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Estimation of BMI and Stress level in Suicide Attempters: A Comparison with Healthy Controls

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Abstract

This study was based on mental and biochemical parameters, analysis of already identified mentally ill, impulsive, depressed persons with high anxiety level and with suicidal mentality, but not attempted suicidal act yet , who have had registered in any Psychological treatment center.

We had selected 70 such already identified depressed subjects by contacting various Psycho-therapeutic clinics in Bilaspur city including State mental hospital, Sendri, Bilaspur, Dr Shrivastava's clinic ; Mental Health wellness clinic and Happy CEED Clinic, we had analyzed their mental profile by using various psychological tests, to assess their level of depression, anxiety, suicidal tendency. Also various biochemical parameters were assessed to assess the level of stress, depression, anxiety and suicidal tendency. The following patients' domains: age, gender, marital and occupational status, education level, suicide attempts, and suicide method were carefully investigated and documented.

TABLE-1 Demographic Data of subjects (n=70)

Age range	Subjects	Height	Weight in Kgs	BMI Kg/m^2	Education
18-22	6	5.3	51	19.61	School
23-27	9	5.6	44	15.22	Graduate
28-32	9	5.2	41	16.46	school
33-38	9	5.6	50	17.30	Post graduate
39-43	9	5.4	60	22.38	Primary school
44-48	6	5.7	57	19.06	graduate
48-52	7	5.3	69	26.64	High School
53-57	9	5.4	43	16.04	Primary School
60±	6	5.5	51	18.34	Primary school
Average age 37 years	**70**	**Average height 5'4**	**51.7 Kgs**	**19.005 Kg/m^2**	-----

TABLE-2 Demographic Data of healthy Controls (n=70)

Age range	Subjects	Height F'	Weight in Kgs	BMI Kg/m^2	Education
18-22	6	5.2	62	24.7	High School
23-27	9	5.4	59	27.57	High school
28-32	9	5.5	58	12.34	Graduate
33-38	9	5.7	60	19.93	graduate
39-43	9	5.5	64	13.61	Post graduate
44-48	6	5.3	67	25.76	Technical graduate
48-52	7	5.6	71	24.29	Graduate
53-57	9	5.2	78	31.07	High School
60±	6	5.5	69	24.64	High school
Average age 39 years	**70**	**5.43 F'**	**65.33 Kgs**	**22.65 Kg/m^2**	**-------**

Table-3 Comparison of the BMI between Subjects and Controls

Age range	SUBJECT BMI Kg/m^2	CONTROL BMI Kg/m^2	Level of Significant Difference "t" value
18-22	19.61	24.7	2.605*
23-27	15.22	27.57	3.372 *,**
28-32	16.46	12.34	2.866*
33-38	17.30	19.93	1.263*
39-43	22.38	13.61	3.341 *,**
44-48	19.06	25.76	3.558*,**
48-52	26.64	24.29	3.805 *,**
53-57	16.04	31.07	4.914*,**
60±	18.34	24.64	2.402*
Average age 37/39 years	**19.005 Kg/m^2**	**22.65 Kg/m^2**	**2.063***

**0.01, * 0.05 level of significance

- The total number of mental disorder suffering subjects were 70, 42 of them were male, 28 were females.
- The average age of the disease victims was 36 years.
- From the selected subjects 41 were from Urban Bilaspur, rests 29 were from

