

## Cognitive and Psycho-Social Effects of Childhood Obesity

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### ABSTRACT

Childhood obesity has been declared as a global epidemic. Several studies have reported inverse associations of childhood obesity with cognitive and psycho-social functioning of obese children. The present study is an attempt to understand the cognitive and psycho-social aspects of childhood obesity in Indian context. The objective of the study was to compare the cognitive functions (memory, attention, and visual retention) and psychosocial functioning (body shape concerns and insecurity) of obese children with normal weight controls. The cross sectional research was carried out. Purposive sampling was used to collect the sample of 30 obese children and 30 normal weight children (controls) from schools in Delhi. The inclusion criteria for cases and controls were obese and normal weight children as per ICMR criteria, within the age range of 10-14 years. Children with previous history of head injury or other physical, medical or neurological problems, chronic medical illness and other metabolic disorders (diabetes and thyroid), were excluded from the study. All the children were assessed on cognitive functions (Digit symbol test and immediate memory test) and psycho-social functioning (Body Shape Questionnaire, Mohsen's security insecurity questionnaire). The performance of obese children was found to be poor compared to normal weight children by using t-test. Obese children performed significantly poor on attention and visual retention and immediate memory for direct reciprocation. However, there was no significant difference on reverse immediate memory test. Obese children were also found to be more insecure compared to the normal weight controls about their body image. Obese children expressed high body shape concerns compared to normal weight counterparts. Findings suggest independent associations of specific cognitive and psycho-social aspects with childhood obesity that can be targeted for prevention and management of this global epidemic.

**Keywords:** *Cognition, Psycho-Social, Childhood Obesity, Memory, Visual Retention, Security-Insecurity, Body Shape Concern.*

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## Cognitive and Psycho-Social Effects of Childhood Obesity

Obesity is defined as a condition of abnormal or excessive fat accumulation in adipose tissue that may impair health (Garrow, 1988). The prevalence of childhood Obesity has been rising continuously over the past two decades and it has become a major health problem both in developed and developing countries including India (Ebbeling, Pawlak, and Ludwig, 2002). Traditional Indian culture upholds certain myths and misconceptions about childhood obesity such as a fat child is a healthy child, plumpness passes away with growth spurt over the years, fatness in an offspring is indicative of the prosperity of his or her family, and childhood is the age to eat and relax. But unlike the past, today obesity is recognized as a major health risk condition.

Obesity not only leads to physical health problem (type 2 diabetes, asthma, obstructive sleep apnoea, cardiovascular problems, musculoskeletal problems, stroke and some form of cancer, etc.) but to many other issues such as impairment in cognitive functioning (memory, attention, visuo-spatial ability, response inhibition, executive function, verbal fluency, intelligence etc.) and psychosocial problems (depression, anxiety, low self-esteem, confidence, insecurity, stress, body shape concern, negative body image, psychopathology, eating behaviour etc.).

Cognitive functions are cognitive processes/functions closely associated with function of one or more specific areas of the brain. It covers a range of cognitive functions or domains such as intelligence, perception, attention, memory and executive function. Standardized neuropsychological tests are used to assess different cognitive functions. Several studies have attempted to examine the neuro-cognitive aspects of childhood obesity and reported an association between childhood obesity and poor cognitive functions. The association of higher body mass index (BMI) and reduced performance on various cognitive tests has been relatively well established in adults (Elias, Elias, Sullivan, Wolf, & D'Agostino, 2003; Fagundo et al., 2012). Recent work suggests that the relationship of obesity and cognitive functioning may not be limited to grown-ups only. It can also be observed in children and adolescents. Some of the studies reported a negative association of cognitive functions and childhood obesity specifically in the realm of intelligence (Miller et al., 2006; Yu, Han, Cao, Guo, 2010), executive functions (Lokken, Boeka, Austin, Gunstad, & Harmon, 2009; Schwartz et al., 2013; Verdejo-Garcia et al., 2010) and memory (Abdel-Nabi, Kalifa, Ahmed, Eskander, & Sayed, 2010; Li, Dai, Jackson, & Zhang, 2008).

