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Clinical correlates of insomnia symptoms in overweight and obese patients qualified for weight management intervention

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Clinical correlates of insomnia symptoms in overweight and obese patients qualified for weight management intervention

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Abstract

Background: Insomnia symptoms are common among individuals with overweight and obesity, yet their clinical significance in this population remains insufficiently understood. In particular, it remains unclear whether insomnia symptoms may serve as a marker of the multidimensional comorbidities associated with excess body weight, including psychiatric symptoms, impaired quality of life, and metabolic disturbances.

Methods: A total of 97 adult outpatients eligible for a weight management intervention were enrolled in this cross-sectional study. Participants underwent anthropometric and laboratory assessments and completed self-report questionnaires evaluating insomnia symptoms (Athens Insomnia Scale, AIS), daytime sleepiness (Epworth Sleepiness Scale), depressive symptoms (Patient Health Questionnaire-9), anxiety symptoms (Generalized Anxiety Disorder-7), quality of life (EuroQol 5-Dimension 5-Level Questionnaire), and food addiction symptoms (Modified Yale Food Addiction Scale 2.0).

Results: Participants with insomnia symptoms constituted 56.7% of the study sample. Compared with those without insomnia symptoms, they demonstrated significantly higher levels of depressive and anxiety symptoms, daytime sleepiness, poorer quality of life, and higher prevalence and severity of food addiction. No positive correlation was observed between insomnia symptoms and BMI or metabolic parameters.

Conclusions: These findings suggest that insomnia symptoms may represent a clinically relevant marker of psychiatric and behavioral burden in this population and highlight the potential value of routine screening for insomnia symptoms in obesity management clinics.

Level of evidence Level III: Evidence obtained from well-designed cohort or case-control analytic studies.

Key words: obesity management, insomnia, depression, anxiety, food addiction, metabolic dysfunction

1. Introduction

Over the past decades, obesity has emerged as a major global health challenge, with the worldwide prevalence of adult obesity more than doubling since 1990 [1]. Excess body weight is associated with numerous adverse health outcomes, including both somatic and psychiatric comorbidities [2]. Moreover, individuals with obesity have an approximately two- to threefold higher risk of mortality and a reduction in life expectancy of 10–30 years [3,4].

Obesity is now widely recognized as a complex, multifactorial disease resulting from interactions between genetic, metabolic, neuroendocrine, behavioral, and environmental factors [5]. Its development is influenced by lifestyle-related factors, including an unhealthy diet, physical inactivity, and chronic stress, as well as by genetic susceptibility and metabolic and neuroendocrine disturbances [6,7]. Obesity is also closely associated with several common mental disorders, particularly depression, anxiety, and sleep disorders. These conditions frequently coexist in clinical practice and represent an important focus of routine assessment in primary care. However, despite extensive research, the mechanisms underlying the associations between obesity and these psychiatric conditions remain incompletely understood [8,9,10,11].

Among sleep disorders, insomnia appears to be particularly relevant in individuals with overweight and obesity [12,13]. It is typically defined as persistent difficulty initiating or maintaining sleep, or early morning awakening despite adequate opportunity for sleep, accompanied by impaired daytime functioning [14]. Epidemiological studies indicate that insomnia symptoms are more prevalent among individuals with excess body weight than in the general population [15]. Like obesity, insomnia is associated with an increased risk of hypertension, type 2 diabetes mellitus, and cardiovascular disease [3,4,9]. In addition, insomnia has consistently been linked to a broad spectrum of psychiatric disorders, particularly depression and anxiety [16], as well as to behavioral and substance-related addictions [17,18,19]. Emerging evidence also suggests that insomnia is associated with unhealthy lifestyle behaviors, including food addiction [16,10,21]. Furthermore, both obesity and insomnia have been shown to adversely affect quality of life [22,23].

Despite growing evidence linking excess body weight and insomnia at the population level [9], it remains unclear whether insomnia symptoms reflect the clinical burden of obesity, including its psychiatric, behavioral, and metabolic manifestations. In particular, the clinical significance and practical implications of insomnia symptoms in patients with obesity has not been sufficiently characterized. A better understanding of the clinical correlates of insomnia across psychiatric, quality-of-life, and metabolic domains may improve the

comprehensive assessment of patients seeking obesity treatment. Although previous studies have demonstrated an association between obesity and insomnia [12,13], evidence directly applicable to routine clinical practice - such as whether insomnia symptoms identify patients with a greater burden of comorbidities - remains limited. To our knowledge, no previous study has comprehensively evaluated these associations within a unified clinical framework of patients referred for a weight management intervention.

