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Research article

INDIRECT DETERMINANT'S OF OBESITY IN BANK EMPLOYEES OF URBAN VADODARA – A CROSS SECTIONAL STUDY

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ABSTRACT: Obesity has reached epidemic proportions in India as well as in Gujarat state. Recent research has suggested prominent role of indirect unconventional parameters influencing hunger and appetite. A cross sectional study was designed to determine the prevalence of obesity and indirect determinants like pattern of caffeine products and alcohol consumption, depression status and levels of hunger-satiety amongst the non-obese and obese young bank employees of urban Baroda. Bank employees (595) were screened for anthropometric measurements. Pattern of caffeine products and alcohol consumption, depression and hunger-satiety were studied using a score card. Non-obese (100) and obese grade I (126) young bank employees (25-35 yrs) were selected for further study. Out of 595 subjects, 41% were obese (BMI >25) and 20% were overweight. Consumption pattern of caffeine products and alcohol showed that obese subjects consumed more alcohol (57%), cigarette (28%), tea (68%) and coffee (25%) ($p<0.001$). Depression was more pronounced in non-obese (20%) subjects. Obese subject reported significantly higher ($p<0.001$) scores for delayed satiety. A strong significant association ($p<0.001$) was observed between consumption pattern of caffeine products and alcohol, its degree of consumption, and satiety scores of obese subjects. The significant difference in consumption pattern of caffeine products and alcohol, satiety scores and depression between obese and non-obese subjects may have played a role in the higher prevalence of obesity in the Bank employees.

Key words: Indirect determinants, Depression, Hunger, Satiety, Caffeine, Alcohol

INTRODUCTION

Obesity is rising rapidly in India and Gujarat ranks 10th for males and 7th for females in the prevalence of overweight and obesity (Ramachandran A, et.al, 2010). Obesity is now termed as "New World Syndrome" as it is a cluster of non-communicable diseases creating an enormous socioeconomic and public health burden in poorer countries (Unnikrishnan AG., et.al, 2012). It affects every region of the globe and is the most neglected public health problem of today. In the United States, along with obesity, the major cause of disability is the depression and in Europe it is the third largest cause behind heart disease and stroke (World Health Statistics, 2013). According to the National Family Health Survey (NFHS), the percentage of overweight or obesity increased from 11% in NFHS- 2 to 15% in NFHS-3 and more than thrice in urban areas (International Institute for Population Sciences (IIPS) and Macro International, 2007). This may be due to lesser physical activity in the urban areas. Women have higher tendency of being overweight and obese due to endocrine basis. They are also prevented from leading a healthy lifestyle due to its roots in societal and cultural roles (Pednekar MS, 2008). In India 30% of women in Punjab are found to be overweight and obese, 28% in Kerala, 26% in Delhi and these states are relatively richer states (World Health Statistics, 2013) .In men similar variations are seen by age, education, and wealth index (World Health Statistics, 2013; Ramachandran A, et.al, 2010). Urbanization and Industrialization are considered as the main culprits for the increase in the prevalence on obesity. Variation in the prevalence rates within the country is attributed to the difference in lifestyle, mainly in the dietary patterns, and physical activity. Unique features are exhibited by obese individuals like excess total body fat, intra abdominal fat, excess subcutaneous fat, and deposition of fat in liver and muscle. Ingestion of alcohol could also enhance the process of fat deposition as supported by several experimental metabolic studies have shown suppression of lipid oxidation by alcohol. The non-oxidized fat is preferentially deposited in the abdominal area. Also, it affects every component of the energy-balance equation due to its appetite-enhancing effects (Sutter PM, 2005). There is no clear causal relationship between alcohol consumption and obesity.