Overall literature supports the negative association of obesity and neuro-cognitive functioning. However, there is a gap with regards to the association of obesity and specific cognitive functions such as general intellectual functioning, learning, memory, language and visuo-spatial skills (Liang, Matheson, Kaye, & Boutelle, 2013).

Psycho-social aspect of obesity is related to the interrelation of social factors and individual thought and behavior such as, self-esteem, stress, body shape concerns and eating behavior,

## Cognitive and Psycho-Social Effects of Childhood Obesity

insecurity, psychopathology, impulsivity. Research on the psychosocial aspects of obesity has grown extensively over the years, from purely theoretical articles to cross-sectional comparative studies of people with and without obesity to longitudinal investigations of the temporal sequencing of obesity and psychopathology (Fabricatore & Wadden, 2004). As we all know that the changing lifestyle of children in the so call modernized India has led to increased hours of inactivity often attributed to mounting academic pressure and competitive stress. Stress has been seen as an important psychosocial contributor to obesity and stressed children are more prone to indulge in emotional overeating (Puhl & Latner, 2007; Vaidya, 2006). Obesity also has significant negative impact on the emotional development of a child. Obese children present with more psychosocial problems, and if not attended, they may worsen and affect the child's attempts to lose weight. Despite their best attempts when children are not able to lose weight they experience stress, disappointment and other negative emotions, which further lead to emotional overeating and physical inactivity and even more increase in weight, thus perpetuating the vicious cycle. To break this vicious cycle, it becomes imperative for health professionals to integrate psychosocial assessment of obese children into their clinical evaluations, which is also suggested by a recent review (Latzer & Stein, 2013).

Considering the due importance of all the above factors and suggestions obtained from previous studies, the aim of this research was to assess the cognitive (attention, memory, visual retention) and psycho-social (body shape concern and insecurity) aspect of childhood obesity. Although, ample of evidence is available on neuro-cognitive and psychosocial aspects of childhood obesity, the need for continued research into these aspects of childhood obesity is important, especially considering paucity of sustained research on this topic in India. This study would add to our knowledge about psychosocial and cognitive aspects associated with obesity as a first step. Furthermore, the knowledge and better understanding of these factors enables us to tailor prevention and intervention strategies as per the need of the target group.

### REVIEW OF LITERATURE

Maayan et al., (2011) examined the relationship between obesity, executive functions and disinhibition. A total of 91 adolescents (obese=54, lean=37) were assessed for various frontal lobe functions and neuro-structural deficits using Controlled Oral Word Association Test (COWAT), Trail Making Test part A & B, Stroop Test, Wide Range Assessment Of Learning and Memory (attention concentration index and working memory index) and Magnetic Resonance Imaging (MRI). Obese children performed significantly poor on all the tasks measuring executive functioning mean. The performance of obese adolescents was found to be significantly poor on the tasks of inhibition ( $P < 0.001$ ), attention ( $P < 0.001$ ), cognitive flexibility ( $P = 0.008$ ), verbal fluency ( $p = 0.032$ ), working memory ( $p < 0.001$ ) and attention/concentration ( $p = 0.012$ ) compared to the lean adolescents. Obese group showed significant decrease in grey matter volume of orbitofrontal cortex, a brain region responsible for behavioural inhibition and impulse control. Li et al., (2005, 2008) found significantly poor performance of overweight

## **Cognitive and Psycho-Social Effects of Childhood Obesity**

children on Digit Span Test of working memory and attention. Li, Dai, Jackson, & Zhang (2008) reported independent associations between increased BMI and cognitive functioning (visuospatial organization and general mental ability) after adjusting for a number of other factors such as hours of TV watching, physical activity involvement, psycho-social development, blood pressure, parental/familial characteristic and serum lipid profile. However, the associations between increased BMI and academic performance were not significant after adjusting for parental/familial characteristics.

Early Onset Morbid Obesity obtained significantly lower scores on different cognitive functions and had more behavioural problems than control subjects. Brain MRI revealed white matter lesions in 5 participants with Early Onset Morbid Obesity and 6 subjects with Prader-Willi Syndrome the study reported association of Early Onset Morbid Obesity with lower intellectual ability in children. The performance of obese adolescents was poor compared to the controls on inhibition, mental flexibility and decision making however no significant difference was observed in the EF domain of working memory, planning and reasoning (Miller et al., 2006).

