Relationships between obesity, bipolar spectrum features, and personality traits: a case-control study

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Abstract. – OBJECTIVE: Recently there has been widening stream of research on the relationships between obesity and mental disorders. Patients with obesity seem to be prone to developing bipolar spectrum disorders and they present with specific personality traits. The aim of this study was to analyze the associations between obesity, bipolarity features, and personality traits.

PATIENTS AND METHODS: A nested case-control study was performed. Patients with obesity constituted the sample of cases (N = 90), and healthy individuals were ascribed to the control group (N = 70). The lifetime presence of bipolarity features was analyzed with the Mood Disorder Questionnaire (MDQ), while personality traits were assessed with the NEO-Five Factor Inventory (NEO-FFI).

RESULTS: Bipolarity features were more prevalent in the patients with obesity, as compared to healthy individuals. Patients with obesity had both higher mean value of MDQ score (*p* = 0.01) and a higher proportion of subjects with MDQ score ≥ 7 points (*p* = 0.012) as well as lower score on the NEO-FFI openness to experience (*p* > 0.001), compared to control subjects. Using multivariate model, in patients with obesity, a significant positive correlation between bipolarity and neuroticism, and negative with agreeableness and conscientiousness was established. Such relationship was not observed in control subjects.

CONCLUSIONS: In the population of patients with obesity, there is a specific combination between bipolarity and personality traits (high-trait neuroticism, low-trait conscientiousness, and low-trait agreeableness). This may have some consequences for both pharmacological and psychological management of such patients.

Key Words:
   Obesity, Bipolarity, Personality, Mood Disorder Questionnaire, NEO-five factor inventory.

Introduction

Contemporarily, obesity remains at the forefront of medical challenges worldwide. In the past two decades the global burden of disorders related to high body mass index has increased by 40%, illustrating the on-going pandemic of obesity[1], apparently unaffected by any public health measures. Since obesity is conceptualized as 'the result of people responding normally to the obesogenic environment they find themselves in'[2], healthcare interventions keep on focusing on individual, rather than societal level. Therefore, the research into clinical correlates and risk factors for obesity remain highly important.

Studies on the relationships between severe mental disorders and obesity have been gaining momentum in recent years. Consequently, it has been recognised that schizophrenia, bipolar disorder (BD), major depressive disorder (MDD), and obesity may be mutually related[3,4]. As com-

pared to general population, subjects with affective disorders are more likely to develop obesity[5,6] and the presence of metabolic syndrome is related to less favourable outcomes in patients with BD and MDD[7].

Lately, there has been widening stream of research on the relationships between obesity and personality or temperamental features. As indicated in the recent systematic reviews by Jokela et al[8] and Gerlach et al[9] various personality traits play either protective role or serve as risk factors for obesity. Accordingly, neuroticism (alongside impulsivity and sensitivity to reward) seems to increase the likelihood of developing overweight or obesity, while conscientiousness (as characterized by marked self-control, orderliness, and adherence to social norms) is related to lower risk for obesity.

Also, the possible links between personality traits and mental disorders have been comprehensively analyzed[10-13]. According to the STEP-BD trial, subjects with bipolar disorder exhibit with high-trait neuroticism and openness to experience, as opposed to low-trait extraversion, conscientiousness, and agreeableness[11]. However, the research base on the relationships between the 'soft' bipolar spectrum, personality features, and co-morbid medical conditions remains scarce[14]. Notably, in a recent study by Vannucchi et al[15] obesity has been identified as a risk factor for bipolarity in patients with major depressive disorder (MDD), yet this finding needs to be considered as preliminary. In our recent study we demonstrated a significant relationship between bipolar features and neuroticism personality traits in women with postpartum depression[16] and it is possible that such an association may be also present in obese subjects.

The aim of this case-control study was to compare the bipolarity features and personality traits, and their relationship, in the groups of obese and control subjects.

Patients and Methods

Participants

The participants of this nested case-control study were divided into two groups. The cases sample was constituted by 90 patients with obesity (BMI $\geq$ 30 kg/m^2) provided with treatment in the 2nd Department of General Surgery, Jagiellonian University, Collegium Medicum (Cracow, Poland). The controls were recruited from a population of 70 healthy volunteers (BMI: 18.5-24.99 kg/m^2). The study protocol had been approved by the Bioethics Committee of the Jagiellonian University. Prior to the participation in the study all the subjects expressed the informed consent.

Overall, 114 individuals were addressed to join the study. Twenty patients refused to participate, and 4 had been diagnosed with major mental disorders (3 cases of MDD, and 1 case of schizophrenia). Out of the healthy subjects, 70 were enrolled in the project[17].