However, associations between alcohol and obesity are well established being influenced by lifestyle, genetic and social factors (Bates B, et.al, 2009; Dennis EA, et.al, 2009). As alcohol consumption leads to increase in the food intake, its effect on body weight in overweight and obese people may be more pronounced (Arif AA, et.al, 2005; Tolstrup JS, et.al, 2005). Frequency and amount of alcohol consumption also plays important role. Less frequent but heavy drinkers seem to be at higher risk of obesity than frequent and moderate drinkers (Schutze M, et.al, 2009). Presently, it can be said that alcohol calories count in combination with a high-fat diet and in overweight and obese subjects (Colditz G, et.al., 1991). Also, a recent American study found that the development of depression was stronger in obese subjects (Luppino FS, et.al, 2010). A longitudinal study of a large birth cohort from northern Finland found that adolescent obesity was associated with adulthood depression (Heva A, et.al, 2006). Hence, it is now important to know the "weight of the nation" to curtail the long-term consequences like metabolic syndrome and type-2 diabetes mellitus (T2DM) and the financial burden on the health care system (Pednekar MS, 2008). A better understanding of the numbers and causes of obesity can help overcome barriers to the primary prevention of obesity for youth and adults in communities and at workplaces. No published literature can be found in this part of the country to assess the prevalence and determinants of obesity among young adults. Studies of such a nature will be useful tool in planning and developing appropriate intervention methods. In this context, the present study has been conducted to estimate the prevalence and indirect determinants of obesity among young bank employees aged between 25 and 35 years, of urban Vadodara city in Gujarat state.

METHODS AND MATERIAL

Sample size calculation (David Freedman, 1997)

The sample size estimates were based upon two sided confidence level of 95%, confidence interval of 4 and a power of 90% Sample size was calculated using formula for finite population, where the population is less than 50,000. This formula was selected as the population of bank employees working in private sector banks in Vadodara city is limited to 1500 employees.

Sample Size – Infinite Population (Where the population is more than 50,000)

$$SS = \frac{Z^2 \times (P) \times (1 - P)}{C^2}$$

Where, SS = Sample size
Z = Z value (e.g. 1.96 for 95 % Confidence level)
P = Percentage of population picking a choice, expressed as decimal
C = Confidence Interval expressed as decimal

Sample Size – Finite Population (where the population is less than 50,000)

$$\text{New SS} = \frac{SS}{(1 + (\frac{SS - 1}{Pop}))}$$

Where, SS = Sample size calculated using infinite population
Pop = Population (1500 for private bank employees of Vadodara city)

Using the formula for infinite population a figure of 600 subjects was arrived. This figure of 600 was put in the formula of finite population and the final sample size was calculated to 428 subjects for screening.

Selection of the banks

List of private banks was taken from the website of Indian Banks Association (www.iba.org.in /viewmembanks.asp? id=3). Eighteen out of listed 24 private banks exist in Vadodara city. Six banks in different areas of Vadodara city were conveniently selected based on the permission obtained from the administration department to organize the health screening camp.

Selection of the subjects

A total of 595 bank employees irrespective of age and gender were screened for their anthropometric measurements, Body fat percentage, Basal metabolic rate, Blood pressure and random blood sugar. These 595 subjects were classified under the various categories of BMI (Non-obese and Obese). Out of 595 subjects screened, 100 bank employees with normal BMI and without any disorders as mentioned in inclusion – exclusion criteria were selected. As this study is on young adults, age range was restricted to 25 – 35 years as: A) In most banking sector people are employed in this age group and B) to avoid weight related biological and lifestyle changes in both genders as well as to prevent hormonal fluctuations likely to be experienced by older women during early menopause and hypothyroidism. Written and verbal information was provided to these subjects about the study. The subjects who willingly signed the written informed consent form were enrolled in our study.

Tools and Techniques

Anthropometric measurements is the measurement of body dimensions to characterize skeletal and tissue development,

Weight: A digital weighing scale to the nearest 100 g was used to measure weight. Scale was calibrated using standard weights.

Height: Height meter was used to measure the height of the subjects. Two consecutive reading were taken.

Waist and Hip Circumference: The circumference was recorded using the constant tension, spring loaded tape at the narrowest part of the abdomen between the ribs and iliac crest. The measurement was taken to the nearest 0.1 cm at the end of a normal expiration, without the tape compressing the skin.

Body Mass Index (BMI): A relatively new classification of BMI has been recommended by JAPI, 2009 and WHO 2000 for the Asians. According to this new classification, obesity starts from BMI > 25 as compared to previous one of BMI>30 for Asian Indians (Table 1).

Biophysical parameters:

Blood Pressure: It was measured in sitting position using the digital blood pressure monitor UA-767PC (Saitama, Japan) on the right arm (Table 2).

Body Fat analysis: Digital body fat analyzer of Omron Healthcare co. Ltd Japan; Model no. HBF – 306 –C1; SN: 2010100047 IUF was used.

