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Prevalence and Correlates of Obesity in Childhood Autism Spectrum Disorders: A Literature Review

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Abstract

Background: It has been suggested that obesity and overweight in young people with autism spectrum disorder (ASD) presents a challenge to conventional weight reduction measures leading to poorer health outcomes in this population in comparison with typically developing children. In order to effectively adapt current obesity management guidelines for use in children with ASD more needs to be understood about the prevalence of overweight and obesity and the associated factors in this population.

Aim: The purpose of this review is to appraise the evidence on obesity and overweight prevalence in the childhood ASD population from relevant studies selected using a computer generated database. The review explores the link between age, gender, physical activity and obesity in childhood ASD; and highlights areas for further research. The link between antipsychotic treatment and weight gain in childhood ASD is already well established and this review doesn't include an appraisal of the evidence supporting this link.

Results: Compared to an obesity rate of 17% in typically developing children from the CDC's National Health and Nutrition Examination survey (2011-2014); eight of the eleven studies included in this review reported higher obesity rates among children with ASD. Of these eight, three were only marginally higher than the NHANES prevalence. The highest rate was 30% and the lowest was 10%.

Conclusion: There is a wide variation in prevalence estimates for obesity in children and adolescents with ASD, with most studies reporting prevalence rates equal to or greater than rates found in typically developing children. Several associated factors were identified but the strength of the evidence limits the value applicability of these findings. Many studies lacked a comparison group and more robust longitudinal studies are needed to ascertain strength of association and risk.

Keywords: Autism spectrum disorder; Obesity; Overweight; Children; Adolescents; Physical activity; Age

Introduction

Childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years [1]. The World Health Organization describes the trend as one of the most serious global public health challenges of the 21st century. In response to the crisis, the UK government in its 2008 White paper, Healthy Weight, Healthy Lives; a cross government strategy for England; aimed to reduce paediatric overweight and obesity to levels prevalent in 2000 by the year 2020. A year later, the department of health launched the Change4Life campaign to raise awareness about diet and physical activity, and encourage families to "eat well, move more and live longer". Observatories such as the National Obesity Observatory were established to track paediatric obesity trends and monitor the effectiveness of policy initiatives. Another reporting mechanism was the National Child Measurement Programme (NCMP) which publishes annual UK childhood obesity rates. Nonetheless, more action is required at a public health level to achieve these government targets, and these include policy measures for a sugar tax on the food industry to tackle the high caloric intake culture of our 'obesogenic' society. With more than half of obese school age children likely to become obese adults, the cost of obesity to the NHS is extremely high. The Foresight report published in 2007 estimated that direct health care costs attributable to being overweight or obese were £4.2 billion, potentially rising to £6.3 billion in 2015 and up to £9.7 billion by 2050. A more recent analysis estimated that being overweight or obese costs the NHS £5.1 billion per year [2].

Obese children are at greater risk of developing obesity related diseases such as insulin resistance, type 2 diabetes, cardiovascular and circulatory problems (heart disease and stroke), certain cancers, osteoarthritis and some mental health disorders [3]. The morbidity and disability burden is therefore high and obesity is a risk factor for early death. Childhood obesity rates in the UK have levelled off somewhat in recent years, having peaked in 2004 (ONS, 2013); however they are still much higher than they used to be. According to data from the Health Survey for England, in 2013, the obesity prevalence of children aged 2-15 was 15%. Rates in Wales were significantly higher at 19% (20% for boys). Most recent reports from the NCMP in 2014-15, put obesity prevalence at 19.1% in children aged 10-11 and 9.1% in 4-5 year olds. Rates in the United States are about 17% with higher rates among boys and older children in general (NHANES, 2014).

Unfortunately, we do not have the benefit of such precise obesity prevalence data for paediatric autism spectrum disorders (ASD). ASD is characterised by communication deficits, such as responding inappropriately in conversations, misreading nonverbal interactions, or difficulty building friendships appropriate to their age. In addition, these young people may be overly dependent on routines, highly sensitive to changes in their environment, or intensely focused on inappropriate

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items [4]. This neurodevelopmental disorder has a higher prevalence in boys [5]. In 2008, NHS England put the prevalence of ASD among 5-16 year olds at 1%.

