Prevalence of Obesity and Autism Spectrum Disorder

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Childhood obesity is a growing public health concern and is increasingly prevalent in recent years. There are a variety of risk factors for obesity in children with autism spectrum disorder (ASD). To estimate the prevalence of obesity in children with ASD, a secondary data analysis was conducted on the nationally representative National Survey of Children's Health (NSCH; 2011–2012) archival database. Variables specific to ASD as well as body mass index were analyzed using a cross-tabulation analysis to compare a sample of children with ASD with a random control sample. The prevalence of obesity in children with ASD was 12.6% compared with 7.2% of children without ASD. Additionally, 9.3% of children with ASD met criteria for being overweight compared to 7.5% of those without ASD. These findings suggest that children with ASD could benefit from applied behavioral interventions to reduce risk factors for obesity. Specific recommendations for behavior-analytic treatment are discussed as well as recommendations for future research to better understand these risk factors.

Keywords: autism, obesity, behavioral intervention, overweight children

Obesity is a significant health concern that has increasingly been at the forefront of psychological and medical research over the past several years. Obesity rates in children have nearly tripled in the past 30 years, and as of 2012, it was estimated that over one third of all children in the United States met criteria for obesity (Centers for Disease Control and Prevention [CDC], 2015). Childhood obesity is associated with numerous health risks, including high blood pressure and/or cholesterol, insulin resistance and Type 2 diabetes, joint pain, and sleep complications (Thompson, 2015). Moreover, childhood obesity has been found to be a predictor of obesity-related morbidity in adulthood (Llewellyn, Simminds, Owen, & Woolacott, 2015).

Although there is a significant amount of contemporary literature on childhood obesity, research on childhood obesity in individuals with neurodevelopmental conditions such as autism spectrum disorder (ASD) has been somewhat limited until recently. ASD is a developmental disability that affects social, emotional, and behavioral development often presenting in early childhood (Ventola, Saulnier, Steinberg, & Chawarska, 2014). Insofar as obesity is in part a behavioral disease, particularly in children (Katzmarzyk et al., 2015), those with ASD are presumably at an increased risk.

Multiple behaviors of children with ASD can contribute to obesity. Restrictive and repetitive behaviors, as well as perseverative thinking, are examples of these high-risk behaviors in children with ASD (Gabriels, Cuccaro, Hill, Ivers,

& Goldson, 2005). These are often manifested in the children's eating habits, resulting in extreme food selectivity (Cermak, Curtin, & Bandini, 2010). Their selectiveness can range from foods of only one texture, color, brand, and/or one category such as fried foods or starches. This greater food selectivity can place children with ASD at risk for malnourishment and being underweight or alternatively being overweight or obese (Bandini et al., 2010; Sharp et al., 2013).

Gross motor skill deficits are also common in children with ASD, including their ability to walk, run, and jump (MacDonald, Lord, & Ulrich, 2013). As a result, they are less likely to exercise and to engage in fitness-based activities that could reduce the negative effects of their exclusivity in eating patterns and therefore their risks for obesity.

Despite these factors that place children with ASD at an increased risk for obesity and becoming overweight, the prevalence of overweight status and obesity has rarely been studied in these children. Those studies that are available have a number of methodological limitations, including small and restricted sample sizes and studies that do not compare children with ASD to those without ASD. Although at least one large-sample analysis has been conducted on both an ASD and non-ASD control group, the data had been collected 6 years prior to publication and are now over 10 years old (Curtin, Andersen, Must, & Bandini, 2010). More recent research on a large national sample revealed a positive correlation between obesity and ASD (Phillips et al., 2014). However, the sample included children with learning disabilities and other behavioral disabilities, thus confounding the comparison between children with and without ASD. Researchers conducted a recent study that compared children with ASD, whose diagnosis was confirmed by standardized testing. Children with ASD had greater rates of obesity and overweight classification compared to reported U.S. population samples (Hill, Zuckerman, & Fombonne, 2015). Unfortunately, this study did not include a control group within the same study but rather used normative data as their comparison group.