Therefore, the aim of this cross-sectional study was to investigate whether insomnia symptoms are associated with selected psychiatric, behavioral, and somatic characteristics in adults with overweight or obesity referred for a weight management intervention.

2. Materials and methods

2.1. Ethical statement

The study was approved by the Ethics Committee of the Medical University of Lublin and conducted in accordance with the Declaration of Helsinki of the World Medical Association (WMA). All participants were informed about the study aims and procedures and provided written informed consent before participation.

2.2. Inclusion and exclusion criteria

The study sample consisted of adult women and men with overweight or obesity who underwent an initial eligibility assessment for a weight management program between June 2023 and February 2024. Participants were recruited consecutively from a province-wide obesity treatment service run by the Department of Endocrinology, Diabetology and Metabolic Diseases of the Medical University of Lublin. Overweight and obesity were defined according to the WHO classification as BMI of 25.0–29.99 kg/m² and ≥30.0 kg/m², respectively [24].

Exclusion criteria included lack of written informed consent, acute somatic conditions (e.g., acute myocardial infarction, stroke, pulmonary embolism, or severe infection), and acute psychiatric conditions (e.g., acute psychotic episode, acute mania, or substance intoxication or withdrawal) requiring urgent treatment.

Approximately 12% of patients approached for participation did not provide written informed consent. As a result, 101 participants were enrolled. Subsequently, four participants were excluded because of incomplete questionnaire data. Therefore, the final study sample consisted of 97 participants.

2.3. Patients assessment

All study procedures were performed in the morning after an overnight fast (8–10 hours since the last meal). A medical interview was conducted by trained clinicians and included the collection of sociodemographic data. Each participant underwent a routine physical examination and anthropometric assessment. Body weight and height were measured to the nearest 0.1 kg and 1 cm, respectively, using a validated scale equipped with a stadiometer. Body mass index (BMI) was calculated as body weight in kilograms divided by height in meters squared (kg/m^2) [24].

Venous blood samples were collected for the assessment of C-reactive protein (CRP), fasting plasma glucose, glycated haemoglobin (HbA1c), thyroid-stimulating hormone (TSH), insulin, total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides. Complete laboratory data were unavailable for 14 participants because of technical reasons.

Finally, participants completed a series of self-report questionnaires (described below), with assistance from a clinician when necessary.

2.4. Questionnaires

2.4.1. Athens Insomnia Scale (AIS) and sleep duration

The severity of insomnia symptoms was assessed using the Athens Insomnia Scale (AIS), an eight-item self-report questionnaire developed in accordance with the diagnostic criteria of the International Classification of Diseases, 10th Revision (ICD-10). Total scores range from 0 to 24, with higher scores indicating greater insomnia severity [25].

The Polish version of the AIS has been validated and has demonstrated satisfactory psychometric properties. Consistent with the validation study, a total score of ≥8 was used as the optimal cutoff for identifying clinically relevant insomnia symptoms [26]. Accordingly, participants were classified as having insomnia symptoms ("insomniacs"; AIS ≥8) or not having insomnia symptoms ("non-insomniacs"; AIS <8). In addition, AIS total scores were analysed as a continuous variable in regression analyses.

Participants also reported their habitual sleep duration. Short sleep duration was defined as <6 hours per night, using a commonly applied cutoff [27].

2.4.2. Epworth Sleepiness Scale (ESS)

Daytime sleepiness was assessed using the Epworth Sleepiness Scale (ESS), a widely used self-report questionnaire. The ESS consists of eight items rated on a four-point scale (0–3), yielding a total score ranging from 0 to 24, with higher scores indicating greater daytime sleepiness [28]. The ESS has demonstrated satisfactory internal consistency and construct validity in adult populations [28,29]. Its clinical validity has also been confirmed in the Polish population [30].