Hunger and satiety scale : A score card was used to rate the degree of hunger and satiety, before and after meals developed by Lisa Burgoon MS, RD, LD, Sports Nutritionist, Sportwell Center, McKinley Health Center, University of Illinois at Urbana – Champain, 1998 (Table 3).

Depression status

Data was obtained using Becks depression inventory. The subjects were classified as normal mild, moderate and severely depressed based on the BDI scores. The Beck Depression Inventory (BDI), created by Dr. Aaron T. Beck, is a 21-question multiple-choice self-report inventory, one of the most widely used instruments for measuring the severity of depression. In its current version the questionnaire is designed for individuals aged 13 and over, and is composed of items relating to symptoms of depression such as hopelessness and irritability, cognitions such as guilt or feelings of being punished, as well as physical symptoms such as fatigue, weight loss, and lack of interest in sex (Beck AT, 1972).

The original BDI, first published in 1961 (Beck AT, et.al., 1961) consisted of twenty-one questions about how the subject has been feeling in the last week. Each question has a set of at least four possible answer choices, ranging in intensity. For example:

- (0) I do not feel sad.
- (1) I feel sad.
- (2) I am sad all the time and I can't snap out of it.
- (3) I am so sad or unhappy that I can't stand it.

When the test is scored, a value of 0 to 3 is assigned for each answer and then the total score is compared to a key to determine the depression's severity. The standard cut-offs are as follows: (Beck AT, et.al., 1988).

- 0–9: indicates minimal depression
- 10–18: indicates mild depression
- 19–29: indicates moderate depression
- 30–63: indicates severe depression.

Higher total scores indicate more severe depressive symptoms.

STATISTICAL ANALYSIS

To compare the means between two groups students‘t’ test was used. Association was studied by chi square using Epi-info software.

RESULTS AND DISCUSSION

Screening of 595 bank employees revealed, 75.79% were male and 24.20% were females. Most of the bank employees (69%) belonged to the age range of 26- 35 years (Table 4). According to the Consensus statement for diagnosis of obesity (JAPI 2009) and WHO Asia pacific perspective redefining obesity and its treatment (2000), 41% of subjects were found to be obese, 20% were overweight and 32% and 7% were normal and underweight respectively (Table 5). Obesity grade –I was more pronounced in males (43%) as compared to females (34%).

However, 11% of females belonged to obesity grade – II as compared to males (6%). Similar results are also mentioned in report of National Family and Health Survey -3 (NHFS 3), where in percentage of overweight and obese women increased from 11% in NFHS-2 to 15% in NFHS-3. Even in states like Punjab (30%), Kerala (28%) and Delhi (26%), percentage of overweight and obesity amongst women is highest (Unnikrishnan AG., et.al., 2012).

Table 1: Classification of BMI (JAPI 2009 and WHO 2000)

BMI (kg/m^2)	Classification	Risk of Comorbidities
< 18.5	Underweight	Low (but risk of other clinical complications)
18.5–22.9	Normal	Acceptable Risk
23.0–24.9	Overweight	Increased risk
25.0–29.9	Obesity Grade I	Moderate
≥ 30.0	Obesity Grade II	Severe

Table 2: Classification of Hypertension (JNC VII, 2003)

Blood Pressure Classification	Systolic blood pressure	Diastolic blood pressure
Normal	< 120	and < 80
Pre-hypertension	120 – 139	or 80 – 89
Stage I Hypertension	140 – 159	or 90 – 99
Stage II Hypertension	> 160	or > 100

Table 3: Hunger – Satiety Score Card

Scale	Score
Famished, starving	1
Headache, weak, cranky, low energy	2
Want to eat now, stomach growls and feels empty	3
Hungry - but could wait to eat, starting to feel empty but not there yet	4
Not hungry, not full	5
Feeling satisfied, stomach feels full and comfortable	6
Feeling full, definitely don't need more food	7
Uncomfortably full	8
Stuffed, very uncomfortable	9
Bursting, painfully full	10

Table 4: Distribution of the Subjects According to the Age

Categories of age	Number of subjects	Percentage (%)
	Male	
21 - 25 yrs	77	17
26 - 30 yrs	187	41.4
31 - 35 yrs	131	29.04
36 - 40 yrs	48	10.64
41 - 45 yrs	4	0.88
>45 yrs	4	0.88
	Female	
21 - 25 yrs	45	31.25
26 - 30 yrs	66	45.83
31 - 35 yrs	25	17.36
36 - 40 yrs	3	2.08
41 - 45 yrs	5	3.47