Erermis et al., (2004) compared the psychopathology types and frequency among clinical obese (n=30). All the participants were assessed on Child Behavior Checklist, Children Depression Inventory, Rosenberg Self-esteem Scale, Eating Attitude test and non-structured psychiatric interview. The ratio of psychopathology (depression), behavioural problems and low self-esteem was higher among clinical obese adolescents compared to non-clinical obese group. In another study Tanofsky-Kraff et al., (2004) examined psychopathology in non-treatment seeking overweight and normal weight aged 6-13 years. Results revealed no significant group differences on self-reported depression and anxiety as assessed on Children's Depression Inventory and State-Trait Anxiety Inventory for Children (STAIC). However, parent reported internalizing and externalizing scores were higher among overweight children compared to normal weight controls.

### ***Obesity and Psychological Issues***

Several studies found association of childhood obesity with number of psycho-social aspects such as reduced academic and social performance, poor quality of life, social discrimination, teasing, lower self and body esteem with neuro psychological dysfunctions (Latzer and Stein, 2013). There is lack of significant evidence for the direct causal link from obesity to depression. It was concluded that obesity might not directly cause depression in adolescents but other indirect pathways and experiences such as stressful life events, peer victimization and weight based teasing may lead to depression in obese adolescents Nemiary, Shim, Mattox & Holden (2012).

Mond et al. (2011) assessed 806 adolescents (female=366 and male=440) using self-reported measures of body dissatisfaction, emotional well-being (self-esteem and depressive mood),

## Cognitive and Psycho-Social Effects of Childhood Obesity

height, weight and socio demographic information at early adolescence (mean age=12.8 years) and late adolescence (17.3 years). It was found that after controlling the body dissatisfaction, the associations between obesity and low self-esteem was not significant at both of the stages and in both genders. Pine, Goldstein, Wolk, & Weissman, (2011) in a study showed positive association of childhood depression and adult BMI longitudinally after controlling for number of other factors such as (age, sex, social class, pregnancy or medication history and use of cigarette or alcohol). Authors concluded that overall duration of depression in childhood emerged as a strong predictor of elevated adulthood BMI.

Van den Berg et al. (2011) revealed significant association of overeating, impulsivity and reward responsiveness with childhood BMI. Further analysis confirms the hypothesis that the personality characteristics of impulsivity and reward responsiveness were indirectly associated with BMI through overeating. Author concluded that these personality characteristics are risk factors for obesity in children. Puder and Munsch (2010) studied psychological correlates of childhood obesity and reported higher prevalence of behavioural and emotional problems in clinical, treatment seeking samples of obese children. They found specific externalizing (impulsivity and attention-deficit hyperactivity disorder), internalizing (depression and anxiety), and uncontrolled eating behaviour as the most often reported psychosocial factors in obese children. The relationship between obesity and psychological problems can be understood as a bi-directional process wherein significant psychological distress may foster weight gain and on the other hand obesity may lead to psychosocial problems. Braet, Mervielde, and Vandereycken (1997) suggested that clinical sample of obese children have higher risk of developing psychopathology compared to the non-clinical obese children.

### ***Obesity and Body shape concern***

Obese children express higher body dissatisfaction and lower self-esteem than their normal weight and overweight controls. Higher level of body dissatisfaction also mediates the association between obesity and self-esteem. Therefore, body dissatisfaction is strongly associated with childhood obesity and acts as a predictor of low self-esteem and higher level of depressive symptoms in obese children (Shin and Shin, 2008).

In a study, Allen et al. (2006) did a cross-sectional study and reported that overweight children were more concerned about weight and shape than healthy weight controls. Further analysis revealed, children with high concern for weight and shape also reported to have lower self-esteem, depression and higher level of body dissatisfaction than children with low concern for weight and shape. Wardle and Cooke (2005) also reported the association of obesity and body dissatisfaction is well supported in children and adolescents. Overweight status, female gender and binge eating as a risk factor for body image disturbances and psychological distress in obese individuals (Schwartz and Brownell, 2004; Young-Hyman, et al. 2003).

