

Impulsivity and Set Shifting Ability-Comparison between obese and Non-obese Adults

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Obesity is a medical condition in which excess body fat accumulates to the extent that it has an adverse effect on health. Researchers have proved that obesogenic environments, cognitive factors are critical determinants of eating behavior and the risk of obesity. The objective of the study is to differentiate between obese and non-obese adults in terms of impulsivity and set shifting ability. 60 individuals age ranging from 20-40 years, participated in the study, thirty in each group (obese and non-obese), divided on the basis of body mass index (BMI). Stroop Colour Word Test and Wisconsin Card Sorting Test were used for assessment of impulsivity and set shifting ability. Findings reveal that obese individuals had more impulsivity. Obese females differed significantly from non-obese females, in terms of set shifting, indicating deficit in cognitive flexibility and feedback utilization. However, male obese individuals do not differ significantly from the non-obese males. Thus they may be less affected by these factors in comparison to female counterparts. Present study would contribute to identify cognitive factors related to obesity, which needs to be addressed for its treatment.

Keywords: Obesity, impulsivity, Set shifting ability, Stroop colour test, Wisconsin card sorting test.

Obesity is one of the most troubling health problems now-a-days. It is a fastest growing medical condition. In this, excess body fat has accumulated to the extent, which has an adverse effect on health. Obesity is considered to increase health problems and reduce life expectancy. Obesity is considered obese when individual's body mass index (BMI) is greater than or equal to 30 kg/m² (WHO, 2012).

It was the sixth most important risk factor, which contributes to the overall burden of disease worldwide and it increases the likelihood of various diseases (Haslam, & James, 2005). Apart from the increased risk of other disorders it is associated with reduced self-esteem and a poorer attitudinal body image (Mendelson & White, 1985; Davis, Wheeler, & Willy, 1987; Stein, 1987; Friedman & Brownell, 1995).

Obesity is most commonly caused by excess energy consumption (dietary intake) relative to energy expenditure (energy loss via metabolic and physical activity). However, the etiology of obesity is highly complex and includes genetic,

physiologic, environmental, psychological, social, economic and even political factors that interact in varying degrees to promote the development of obesity (Aronne, Nelinson & Lillo, 2009). Biological inheritance seem to increase the risk of weight gain and interact with other risk factors in the environment, such as unhealthy diets and inactive lifestyles. Psychological factors like stresses of school education, career and nuclear family are important factors. (Ghosh, 2012). Food is often used as a coping mechanism (Collins & Bentz, 2009). Personality traits are consistently associated with the controllable behaviors that lead to obesity (Provencher et al., 2008). Literature states that impulsivity plays a role in the etiology and/or maintenance of obesity, higher levels of impulsivity have been found among the obese (Chalmers, Bowyer & Olenick, 1990). Impulsivity may lead to binge eating and lapse in diet associated with difficulty in set shifting ability.

Obesity has been found to be associated with impulsivity and lack of response inhibition (Sullivan, Cloninger, Przybeck & Klein, 2007;

Davis et al., 2008). Impulsivity involves a tendency to act without thinking in detail. It displays behavior characterized by little or no forethought, reflection, or consideration of consequences (VandenBos, 2007). Increased impulsivity leads to excessive intake of food and find it difficult to stick to his/her diet and end up having relapse. Thus this aspect of personality which is posing as a threat in the individual's path of recovery must be targeted first through psychotherapy or other mode of treatment. Set shifting refers to the ability to display flexibility in the face of changing schedules of reinforcement (Monchi, et al., 2001) and it is another important aspect of executive function which allow us to respond according to the need of the situation (Myers, 2006). This also determines cognitive flexibility which has been found to be impaired in obese individuals (Mobbs et al., 2011) and thus acts as a hindrance in their ability to evaluate environmental or bodily feedback and respond accordingly.

In India, obesity has become a serious concern as it is emerging as an important health problem. The present study targets few cognitive correlates of personality and attempts to compare obese and non-obese individuals in Indian population. The obese and non-obese individuals are compared in the present study on the basis of their impulsivity and set shifting ability. This study aims to find out those relevant cognitive factors which might lead to obesogenic behavior or might pose as a hindrance to recovery, with a hope that these findings would be of great help in therapeutic aspects and life style modification to treat obesity.

Objectives

The objective of the study is to differentiate between obese and non-obese adults in terms of impulsivity and set shifting ability.

