 (0.71-3.72)</td>
</tr>
<tr>
<td>Cognitive Problems</td>
<td>11.7</td>
<td>20.0</td>
<td>1.68 (0.80-3.49)</td>
<td>1.46 (0.68-3.16)</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>17.3</td>
<td>16.7</td>
<td>0.84 (0.39-1.82)</td>
<td>0.86 (0.39-1.88)</td>
</tr>
<tr>
<td>Anxious Shy</td>
<td>12.3</td>
<td>15.0</td>
<td>1.29 (0.59-2.81)</td>
<td>1.21 (0.54-2.72)</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>6.4</td>
<td>5.0</td>
<td>0.78 (0.22-2.69)</td>
<td>0.68 (0.18-2.49)</td>
</tr>
<tr>
<td>Social Problems</td>
<td>8.5</td>
<td>15.0</td>
<td>1.63 (0.71-3.76)</td>
<td>1.26 (0.51-3.09)</td>
</tr>
<tr>
<td>Psychosomatic</td>
<td>9.4</td>
<td>20.0</td>
<td>2.15 (1.02-4.54)</td>
<td>1.59 (0.71-3.56)</td>
</tr>
<tr>
<td>ADHD index</td>
<td>12.0</td>
<td>11.7</td>
<td>0.81 (0.32-2.00)</td>
<td>0.64 (0.24-1.69)</td>
</tr>
<tr>
<td>Global Index- Total</td>
<td>12.3</td>
<td>10.2</td>
<td>0.65 (0.24-1.73)</td>
<td>0.62 (0.23-1.69)</td>
</tr>
<tr>
<td>DSM Inattentive</td>
<td>12.3</td>
<td>16.7</td>
<td>1.25 (0.57-2.73)</td>
<td>1.05 (0.46-2.40)</td>
</tr>
<tr>
<td>DSM Hyperactive</td>
<td>17.6</td>
<td>18.3</td>
<td>0.94 (0.45-1.95)</td>
<td>0.98 (0.46-2.09)</td>
</tr>
<tr>
<td>DSM Total</td>
<td>14.4</td>
<td>13.3</td>
<td>0.78 (0.33-1.82)</td>
<td>0.67 (0.27-1.63)</td>
</tr>
</tbody>
</table>

* Note: Odds Ratios controlled for level of sleep disordered breathing.
Table 4. Percentages, unadjusted, and adjusted odds ratios for probability that a subject who is overweight will be classified within the clinical range for each problem behavior on the CBCL.

<table>
<thead>
<tr>
<th>Scale name</th>
<th>% Normal Weight in Clinical Range</th>
<th>% Overweight in Clinical Range</th>
<th>Odds Ratio (95% CI)</th>
<th>Adjusted Odds Ratio* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive Behavior</td>
<td>7.4</td>
<td>10.2</td>
<td>1.12 (0.41-3.06)</td>
<td>0.96 (0.33-2.79)</td>
</tr>
<tr>
<td>Anxious/Depressed</td>
<td>9.5</td>
<td>16.9</td>
<td>1.69 (0.76-3.75)</td>
<td>1.46 (0.63-3.40)</td>
</tr>
<tr>
<td>Attention Problems</td>
<td>14.0</td>
<td>11.9</td>
<td>0.69 (0.28-1.07)</td>
<td>0.54 (0.20-1.42)</td>
</tr>
<tr>
<td>Somatic Complaints</td>
<td>10.1</td>
<td>16.9</td>
<td>1.58 (0.72-3.50)</td>
<td>1.21 (0.51-2.85)</td>
</tr>
<tr>
<td>Withdrawn</td>
<td>4.5</td>
<td>20.3</td>
<td>4.69 (2.05-10.73)</td>
<td>3.83 (1.59-9.22)</td>
</tr>
<tr>
<td>Social Problems</td>
<td>8.0</td>
<td>23.7</td>
<td>3.18 (1.53-6.60)</td>
<td>2.49 (1.14-5.44)</td>
</tr>
<tr>
<td>Thought Problems</td>
<td>9.2</td>
<td>8.5</td>
<td>0.70 (0.24-2.07)</td>
<td>0.57 (0.18-1.81)</td>
</tr>
<tr>
<td>Delinquent Behavior</td>
<td>11.3</td>
<td>10.2</td>
<td>0.72 (0.27-1.91)</td>
<td>0.73 (0.26-1.98)</td>
</tr>
<tr>
<td>Total Score</td>
<td>12.2</td>
<td>18.6</td>
<td>1.46 (0.68-3.11)</td>
<td>1.38 (0.63-3.03)</td>
</tr>
<tr>
<td>Internalizing</td>
<td>9.2</td>
<td>20.3</td>
<td>2.23 (1.05-4.72)</td>
<td>1.84 (0.83-4.10)</td>
</tr>
<tr>
<td>Externalizing</td>
<td>7.8</td>
<td>10.2</td>
<td>1.08 (0.39-2.92)</td>
<td>0.92 (0.32-2.65)</td>
</tr>
</tbody>
</table>

* Note: Odds Ratios controlled for level of sleep disordered breathing.