The detailed socio-demographic and clinical profiles of the participants have been presented in Table I.

As seen in the table, apart from the BMI, there are no significant differences between obese and non-obese group.

Psychometric Measures

Mood Disorder Questionnaire (MDQ)

We assessed the lifetime presence of bipolarity features by using the Mood Disorder Questionnaire (MDQ)[18]. The MDQ has been developed as a self-rating screening tool to facilitate diagnosis of the DSM-IV-defined bipolar spectrum disorders (i.e. BD-I, BD-II, and BD not otherwise specified). The symptomatic part of the Mood Disorder Questionnaire (MDQ) contains 13 hypomanic symptoms, and the cut-off point

Table I. Sociodemographic features of the study population.

	Mean age (years) ± SD	Mean BMI ± SD	Women	High education	Employees	Married/civil partnership	City dwellers
Cases (N = 90)	41.8 ± 11.8	38.1 ± 7.0*	61 (67.8%)	42 (47%)	64 (71%)	64 (71%)	71 (79%)
Controls (N = 70)	38.5 ± 12.9	21.6 ± 2.1*	42 (60%)	42 (60%)	52 (74%)	55 (79%)	50 (75%)
The whole sample (N = 160)	40.2 ± 12.4	29.9 ± 4.6	103 (64%)	84 (53%)	116 (73%)	119 (74%)	121 (76%)

SD – standard deviation; *$p < 0.05$.

for bipolarity has been established as the presence of 7 or more symptoms. The validation of the Polish version of MDQ has been described previously[19]. In our present study we decided to take only the symptomatic parts of these scales into account. The part of scale assessing deficiency of functioning during hypomania is problematic, since the majority of patients do not acknowledge such a deficiency and some even voice an improvement of their functioning.

NEO-Five Factor Inventory (NEO-FFI)

In order to analyze the personality traits we were using the NEO-Five Factor Inventory (NEO-FFI)[20]. This validated self-rating questionnaire consists of five 12-item categories, pertaining to specific personality dimensions (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness).

Statistical Analysis

The socio-demographic data, as well as the MDQ and the NEO-FFI scores, are presented as the means ± SD or as the percentages. Shapiro-Wilk test was applied to check for normal distribution. In case of normal distribution, the one-way analysis of variance (ANOVA) test and unpaired *t*-test was used. In case of non-normal distribution, we employed non-parametric Mann-Whitney test and the Kruskal-Wallis one-way analysis of variance. Pearson's chi-square (χ^2) test and Fisher's exact test were used for differences in percentage distributions. The correlations between the MDQ scores and personality features were assessed with the Spearman's rank correlation analysis. Also, the multiple regression was performed where the bipolarity features was an dependent variable, and the NEO-FFI scores were independent variables, adjusting for age, gender, marital status, body mass index and

family history of mental disorders. Calculations were performed using the Statistica (StatSoft) version 10 statistical package. The level of statistical significance was determined at $p < 0.05$.

Results

The comparison of MDQ and NEO-Five-Factor Inventory scores in subjects with obesity and in healthy controls is shown in Table II.

As compared to the healthy controls, patients with obesity obtained significantly higher values on the MDQ and higher percentages of MDQ ≥ 7 and scored significantly lower on the NEO-FFI cluster of openness to experience.

In Table III, the analysis of relationship between bipolarity, measured by the MDQ, and the NEO-FFI personality traits in subjects with obesity and in healthy controls are shown. Both correlation analysis as well as a multivariate model, including age, gender, marital status, body mass index and family history of mental disorders were performed

The obese individuals with bipolarity traits had been scoring notably higher on the NEO-FFI cluster of neuroticism and lower on the NEO-FFI items of agreeableness and conscientiousness (as indicated by the multiple logistic regression model). In patients with obesity we found positive correlation between trait neuroticism and MDQ. No such correlation was present in healthy individuals.

Discussion

The results of our study indicate that, in comparison with healthy individuals, patients with obesity are more likely to exhibit with bipolarity

Table II. Comparison of MDQ and NEO-Five-Factor Inventory scores in subjects with obesity and in healthy controls.