Table 5: Classification of Bank Employees According to the Various Categories of BMI

Classification of BMI (kg / m^2)	Male (N=451)	Male (%)	Female (N=144)	Female (%)	Total (N=595)	Total (%)
Underweight (<18.5)	29	07	14	10	43	7
Normal (18.5 - 22.9)	137	30	56	39	193	32
Overweight (23.0 - 24.9)	91	20	25	17	116	20
Obesity Grade I (25.0 - 29.9)	168	37	33	23	201	34
Obesity Grade II (≥ 30.0)	26	06	16	11	42	7

Table 6: Anthropometric Profile and Biophysical Parameters of Non-Obese and Obese Subjects

Parameters		Male	Female	Total Subjects
Height (cms) Mean ± SD	Non-obese	169.97 ± 6.30	156.05 ± 6.78	166.63 ± 8.70
	Obese	170.58 ± 6.36	157.54 ± 6.39	168.82 ± 7.76
	't' value	0.64NS	0.70NS	1.99*
Weight (kg) Mean ± SD	Non-obese	61.14 ± 5.96	50.27 ± 3.84	58.53 ± 7.18
	Obese	80.80 ± 7.89	67.81 ± 6.93	79.05 ± 8.93
	't' value	18.45***	10.36***	18.69***
BMI (kg/m^2) Mean ± SD	Non-obese	21.14 ± 1.30	20.66 ± 1.26	21.03 ± 1.29
	Obese	27.69 ± 1.53	27.25 ± 1.39	27.63 ± 1.51
	't' value	30.51***	15.74***	34.69***
WC(cm) Mean ± SD	Non-obese	80.93 ± 5.88	71.70 ± 7.93	78.7 ± 7.48
	Obese	96.20 ± 7.66	93.88 ± 6.65	95.88 ± 7.50
	't' value	14.69***	9.41***	17.07***
HC (cm) Mean ± SD	Non-obese	90.89 ± 5.16	88.41 ± 4.49	90.3 ± 5.08
	Obese	102.66 ± 6.09	105.52 ± 5.69	103.04 ± 6.10
	't' value	13.72***	10.75***	16.74***
WHR Mean ± SD	Non-obese	0.88 ± 0.05	0.80 ± 0.06	0.86 ± 0.06
	Obese	0.93 ± 0.04	0.88 ± 0.06	0.92 ± 0.04
	't' value	7.07***	3.84***	8.13***
Body Fat (%) Mean ± SD	Non-obese	22.05 ± 3.05	28.82 ± 2.81	23.67 ± 4.14
	Obese	30.26 ± 3.80	38.63 ± 3.83	31.39 ± 4.75
	't' value	15.63***	9.45***	12.78***
Systolic Blood Pressure (mmHg) Mean ± SD	Non-obese	125.72 ±12.59	113.87 ± 10.04	122.88 ± 12.95
	Obese	128.05 ± 8.17	121.64 ± 8.71	127.19 ± 8.50
	't' value	3.47***	2.57*	4.37***
Diastolic Blood Pressure (mmHg) Mean ± SD	Non-obese	77.72 ± 9.59	72.08 ± 8.54	76.37 ± 9.57
	Obese	81.00 ± 7.27	76.29 ± 6.75	80.37 ± 7.36
	't' value	2.64**	1.69NS	3.54***