- rural area.
- The average height was 5.4 feet.
- All the studied subjects belonged to low to lower-middle class families.
- The average weight was 51.7 Kgs .
- The average BMI was 19.005 kg/ M^2
- The level of education was from primary school to post graduation, means diverse level of education showed that it was not the significant contributory factor related with occurrence of depression and suicidal tendencies.
- Out of total subjects thirty one subjects were having problem of substance abuse.
- The all included subjects had Borderline personality disorder (BPD).
- The subjects were not having any other family member suffering from any mental disorder, thus the probability of genetical involvement was curtailed.
- The subjects were already identified mental patients and were already contacted once/ twice to any psychotherapist before registering them in this study.
- Nineteen of them were indoor patients in mental hospital, Sendri, Bilaspur, CG at the start of the study and then they were discharged, six were still admitted at the time of study .
- The age group 23-27 years , 28-32 years and 53-57 years showed lowest body weight along with lower BMI ,less than suggested for this age group in Indians
- by WHO.
- (https://www.who.int/europe/news-room/fact-sheets/item/ahealthylifestyl.WHO. recommendations)
- 5 subjects (20%) subjects were marginally obese.
- People with depression or anxiety may experience weight gain or weight loss due to their mental condition or due to the medications that are prescribed to them. Depression and anxiety can both be associated with overeating, poor food choices and a more sedentary lifestyle. Over time, weight gain may eventually lead to obesity.(Nathan Badillo, Mohammed Khatib,2022), but we observed maximally underweight depressed subjects.
- According to Panel Philip Frank and Markus Jokela (2022) obesity is associated with a distinct set of depressive symptoms. These associations are partially explained by systemic inflammation and obesity-related morbidity. Awareness of this obesity-related symptom profile and its underlying biological correlates may inform better targeted treatments for co-morbid obesity and depression.
- Tricyclic antidepressants, monoamine oxidase inhibitors (MAOIs), serotonin reuptake inhibitors (SSRIs), sertraline (Zoloft) fluoxetine (Prozac) citalopram (Celexa) are commonly prescribed anti-depressant drugs causing over weightiness.
- The all studied subjects were not having higher body weight and BMI, many had much less than the recommendation by WHO for their age group, age group 23-27 and 53-57 showed parameters less than the suggested levels. This might be due to their sluggish body systems due to anti-depressant medicines
- with longer duration of sleeping and lethargy, minimum hunger with poor metabolism.
- Many of them were taking Bupropian , Fluoxetine and Effextor, which are already proved to cause patients less hungry with low metabolic rate , also some were taking Elavil, Vanatrip, Sine quan and Tofranil like medicines , which are already proved to increase sleeping duration with great lethargy

and drowsiness , thus this medication might be the cause of low BMI with less body weight in patients. (https://webmed.com)

- Poor mental health can affect a person's ability to eat, including depression, anxiety, obsessive-compulsive disorder (OCD), and eating disorders, such as anorexia and bulimia. Each of these conditions can affect a person's body image and appetite. (https://www.psychiatry.org/patients-families/eatingdisorders/what-are-eating-disorders)
- About 80 % of the studied subjects were having body weight and BMI lower than the normal values.
- Thus, results of studies concerning the association between obesity and depression were conflicting. Some subjects in this study had a positive association, some had a negative association and some subjects showed no association at all. Most studies, however, examine a linear association between Body Mass Index (BMI) and depression. The present study investigated a nonlinear (U-shaped) trend was preferable over a linear trend that described the relationship between BMI and depression, which meant that both underweight and obesity were associated with depression.
- This result was in alignment with the work done by Leonore M de
- Wit,Annemieke van Straten, 2022.
- The anti-depressants fluoxetine (Prozac) and Bupropion (Wellbutrin) that were in use by four patients , might also lead to weight loss according to the study done by Sun Jae Jung, and Hyung-taek Wooin 2018.
- Weight loss associated with anti-depressants could also happen as a result of reduced appetite or gastrointestinal side effects, such as nausea and upset stomach or diarrhea as per conclusion drawn by the work ofJin-Won Noh, Young Dae Kwon, 2015. According to this study being underweight, it increased the risk or likelihood of depression regardless of gender. In contrast to a large number of studies that investigated the mechanisms that underlie the association between obesity and depression, there were relatively few studies that support the relationship between underweight and depression. Yu et al , 2011 have suggested that people who were underweight might had a negative body image and that their low self-esteem was correlated with depressive symptoms.In certain societies, being underweight might render a negative body image and increased the possibility of depression in men.(Herva, Laitinen, Miettunen, Veijola, Karvonen and Laksy, 2006).However, women who were underweight showed an increased risk of depression in this study and there might be potential underlying biological factors in this relationship. It is possible that low levels of leptin can influence the association between low body weight and depression. Leptin levels are decreased in people with low BMI. (Jequier, E.2002). In addition, leptin is regarded as an effective antidepressant, and there is a strong correlation between low leptin levels and depressive symptoms.(Lawson, Miller, Blum, Meenaghan, Misra and Eddy, 2012)
- Depression can cause weight changes, which may be due to physical changes in the body as a result of depression itself, side effects of anti-depressants or changes in appetite and relationship to food. There is a close link between depression and weight changes, which can work both ways. Drastic changes in weight may affect a person’s emotional state and create physical changes in
- their body that can also affect their mood. Depression can change a person’s eating habits, level of physical activity, and metabolic system, which can all affect weight. Thus, less physical activity due to anti-depressants might be cause of less appetite and low body weight in studied subjects