	Cases N = 90	Controls N = 70	test	*p*
MDQ – mean value	4.52 ± 3.16	3.34 ± 2.58	Mann-Whitney	0.03
MDQ –percentage of subjects ≥ 7 points	25.6%	8.6%	Chi-square	0.01
Neuroticism	22.5 ± 9.4	20.9 ± 9.3	t-test	0.39
Extraversion	27.4 ± 6.5	29.0 ± 7.1	*t*-test	0.26
Openness to experience	26.0 ± 4.9	28.8 ± 4.7	*t*-test	**< 0.001**
Agreeableness	31.5 ± 5.2	30.0 ± 5.3	*t*-test	0.17
Conscientiousness	32.6 ± 6.2	32.1 ± 8.3	*t*-test	0.72

Statistical significance is marked in bold.

Table III. Bipolarity measured by MDQ and NEO personality traits. Correlation and multivariate model, including age, gender, marital status, body mass index and family history of mental disorders.

	Cases (n = 90)		Controls (n = 70)	
	Correlation (Spearman's r)	Multivariate model OR (95% CI)	Correlation (Spearman's r)	Multivariate model OR (95% CI)
Neuroticism	0.22[#]	1.09 (1.003-1.18)*	0.14	1.01 (0.91-1.12)
Extraversion	-0.12	0.95 (0.87-1.05)	0.08	0.97 (0.82-1,15)
Openness to experience	-0.15	0.91 (0.80-1.04)	0.08	0.84 (0.66-1.08)
Agreeableness	-0.21	**0.81** (0.70-0.94)**	-0.11	0.96 (0.79-1.16)
Conscientiousness	-0.13	**0.90** (0.81-0.99)*	-0.02	1.05 (0.93-1.18)

[#]Statistically significant correlation $p = 0.04$. Statistical significance of regression analysis is marked in bold, *$p < 0.05$; **$p < 0.01$.

features. This finding replicates the extant data suggesting that the traits of bipolarity are more common in subject with obesity, as compared to non-obese individuals[15,21,22].

In terms of personality features, we found that openness to experience is negatively associated with obesity, thus replicating results of the previous studies by Brummett et al[23] and Armon et al[24]. We also concluded that subjects diagnosed with obesity who obtained ≥ 7 patients on the MDQ, suggesting a history of lifetime hypomanic symptoms[18], tend to exhibit with high-trait neuroticism, and low-trait agreeableness and conscientiousness. On the other hand, we found no distinct interconnections between bipolarity and personality traits in the sample of non-obese individuals.

Overall, our study provides with preliminary evidence suggesting that in the population of patients with obesity, specific personality traits may indicate the presence of bipolarity features, possibly facilitating the pathway to the correct diagnosis (particularly among the patients with recurrent depression[15]. The significantly higher ratio of the positive MDQ screening in the obesity sample (as compared to the non-obese controls) has been consistent with the results of previous studies, indicating that obesity shall be considered as "candidate biomarker" for bipolar spectrum disorders[21,22].

Our finding linking the presumed bipolarity features (as defined by the positive MDQ screening) to high-trait neuroticism remains in line with the data presented by Akiskal et al[25] who suggested that robust neuroticism is a common feature of both BD type II and MDD (as opposed to BD type I). Since the diagnostic construct of the 'soft' BSD fills the area between the above-mentioned disorders[26-29], it may be hypothesized that the statement by Akiskal et al. would also pertain to subjects with bipolarity features. This is also in line with the results of our recent study in which we demonstrated a significant relationship between bipolar features and neuroticism personality traits in women with postpartum depression[16].

The fact that patients with both obesity and bipolarity features exhibited with lower-trait agreeableness and conscientiousness (as opposed to obese individuals without bipolarity traits) is an important contribution of our study. Since the high-trait conscientiousness has been linked to lower risk for developing obesity[8], it may be supposed that the merger of high-trait neuroticism, low-trait agreeableness and low-trait conscientiousness might denote the presence of bipolarity features in patients with obesity. Nevertheless, this hypothesis needs verification in course of further studies.

Conclusions

On a practical level, our study implies that incorporation of personality assessment into the diagnostic strategies in patients with obesity may facilitate the task of diagnosing BSD. Notably, the evaluation of neuroticism, agreeableness, and conscientiousness may help differentiate obese individuals with major depressive disorder from those with BSD[16]. This idea remains in line with the recent statement by Jokela et al[8], calling for broader incorporation of personality assessment into prevention and treatment strategies for patients with obesity.

The main limitations of this research are due to the case-control design of the study (indicating higher risk of recall bias), and indirectness of the conclusions (i.e. the use of the MDQ screening instead of a structured diagnostic tool)[30].

Conflict of Interest

The Authors declare that there are no conflicts of interest.

References

1) BIKBOV B, PERICO N, REMUZZI G. Mortality landscape in the global burden of diseases, injuries and risk factors study. Eur J Intern Med 2014; 25: 1-5.