2.4.3. Patient Health Questionnaire-9 (PHQ-9)

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9), a self-report questionnaire developed on the basis of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for major depressive disorder [31]. The questionnaire consists of nine items scored from 0 to 3, yielding a total score ranging from 0 to 27, with higher scores indicating greater severity of depressive symptoms [32]. The Polish version of the PHQ-9 has demonstrated satisfactory internal consistency and construct validity [33].

2.4.4. Generalized Anxiety Disorder-7 (GAD-7)

Anxiety symptoms were assessed using the Generalized Anxiety Disorder-7 (GAD-7), a self-report questionnaire developed on the basis of DSM-IV criteria for generalized anxiety disorder [34]. The questionnaire consists of seven items scored from 0 to 3, yielding a total score ranging from 0 to 21, with higher scores indicating greater anxiety symptom severity. The Polish version of the GAD-7 has demonstrated satisfactory psychometric properties [35].

2.4.5. EuroQol 5-Dimension 5-Level Questionnaire (EQ-5D-5L)

Health-related quality of life was assessed using the EuroQol 5-Dimension 5-Level Questionnaire (EQ-5D-5L), a widely used generic measure of health status. Responses to the five dimensions can be converted into a health utility index. In addition, participants rated their overall health using the EQ Visual Analogue Scale (EQ-VAS), ranging from 0 to 100, with higher scores indicating better perceived health [36]. The EQ-5D-5L has been translated into more than 130 languages, including Polish, and has demonstrated good validity in the Polish population [37,38].

2.4.6. Modified Yale Food Addiction Scale Version 2.0 (mYFAS 2.0)

Food addiction symptoms were assessed using the Modified Yale Food Addiction Scale Version 2.0 (mYFAS 2.0), a brief 13-item self-report questionnaire adapted from the full Yale Food Addiction Scale 2.0 and based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria for substance-related and addictive disorders [39]. The questionnaire includes 11 items assessing food addiction symptoms and two items assessing clinically significant impairment or distress. Items are scored dichotomously according to established scoring criteria. According to the “diagnostic” scoring algorithm, food addiction is identified when at least two symptoms are present in combination with clinically significant impairment or distress. In addition, a continuous symptom score (range: 0–11) can be calculated by summing the number of endorsed symptoms [40].

The YFAS 2.0 has demonstrated good psychometric properties and has been validated in multiple languages [41], including Polish [42].

2.4.7. Alcohol consumption and tobacco use

Alcohol consumption was assessed using a question adapted from the Alcohol Use Disorders Identification Test (AUDIT) [43]. Drinking frequency was rated on a five-point scale ranging from 0 ("never") to 4 ("four or more times per week"). Current tobacco use, including both conventional cigarettes and electronic cigarettes, was assessed dichotomously (yes/no).

2.5. Statistical analysis

Sociodemographic and clinical characteristics were summarized as means ± standard deviations (SD) for continuous variables and percentages (%) for categorical variables, as appropriate. Differences between participants with and without insomnia symptoms were assessed using Student's *t*-test for continuous variables and the chi-square (χ^2) test for categorical variables.

Simple linear or logistic regression analyses were performed to examine whether insomnia severity, measured using the AIS total score, predicted depressive symptoms, anxiety symptoms, quality of life, food addiction, BMI, and selected somatic comorbidities (hypertension and diabetes).

A two-sided *p*-value <0.05 was considered statistically significant. Because the study was exploratory in nature, no correction for multiple comparisons was applied. All statistical analyses were performed using Statistica, version 10.0 (StatSoft Inc., Tulsa, OK, USA).

3. Results

3.1. Characteristics of the study sample

The study included 97 adults with overweight or obesity. The mean age of the participants was 48.16 ± 15.51 years, the mean BMI was 37.19 ± 5.63 kg/m², and 74.2% were women. The mean Athens Insomnia Scale (AIS) score was 8.58 ± 4.80. Based on the predefined AIS cutoff (≥8), 55 participants (56.7%) were classified as having insomnia symptoms ("insomniacs"), whereas 42 (43.3%) were classified as not having insomnia symptoms ("non-insomniacs").

3.2. Comparison of participants with and without insomnia symptoms

As shown in Table 1, participants with and without insomnia symptoms did not differ significantly with regard to age, BMI, or other sociodemographic characteristics. However, participants with insomnia symptoms were more likely to be women and to have a university degree than those without insomnia symptoms (Table 1).