This observation was matched with the study done by William Kyle Simmons, Kaiping Burrows and Jason A Avery et al , 2020.Changes in appetite, diet, and eating patterns are common in depression.

Depression can cause a loss of appetite, which may lead to weight loss. However, depression may instead cause an increase in appetite and therefore weight gain. Researchers now describe two types of depression:

- **Type 1:** Symptoms of type 1 include a loss of appetite, weight loss, insomnia, and suicidal thoughts.
- **Type 2:** Symptoms of type 2 include increased appetite and weight gain, a feeling of heaviness in the limbs, excessive daytime sleepiness, and poor metabolic profile. (Nicole Washington, DO, 2022)
- Weight loss might occur as people lose interest or pleasure in eating, which might happen in this study also as a result of changes in the brain's reward system that occur with depression. (W. Kyle Simmons, Kaiping Burrows, 2017)
- Research has shown that rates of depression are twice as high in people with obesity as in those without obesity. Researchers are still unsure whether obesity leads to depression or whether depression leads to obesity.
- Depression and obesity may occur as a result of a change in stress responses in the body. Other factors that may link the two conditions include:
- Inflammation
- oxidative stress
- psychological factors, such as the experience of stigma, isolation, or
- exclusion
- changes in appetite regulation
- reduced physical activity
- changes to metabolic, hormonal, and immune systems
- The problem of over-weightiness was expected in subjects as chronic stress is known to alter the pattern of food intake, dietary preference and the rewarding properties of foods. Also related co-morbid condition like PCOD resulted in obesity as concluded by many previous studies. (Eline S. van der Valk, Mesut Savas, and Elisabeth F. C. van Rossum, 2018), but the observation of this study did not much support this relation, as many of the studied depressed subjects were not obese, even below the normal body weight and BMI levels.
- Also, Stress coincides with an increase in factors that enhance cortisol production, such as consumption of food with a high glycemic index and a reduced amount of sleep. This suggested a vicious circle, where increased action of gluco-corticoid, obesity, and stress interact and amplify each other.
- (Knutson KL, Van Cauter E, Rathouz PJ, DeLeire T, Lauderdale DS 2010 and Cohen S, Janicki-Deverts D.2012). The same trend of obesity pattern was observed in near 20 % of the studied stressed subjects.
- Stress driven high levels of cortisol can increase appetite with a preference for "comfort food" and cause white adipose tissue to redistribute to the abdominal region, which may ultimately lead to abdominal obesity. Interestingly, it had been observed that gluco-corticoids decrease the sensitivity to adrenergic stimulation of brown fat. Furthermore, exogenous gluco-corticoid administration increases the intra-hepatic conversion of cortisone to cortisol thereby potentially contributing to the vicious circle. (Fardet L, Feve B. 2014, van Rossum EF,2017 and Barclay JL, Agada H, Jang C, Ward M, Wetzig N, Ho KK, 2015). Thus, observed stress driven obesity might be the result of increased secretion of cortisol in studied subjects as confirmed by the above cited studies.

