Proportion of Overweight among Children with Attention Deficit Hyperactivity Disorder

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ABSTRACT

BACKGROUND

Childhood obesity is now a public health problem worldwide. The need for exploring more neurobiological aspects in eating behaviours and therefore over nourishment early in life becomes imperative. One behavioural disorder of childhood which has an increasing prevalence rate in children is attention deficit hyperactivity disorder (ADHD). With a common neurobiological correlate in both these conditions, it may be assumed that both diseases may have preponderance for mutual inclusivity. We wanted to estimate the proportion of overweight among children diagnosed with ADHD, who attended the Child Psychiatry OPD, Government Medical College Hospital, Thiruvananthapuram, Kerala, for one year.

METHODS

This cross-sectional study was conducted on 110 children who were newly diagnosed with ADHD. Body mass index was assessed in these children and the proportion of subjects who were overweight was obtained.

RESULTS

The mean age of the study participants was 10.3 + 2.98 years. 90 % of the study subjects were males and 10 % were females. 46 children were over 85th percentile-21 (19.1 %) were obese (>97th percentile) and 25 (22.7%) were overweight. 64 children were under the 85th percentile, 55 (50 %) were of normal weight and 9 (8.2 %) were underweight.

CONCLUSIONS

The proportion of overweight children in a sample of ADHD children was more than the national average of overweight among child and adolescent population. - This shows that children with ADHD symptoms have increased predictability to be overweight.

KEY WORDS

ADHD, Obesity, Overweight, Childhood, BMI

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BACKGROUND

Attention deficit hyperactivity disorder (ADHD) is now a common childhood behavioural disorder.[1] It is characterized by pervasive and impairing symptoms of inattention, hyperactivity, and impulsivity according to DSM-V.[2] As attention, cognition and motor functions are controlled by different areas of the central nervous system (CNS), it could imply that selective areas of the CNS may be involved depending on the predominant clinical expression. ADHD is increasingly being recognized as a disorder affecting executive functions, which are a wide range of central cognitive functions that play a critical role in the management of multiple tasks of daily life. The multiple short terms and long-term sequelae make it a major public health problem. The symptoms of ADHD are multidimensional, suggesting the interaction of neuroanatomical and neurochemical systems. It is now considered that this condition involves functional and anatomical dysfunction in the frontal cortex and basal ganglia segments of the cortico-basal ganglia-thalamocortical circuit.[3,4] This network involves the lateral prefrontal cortex, the dorsal anterior cingulate cortex, and the caudate nucleus and putamen.[5] These areas support the regulation of attentional resources, the programming of complex motor behaviours, and the learning of responses to reinforcement.

ADHD is now becoming increasingly diagnosed and studied worldwide. The incidence of ADHD along with other psychiatric disorders is high and so it is being extensively explored. A comparatively lesser number of researches are done to find the association of ADHD with general medical conditions. One notable observation in recent years is that ADHD prevalence has risen in parallel with the rising prevalence of childhood obesity. There is increasing evidence pointing to a significant association between overweight/obesity and ADHD in children as well as in adults. It has also been reported that children with ADHD have an elevated risk for obesity later in life.

India has been conventionally considered to be plagued with childhood malnutrition. But several recent studies have come up showing an increased prevalence of obesity in both rural and urban children.[6] This coexistence of both undernutrition and overnutrition in the public health realm is alarming.[7] This becomes significant especially as the prevalence of hypertension, type 2 diabetes and other obesity-related diseases are rampant in our adult population.

Thus, reducing the incidence of obesity might be a major public health issue in future. Moreover, the highly increased rates of obesity-related conditions in young adult populations should motivate us to search vigorously for finding the cause of obesity earlier in childhood and intervene at the onset itself to prevent the complications. It is thus imperative to study more about the factors leading to obesity.

Research exploring the relation between ADHD and obesity is still in its infancy. A common genetic, structural, and neurophysiological factor may play a role in both these conditions. It becomes important to understand the sociodemographic, neuropsychological, and environmental determinants of the relation between obesity and ADHD, in exploring the link between these two diseases.

Various studies in different populations worldwide have reported an increased prevalence of overweight /obesity in children with ADHD.[8] There are not sufficient data regarding the prevalence of overweight among children with ADHD from India. Hence, in this study, an attempt was made to assess the weight status of children with ADHD.