Table 1. Baseline characteristics of participants with and without insomnia symptoms

Variable	Non-insomniacs (n = 42)	Insomniacs (n = 55)	Test statistic (χ^2 or t value)	p
Age (years)	46.0 ± 16.3	49.8 ± 14.7	1.2	0.23
Women (%)	61.9	83.6	5.8	0.015 *
BMI (kg/m²)	36.8 ± 5.9	37.4 ± 5.4	0.5	0.56
University education (%)	30.9	56.3	5.2	0.022 *
In a relationship (%)	73.8	70.9	0.1	0.75
Living in a city >100,000 inhabitants (%)	59.5	61.8	0.05	0.81
Employed (%)	64.2	50.9	1.7	0.18

Data are presented as mean ± standard deviation (SD) or percentage (%). Participants were classified according to the Athens Insomnia Scale (AIS), with insomnia symptoms defined as an AIS score ≥8. Continuous variables were compared using Student's *t*-test and categorical variables using the χ^2 test. BMI, body mass index, * $p < 0.05$; see Materials and Methods for other details.

3.3. Psychiatric comorbidities and quality of life among participants with and without insomnia symptoms

As shown in Table 2, participants with insomnia symptoms reported a higher prevalence of short sleep duration (<6 hours) and greater daytime sleepiness than those without insomnia symptoms. They also had significantly higher levels of depressive and anxiety symptoms, as reflected by higher PHQ-9 and GAD-7 scores.

Food addiction was significantly more prevalent among participants with insomnia symptoms, who also reported a greater number of food addiction symptoms. In addition, they reported poorer health-related quality of life, reflected by lower EQ-5D-5L index scores and lower EQ-VAS scores. Current smoking tended to be less frequent among participants with insomnia symptoms.

Table 2. Sleep-related, psychiatric, and behavioral characteristics of participants with and without insomnia symptoms

Variable	Non-insomniacs (n = 42)	Insomniacs (n = 55)	Test statistic (χ^2 or t value)	p
Sleep duration < 6 h (%)	11.9	34.5	6.5	0.011 *
AIS	4.1 ± 2.2	12.0 ± 3.1	13.9	< 0.001 **
ESS	6.1 ± 4.3	10.3 ± 5.1	4.3	< 0.001 **
PHQ-9	5.2 ± 4.4	13.0 ± 5.8	7.2	< 0.001 **
GAD-7	4.3 ± 4.6	9.7 ± 6.0	4.7	< 0.001 **
mYFAS 2.0 symptom score (0 - 11)	1.2 ± 2.0	2.4 ± 2.9	2.2	0.030 *
Food addiction (%)	9.5	30.9	6.4	0.011 *
EQ-5D-5L	0.9 ± 0.07	0.8 ± 0.1	−4.2	< 0.001 **
EQ VAS	65.1 ± 21.2	56.6 ± 15.2	−2.2	0.025 *
Alcohol drinking (frequency)	1.1 ± 0.8	1.0 ± 0.8	−0.1	0.89
Current smoker (%)	26.1	10.9	3.8	0.049 *

Data are presented as mean ± standard deviation (SD) or percentage (%). Participants were classified according to the Athens Insomnia Scale (AIS), with insomnia symptoms defined as an AIS score ≥8. Continuous variables were compared using Student's *t*-test and categorical variables using the χ^2 test. AIS – Athens Insomnia Scale, ESS – Epworth Sleepiness Scale, PHQ-9 – Patient Health Questionnaire-9, GAD-7 – Generalized Anxiety Disorder-7, EQ-5D-5L – EuroQol 5-Dimension 5-Level, EQ VAS – EuroQol Visual Analogue Scale. Food addiction was defined according to the Modified Yale Food Addiction Scale Version 2.0 (mYFAS 2.0) criteria, requiring ≥ 2 symptoms and clinically significant impairment or distress. * $p < 0.05$, ** $p < 0.01$; see Materials and Methods for other details.