- The calculated average BMI was 19.005 kg/ $m^{2,}$ it was within normal range, because although many subjects were having BMI below normal, but near 20 % of the subjects were having BMI towards obesity. (ww.https://healthifyme. Com)
- As most of the studied subjects were lean, those girls and women were having also stress due to their bad body shape. Eight of them contacted gynecologists initially only for the correction of their state of leanness.
- A significant negative correlation was observed between level of stress assessed by SIDAS and Body weight of the studied subjects (r = 0.498)
- Also, a significant positive correlation was observed between level of stress assessed by SIDAS and BMI of the studied subjects (r = -0.780), means more the level of stress, lower the body weight with reduced waist, hip circumference .
- A significant negative correlation between BMI and level of stress was also observed in the studied subjects. (r = - 0.455)

Table-4 Level of Depression assessed by HAMILTON Scale (HAM-A) **in subjects (n =70)**

Age range	Weight in Kgs	BMI Kg/m^2	Education	Score by HAMILTON Test	Level of correlation with body weight
18-22	51	19.61	School	21	
23-27	44	15.22	Graduate	24	
28-32	41	16.46	school	23	**- 0.780**
33-38	50	17.30	Post graduate	21	
39-43	60	22.38	Primary school	22	
44-48	57	19.06	graduate	21	
48-52	69	26.64	High School	20	Level of
53-57	43	16.04	Primary School	24	correlation with
60±	51	18.34	Primary school	23	BMI
Average age 37years	51.7 Kgs	19.005 Kg/m^2	----------	22.4	**- 0.455**

A significant negative correlation was observed between body weight and BMI with level of depression, stress, anxiety and suicidality, means lower the body weight and BMI, higher the level of abnormal psychological profile. This was might be due to less hunger with low BMI , due to medicine or disease drive somnolence , this observation was in association with the work done by Franziska U C E Jung et al in 2023.

Table 5 Level of Depression assessed by HAMILTON Scale (HAM-A) **in Controls (n=70)**

Age range	Weight in Kgs	BMI Kg/m^2	Education	Score by HAMILTON Test	Level of correlation with body weight
18-22	62	24.7	High School	3	

23-27	59	27.57	High school	5	**0.351**
28-32	58	12.34	Graduate	2	
33-38	60	19.93	graduate	7	
39-43	64	13.61	Post graduate	6	
44-48	67	25.76	Technical graduate	3	Level of correlation with BMI
48-52	71	24.29	Graduate	6	
53-57	78	31.07	High School	6	
60±	69	24.64	High school	7	**0.297**
Average age 39 years	65.33 Kgs	22.65 Kg/m^2	--------	5	

- The healthy controls showed insignificant correlation with body weight and BMI level with their scores tested by HAMILTON test. The scores also showed no presence of any abnormal mental status.
- The studied subjects showed significantly high score of depression and suicidal tendency on an average by HAMILTON test as expected. .
- Also, a significant level of negative correlation was found to be existed between the higher body weights and level of depression with suicidal tendency means lower the body weight, higher the level of depression and suicidal tendency.
- A significant negative correlation was observed between BMI and score gained by HAMILTON scale, means the lower the BMI, higher the level of depression & suicidality as shown by the higher scores.
- The result was partially in trend by the work done by Xiying Fu,Yicun Wang,Fangyi Zhao, 2023. They concluded that Acute/chronic inflammation, gut microbiota imbalance, gut-brain dysfunction, diminished neuro-plasticity and HPA axis dysfunction were common mechanisms in the pathogenesis of depression and several of these effects often co-occured in depression and also affected obesity at the same time, because those studied subjects were having moderately normal or over body weight showed score above 20-21, which was considered as high score.
- These factors would potentially provide a disease driven , biologically based multi-level description of weight abnormality and depression. The characterization of the mechanisms of action of adipokines and lipokines and the identification of molecular targets of adipokines and lipokines provided basis of co-morbidities of weight abnormalities and depression.
- The age group showing lower body weight and BMI showed highest level of score by the HAMILTON rating scale in this study, thus the result was not in trend with the work done by Cristian Ramos-Vera, Antonio Serpa Barrientos, 2022.
- This observation was in trend with the work done by Sun Jae Jung,&Hyungtaek Woo in 2018.
- The study done by Sun Jae Jung&Hyung-taek Woostated that underweight (BMI <18.5 kg/m^2) increased the risk of depression onset in both longitudinal and cross-sectional settings. In addition the stated study also concluded that being overweight (BMI 25.0–29.9 kg/m^2) decreased the risk of depression in men and increased the risk in women in cohort designs. Being obese (BMI