Method

Participants

It is a cross sectional, hospital based comparative study, which followed purposive sampling method. The study sample consisted of 30 graduate obese individuals (BMI \geq 25kg/m²) between age range of 20 and 40 years were coming to the obesity and life style clinic in a

government superspeciality hospital in a large metropolitan area in India from November 2012 to August 2013. Adults suffering from any organic disease, endocrinological disorder (thyroidism and Cushing's syndrome), neurological disorder, terminal illness, mental retardation and psychiatric disorders were excluded from the study. Age and gender matched 30 graduate non obese healthy individuals for comparative group, who were meeting the inclusion and exclusion criteria, drawn from the same metropolitan area.

Materials

The following tools were used for assessment.

Semi-structured socio-demographic data sheet: The socio demographic sheet was specially designed for the study was used to collect the background information about the participants such as the name, address, age, sex, educational qualification, marital status, occupation, family type, family income, current height and weight, BMI, health status, details of any medical illness, past medical illness, and family history of any medical and endocrinological disorders.

Stroop Colour Word Test: It was used to assess impulsivity, a multifaceted concept, which measures response inhibition, (Christodoulou et al., 2006). This test was designed by J. R. Stroop in 1935. Scoring was based on the time taken to name - time taken to read the words i.e. the difference of the time taken in the two trials. Siegrist(1995) proved the reliability of the different forms of the Stroop test and found satisfactory coefficients of reliability together with a high inner consistency of this method. (Siska, 2002).

Wisconsin Card Sorting Test (WCST): It is a neuropsychological test of «set-shifting», developed by David A. Grant and Esta A. Berg (1948). Scoring is done in various dimensions like number of trials, correct and error responses, perseverative responses, errors and non-perseverative errors, conceptual level responses, categories completed failure to maintain set and learning to learn. It has high inter scorer reliability (Huettner, Wolfe & Hynd, 1989; Axelord, Goldman & Woodard, 1992;)

and considered as a valid measure of executive function in neurologically impaired population (Heaton, 1981).

Procedure:

Individuals in the study group, who attended the obesity and lifestyle clinic were interviewed and weight, height were measured, and body mass index were calculated. Individuals' whose body mass index (BMI) were ≥ 25 kg/m² and were meeting the inclusion and exclusion criteria, taken for the study. Individuals were interviewed in detail by using semi-structured sociodemographic data sheet. This was followed by administration of Stroop Colour Word Test and Wisconsin Card Sorting Test (WCST). Entire assessment was completed in 2 sessions in a span of 1 week. Same procedure was followed for the comparative group.

Statistical analysis was done using Statistical Package for Social Sciences Version 16 (SPSS 16) (Levesque, 2007).

Results

The present study deals with 60 individuals, with age ranging from 21 years to 36 years (mean 26 ± 2.95). The mean age of obese group has been found to be 26.07 years (± 2.83) and for the non-obese group is found to be 25.93 years (± 3.12). The t value of 0.17 ($p > 0.05$) shows that

there is no significant difference between obese and non-obese groups in terms of age. This reflects that the two groups are matched with respect to age.

Impulsivity:

The Stroop Colour Word Test was used to measure the impulsivity, where taking more time to perform the test indicate impulsivity. The results indicated that the obese individuals took more time in comparison to the non-obese individuals as significant difference was present between the score of two groups (Table 1). Hence, findings indicate more impulsivity in obese group.

When obese and non-obese female groups were compared, result indicated more impulsivity in obese female group in comparison to their non-obese counterparts. However no significant difference was found between obese and non-obese male group (Table 2). Here also findings indicate more impulsivity in obese females.

Set Shifting:

The WCST was used to measure the set shifting ability. It was found that obese individuals took more number of trials to complete the test, in comparison to the non-obese individuals and there was significant difference between their means. Findings indicate difficulty in set shifting

Table 1: Showing Comparison Between Obese And Non-Obese Group According To Impulsivity

Domain	Group				t	df	P
	Obese		Non-Obese				
	Mean	SD	Mean	SD			
Stroop Test	12.63	6.03	9.5	5.34	2.13	58	.04*

(*) significant at 0.05 level

Table 2: Showing Comparison between Obese and Non-Obese Female Group and Male Group according to Impulsivity