Why should the prevalence of obesity in children and adolescents with ASD be any different from rates in their typically developing peers? Several hypotheses abound. It has been suggested for instance, that current guidelines for childhood obesity management and weight control may not apply to children with ASD [6]. These guidelines target three core behaviours that modify weight status i.e. calorie intake, physical activity and sedentary lifestyle. It has been postulated that the core deficits that define ASD limit at the very least how well these guidelines can deliver positive outcomes in children with ASD. Broadly put, these suggestions highlight two possible theories. The first is that physical limitations associated with overt disability as seen in ASD and significant learning disability; or more subtle difficulties with muscle tone and coordination problems; hinder participation and engagement in existing curriculum and community based exercise programs as designed for typically developing children. The other argument is that the core social interaction and communication deficits of ASD limit access to and participation in physical activity programs in and out of school.

In principle, this subject has a place on the national 'Parity of Esteem' agenda in that by meeting the physical health needs of children with ASD; we can guarantee better outcomes for them in the area of obesity related morbidity and mortality. This paper presents a general review of the literature on the prevalence of obesity and overweight in children and adolescents with ASD. It explores selected associated factors (with a focus on age and physical activity) in an attempt to provide answers to the question raised in the preceding paragraph. The link between antipsychotic treatment and weight gain in childhood ASD is well established and this review doesn't include an appraisal of the evidence supporting this link.

Method

Computer databases (PsychInfo, Embase, CINAHL and Medline) and Google Scholar for the period up to September 2015 were searched for articles using key words 'autism spectrum disorder', 'pervasive developmental disorder', 'autism', obesity', 'overweight', and' childhood'. Inclusion and exclusion criteria were applied to the abstracts of the papers generated from this search to obtain relevant papers included in the review. Other relevant papers were identified by searching the reference lists of these suitable papers.

Inclusion and exclusion criteria

Studies focused on obesity and overweight in childhood ASD or PDD including case reports were included (Figure 1). Studies reporting physical activity patterns levels in children and young people up to the age of 19 with ASD were included.

Studies reporting obesity prevalence rates in other neurodevelopmental disorders were included provided children or adolescents with ASD were also studied. Papers focused on food selectivity and sensitivity in children and young people with ASD were excluded. Also excluded were studies focused on genetic factors and chromosomal syndromes and those including young people with physical disabilities.

All papers were in the English language (one paper may have been translated by the authors from Chinese for inclusion in the English literature). 12 cross sectional studies were included in the review. Obesity was defined as BMI above the 95th percentile and overweight

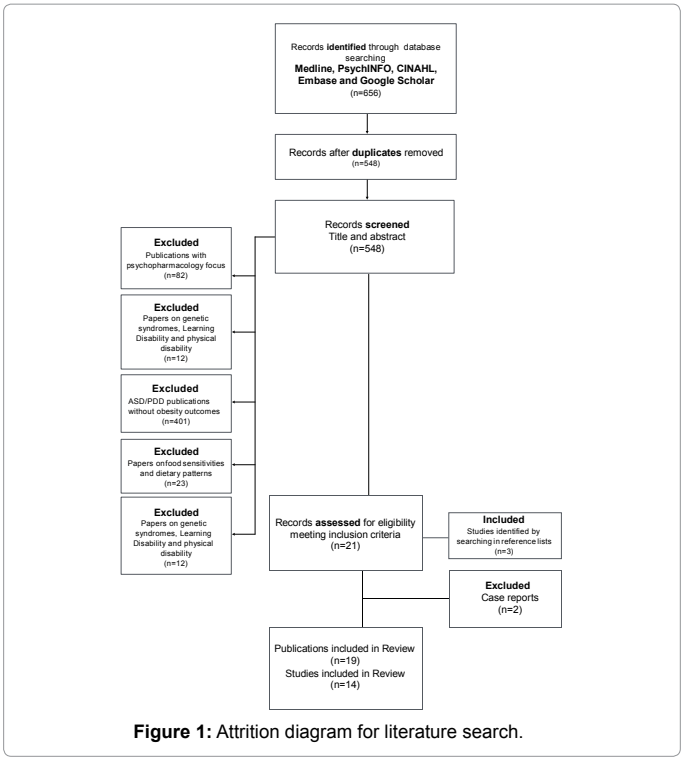

Figure 1: Attrition diagram for literature search.

was defined as MI between the 85th and 95th percentile using the Centre for Disease Control's BMI growth reference charts.