- ⩾30 kg/m^2) increased the risk and likelihood of depression in both longitudinal and cross-sectional designs. In cross-sectional studies, people with more severe obesity (BMI ⩾40 kg/m^2) showed a stronger association, which reflects a dose-response pattern. Thus the association between body weight , BMi and level of depression was found conflicting as some depressed subjects was obese , but many of them were lean , even significantly underweight. This pattern was also observed by a study done by Sun Jae Jung, Hyung-taek Woo, 2018.
- Also the level of education did not observed as influencer factor in this study, as no significant correlation was observed between these two factors.
- This conclusion was not in accordance with the work done by Michael J. McFarland and Brandon G. Wagner in 2016, which concluded that having a college degree or higher education was inversely associated with depressive symptoms and suicidal tendenc.
- The observation was reinforced the conclusion drawn by the work of Brent S. Medoff , Brandon M. Herbert in 2021 that education has no effect on level of depression and suicidal tendency.

Table-6 Level of Depression assessment by SIS -MAP and SIDAS Scale (n=70)

Age range	Body weight in Kgs	SIS-MAP SCALE	Level of correlation with body weight	SIDAS SCALE	Level of correlation with body weight
18-22	51	28	**-0.68726**	43	**-0.85678**
23-27	44	30		47	
28-32	41	34		48	
33-38	50	27		43	
39-43	60	29	Level of correlation with BMI **-0.52299**	42	Level of correlation with BMI **-0.78881**
44-48	57	28		44	
48-52	69	27		42	
53-57	43	33		47	
60±	51	27		45	
Average age 37 years	51.7 Kgs	29.22		44.55	

- The psychological profile of the selected subjects was also assessed by SISMAP (Scale for Impact of Suicidality - Management, Assessment and Planning of Care (SIS-MAP) test.
- The score 23-32 consider psychosis, previous suicide attempts.
- Scores >33 = admit highly recommended
- The average score by SIS-MAP test was 29.22, which showed state of psychosis with previous suicidal attempts.
- The age group 23-27 and 53-57 showed maximum scores.
- The SIS –MAP score showed a significant negative correlation with body weight, means lower the body weight, higher the score in SIS-MAP test, also the BMI showed negative correlation with the score by SIS-MAP test.

- This conclusion was in agreement with the work done by Jeongmin Lee, Jin-Hyung Jung in 2024.
- A study conducted in Sweden revealed that, for each 5 kg/m^2 increase in BMI, the risk of suicide decreased by 15%. Similarly, a study using data from the U.S. National Health Interview Surveys demonstrated that, with each 5 kg/m^2 increase in BMI, the risk of suicide decreased by 18% for men and 24% for women.(Mark S Kaplan, Bentson H Mc Farland, Nathalie Huguet, 2007)