## Cognitive and Psycho-Social Effects of Childhood Obesity

Vander Waland Thelen (2000) compared eating behaviour and body image concerns of obese and normal weight children. Results revealed that obese children were significantly more likely to engage in dieting behaviours and restrained eating compared to the normal weight children. Obese children also express more weight concern and more dissatisfaction with their body image than normal weight children. Gender based analysis revealed girls were more likely to exhibit these behaviours than were boys.

### **METHOD**

#### **Aim:**

To study Cognitive and Psychosocial effects of childhood obesity.

Objective of the present study were:

- to compare cognitive functions (memory, attention, and visual-retention) between children with normal weight and children with obesity.
- to assess the difference in psychosocial aspects (body shape concern, and insecurity) between children with normal weight and children suffering from obesity.

#### **Hypotheses:**

H<sub>1</sub>. There will be a significant difference in cognitive functioning (memory, attention, and visual-retention) in obese children and normal weight children.

H<sub>2</sub>- There will be a significant difference in psychosocial functioning (body shape concerns, insecurity) in obese children and normal weight children.

#### **Study Design**

The current study adopted a cross-sectional design.

#### **Sample and Sampling Technique:**

The present research used purposive sampling as a method for data collection. The sample selected for this study was a total of 60 children (both male and female) with 30 obese children and 30 normal weight controls. Inclusion and exclusion criteria are mentioned below:

#### **Inclusion Criteria:**

- Obese children as per BMI, ICMR( $BMI \geq 30 \text{Kg/m}^2$ )
- Age range- 10-14

#### **Exclusion Criteria:**

- Children suffering with previous history of significant head injury or other significant physical, medical or neurological problems.
- Children suffering with chronic any medical illness and any other metabolic disorders like diabetes and thyroid.

#### **Measures**

**Mohsin's security insecurity test:** The MSIT is a measure of social and emotional security and insecurity developed by Dr. S.M. Mohsin (1979). It consists of 60 items which covers characteristics like social security, suitableness, friendliness, emotional stability, optimism, and self-confidence versus social insecurity, egocentricism, distrust, emotional instability, pessimism and dejection. It is a five point likert scale.

## Cognitive and Psycho-Social Effects of Childhood Obesity

**Body Shape Questionnaire-8C:** It is a measure of body image disturbances, originally developed by Cooper et al. (1987). Evans and Dolan (1993) later developed the short version of Body Shape Questionnaire known as BSQ-8C which contains 8 items. It is a self-report questionnaire requiring subjects to answer on six point forced choice scale.

**Digit symbol:** PGI-Memory scale for children was developed by Kohli et al., (1998). Its items were adopted from PGI-Memory scale for adults developed by Pershad & Wig (1977). Digit symbol is a subtest of PGI-Memory scale of children, which assess the visual retention of dissimilar pair. For each correct answer 1 mark is provided and maximum score obtained is 100. The test-retest reliability after the interval of one month was found to be 0.82.

**Immediate memory test:** Immediate memory test is a subtest of Bhatia battery test developed by Dr. C.M Bhatia (1955). This assesses immediate memory verbally by repeating the digits directly and reversely. One mark each for the number of digits reproduced directly and reversely. The maximum possible score provided for direct reproduction is 9 and for indirect reproduction are 6. The validity of the test is and reliability is 0.86 and validity is .84.

### *Procedure*

The sample for present study were recruited from three schools of Delhi. Total 72(normal weight 42 and obese 30) children were screened for the study. However, 12 children were not included as 7 of the children were under weight and 4 of them did not met the criteria and 1 did not complete the assessment.

At first height and weight of children was measured to calculate the BMI followed by the screening assessment based on the specified inclusion/exclusion criteria, and then the questionnaires on BSQ-8C and MSIT was conducted with a short break in between and then digit symbol test and immediate memory test was administered individually. The assessment session took around 30 minute to complete and all the records were entered manually.

## **RESULT AND DISCUSSION**

India is adapting the western culture and lifestyle; it is changing in a rapid way and following the trend of other countries where children are steadily becoming obese. Childhood obesity and overweight has become an emerging problem in India as learned by the recent researches of childhood obesity. In Indian literature there are many studies regarding prevalence of childhood obesity though there is scarcity of studies that address cognitive and psycho-social aspect of Indian obese children, thus this provided me the motivation to work on this research.