Results

Prevalence

In a retrospective chart review involving 42 children with a diagnosis of ASD from a tertiary clinic in Boston, Curtin et al. [7] reported a 19% and 35.7% prevalence of obesity and overweight respectively. Compared with data from the National Health and Nutrition Examination Study (NHANES, 1999-2002), the investigators concluded that obesity and overweight rates in the childhood ASD population was similar to rates in typically developing children and the problem was as 'significant in children with ASD as in the general population'. The sample was small and no sample size calculation was reported. Almost ninety percent of the charts reviewed were of children 11 years or younger with half of the entire sample 5 years or less. Furthermore there was no comparison group and the sample contained no children of African-American ethnicity. The data represented ASD children from a special population and the reported obesity rates are unlikely to be generalizable to the broader population of children with ASD, thus limiting the external validity of this study.

With data from a larger sample of 2976 children collected in the 2003-2004 National Survey of Children's Health in the United States, Curtin et al. [8], re-examined obesity prevalence in 454 ASD children and reported higher rates of 30.4% compared to 23.6% in the non-ASD group ($p = 0.075$). The data set was obtained by random digital dialling of households across all fifty states of the US and DC with a response rate of 55%. Information on height and weight was obtained by parental report and was thus subject to information bias. Case ascertainment was derived from a single screening question with no robust diagnostic evidence thus increasing the risk of misclassification bias. The investigators concluded that children with ASD were more likely to be obese than

children without ASD; the unadjusted odds of obesity in children with ASD was 1.42 (95% CI, 1.00, 2.02, p = 0.052) (Figure 2).

Zuckerman et al. [6] examined the prevalence and correlates of obesity and overweight in a clinical sample of 376 Oregon children with ASD and reported rates of 17% and 18.1% respectively. This study like the two mentioned above, involved secondary analysis of data not originally collected for this primary purpose; and in this case was derived from the Autism Treatment Network Registry. Weight and height data were obtained by trained clinical staff and ASD diagnosis informed by ADOS records. However, the sample was drawn from academic health centres with a mean age of 5.5 years, and problems with generalizability to the wider ASD population are likely. Missing data was also a weakness of the study. Using the same data registry, Vinck-Broody et al. [9] investigated obesity and overweight in a sample of 2769 children. The study included a comparison group of a matched sample of children from the NHANES, 2005-2010. The prevalence of obesity and overweight was 18.2% and 33.9% respectively and ASD was associated with a higher risk of obesity (but not overweight relative to the NHANES sample (odds ratio 1.16; 95% CI 1.05-1.28, p = 0.003). A similar prevalence for obesity (17.58%) but lower rate for overweight (15.38%) was reported by Egan et al. [10] in a study involving a retrospective chart review of 273 children with ASD referred for specialist treatment. The mean age of the sample was a mere 3.89 years. By contrast, Broder-Fingert et al. [11] in their work with American children with 'autism' and 'Asperger's syndrome' reported an obesity prevalence of 23.8%; a rate surpassed only by reports from Curtin et al. [8] and Memari et al. [12] They carried out secondary data analysis of just under 3000 children and included a control group (obesity rate 10.9%; overweight rate 6.3%) However, no mean age was reported and the diagnostic category 'pervasive developmental disorder not otherwise specified' was excluded from the sample, giving rise to misclassification bias. Overweight prevalence was reported as 13.6%. The weight status of 113 Iranian children with Autism Spectrum Disorder was investigated by Memari et al. [12] The study sample was drawn by stratified random sampling from relatively well functioning children aged 7-14 years enrolled in five autism specific schools in Tehran. All children had a diagnosis of ASD confirmed by a child psychiatrist using DSM IV TR criteria. No power calculation for sample size was performed and there was no control group. The prevalence of obesity was reported at 27.4% with 13.3% overweight. As this sample comprised children attending 'autism-specific' school in urban Iran, doubt is cast on the external validity of these results. Nonetheless, the study does raise important issues related to the difficulty of obtaining a representative sample in studies of this kind.