Table –7 Level of correlation among Psychological Tests and Body weight

Age range	Body weight in Kgs	BMI	SINAS SCALE SCORE	Correlation with body weight	8 SQ SCALE of Quran & Cattle Scores for Major Deep epression (MDD)	Correlation with body weight
18-22	51	19.61	8	**-0.818**	3.99	**-0.706**
23-27	44	15.22	7		4.83	
28-32	41	16.46	9		4.89	
33-38	50	17.30	9	Correlation with BMI **- 0.554**	3.77	Correlation with BMI **-0.568**
39-43	60	22.38	7		3.69	
44-48	57	19.06	8		3.82	
48-52	69	26.64	10		4.11	
53-57	43	16.04	8		4.94	
60±	51	18.34	7		4.33	
Average age 37 years	51.7 Kgs	19.005	8.11		4.26	

- Suicidal intrusions are uncontrollable, intrusive mental images (e. g., visualizing a future suicidal status). They may also be called suicidal "flashforwards." Despite the importance of integrating the assessment of suicidal intrusions into a clinical routine assessment, the SINAS test was used. The
- SINAS study describes the development of a new instrument-Suicidal Intrusions Attributes Scale (SINAS)-to assess the severity and characteristics of suicidal intrusions and examines its psychometric properties. To assess this mental condition of the psychological profile of the studied subjects, SINAS test was also applied on the subjects with depression and suicidality.
- The 10 pointer SINAS scale showed that most of the studied subjects were having score above 7, means all were having Suicidal intrusions.
- The maximum score was showed by the age group who had lowest body weight and lowest BMI.
- A significant negative correlation was observed between body weight and score in SINAS scale, means lower the body weight and BMI, higher the level and frequency of Suicidal intrusions.

- This observation was in accordance with the work done by Haesoo Kim, Hong Jin Jeon, 2018. The study also stated that underweight individuals were not the only ones who were found to have a higher risk for suicidal behaviors. The subjective well-being of underweight individuals seemed to be lower than that of other BMI groups. Individuals who were underweight perceived themselves to be suffering from severe stress and they were also more likely to express dis-satisfaction with their life. The underweight group in stated study consisted of mostly females (nearly 80%) who are younger and single, possibly with higher sensitivity to their body size. The females were more likely to believe that they are overweight and their perception of being overweight was associated with poorer life satisfaction. In other words, underweight individuals in our study were found to believe that they are overweight (although physically, they are actually not), and perhaps a consequence of this is their poorer life satisfaction. Another explanation for the severe stress and life dissatisfaction of the underweight group could be related to a shared personality trait such as neuroticism. A number of existing studies found a high level of neuroticism among under-weight individuals and among those with anorexia nervosa . Neuroticism was also associated with a lower level of happiness. Our study did not consider the potentially confounding variables of either subjective perception of body size or personality traits, so future studies should examine each when investigating one's psychological wellbeing.

Table –8 Level of correlation between various Psychological Tests applied

Age range	SIDAS SCALE	SIS-MAP SCALE	Level of correlation between both the tests	SIDAS SCALE	8 SQ test of Quran & Kettle SCALE	Level of correlation between both the tests
18-22	44	30		44	8	
23-27	47	28		47	7	
28-32	48	34		48	9	
33-38	49	30		49	9	
39-43	47	31	**0.520**	47	7	**0.594**
44-48	48	31		48	8	
48-52	49	33		49	10	
53-57	44	32		44	8	
60±	42	27		42	7	
Average age 37 years	46.88	30.66		46.88	8.11	

- A significant positive correlation was observed between all the scores showed by the various used psychological tests.
- That showed the applied psychological tests used were in alignment.

Conclusion

The suicide attempters with high level of depression and stress showed low BMI in comparison with the

healthy controls, this might be due to food aversion due to their mental condition , also might be due to medication they were taking , because most of the antidepressant medicines have side effect of food aversion. The subjects stress level was observed higher than healthy controls as expected, also tests conducted by various tests as HEMILTON, 8SQ Test and SI-MAP , SIDAS all showed results in alignment , with significant level of correlation , thus conforming the subjects disturbed mental profile.

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