2) SWINBURN BA, SACKS G, HALL KD, MCPHERSON K, FINEGOOD DT, MOODIE ML, GORTMAKER SR. The global obesity pandemic: shaped by global drivers and local environments. Lancet 2011; 378: 804-814.

3) MITCHELL AJ, VANCAMPFORT D, SWEERS K, VAN WINKEL R, YU W, DE HERT M. Prevalence of metabolic syndrome and metabolic abnormalities in schizophrenia and related disorders--a systematic review and meta-analysis. Schizophr Bull 2013; 39: 306-318.

4) GOLDSTEIN BI, LIU SM, ZIVKOVIC N, SCHAFFER A, CHIEN LC, BLANCO C. The burden of obesity among adults with bipolar disorder in the United States. Bipolar Disord 2011;13: 387-395.

5) LUPPINO FS, DE WIT LM, BOUVY PF, STIJNEN T, CUIJPERS P, PENNINX BW, ZITMAN FG. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. Arch Gen Psychiatry 2010; 67: 220-229.

6) MCELROY SL, KECK PE, JR. Metabolic syndrome in bipolar disorder: a review with a focus on bipolar depression. J Clin Psychiatry 2014; 75: 46-61.

7) MCINTYRE RS, ALSUWAIDAN M, GOLDSTEIN BI, TAYLOR VH, SCHAFFER A, BEAULIEU S, KEMP DE; CANADIAN NETWORK FOR MOOD AND ANXIETY TREATMENTS (CANMAT) TASK FORCE. The Canadian Network for Mood and Anxiety Treatments (CANMAT) task force recommendations for the management of patients with mood disorders and comorbid metabolic disorders. Ann Clin Psychiatry 2012; 24: 69-81.

8) JOKELA M, HINTSANEN M, HAKULINEN C, BATTY GD, NABI H, SINGH-MANOUX A, KOVIMAKI M. Association of personality with the development and persistence of obesity: a meta-analysis based on individual-participant data. Obes Rev 2013;14: 315-323.

9) GERLACH G, HERPERTZ S, LOEBER S. Personality traits and obesity: a systematic review. Obes Rev 2014; 16: 32-36.

10) OHI K, HASHIMOTO R, YASUDA Y, FUKUMOTO M, YAMAMORI H, IWASE M, KAZUI H, TAKEDA M. Personality traits and schizophrenia: evidence from a case-control study and meta-analysis. Psychiatry Res 2012; 198: 7-11.

11) BARNETT JH, HUANG J, PERLIS RH, YOUNG MM, ROSENBAUM JF, NIERENBERG AA, SACHS G, NIMGAONKAR VL, MIKLOWITZ DJ, SMOLLER JW. Personality and bipolar disorder: dissecting state and trait associations between mood and personality. Psychol Med 2011; 41: 1593-1604.

12) MIDDELDORP CM1, DE MOOR MH, MCGRATH LM, GORDON SD, BLACKWOOD DH, COSTA PT, TERRACCIANO A, KRUEGER RF, DE GEUS EJ, NYHOLT DR, TANAKA T, ESKO T, MADDEN PA, DERRINGER J, AMIN N, WILLEMSEN G, HOTTENGA JJ, DISTEL MA, UDA M, SANNA S, SPINHOVEN P, HARTMAN CA, RIPKE S, SULLIVAN PF, REALO A, ALLIK J, HEATH AC, PERGADIA ML, AGRAWAL A, LIN P, GRUCZA RA, WIDEN E, COUSMINER DL, ERIKSSON JG, PALOTIE A, BARNETT JH, LEE PH, LUCIANO M, TENESA A, DAVIES G, LOPEZ LM, HANSELL NK, MEDLAND SE, FERRUCCI L, SCHLESSINGER D, MONTGOMERY GW, WRIGHT MJ, AULCHENKO YS, JANSSENS AC, OOSTRA BA, METSPALU A, ABECASIS GR, DEARY IJ, RÄIKKÖNEN K, BIERUT LJ, MARTIN NG, WRAY NR, VAN DUIJN CM, SMOLLER JW, PENNINX BW, BOOMSMA DI. The genetic association between personality and major depression or bipolar disorder. A polygenic score analysis using genome-wide association data. Transl Psychiatry 2011; 1: e50.

13) NEWTON-HOWES G, TYRER P, JOHNSON T, MULDER R, KOOL S, DEKKER J, SCHOEWERS R. Influence of personality on the outcome of treatment in depression: systematic review and meta-analysis. J Pers Disord 2014; 28: 577-593.