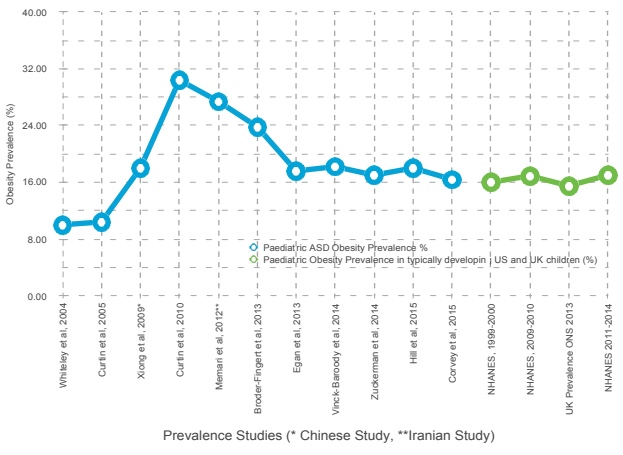

Figure 2: Paediatric obesity rates in autism spectrum disorder.

Xiong et al. [13] studied the physical status of 429 Chinese children (the vast majority male) with autism recruited from a school for autism that provided an Applied Behavioural Analysis course. The mean age was 5.1 years. The diagnosis of 'autistic disorder' was confirmed either by a paediatrician or psychiatrist based on the Chinese classification and diagnostic criteria of Mental Disorders. Children with Asperger's Syndrome and 'other autism disorders' were excluded from the study sample. Based on this sample, Xiong et al. [13] reported an obesity prevalence of 18.4% with 33.6% overweight. However, sampling factors and classification differences make it difficult to compare of the children had BMI values that exceeded the cut-off scores for obesity while 42% were overweight. There are several limitations to this study not least the small sample size and the absence of a power calculation. The authors present the highest overweight prevalence of the studies presented in this review in an age range between just over 2 years and 12.3 years. There were no significant differences between the PDD sub-groups.

Corvey et al. [14] in their work on 1385, 6-17 year olds with ASD, used data from the National Survey of Children's Health (2011-2012); and reported an obesity these rates with those obtained in other studies (Table 1).

The body mass index of fifty boys with pervasive developmental disorder in the UK was investigated by Whiteley et al. [15]. Formal diagnosis was defined as autism, Asperger's syndrome and ASD and the boys had a mean age of 6.6 years. It is unclear how the sample was recruited and no mention is made as to whether these were clinic or community samples. 10% prevalence rate of 16.4% with an overweight rate of about 10%. They concluded that having a diagnosis of ASD was associated with higher odds of obesity (OR 1.76, CI 1.27-2.43, p < 0.001). However, when 'secondary conditions' were controlled for i.e. The presence of learning disability and medication use, the association with obesity is lost. We note that 73% of their sample had a learning disability and 25% an intellectual disability both of which were not defined by the authors. These comorbidity rates may not be typical of the wider ASD population and it raises generalizability questions. Furthermore, the accuracy of data based on parental responses to single screening questions also places limits on the utility of these findings. Hill et al. [16], compared obesity and overweight rates in 5053 children with ASD and 8844 age matched children from the general population and concluded that obesity was higher in ASD children; however the difference was only statistically significant with non-white Hispanics aged 2-17 years and His panic children aged 2-11 year. The ASD sample was drawn from the Autism Talks Network registry and the comparison sample from NHANES surveys over six years to 2013. Overall they reported an obesity prevalence of 18% among children and adolescents with ASD and 31.8% overweight prevalence. Though constrained by the limitations of a secondary data analysis, the study was considerably robust on sample size and case ascertainment only including children diagnosed by professionals using the Autism Diagnostic Observation Schedule (ADOS).