Domain	Female						Male							
	Obese		Non-obese		t	df	p	Obese		Non-obese		t	df	p
	Mean	SD	Mean	SD				Mean	SD	Mean	SD			
Stroop Test	14.47	6.91	7.60	3.10	3.33	28	.00*	10.80	4.52	11.40	5.94	.31	28	.76

(*) significant at 0.05 level

Table 3: Showing Comparison Between Obese and Non-Obese Group According to Set Shifting Ability

Domains	Group				t	df	p
	Obese(N ₁)		Non-Obese(N ₂)				
	Mean	SD	Mean	SD			
Wcst Total Trial	102.87	19.54	92.30	21.23	2.01	58	.05*
Wcst Correct	73.60	7.88	70.30	7.09	1.71	58	.09
Wcst Error	29.27	16.80	22	15.76	1.73	58	.09
Wcst Perseverative Response	15.60	9.77	12.30	8.72	1.38	58	.17
Wcst Perseverative Error	14.13	8.22	11.30	7.95	1.36	58	.18
Wcst Non Perseverative Error	15.13	10.49	11.03	9.18	1.61	58	.11
Wcst Conceptual Level Response	66.03	9.05	65.03	5.84	.51	58	.61
Wcst Total Category	5.57	.97	5.67	.88	.42	58	.68
Wcst Trial For 1 st Category	17.30	13.27	13.23	3.56	1.62	58	.11
Wcst Failure To Maintain Set	0.57	.68	0.43	.71	.73	58	.47

(*) significant at 0.05 level

Table 4: Showing Comparison Between Obese And Non-Obese Female Group According To Set Shifting Ability

Domains	FEMALE				t	df	p
	Obese		Non-obese				
	Mean	SD	Mean	SD			
Wcst Total Trial	102.73	19.04	79.47	11.34	4.07	28	.00*
Wcst Correct	75.67	7.84	66.40	3.99	4.08	28	.00*
Wcst Error	27.07	13.16	13.07	7.71	3.56	28	.00*
Wcst Perseverative Response	14.07	7.15	7.73	5.64	2.70	28	.01*
Wcst Perseverative Error	12.87	5.94	7.27	5.02	2.78	28	.00*
Wcst Non Perseverative Error	14.20	8.79	5.80	3.36	3.46	28	.01*
Wcst Conceptual Level Response	68.53	7.03	64.40	3.23	2.07	28	.05*
Wcst Total Category	5.87	.36	6.00	.00	1.47	28	.16
Wcst Trial For 1 st Category	13.20	4.09	11.53	1.41	1.50	28	.15
Wcst Failure To Maintain Set	.60	.74	.13	.36	2.21	28	.04*

(*) significant at 0.05 level

in obese individuals which led them to take more trials. However, no significant difference was present between the two groups in terms of total correct and error responses, perseverative response, perseverative errors and non-perseverative errors, categories completed and failure to maintain set (Table3).

When obese and non-obese female groups

were compared it was found that obese female group took more number of trials to complete the test, had more number of errors, perseverative responses, perseverative errors and failure to maintain set, thus results are indicative of difficulty in set shifting. Significant difference between the two groups was also present in terms of total correct responses, number of

non-perseverative errors and conceptual level responses (Table 4).

However, comparison between obese and non-obese males did not yield any significant difference in the sub domains of Wisconsin Card Sorting Test.

Discussion

Obesity is a complex condition which involves biological, psychological, sociocultural and environmental components. Research shows that eating behaviors in humans are regulated by a complex interplay of metabolic and cognitive control processes in the brain. Literature states that impulsivity plays a role in the etiology and/or maintenance of obesity, higher levels of impulsivity have been found among the obese, even a tendency to act impulsively is associated with a tendency to overeat, and may be a factor which predicts the likelihood of the development of binge eating and may also lead to lapse in dieting (Yeomans, 2008). Stroop test has been frequently used as a part of neuropsychological assessment to measure response inhibition, which is part of the multifaceted concept of impulsivity (Christodoulou et al., 2006). The results indicated in previous studies that poor response inhibition in obese individuals in comparison to non-obese individuals (Khodapanah, Moradi, Vosough & Khodapanah, 2010; Fagundo et al., 2012). Both self-report measures and behavioural measures have reported that impulsivity is high in obese individuals in comparison to their normal counterparts (Nederkoorn et al., 2006; Nederkoorn, Smulders, Havermans, Roefs, & Jansen, 2006; Mobbs et al., 2010; Jasinska et al. 2012). In the present study it was found that the obese individuals took more time in Stroop Colour Word Test and there was significant difference present between the score of two groups (Table 1). This indicated more impulsivity in obese individuals in comparison to the non-obese. Similarly, when obese and non-obese female groups were compared, result indicated more impulsivity in obese female group as significant difference existed between the two group scores (Table 2). Thus the findings of the current study are in accordance with the previous literature available stating; obese individuals are