14) AKISKAL HS, MALLYA G. Criteria for the "soft" bipolar spectrum: treatment implications. Psychopharmacol Bull 1987; 23: 68-73.

15) VANNUCCHI G, TONI C, MAREMMANI I, PERUGI G. Does obesity predict bipolarity in major depressive patients? J Affect Disord 2014; 155: 118-122.

16) DUDEK D, JAESCHKE R, SIWEK M, MĄCZKA G, TOPÓR-MĄDRY R, RYBAKOWSKI J. Postpartum depression: Identifying associations with bipolarity and personality traits. Preliminary results from a cross-sectional study in Poland. Psychiatry Res 2014; 215: 69-74.

17) SIWEK M, DUDEK D, JAESCHKE R, DEMBIŃSKA-KIEĆ A, WITKOWSKI L, ARCISZEWSKA A, HEBAL F, MATŁOK M, MALCZEWSKA-MALEC M, WNĘK D, PILECKI MW, MAJOR P, EPA R, RYBAKOWSKI J. Bipolar spectrum features in obese individuals. Psychiatr Pol 2015; 49: 993-1004.

18) HIRSCHFELD RM, WILLIAMS JB, SPITZER RL, CALABRESE JR, FLYNN L, KECK PE, JR., LEWIS L, MCELROY SL, POST RM, RAPPORT DJ, RUSSELL JM, SACHS GS, ZAJECKA J. Development and validation of a screening instrument for bipolar spectrum disorder: the Mood Disorder Questionnaire. Am J Psychiatry 2000; 157: 1873-1875.

19) KIEJNA A, PAWLOWSKI T, DUDEK D, LOJKO D, SIWEK M, ROCZEN R, RYBAKOWSKI JK. The utility of Mood Disorder Questionnaire for the detection of bipolar diathesis in treatment-resistant depression. J Affect Disord 2010; 124: 270-270.

20) MCCRAE RR, COSTA PT. A contemplated revision of the NEO Five-Factor Inventory. Pers Indiv Differ 2004; 36: 587-596.

21) ALCIATI A, D'AMBROSIO A, FOSCHI D, CORSI F, MELLADO C, ANGST J. Bipolar spectrum disorders in severely obese patients seeking surgical treatment. J Affect Disord 2007; 101: 131-138.

22) ALCIATI A, GESUELE F, RIZZI A, SARZI-PUTTINI P, FOSCHI D. Childhood parental loss and bipolar spectrum in obese bariatric surgery candidates. Int J Psychiatry Med 2011; 41: 155-171.

23) BRUMMETT BH, BABYAK MA, WILLIAMS RB, BAREFOOT JC, COSTA PT, SIEGLER IC. NEO personality domains and gender predict levels and trends in body mass index over 14 years during midlife. J Res Pers 2006; 40: 222-236.

24) ARMON G, MELAMED S, SHIROM A, SHAPIRA I, BERLINER S. Personality traits and body weight measures: concurrent and across-time associations. Eur J Pers 2013; 27: 398-408.

25) AKISKAL HS, KILZIEH N, MASER JD, CLAYTON PJ, SCHETTLER PJ, TRACI SHEA M, ENDICOTT J, SCHEFTNER W, HIRSCHFELD RM, KELLER MB. The distinct temperament profiles of bipolar I, bipolar II and unipolar patients. J Affect Disord 2006; 92: 19-33.

26) AKISKAL HS. The bipolar spectrum--the shaping of a new paradigm in psychiatry. Curr Psychiatry Rep 2002; 4: 1-3.

27) ANGST J. The bipolar spectrum. Br J Psychiatry 2007; 190: 189-191.

28) FERENSZTAJN E, RYBAKOWSKI J. Staging of bipolar affective illness. Psychiatr Pol 2012; 46: 613-626.

29) FERENSZTAJN E, REMLINGER-MOLENDA A, RYBAKOWSKI J. Staging of unipolar affective illness. Psychiatr Pol 2014; 48: 1127-1141.

30) GUYATT GH, OXMAN AD, VIST G, KUNZ R, BROZEK J, ALONSO-COELLO P, MONTORI V, AKL EA, DJULBEGOVIC B, FALCK-YTTER Y, NORRIS SL, WILLIAMS JW JR, ATKINS D, MEERPOHL J, SCHÜNEMANN HJ. GRADE guidelines: 4. Rating the quality of evidence--study limitations (risk of bias). J Clin Epidemiol 2011; 64: 407-415.