Fortunately, a significant literature provides examples of effective behavioral interventions for these challenges. For example, Kuhl, Rudrud, Witts, and Schulze (2015) evaluated the effectiveness of group contingencies in a classroom setting for increasing physical activity in children. Their findings suggested that individual goal settings resulted in increased physical activity. Similarly, goal settings, performance feedback, and reinforcement were moderately effective in increasing physical activity and gross motor engagement in obese preschool children (Hustyi, Normand, & Larson, 2011). Other researchers found that parent attention or interactive play contingent on moderate to vigorous physical activity was successful in increasing activity levels in young children (Zerger, Normand, Boga, & Patel, 2016). Recent research has also supported the use of behavioral intervention with regard to pediatric feeding disorders. Interventions including differential positive reinforcement (Tanner & Andreone, 2015), negative reinforcement (Vaz, Volkert, & Piazza, 2011; Voulgarakis & Forte, 2015), utensil manipulation (Wilkins et al., 2014), and manipulation of response effort (Volkert, Piazza, & Ray-Price, 2016) have all been effective. Moreover, many recent studies include a parent generalization component indicating teachable strategies that families can implement (Murphy & Zlomke, 2016).

The purpose of the current study was to determine the current prevalence of overweight and obesity in children with and without ASD. Although there is a small but established body of research supporting a high co-occurrence, this study replicated these findings while also including a control group within the same data set. Based on the results of this analysis, prevalence information can be provided for behavior analysts regarding treatment recommendations to reduce these risk factors and behavioral disparities.

Method

Participants

For the current study, archival data were taken from the National Survey of Children's Health (NSCH, 2011–2012) which is a national survey conducted by the National Center for Health and Statistics at the CDC, in collaboration and under the direction of the Federal Maternal and Child Health Bureau. The original data were gathered via telephone survey, and a random sample of phone numbers was called to

find households with children ages 0–17. Houses with no children were omitted, while respondents with children were asked how many children resided in the home. For homes with more than one child, one was randomly selected to be the child participant of the survey. Either parent/guardian completed the survey, based on the one who knew the child best. In total, 95,677 surveys were completed nationally, with approximately 1,850 collected per state. Finally, results were weighted to represent the population of the nation and each state. Trained interviewers conducted the surveys with questions on social, emotional, and psychological functioning, as well as physical and behavioral health.

To estimate the presence of ASD and related disorders in the participant pool, parents responded to the question, "Has a doctor or other health care provider ever told you that your child has Autism, Asperger's disorder, pervasive developmental disorder (PDD), or other autism spectrum disorder?" The sample included 2,041 children whose parents responded affirmatively. Children's parents who denied any instance of ASD or PDD were then selected for the control group. Children who were reported to have other developmental disabilities, gastrointestinal difficulty, and metabolic conditions were excluded.

To determine body mass index (BMI), the NSCH used information from the National Center for Health Statistics to determine the BMI-for-age classifications that include underweight (less than the 5th percentile), healthy weight (5th to less than the 85th percentile), overweight (85th to less than the 95th percentile), and obese (equal to or greater than the 95th percentile). BMI was already calculated and integrated into this database and was not a separate analysis within this study.

Data Analysis

For the SPSS data analysis, the children with ASD (as reported by the parents/guardians) were selected. The following cases were excluded: (a) those who responded "no/does not currently have," "told, but not current," and "don't know"; (b) missing cases; and (c) children under 2 years of age because of the difficulty accurately diagnosing ASD before this age. This process generated a sample of 2,041

children with ASD. Random sampling functions were then used to select a random sample of 2,041 children whose parents/guardians said they did not have ASD. Using a cross-tabulation analysis and Pearson's Chi-Square Test, the two groups were compared on the overweight and obesity classifications to summarize and compare the data from both groups.

Results

Descriptive statistics were used to generate demographic information for each sample. Demographics of children with and without ASD are represented in Table 1. Based on a review of the demographics table, the age distribution appears to be relatively similar in both groups. The distribution of those speaking English in the home was also similar in the two groups, suggesting that this was not a confounding variable. In terms of gender, the ASD group had nearly four times as many males as females compared to the non-ASD group, which had a nearly even split of 51.7% males and 48.3% females. These distributions were expected based on the significant gender imbalance in the diagnosis of ASD, although the cause is unknown (CDC, 2015).