Associated Factors

Age

In their study of 113 Iranian children, Memari et al. [12], compared obesity rates in four age groups with one year intervals across a 7-14 year range (mean age of 9.7 years). They found the highest prevalence

Authors	Country	Obesity Prevalence rate (%)	Overweight prevalence rate (%)	Sample size (N)	Sample Mean age in years (where mean age is not provided age range is given in italics)
Whiteley et al. [15]	UK	10	42	50	6.6
Curtin et al. [7]	USA	19	36	42	2-18
Xiong et al. [13]	China	18.4	34	429	5.5
Curtin et al. [8]	USA	30.4		483	3-17
Memari et al. [12]	Iran	27.4	13	113	7-14
Egan et al. [10]	USA	17.58	15	273	3.89
Vinck-Baroody et al. [9]	USA	18.2	34	2769	6.45
Zuckerman et al. [6]	USA	17	18	376	5.5
Broder-Fingert et al. [11]	USA	23.83	14	2976	2-20
Hill et al. [16]	USA	18	33.6	5053	2-17
Corvey et al. [20]	USA	16.4	9.9	1385	6-17

Table 1: Summary table of studies investigating obesity prevalence in paediatric ASD populations.

in the 13-14 year group ($p = 0.06$) with girls more likely to be obese than boys. Half the sample was within normal BMI limits, thus limiting the sample size of obese children. Furthermore, younger children were not included in the study, thus limiting comparison across the entire paediatric age range. Their conclusion that obesity is more prevalent in older children with ASD is consistent with reports by Broder-Fingert et al. [11].

Egan et al. [10] reported relatively high obesity prevalence rates (17.58%) in a study of US preschool children with ASD (range 2.5 to 5 years; mean age 3.89, SD = 0.91). They suggest these findings are consistent with prior research trends that demonstrate lower obesity rates in younger typically developing children. However, the findings do question whether age is indeed a risk factor for obesity in the paediatric ASD population. The reported obesity rates are higher than those seen in typically developing children of the same age; and suggest that weight management interventions may need to commence much earlier than previously realized. Unfortunately, no comparisons with older children were made. Zuckerman et al. [6] in their study of 376 young children with ASD (mean age of 5.5 years, SD 3.2) reported similar obesity rates but did not find any correlation between age and weight status. In China, Xiong et al. [13] also studied the weight status of younger children with a mean age of 5.1 years (SD=1.7; range 2-11) with 71% of the sample aged 5 or younger. Obesity rates were significantly higher in the 6-11 year group (21.8%) than in the 5 and under (17%). The data was not compared to rates in age-matched typically developing Chinese children. In a investigation of 50 UK children diagnosed with pervasive developmental disorders, and aged between 2.4 to 12.3 years, Whiteley et al, 2004 reported a relatively low obesity rate of 10%. The mean age of the sample was 6.6 years and there was no control group.

Vinck-Baroody et al. [9] studied the weight status of children with ASD in a large North American multisite clinic sample. The inclusion criteria included age 2-17 years, though more than half the sample was 5 years or younger and only 9% were adolescents age 12-17. The investigators admit that as a whole the data bank from which the sample was drawn is young. Rates of obesity were compared with typically developing children in the national population sample (NHANES) and the unadjusted OR in the 12-17 year group was 1.59 (95% CI,1.22-2.06; $p < 0.05$). The OR in the 2-5 and 6-11 year groups showed no significant association with obesity further suggesting that the risk of obesity in children with ASD may increase with age. A similar trend was reported in the Curtin et al. [7] study. Over 80% of the 42 children with ASD investigated were 11 years or younger with half the sample aged 2-5 years and only 12% aged 12-19 years. Obesity rates were highest in the 12-19 age groups (50%) and lowest in the 2-5 age groups (14.2%). The numbers in each age group however were quite small limiting the power of the study and the external validity of these findings. Broder-Fingert et al. [11] also demonstrated higher obesity rates among older age groups in their study of almost 3000 children with ASD. Compared to children aged 6-11years, the odds of obesity were higher in children aged 12 to 15 years (OR 1.87 CI: 1.33-2.63). The older children (age 16 and above) had even higher odds (OR 1.94 CI: 1.39-2.71).