more impulsive than non-obese counterparts. Thus impulsivity might affect eating behaviour as it leads to lack of consequence consideration; this might lead to over eating tendencies and make it difficult for the individuals to deal with obesity. This is also associated with whimsical acts which might lead to lapse in dieting. The present study deals with primary obesity, where excessive calorie consumption, sedentary lifestyle plays important role, where lack of inhibition in daily life might play crucial role. So not only impulsivity might lead to obesity but may be considered as the reason for relapse.

However, no significant difference was found between obese and non-obese males (Table 2), leading to the impression that obese male is as likely to act at the spur of the moment as their non-obese counterparts. Thus impulsivity might not play that much important role in case of male group as it plays in case of female group.

In case of set shifting ability there was significant difference between obese and non-obese individuals in terms of number of trials taken to complete the test (WCST) (Table 3). This indicated presence of deficit in set shifting leading to the need of more trials to complete the six given categories. However, in other sub domains of WCST like total number of errors, perseverative errors, failure to maintain set etc., no significant difference between the two groups regarding these variables were found.

Comparison between obese and non-obese males did not yield any significant difference in the sub domains of Wisconsin Card Sorting Test. However, when obese and non-obese female groups were compared it was found that obese female group took more number of trials to complete the test, had more number of errors, perseverative responses, perseverative errors and failure to maintain set, thus results are indicative of difficulty in set shifting. Significant difference between the two groups was also present in terms of total correct responses, number of non-perseverative errors and conceptual level responses (Table 4). This is in accordance with studies on this domain suggesting that obese individuals' performance had greater number of perseveration and errors than normal controls, thus indicating deficit in set

shifting and cognitive flexibility (Borkowska et al., 2009; Lokken et al., 2009; Duchesne et al., 2010; Khodapanah et al., 2010; Fagundo et al., 2012).

Thus obese female had difficulty in mental set shifting, utilizing the feedback from environment. The focus was on particular aspects of the stimulus and proper utilization of the environmental cues were not present; this is in accordance with the studies stating presence of cognitive deficits and attentional biases in obese, which play a role in the development and maintenance of obesity and eating disorders (Mobbs et al., 2011).

The obese female had at times perseverated to the mental set (perseverative errors), without using the negative feedback and had at times shifted the set easily, ignoring the positive feedback (failure to maintain set) from examiner. Thus they had difficulty in proper planning in reaching a goal and found it difficult to shift cognitive strategies and inhibit their behaviour and modify them in accordance with the changing environment. This lack of planning and disinhibited behaviour may lead to disinhibited eating and greater food cravings (Lena et al., 2004; Spinella & Lyke, 2004; Tchanturia et al., 2005; Boeka & Lokken, 2008; Siervo et al., 2011; Smith et al., 2011).

However, findings regarding overall obese group and male obese group is not in accordance the current literature. It can be concluded that the result of the overall obese group was influenced by the scores of obese male individuals. From the study, however it can be concluded that the cognitive flexibility and feedback utilization of the male obese group does not differ significantly from non-obese males. Sufficient literature was not available to support such findings especially in Indian population. However, from the present study it can be commented that several other factors might have influenced this outcome. Persistence towards the task in hand and acceptance of failure might have played an important role, which was behaviourally observed in participants. As few individuals were easily frustrated when faced failure in the trials and lost the interest. They had difficulty in persisting to their work and needed motivation. Especially in case of non-obese male these

factors might have affected their performance, planning ability, concentration, thus leading to the difference in score with obese group being not significant.

Conclusions

Obesity is a global issue of epidemic proportion. In India also it is an important health problem. It can be concluded from the present study that obese individuals are more impulsive, leading to difficulty in response inhibition. Obese female appeared more impulsive, had deficit in cognitive flexibility and feedback utilization. However, male obese individuals do not differ significantly from the non-obese males in terms of impulsivity and set shifting. Thus they may be less affected by these factors in comparison to female counterparts. Present study would contribute to identify cognitive factors related to obesity, which needs to be addressed for its treatment.

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