NS = Non-significant, $p < 0.05$: *, $p < 0.01$: **, $p < 0.001$: ***

Comparison of non-obese and obese subjects

Table 6 depicts anthropometric and biophysical profile of non-obese and obese subjects. Significant difference was observed in all the anthropometric and biophysical parameters between non-obese and obese group ($p < 0.001$). Obese subjects were found to be taller by 2.19 ± 0.94 cm than the non-obese. Also, obese subjects weighed more by mean weight of 20.52 ± 1.75 kg and mean waist circumference by 17.18 ± 0.02 cm as compared to non obese subjects. Result of biophysical parameters depicts that the body fat of obese individuals was 7.72% higher than the non-obese and this difference was found to be statistically significant ($p<0.001$). According to the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC IV, 2003), both non-obese and obese males belonged to lower side of pre-hypertensive category and had mean systolic blood pressure of 125.72 ±12.59 and 128.05 ± 8.17 respectively. However, their diastolic blood pressure was in normal range (Table 6). Substantial evidence from epidemiological data supports relationship between obesity and hypertension. However, the mechanism between the two disorders is not straightforward and most likely represents an interaction of demographic, genetic, hormonal, renal, and hemodynamic factors. Age, race, and sex also modulate the strength of the association between obesity and hypertension (V Kotsis, et.al, 2010). As represented in Table 7, 82% of obese subjects had abdominal obesity. However, 9% of non-obese subjects were also not exempted from abdominal obesity. Out of these 9% non-obese subjects, 17% were females and 7% were males. Abdominal adiposity assessed using waist circumference is considered to be more appropriate to predict metabolic disorders than generalized adiposity assessed by BMI (Parikh R, et.al, 2012). These 9% of non-obese subjects can be considered at risk of developing future complications related to abdominal obesity. Also, highly significant association was observed between abdominal obesity of non-obese and obese subjects. Table 8 depicts that obese subjects consumed more of alcohol (57%), cigarette (28%), tea (68%) and coffee (25%) as compared to the non-obese bank employees. Association between BMI and intake of alcohol ($\chi^2 = 8.18$), tea and coffee was highly significant a ($p < 0.001$).

Tobacco and Aerated drinks were consumed almost equally by non-obese and obese bank employees and the difference was non-significant. No significant association was observed between BMI and intake of tobacco and aerated drinks. Similar results were observed in a current research that clearly shows that energy consumed as alcohol is additive to that from other dietary sources, leading to short-term passive over-consumption of energy when alcohol is consumed. Indeed, alcohol consumed before or with meals tends to increase food intake, probably through enhancing the short-term rewarding effects of food. Alcohol is a significant source of calories, and drinking may stimulate eating, particularly in social settings. However, calories in liquids may fail to trigger the physiologic mechanism that produces the feeling of fullness. It is possible that, in the long-term, frequent drinkers may compensate for energy derived from alcohol by eating less, but even infrequent alcohol-related overeating could lead to weight gain over time (Yeoman, 2010). As Shown in Table 9, 28 % of obese subjects were found in severe category of addiction as compared to 11 % of non-obese subjects. Highly strong association was observed between the BMI and degree of addiction. As shown in Table 10, depression was more prominent in non-obese subjects (20%) as compared to obese subjects (8%). Strong inverse association was observed between BMI and varying degree of depression (χ^2 value = 6.22; $p<0.045$). This could be due the BMI range as most of the studies that have established an association between depression and obesity had BMI $\geq$ 30.

Table 7: Association between Abdominal Obesity, BMI and Gender of Non-Obese and Obese Bank Employees

Abdominal obesity (Waist Circumference)	Obese Male N=109 (%)	Non-Obese Male N =76(%)	χ^2 Value	Obese Female N = 17 (%)	Non-Obese Female N =24(%)	χ^2 Value	Obese N=126 (%)	Non-Obese N=100 (%)	χ^2 Value
Present Male > 90cm ; Female > 80cm	88 (81)	5 (7)	**97.96 *****	15 (88)	4 (17)	**20.00 *****	103 (82)	9 (9)	**117.5* ****
Absent Male < 90cm ; Female < 80cm	21 (19)	71 (93)		2 (12)	20 (83)		23 (18)	91 (91)	

Figures in parenthesis represent percentage of subjects. NS = Non-significant, p < 0.05: *, p < 0.01: **, p < 0.001: ***

Table 8: Association between BMI and Consumption Pattern of Alcohol And Caffeine Products of Non-Obese and Obese Bank Employees

Consumption Pattern	BMI Status		χ^2 Value	p value
	Non-obese N = 100 (%)	Obese grade 1, N = 126 (%)		
Alcohol	38 (38)	72 (57)	8.18^{***}	0.004
Cigarette	17 (17)	36 (28)	4.16^{*}	0.041
Tobacco	07 (07)	10 (08)	0.70^{NS}	0.790
Tea	35 (35)	86 (68)	24.8^{***}	0.001
Coffee	08 (08)	31 (25)	10.8^{***}	0.001
Aerated Drinks	91(91)	109 (86)	1.11^{NS}	0.293

