

## Prevalence of obesity in students with specific learning disorder in a metropolitan city of India

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Received - 29 August 2018

Initial Review - 16 September 2018

Accepted - 07 October 2018

### ABSTRACT

**Background:** Obesity is common in urban school children. Learning disability (LD) prevalence is also growing, primarily in cities. **Objective:** The objective of this study is to find the prevalence of obesity in students with specific LD (SLD). **Materials and Methods:** This observational cross-sectional study carried out at a tertiary care center attached to a medical college in Maharashtra, after obtaining permission from the institutional ethics committee. Consecutive 150 students with SLD between the ages of 8 and 18 years were studied over 18 months. Obesity was classified as per body mass index. Descriptive statistics and subgroup analysis were done by unpaired t-test. **Results:** Prevalence of obesity in students with SLD was 22.7% without gender predisposition and family history correlation. Of total students with SLD, 44 (29.3%) had attention-deficit hyperactivity disorder (ADHD) without any association with the obesity. **Conclusions:** Family history, ADHD, gender, other medical conditions, and drug history have no correlation with regard to obesity in SLD. There is a further requirement of research with large population control size.

**Key words:** Attention deficit hyperactivity disorder, Obesity, Specific learning disability

As per Diagnostic and Statistical Manual classification, specific learning disability (SLD) requires a multidisciplinary approach which comprises heterogeneous group of neurodevelopmental disorders manifested by considerable, definite, and persistent difficulties in speaking, reading (dyslexia), writing (dysgraphia), mathematical reasoning, or calculations (dyscalculia) and their sub-skills after exclusion of visual, hearing or motor handicaps, subnormal intelligence, emotional disturbances, or sociocultural disadvantages [1,2]. SLD affects 80% of all those identified as learning disabled, with a prevalence of 10% with equal predilection in male and female [3,4]. The prevalence of SLD in school children is found out to be 6.6% [5]. The incidence of dyslexia in primary school children of India has been reported to be 2–18%, dysgraphia 14%, and dyscalculia 5.5% [5,6]. About one-third of SLD also have attention-deficit hyperactivity disorder (ADHD) [7].

In many studies around the world, the prevalence of obesity was found to be higher among those with SLD than in the general population [2]. According to the World Health Organization, within the intellectual disability (ID) population, obesity and cholesterol levels are generally higher than in the general population [8]. Many factors, including genetic predisposition, culture, environment, metabolism, lifestyle preferences, and eating habits, are believed to play a role in the development of obesity [9]. Yamaki reported a prevalence of 34.60% of obesity in

SLD, from 1997 to 2000 in the United States (US), while Emerson in 2005 reported the same as 27% in 1304 residential service users of England from 1998 to 2001 [10,11]. The overweight prevalence in SLD changed dramatically between 1980 and 2006 for children 2–19 years of age, increasing from 5.5% to 16.3% [12]. Reinehr *et al.* reviewed 38 articles and found the prevalence of obesity in SLD, autism spectrum disorder (ASD), and ADHD as 19.3%, 23.4%, and 18.9%, respectively [13].

The dearth of knowledge among the educated populace of society such as school teachers and educators who play a foremost and primary role in the sensitization of such children leads to delayed help and poor outcome in terms of prognosis [14]. Special education such as learning stratagem instruction, using a sequential, synchronized structured multisensory approach, pervasive influence of cognitive strategy, and direct instruction models are essential for remediating the academic snags for children with SLD and should be started at an early age [15].

### MATERIALS AND METHODS

This observational cross-sectional study was carried out at a tertiary care center attached to a medical college at a metropolitan city in Maharashtra, after obtaining permission from the institutional ethics committee. The sample size was calculated with Medcalc software with type I error (alpha) of 0.05 and

type II error of 0.20 which came out to be a minimum of 47. A sample size of 150 was taken to increase the strength of the study. Consecutive 150 children being certified as SLD enrolled after assent from the enrolled children and written consent from their parents. All the sequential cases with SLD certified during the study period were enrolled; hence, no special sampling method was applicable. Exclusion criteria were visual handicap (>60%), hearing handicap (>60%), physical handicap, and borderline intellectual functioning/mental retardation documented by the specialists.

Students were diagnosed as SLD on the basis of DSM-V criteria by the team of experts. The standard psychoeducational battery, which included tests of academic excellence (Woodcock–Johnson test) and tests of intelligence (e.g., Wechsler Intelligence Scale for Children) performed to aid the diagnosis. The diagnosis of comorbid conditions (e.g., ADHD) was confirmed by the consultant pediatricians and psychiatrists on clinical grounds and with DSM-V criteria.

A detailed clinical examination of the cases carried out along with the physical parameters such as height, weight, occipitofrontal head circumference, and waist circumference. Students were classified into obese and non-obese based on markings of body mass index (BMI) percentiles for age- and gender-specific norms of the Indian Academic of Pediatrics Charts (adult equivalent 27 cutoff BMI lines) of children above 5 years [16,17]. Association between qualitative variables was assessed by Chi-square test with continuity correction. The study statistics were charted and analyzed for the prevalence and tests of significance using Microsoft Excel with Windows 2007.