3.4. Somatic and metabolic characteristics among participants with and without insomnia symptoms

Clinical and metabolic parameters are presented in Table 3. No significant differences were observed between participants with and without insomnia symptoms in most metabolic parameters. However, participants with insomnia symptoms had significantly lower LDL cholesterol and triglyceride levels compared with those without insomnia symptoms.

The proportion of participants using GLP-1 receptor agonists, metformin, or bupropion did not differ significantly between groups.

Table 3. Metabolic and clinical characteristics of participants with and without insomnia symptoms

Variable	Non-insomniacs (n = 34)	Insomniacs (n = 49)	Test statistic (χ^2 or t value)	p
Glucose (mg/dL)	94.9 ± 9.7	98.8 ± 40.2	0.5	0.58
Glycated haemoglobin (%)	5.3 ± 0.3	5.4 ± 1.2	0.5	0.61
Insulin (mU/L)	14.2 ± 8.3	13.6 ± 6.5	−0.3	0.74
Total cholesterol (mg/dL)	190.8 ± 47.0	174.0 ± 34.7	−1.8	0.06
HDL cholesterol (mg/dL)	43.3 ± 12.2	47.5 ± 10.9	1.6	0.10
LDL cholesterol (mg/dL)	120.4 ± 45.7	101.9 ± 28.6	−2.2	0.026 *
Triglycerides (mg/dL)	143.4 ± 54.8	116.3 ± 53.5	−2.2	0.028 *
TSH (mIU/L)	1.5 ± 0.8	2.7 ± 4.9	1.4	0.15
CRP (mg/dL)	4.6 ± 5.0	8.8 ± 18.9	1.2	0.20
Diabetes (%)	11.7	14.2	0.1	0.73
Hypertension (%)	47.0	44.9	0.04	0.84
Metformin (%)	20.5	16.3	0.2	0.62
GLP-1 receptor agonist (%)	11.7	10.2	0.05	0.82
Bupropion (%)	8.8	2.0	2.0	0.15

Data are presented as mean ± standard deviation (SD) or percentage (%). Participants were classified according to the Athens Insomnia Scale (AIS), with insomnia symptoms defined as an AIS score ≥8. Continuous variables were compared using Student's *t*-test and categorical variables using the χ^2 test. Laboratory analyses were available for 83 participants (49 participants with insomnia symptoms and 34 participants without insomnia symptoms). HDL – high-density lipoprotein, LDL – low-density lipoprotein, CRP – C-reactive protein, TSH – thyroid-stimulating hormone. * $p < 0.05$; see Materials and Methods for other details.

3.5. Associations between insomnia severity and clinical outcomes

Regression analyses presented in Table 4 showed that greater insomnia severity, assessed using the AIS total score, was significantly associated with higher levels of depressive symptoms (PHQ-9), anxiety symptoms

(GAD-7), and increased odds of food addiction according to the mYFAS 2.0 criteria. Higher AIS scores were also significantly associated with poorer health-related quality of life.

In contrast, insomnia severity was not significantly associated with BMI or somatic outcomes, including diabetes and hypertension (Table 4).

Table 4. Regression analyses of the associations between Athens Insomnia Scale (AIS) scores and selected clinical outcomes

Outcome variable	Regression model	p
PHQ-9	$R^2 = 0.45$, $F(1,95) = 80.7$	<0.001 **
GAD-7	$R^2 = 0.18$, $F(1,95) = 21.9$	<0.001 **
Food addiction	OR = 1.17 (95% CI: 1.0-1.3)	0.003 **
EQ-5D-5L	$R^2 = 0.26$, $F(1,95) = 34.9$	<0.001 **
EQ VAS	$R^2 = 0.05$, $F(1,95) = 5.5$	0.020 *
BMI	$R^2 = 0.003$, $F(1,95) = 0.30$	0.58
Diabetes	OR = 0.97 (95% CI: 0.8-1.1)	0.64
Hypertension	OR = 0.95 (95% CI: 0.8-1.1)	0.53

Simple linear and logistic regression analyses were performed with the total Athens Insomnia Scale (AIS) score entered as the independent variable. For linear regression models, R^2 and F statistics are presented. For logistic regression models, odds ratios (ORs) with 95% confidence intervals (CIs) are presented. PHQ-9 – Patient Health Questionnaire-9; GAD-7 – Generalized Anxiety Disorder-7; EQ-5D-5L – EuroQol 5-Dimension 5-Level Questionnaire; EQ-VAS – EuroQol Visual Analogue Scale; BMI – Body Mass Index. Food addiction was defined according to the Modified Yale Food Addiction Scale Version 2.0 (mYFAS 2.0) criteria, requiring ≥2 symptoms and clinically significant impairment or distress. * $p < 0.05$, ** $p < 0.01$.