Physical activity

It has been suggested that access to physical activity sessions as part of a healthy lifestyle or indeed a weight management intervention by children with ASD may be significantly restricted due to factors uniquely related to ASD [6]. These factors broadly fall into two categories i.e. those related to physical limitations such as impaired coordination and those related to impaired social communication which throws up barriers to participation in group exercises; during school recess and at other times. Atypical physical activity among children and adolescents with ASD has been suggested as an explanation for high obesity rates in this population. Pan and Frey [17] examined the physical activity patterns of youth with autism spectrum disorders using accelerometry and data obtained by questionnaire; and found that older children with ASD exercise less than their younger counterparts. Elementary school youth were more active than their middle and high school peers irrespective of day of the week or time of day. They also didn't find any consistent patterns in physical activity in youth with ASD. However, the quality of the data is limited by a small sample size (n=30), with no sample size power calculations; a predominantly male cohort, no comparison group of typically developing children and a selection of high functioning children. These all raise questions about the external validity of their results.

Sandt and Frey [18] went further by comparing physical activity levels between children with and without ASD. They found that there was no significant difference between the two groups and based on their data concluded that school activities and unstructured afterschool activities provide sufficient opportunities for children with ASD to be active. Their results are informative and attempt to answer the important question of access to physical activity programs by children with ASD. However, these findings are also unlikely to be authoritative or generalizable. A small convenience sample of volunteers was used (n=15) and all the children were younger than 12 years. More work in this area was done by Tyler et al. [19] who assessed physical fitness and physical activity in a group of young people with ASD and compared them to children without a diagnosis of ASD (typically developing peers). Although the sample sizes were small (n=17 in the ASD group, n=12 in the non-ASD group) and selection was not randomized; case ascertainment was relatively robust. The autism diagnostic observation

schedule (ADOS) was administered to confirm the diagnosis in each participant of the case group. The two groups were significantly dissimilar in age (the ASD group was made up of mostly 15 year olds and the control group were mostly 9 year olds). They concluded that children with ASD spent less time in light, moderate and moderate-vigorous physical activity and more time in sedentary behaviour compared to their typically developing peers. In spite of these slight differences the authors explain that aspects of physical fitness are attainable and comparable to peers without ASD.

These findings are broadly consistent with existing evidence in this field and further stress the point that children with ASD can successfully participate in existing physical activity programmes. In a bid to address the generalizability and small sample size limitations of previous studies, Corvey et al. [20] studied the links between an ASD diagnosis and four outcomes viz. obesity, overweight, physical activity and sedentary behaviours in a large sample (n=1385) of American children. The data was drawn from pre collected information in the CDC's National Survey of Children's Health 2011-2012 which relied solely on parental reports during a telephone survey. Parental responses were dichotomized based on answers to two screening questions related to physical activity and screen time which only explored activity in the preceding week. In addition if a child had undertaken MVPA (moderate to vigourous physical activity) for 20 minutes or more in six but not seven days in the last week, the response was dichotomized to zero. They found no significant association between ASD and a lack of physical activity (though children who also had a learning disability were found to have significantly lower odds of engaging in physical activity at recommended levels. They also didn't find any significant association between ASD and sedentary behaviour (2 or more hours of screen time/day); however, the presence of intellectual disability (which was ill defined by the authors) was associated with higher odds. There are limitations to the data as outlined in the prevalence paragraph above but it is also important to note that the sample in this study had a 73% comorbidity rate for learning disability and about a quarter has 'intellectual disability'. Nonetheless, these results reflect reports from previous studies. In contrast, Pan et al. [21], demonstrated that students with ASD were less physically active overall than their typically developing peers. They studied the daily physical activity and proportion of time spent in MVPA in small convenience sample of 30 Taiwanese students aged 12-17 years with a diagnosis of ASD using uniaxial accelerometry. The comparison group was age matched with no diagnosis of ASD and there was no significant difference in weight and BMI between the groups. They found a significant difference in the proportion of time spent in MVPSA activity and the percentage in each group that were compliant with physical activity guidelines. The small sample size and convenient sampling may make these findings difficult to replicate and indeed generalise.

Discussion

Compared to an obesity rate of 17% in typically developing children from the CDC's National Health and Nutrition Examination survey (2011-2014); six of the nine studies included in this review reported higher obesity rates among children with ASD. Of these six, three were only marginally higher than the NHANES prevalence. The highest rate of 30% was reported by Curtin et al. [8] Memari et al. [12] and Broder-Fingert et al. [11] reported rates of 27.4% and 23.8% respectively. There are problems with the data as outlined above and one must question the validity of these findings. Most of these prevalence studies didn't report sufficiently robust case ascertainment procedures and there are inconsistencies with what was included as ASD and what was not.