METHODS

This cross-sectional study was conducted on 110 children who were newly diagnosed with ADHD, and attended the Child Psychiatry OPD, Government Medical College Hospital, Thiruvananthapuram, Kerala. The study was conducted after obtaining the institutional ethics committee approval (IEC No: 08/8/2012 MCT). Prior informed consent was obtained from the parents of all the subjects before collecting the data. The details were recorded in the proforma after obtaining the consent.

The sample size was fixed on the primary objective. The study conducted by Curtin C et al.[9] was used to calculate the sample size.

Screening for ADHD: The diagnosis of ADHD was done based on the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V).

Assessment of Bodyweight: Overweight is defined as a BMI > 85th percentile of weight for age and gender according to the criterion by the World Health Organization (WHO) growth reference chart of BMI.[10] The WHO defines ''normal weight'' as that ranging between 3rd and 84th percentile, ''overweight'' as ranging between 85th and 96th percentile, and ''obesity'' as equal to or greater than 97th percentile.

Inclusion Criteria

Children included in this study met the following criteria:

1. Newly diagnosed ADHD according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) falling under any of the subtypes: ADHD inattentive type, ADHD hyperactive-impulsive type, and ADHD combined type;
2. Aged between 5 and 17 years;
3. IQ above 80 based on the WISC-R;

Exclusion Criteria

Subjects were excluded if they had:

1. Any other mental illness or neurodevelopmental disorders.
2. Any physical disabilities (hearing, visual or locomotor impairment).
3. On treatment for ADHD (on drugs like methylphenidate, clonidine, or atomoxetine).
4. Any other longstanding physical illnesses.

Statistical Methods

Statistical analyses were performed with SPSS 15.0 version for Windows. Subjects were stratified into two groups according to the weight/BMI classification as per WHO criterion. First, demographic and baseline characteristics of children with ADHD were compared between these groups. The proportion of overweight was estimated.

RESULTS

Age(Years)	Number of Children	Percentage
5 -9	40	36.4%
9-13	52	47.3%
13-17	18	16.3%
Total	**110**	**100**

Table 1. Distribution of Study Subjects Based on Age

The mean age of the study participants was 10.3 ± 2.98 years.

Gender	Number	Percentage
Boys	99	90.0
Girls	11	10.0
Total	**110**	**100.0**

Table 2. Distribution of Study Subjects Based on Gender

Of the 110 study participants, 99 (90 %) were boys and 11 (10 %) were girls.

BMI	Frequency	Percent
<85th percentile(normal and underweight)	64	58.2
>85th percentile(overweight and obese)	46	41.8
Total	**110**	**100.0**

Table 3. The Proportion of Overweight among ADHD Children

Of the 46 participants who were over 85th percentile, 21 (19.1 %) were obese (> 97th percentile) and 25 (22.7 %) were overweight. Of the 64 who were under the 85th percentile, 55 (50 %) were of normal weight and 9 (8.2 %) were underweight.

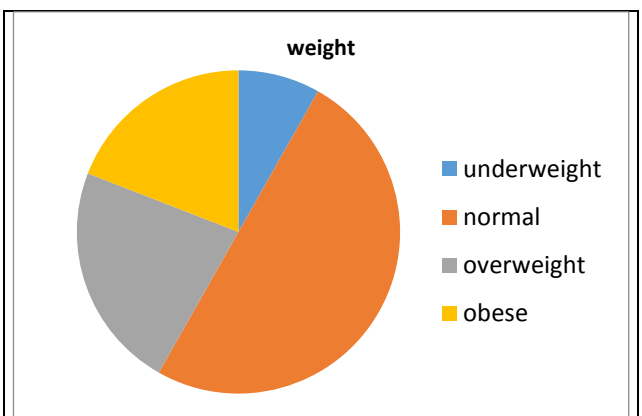

Figure 1. Association between Age and BMI

Bivariate analysis between two age categories (less than 12 years and more than 12 years) did not show any significant association between age and body mass index.

		Overweight		Total
		Over Wt.	Others	
Age	>=12	28	35	63
	<12	17	30	47
Total		**45**	**65**	**110**
Chi-Square-0.762a, df-1, P Value -0.383				

Association between gender and body mass index.