## RESULTS

Of the 150 students studied, 34 (22.7%) were obese and 116 (77.3%) non-obese. Thus, the prevalence of obesity in students with SLD was 22.7%. The mean age of students presenting for evaluation and diagnosis of SLD along with obesity was  $13.35 \pm 1.71$  years and for SLD without obesity was  $12.72 \pm 1.99$  years. Of 150 students with SLD, 40 were female and 110 were male. Among the 34 students diagnosed to have SLD with obesity, 6 (17.6%) were females while 28 (82.4%) were males with male:female ratio of 2.8:1. Of 116 students diagnosed to have SLD without obesity, 34 (29.3%) were females and 82 (70.7%) males. The association was not significant, and hence, there was no sex predilection in both the groups (Table 1).

Only 12 (8%) of total SLD cases had medical illnesses, of which 2 (17%) were obese and 10 (83%) were non-obese. Among these 12 students, 5 had seizure disorder, of which only 1 was obese and others were non-obese. The rest included one case each of asthma, febrile convulsion, head injury, heart disease, lymph node tuberculosis, and migraine all of whom were non-obese and one case of typhoid was obese.

Among two students (1.3%) having a family history of obesity, 1 (50%) was obese and the other (50%) was non-obese. Among all the SLD cases, 50 (33.33%) were on some form of medication,

of which 21 were on oral atomoxetine (42%), but only 4 among them had obesity (19%) and almost equal number of children were on oral methylphenidate, wherein again 4 children were found to be obese. Six were on oral atomoxetine and risperidone both, but none was obese. Of the 3 cases who were on oral valproate, 1 was obese (33%). The other four students were on oral atomoxetine and phenytoin dual therapy, antituberculosis drugs, antiasthmatic drug, and sumatriptan, and none of whom were obese. Although we found a maximum number of students with SLD and obesity to be on oral atomoxetine and oral methylphenidate, there was no significant association.

Among all the study cases of SLD, 44 (29.3%) had ADHD with 8 children being obese (18%). Out of 106 SLD without ADHD, 26 (24.5%) were obese and 80 (75.4%) were non-obese (Table 1). The association is not significant and hence, ADHD were found to be equally occurring in both the groups.

## DISCUSSION

Since obesity *per se* shrinks the life expectancy by 5–20 years, it becomes essentially crucial to seek out in a child who is already suffering from an added medical illness [18]. The prevalence of obesity among students with SLD in this study was found to be 22.7%, which was quite similar to that found in a study by Chen *et al* (19.3%) [19]. The analysis of the National Health And Nutrition Examination Survey 1992–2002 carried out in the US showed that the prevalence of being overweight was significantly higher in children and young people aged 6–17 years with SLD compared to those without SLD (21.9% compared to 15.7%), and this was consistent with another study [20]. No Indian studies have been carried out in this respect so far. This study had limited objective of the prevalence of obesity, and the study population and subpopulation were inadequate for in-depth analysis of subgroups. However, it seems that children with SLD may be prone to obesity due to various factors including temper tantrums, concern of parents, lack of stimulation, indoor games and restricted physical activity, exposure to medications that are appetite altering, and deformed eating habits [21]. However, no such inference could be concluded from this study. Since discrepancies of about 10% are found in the prevalence of obesity if different reference percentile charts are used at same population, local BMI percentile charts (Indian academy of pediatrics) were used in the current study [22].

This study showed that the presence or absence of obesity in students with SLD did not affect the age of presentation for the evaluation and diagnosis of SLD. Mean age of presentation of the students for the evaluation of SLD with and without obesity was  $13.35 \pm 1.71$  years and  $12.72 \pm 1.99$  years, respectively. Of the 40 girls who had SLD, 6 were found to be obese (15%) versus 28 of 110 boys having SLD (25.45%). Thus, more number of boys with SLD were found to be obese as compared to girls, without any statistical significance which might be explained by the fact that latest studies had no gender predisposition in relation to the occurrence of SLD.