Establishing if obesity rates are inherently higher in ASD children is an essential first step in understanding whatever mechanisms underlies this phenomenon. Unfortunately, the current evidence still remains largely inconclusive. The studies reviewed in this article are both inconsistent in their findings and different in their methodology; making meaningful comparisons across studies difficult.

The diagnostic criteria varied across studies and given that the larger studies were based on secondary data analysis, utilizing data not originally collected for the purpose of answering the research question on obesity rates, problems with missing data and measurement bias were evident. On the other hand the two studies reporting rates lower than the NHANES rate, Curtin et al. [7] and Whiteley et al. [15] were based on very small samples with no sample size power calculations. The research base in this area is undoubtedly sparse and more robust studies are required, preferably of a prospective nature to clarify these findings. Previous reviews have at the very least suggested that the rates of obesity in children with ASD are at least as high as those found in their neurotypical peers. Based on the data presented here we must now consider that obesity rates in ASD children are indeed higher than in typically developing children; and these children are at greater risk of the mental and physical health consequences of obesity.

Possible explanations for these higher obesity rates in ASD include 'food faddiness' (being exceptionally fussy about food) and sensory difficulties related to diet; increased calorie intake, sedentary lifestyle (characterised by preoccupation with arm chair entertainment technology i.e. games consoles, long hours watching television) and lack of physical activity. It is essential to know if children with ASD can take up physical activity programs as prescribed for typically developing children and this has been the central theme of the very few studies devoted to physical activity levels and patterns in ASD children. This review included three studies. The physical activity recommendations for children are an hour a day of moderate to vigorous activity (MVPA) on all or most days and for adolescents, at least 20 minutes of MVPA three or more times a week. The data suggests that most children with ASD were capable of achieving these recommendations and no significant differences in activity levels and patterns were found in ASD children compared with children without ASD [18].

There are reports that access to existing physical activities in school or outside of school hours may be restricted for ASD children due to social communication difficulties. However, a descriptive report of a small group of children with ASD by Schultheis et al. [22] based on the TEACHH program demonstrates that with minor and inexpensive modifications, physical activity sessions can be successful in ASD children and based on the evidence should be incorporated into weight management programs targeted at ASD children. As would be expected in the general population, age and gender showed the strongest association with obesity in these review i.e. higher rates in girls and older children. This reflects a decrease in physical activity from childhood into adolescent is reported. The association between obesity and psychotropic medication i.e. atypical antipsychotics was either not explored in the review papers or the number of children on these medications was small. Memari et al. [12] for instance reported only a weak positive correlation between antipsychotic treatment and obesity; and that was only in boys (only 23 of 113 study participants were girls). Antipsychotic medication is widely used in the management of behavioural difficulties in children with ASD and the obvious question is 'are the apparent higher obesity prevalence rates in ASD children independent of the contribution from antipsychotic use?' Findings from this review suggest that antipsychotic medication further increases the risk of obesity in ASD children over and above an existing risk. Corvey

et al. [20] reported that the significant association found between ASD and obesity in their study disappeared when medication and 'possible' secondary conditions were accounted for. But several studies in this review reported higher obesity rates in ASD children were not on antipsychotic medication.

Conclusion

The available evidence on the prevalence of obesity in paediatric ASD is largely inconsistent; though recent studies appear to coalesce around a similar prevalence. However, patterns and trends emerging from the data, (more so recent studies) appear to support the assertion that the odds of obesity may be slightly higher in children with ASD compared to their typically developing peers. Single studies from non-Western populations such as Iran and China also seem to support this conclusion. Obesity prevalence is also directly related to age with higher odds in older children. ASD is a pleomorphic disorder with significant comorbidity, making research in this area difficult. Several factors are likely to contribute to the risk of weight gain in ASD children and more robust research is required to elucidate these. The review findings also have some clinical utility, the risk of obesity increases with the advent of adolescence and a corresponding decline in physical activities. This transition requires targeted weight management interventions in this population.

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