The aim of the study was to assess the cognitive and psycho-social aspects of childhood obesity. According to the objective of the study, scores on cognitive functions (memory, attention, and

## Cognitive and Psycho-Social Effects of Childhood Obesity

visual-retention) and psycho-social function (insecurity and body shape concern) of obese and normal weight children were compared.

**TABLE 1: Comparison of normal and obese children on BSQ-8C, MSIT, Digit Symbol and Immediate Memory (Direct and Reverse)**

Variables	NORMAL(N=30)		OBESE(N=30)		Df	t-value
	Mean	Sd	Mean	Sd		
BSQ-8C	16.43	4.7	31.27	3.7	58	<b>5.77**</b>
MSIT	204.5	24.12	123.07	38.6	58	<b>2.14*</b>
DIGIT SYMBOL	70.9	20.24	40.07	18.7	58	<b>2.20*</b>
IMT-D	5.2	1.2	3.4	0.99	58	<b>2.15*</b>
IMT-R	2.5	1.73	1.43	1.2	58	0.0087

\*significant at 0.05 level, \*\*significant at 0.01 level

The mean score obtained by obese and normal weight children on BSQ-8C was 31.27 (sd= 3.7) and 16.43(sd= 4.7) respectively. The t-value was 5.8 (p<0.01). The body shape concerns was high in obese as compared to normal weight children.

The mean score obtained by obese and normal weight children on MSIT was 123.07(sd=38.6) and 204.5(sd= 24.1) respectively. The t-value was 2.14(p<0.05). The normal weight children are more secure than obese children about their body shape image. Thus the children with normal weight have scored higher than obese.

The obese and normal weight children scored mean on digit symbol was 40.07(sd=18.7) and 70.9(sd=20.24). The t-value was 2.20(p<0.05). The normal weight children have performed better on Digit Symbol Test as compared to obese children.

The score of mean obtained on IMTD by obese and normal weight children was 3.4(sd=0.99) and 5.2(sd=1.2) and on IMTR was 1.43(sd=1.2) and 2.5(sd=1.73) The t-value for IMTD was 2.15 (p<0.05) and for IMTR was 0.0087(p>0.05). The normal weight children have performed better on IMTD as compared to obese children and there is no difference in the performance of normal weight children and obese children on IMTR.

However, this study showed a marked difference in the cognitive and psychosocial functioning of obese children and normal weight children. The obese children have performed poor in cognitive test as compared to normal and showed more issues in psycho-social functioning of obese children than normal weight children.

Thus, the present study on the cognitive and psycho-social aspects of obesity helps to create awareness among people about the various difficulties faced by obese children, not only in



## Cognitive and Psycho-Social Effects of Childhood Obesity

physical domain but also cognitive and psycho-social domains. In this regard, one can better understand and take appropriate measures in planning early intervention for such difficulties faced by obese children, and thus deal with the global issue of obesity as early as possible.

Several studies have shown a negative relationship between obesity and neuro-cognitive and psycho-social functioning of children (Brook et al., 2009; Li et al., 2008). Obese and overweight children experience more behavioural issues than normal weight children. Though, many current studies have also reported contradictory finding with regard to cognitive and psychosocial functioning of obese children and are proposed for further examination to expand knowledge in this area (Liang et al., 2013).

### CONCLUSION

The current research focused on the cognitive and psychosocial effects of obesity. It can be concluded that cognitive and psychosocial functioning plays a significant role in obesity as the obese children were found to be poor compared to the normal weight controls. The performance of obese children on memory and visual perception and retention abilities was also lower compared to normal weight controls. Body shape concerns were also high in obese children compared to normal weight controls and majority showed marked concern with their body shape. Obese children experience more insecurity about their body image than normal weight children. Thus obesity is not only related to health risk factors but cognitive and psychosocial issues also.

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### Conflict of Interests

The author declared no conflict of interests.

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## Cognitive and Psycho-Social Effects of Childhood Obesity

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## Cognitive and Psycho-Social Effects of Childhood Obesity

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