The prevalence of obesity (BMI in the 95th percentile or greater) in children with ASD was 12.6% ($n = 285$) of the sample compared to 7.2% ($n = 146$) of children without ASD ($p = .015$). Similarly, 9.3% ($n = 189$) of children in the ASD sample were classified as overweight (85th percentile to less than the 95th) compared to 7.5% ($n = 154$) of children without ASD

Table 1

Demographic Data on Children With and Without Autism Spectrum Disorder (ASD)

Variable	Children with ASD, n (%)	Children without ASD, n (%)
Gender		
Male	1,056 (51.7)	1,618 (79.3)
Female	983 (48.3)	422 (20.7)
Age (y)		
2–6	585 (28.6)	409 (20.0)
7–11	617 (30.2)	776 (38.0)
12–17	839 (41.1)	857 (41.9)
Primary language		
English	1,881 (92.2)	1,969 (96.5)
Other than English	160 (7.8)	72 (3.5)

($p = .018$). As such, children with ASD are more likely to be classified as overweight or obese than children without ASD, χ^2 (1, $N = 747$) = 5.92, $p = .015$. Findings are given in Table 2.

Discussion

The results of this study suggest that both obesity and being overweight are more common in a recent sample of children with ASD compared to a sample of children without ASD. These data that represent children from across the country replicated data from a similar study on an earlier sample that used the 2003–2004 NSCH database (Curtin et al., 2010). Of particular strength, the current study used a nationally representative sample, including females, from across the Unites States. A control group representing children without ASD was included via the available data to provide a direct comparison to children within the same data sample. Although this study used parent reports as the source of information rather than collected data, this provides an important extension of the current literature. The current study replicated a study that used raw diagnostic data, indicating that parent reports are reliable data. This is corroborated by literature showing the similarity between diagnostic and parent-report data (Duvekot, van der Ende, Verhulst, & Greaves-Lord, 2015).

Findings from this study should be considered within the context of a number of limitations. First, the data were obtained from a survey and the ASD diagnoses were not confirmed via standardized instruments such as the Autism Diagnostic Observation Schedule – Second Edition (ADOS-2; Lord et al., 2012) or the Autism Diagnostic Intervie – Revised (ADI-R; Rutter, LeCouteur, & Lord, 2008). Also, a number of other variables such as other forms of illness or unreported developmental factors that may have contributed to weight gain were not included in the analyses.

Although obesity is affected by internal mechanisms such as energy imbalance, this imbalance is, in turn, affected by calorie intake and energy expenditure (Hill, Wyatt, & Peters, 2012). Both of these variables are highly influenced by behavioral factors such as eating habits and daily exercise. This information, combined with the results of this study, may have important implications for behavioral interventions. The Applied Behavior Analysis (ABA) literature on interventions to increase physical activity and gross motor skills in children is well representedand should be integrated into treatment planning. Unfortunately, there is little research available on these interventions in children with ASD.

Children with ASD notably engage in food refusal and/or rigidities, which frequently result in diets consisting of starches and processed foods, likely contributing to a metabolic imbalance. These atypical eating habits could contribute to the development of obesity in childhood in a variety of populations. However, they become exacerbated due to the rigidity and difficult behaviors that children with ASD exhibit. As such, behavioral objectives related to food intake, increasing variety in food intake, toler-

Table 2

Prevalence of Obesity and Overweight in Children With and Without Autism Spectrum Disorder (ASD)

Variable	Children without ASD	Children with ASD	*p* value for difference
Obesity (<95th percentile)			
Percent	7.2	12.6	.015
N size	146	285	
Overweight (85th–94th percentile)			
Percent	7.5	9.3	.018
N size	154	189	
Chi-square tests			
Pearson chi-square value	5.923		
Degrees of freedom	1		
Fisher's exact test	.017		

ating different foods, acceptance of food from a parent or caregiver, and increasing self-feeding skills should be recommended for this population.

Future research should also include an exploration of when and, more specifically, how feeding disorders, including food refusal or binge eating, develop in children with ASD. Additionally, anecdotal reports suggest gastrointestinal sensitivities, allergies, and other medical complexities in children with ASD that could contribute to overweight and obesity in these children. Future research should examine these comorbidities in order to further understand why obesity is more prevalent in children with ASD. Finally, given that this disorder presents with varying levels of severity, future research should focus on symptoms that might contribute to the severity of medical comorbidities such as obesity and gastrointestinal disorders.

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