Studies of comorbid medical illnesses in SLD children and adolescents with obesity are lacking. However, in general,

**Table 1: Factors related to obesity with statistical co-relation**

Factors	Present/absent	Total number (n=150)%	Obese%	Non-Obese%	p-value
Females	+	40 (26.6)	6 (15.0)	34 (85.0)	0.176
Males	+	110 (73.3)	28 (25.4)	82 (74.5)	
Family history	+	02 (1.3)	01 (50.0)	01 (50.0)	0.353
	-	148 (98.6)	33 (22.2)	115 (77.7)	
ADHD	+	44 (29.3)	08 (18.1)	36 (81.1)	0.398
	-	106 (70.6)	26 (24.5)	80 (75.4)	
Drug history	+	50 (33.3)	09 (18.0)	41 (82.0)	0.888
	-	100 (66.7)	25 (25.0)	75 (75.0)	
Medical history	+	12 (8.0)	02 (16.6)	10 (83.3)	0.735
	-	138 (92.0)	32 (23.1)	106 (76.8)	

(+) Present; (-) absent; statistically insignificant distribution. ADHD: Attention-deficit hyperactivity disorder

Khaodhiar *et al.* had found that obese patients are at an increased risk for developing many medical problems including insulin resistance and type 2 diabetes mellitus, hypertension, dyslipidemia, cardiovascular disease, stroke, sleep apnea, gallbladder disease, hyperuricemia, gout, asthma, and osteoarthritis [23]. In the current study, only two cases were obese who had SLD and medical illness. Medical illnesses found in the current study were seizure disorder, asthma, febrile convulsion, head injury, heart disease, lymph node tuberculosis, and migraine.

Studies of the family history of obesity in SLD children and adolescents are lacking, and hence, association has not yet been established. Stewart *et al.* studied 150 children from birth to 9.5 years of age and found that, of the total, 38 (25.3%) were above the 85<sup>th</sup> percentile of BMI at 9.5 years of age, including 14 (9.0%) above the 95<sup>th</sup> percentile, with strongest relation to parental BMI [24,25]. In the current study, two students had a family history of obesity, of which 1 (50%) was obese; however, the presence of obesity in this student with SLD is attributable more to the strong family history of obesity than to the strong association with SLD *per se*. However, no such conclusion can be made from a single case. Other researchers also found a link between frequent temper tantrums and childhood obesity with the fact that persistent tantrums over food from ages 2 to 5 years results in children being three times more overweight than those without a history of tantrums. This may be indirectly related to the kids with SLD where bribe was given by parents to the kids to keep them calm [24]. In this study, students with SLD were found to be on medication for various reasons almost equally in obese and non-obese group. History of drug intake for medical illnesses was obtained in 50 of 150 SLD students (33.33%). Of those 50, nine were obese (6%) and were on some form of psychotropic drugs.

Seizure disorder was found to be the most common medical illness in students with SLD. De Gaspari found that weight gain associated with antiepileptic drugs is frequent, chiefly with drugs such as valproate, carbamazepine, gabapentin, and tricyclic antidepressants [26,27]. Megan Brooks found that ADHD children treated with stimulants demonstrated slower BMI growth early in childhood, but they rebounded later in adolescence with higher BMI that was higher than in children without a history of ADHD

or stimulant use [28]. Diagnoses of ADHD have been found to be more prevalent in obese children than in their normal weight peers [29].

In the current study, ADHD was diagnosed in 44 students (29.3%), of which 8 (18.18%) were obese and 36 (81.81%) were non-obese, which is supported by similar results of many studies [19,30-32]. Cortese *et al.* found the increased joint prevalence of obesity by 40% in children with ADHD (10.3%, 95% CI=7.9–13.3) compared with those without ADHD (7.4%, 95% CI=5.4–10.1) probably due to not considering SLD as a compounding factor [33]. In a meta-analysis, a significant association between ADHD and obesity was found in 41 studies over 4 years, from 2012 to 2016, regardless of possible confounding factors such as psychiatric comorbidities, medications, and population character [34]. The obesity in SLD with ADHD is not ascribed to ADHD *per se* and seems to be more related to sedentary lifestyle, lack of stimulation, and poor dietary habits. Inattention, reward sensitivity, and impulsivity determine the extent of problems associated with obesity and/or interfere with the ability to lose weight [35]. We need to have stern concern related to derived comorbidities allied to SLD to have a good quality of life.

None of the SLDs with obesity had evidence of hypothyroidism/ thyroid function disorder. Thus, investigation for hypothyroidism in every child and adolescent of SLD with obesity should be avoided, especially in resource-limited settings. There was no significant statistical correlation found in relation to family history of obesity in ASD. It may be important to plan a large-scale study to understand the prevalence of obesity in children with SLD which is limitation of the current study also.

## CONCLUSION

Percentage of obesity as a comorbidity in students with SLD was 22.7%. The presence or absence of obesity in students with SLD did not affect the age of presentation and gender predisposition for evaluation and diagnosis of SLD. Seizure disorder was found as a common medical illness in SLD students. Prevalence of ADHD was 29.3% in SLD students, and the obesity was found equally prevalent in SLD students with or without ADHD.

## ACKNOWLEDGMENT

The authors would like to thank Dean TNMC Mumbai, for permission to study and publish.

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*Funding: None; Conflict of Interest: None Stated.*

**How to cite this article:** Kondekar S, Anand V, Mundada P, Rathi SP, Shah H. Prevalence of obesity in students with specific learning disorder in a metropolitan city of India. *Indian J Child Health*. 2018; 5(10):622-625.

Doi: 10.32677/IJCH.2018.v05.i10.005