The bivariate analysis did not show any significant relationship between gender and body mass index (BMI)

		Overweight		Total
		Over Wt.	Others	
Gender	Girls	6	5	11
	Boys	39	60	99
Total		**45**	**65**	**110**
Chi-Square-0.94, df-1, P-Value -0.332				

DISCUSSION

The proportion of study subjects with BMI more than 85th percentile for age and gender was 41.8 %. Of these, 20 % were obese (97th percentile) and 21.8 % were overweight (between 85th and 97th percentile). The mean BMI obtained in the study was 18.7 + 4.2.

Thus, the present data reveals that the proportion of overweight was more in children with ADHD when compared to the general population. It has been reported that children with ADHD have an elevated risk for obesity in both epidemiological[11] and clinical samples.[12,13,14] The findings of this study is in line with previous reports by others[15,16,17] and point towards the probability of overweight/obesity being yet another comorbid condition among children with ADHD.

Many theoretical models have been proposed regarding the factors linking ADHD and body weight regulation. It can be thought that ADHD and obesity/overweight need not rather be considered as a mutually exclusive phenomenon but a continuum (spectra) in which one progresses to the next.

Neural regulation of human cellular metabolism is maintained by many nuclei each of which has a critical role in the energy balance.[18-24] Hypothalamus was considered to play a prominent role in regulating energy balance, earlier. The role of other important brain structures was deciphered only recently. The factors other than the metabolic needs, involved in eating behaviours were described more recently. These factors influencing and motivating the food intake include the rewarding features of the food, emotion, and cognition. They modulate the non-homeostatic/ hedonic control of food intake. The hedonic control centres are mainly the hippocampus, amygdala, ventral tegmental area (VTA), nucleus accumbens and prefrontal cortex. These areas control the reward pathways which make highly palatable foods attractive even in a well-fed state similar to the effects seen in drug abuse.[25].

Although both these pathways work together to control food intake, the hedonic circuit may prevail over homeostatic pathways in the satiated state by increasing the desire to ingest highly palatable foods.[26] Substances that stimulate dopamine release from neurons in the VTA that project to the nucleus accumbens (ventral striatum) are highly addictive including high calorie food.[27-29] This increased release of dopamine results in the rewarding response to highly palatable foods (those typically high in fat and sugar). Interestingly obese individuals appear to show a greater response to food cues in these areas compared to their lean counterparts[30,31] in PET scans and fMRI studies. These findings have shown that obese individuals anticipate greater dopaminergic reward pathway activation from eating and appetitive food cues, and may stimulate greater appetitive drive in heavier individuals, making them eat more. Thus consumption of high calorie food in the absence of hunger is probably a result of multiple neural signals comprising of pleasurable feelings of reward, learning and impaired satiety, together culminating in excess energy intake eventually leading to increased storage in the form of fat.

The role played by genetics cannot be ignored. Obesity is commonly seen in families, and inheritance is usually not Mendelian. Many genes are implied to cause an obese

phenotype. Mutations in MC4R are particularly of interest as the same mutation is said to cause ADHD too.

Although behavioural disorders predispose to obesity, they may in turn arise from obesity as well.[32] The directionality of this comorbidity has not yet been understood well. Probably, obesity and ADHD might be different expressions of common underlying pathology. This postulation has been explained by several hypotheses.[33,34]

One recurrent observation is the genetic dysfunction (DRD4, DAT)[35] of the dopaminergic system, commonly seen in obesity, abnormal eating behaviours, and ADHD.[36] The deficiency of dopamine receptors and faulty transport of dopamine back into the cytosol leads to an imbalance in the dopaminergic reward system. This results in reduced attention to performing tasks.[37] Thus ADHD symptoms arise, especially due to reduced dopamine (DA) in the mesolimbic system. Consequently, they will be unable to delay gratification,[38] become less sensitive to reinforcement schedules[39,40] and prefer immediate rewards. This may contribute to abnormal impulsive eating habits[41] and promote the tendency to binge on easily accessible unhealthy food of high calories which will also lead to overweight/ obesity.

CONCLUSIONS

The proportion of overweight children in a sample of ADHD children was more than the national average of overweight among child and adolescent population. - This shows that children with ADHD symptoms have increased predictability to be overweight.

In light of the personal and social burden that comorbid ADHD adds to obesity and considering that the treatment of ADHD might improve the management of obesity itself, the need for further studies on this comorbidity is necessary. Longitudinal evidence suggests that childhood ADHD persists into adulthood in 60–70 % of cases and thus can be perceived as a lifespan disorder with childhood-onset.[42,43] If so, its potential role as a risk factor for other childhood and adult organic diseases cannot be ignored.

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