Figures in parenthesis represent percentage of subjects. NS = Non-significant, p < 0.05: *, p < 0.01: **, p < 0.001: ***

Table 9: Association of BMI with Varying Degree of Consumption Pattern of Non-Obese and Obese Bank Employees

Degree of consumption	BMI status		χ^2 VALUE	p value
	Non-obese N = 100(%)	Obese grade-I, N = 126 (%)		
Mild (0 – 1 habit)	40 (40)	19 (15)	**21.7^{***}**	**0.0001**
Moderate (2 – 3 habit)	49 (49)	72 (57)		
Severe ($\geq$ 4 habit)	11 (11)	35 (28)		

Figures in parenthesis represent percentage of subjects. NS = Non-significant, p < 0.05: *, p < 0.01: **, p < 0.001: ***

Table 11 depicts that no significant difference was observed in the mean hunger scores of non-obese and obese subjects. The intensity of hunger pattern was same in both the groups. However, as shown in Table 12, the satiety was significantly delayed ($p<0.001$) in obese subjects at the specific meal time of lunch, evening and dinner compared to non-obese subjects. The non-obese subjects consumed less quantity of food and had early satiety compared to obese individuals. This could be attributed to the higher body fat mass in obese individuals that secrete an excess of leptin by the adipose cells. This causes the negative feedback system to become unresponsive to leptin or to have a receptor defect on the target cells in the hypothalamus leading to feeling of hunger even after a big meal. This could be the contributing factor that leads to obesity.

Table 10: Association between Varying Degree of Depression and BMI of Non-Obese and Obese Bank Employees

	Male		Female		Total	
Depression Level	**Non-obese N=100 (%)**	**Obese N=126 (%)**	**Non-obese N=100 (%)**	**Obese N=126 (%)**	**Non-obese N=100(%)**	**Obese N=126 (%)**
Normal	46 (46)	72 (57)	11 (11)	8 (6)	57 (57)	80 (63)
Mild Mood Disturbance	15 (15)	31 (25)	8 (8)	5 (4)	23 (23)	36 (28)
Clinical to Severe Depression	15 (15)	5(4)	5(5)	5(4)	20 (20)	10 (8)
χ^2 value	**9.57****		**0.315^{NS}**		**6.22***	
Level of significance	**0.008**		**0.854**		**0.045**	

Figures in parenthesis represent percentage of subjects. NS = Non-significant, $p < 0.05$: *, $p < 0.01$: **, $p < 0.001$: ***

Table 11: Mean Hunger Scores of Non-Obese and Obese Bank Employees at Various Meal Timings

Meal	**Hunger Scores**		**Level of Significance**
	Non-obese(Mean ± SD)	**Obese (Mean ± SD)**	
Breakfast	4.09 ± 0.78	3.94 ± 0.89	NS
Lunch	3.51 ± 0.68	3.59 ± 0.86	NS
Evening	4.08 ± 0.90	4.19 ± 0.85	NS
Dinner	3.49 ± 0.78	3.52 ± 1.07	NS
Total mean score	3.79 ± 0.54	3.81 ± 0.59	NS

Figures in parenthesis represent percentage of subjects. NS = Non-significant, $p < 0.05$: *, $p < 0.01$: **, $p< 0.001$: ***

Table 12: Mean Satiety Scores of Non-obese and Obese Bank Employees

Meal	**Satiety Scores**		**Level of Significance**
	Non-obese Mean ± SD	**Obese grade 1 Mean ± SD**	
Breakfast	6.16 ± 0.65	6.33 ± 0.81	NS
Lunch	6.39 ± 0.71	6.8 ± 0.89	***
Evening	5.67 ± 0.99	6.02 ± 0.66	**
Dinner	6.71 ± 0.82	7.2 ± 1.02	***
Total mean score	6.23 ± 0.61	6.59 ± 0.59	*

Figures in parenthesis represent percentage of subjects. NS = Non-significant, $p<0.05$: *, $p < 0.01$: **, $p<0.001$: ***

CONCLUSION

Hence, the addiction pattern, satiety scores and depression differed significantly between obese and non-obese subjects. These indirect determinants of obesity are associated with various mechanisms that are regulated by the hormones involved in regulating the appetite, hunger, satiety and depression. Considering their role in influencing the obesity outcome, they should become a part of prevention, management and counselling techniques of obesity.

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DISCLOSURE

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