4. Discussion

To the best of our knowledge, this study is among the first to comprehensively examine both psychiatric and somatic correlates of insomnia symptoms in adult outpatients with overweight or obesity referred for a weight management intervention. Our findings indicate that insomnia symptoms are strongly associated with psychiatric and behavioral burden, including higher levels of depressive and anxiety symptoms, greater prevalence and severity of food addiction symptoms, and poorer health-related quality of life. In contrast, insomnia symptoms were not associated with BMI, hypertension, diabetes, or most metabolic parameters. These findings suggest that, in individuals with excess body weight, insomnia symptoms may represent a clinically relevant marker of psychiatric and behavioral burden rather than metabolic dysfunction.

Consistent with the clinical characteristics of insomnia, participants with insomnia symptoms more frequently reported short sleep duration (<6 h) and greater daytime sleepiness than those without insomnia symptoms. These findings are consistent with previous studies showing that insomnia commonly co-occurs with insufficient sleep duration and excessive daytime sleepiness both in individuals with obesity and in the general population [44,45]. Furthermore, previous research suggests that the coexistence of insomnia symptoms and short sleep duration may be associated with a more adverse clinical profile and increased cardiometabolic risk [15,45].

Our findings regarding the association between insomnia symptoms and psychiatric symptoms are also consistent with previous observations in both the general population and individuals with obesity undergoing bariatric treatment [46,47]. Participants with insomnia symptoms demonstrated significantly higher levels of depressive and anxiety symptoms than those without insomnia symptoms. Several common biological mechanisms may underlie these associations, including circadian rhythm disruption, altered inflammatory signaling, and neuroendocrine dysregulation [48,49,50]. However, the directionality of these relationships remains complex. Longitudinal studies suggest that insomnia symptoms may increase the risk of subsequent depression and anxiety, whereas depressive and anxiety symptoms may also contribute to the development or persistence of insomnia, indicating a bidirectional relationship [51,52,53].

Another important finding of the present study was the higher prevalence and greater severity of food addiction symptoms among participants with insomnia symptoms. The prevalence of food addiction in this group (30.9%) was comparable to that previously reported in populations with overweight and obesity [54,55]. Previous studies have shown that food addiction is associated with higher levels of depressive symptoms and poorer quality of life among individuals with obesity [56], as well as with greater insomnia severity [21]. Moreover, food addiction symptoms may represent a barrier to successful weight reduction and long-term weight management [57]. Taken together, these findings suggest that the coexistence of insomnia symptoms and food addiction may identify a subgroup of patients with obesity characterized by greater psychological and behavioral complexity and potentially requiring more comprehensive therapeutic approaches.

Another important domain associated with insomnia symptoms in the present study was health-related quality of life. Participants with insomnia symptoms reported significantly lower EQ-5D-5L index and EQ-VAS scores than those without insomnia symptoms. These findings are consistent with previous research showing that insomnia is associated with poorer quality of life across multiple domains in patients with obesity [58]. From a clinical perspective, these findings further emphasize the importance of assessing both psychiatric symptoms and

maladaptive eating behaviors in patients presenting with insomnia symptoms in the context of overweight and obesity.

In the present study, insomnia symptoms were not significantly associated with BMI, glycemic parameters, or the prevalence of somatic comorbidities (hypertension and diabetes). These findings suggest that insomnia symptoms may not directly reflect the severity of metabolic dysfunction in this clinical population. This observation is consistent with findings from bariatric surgery-seeking populations showing no clear associations between insomnia symptoms and either BMI or somatic comorbidities, including hypertension and diabetes [47].

Interestingly, participants with insomnia symptoms had lower LDL cholesterol and triglyceride levels than those without insomnia symptoms. However, these findings should be interpreted cautiously, as they were not accompanied by consistent differences across other metabolic markers. Previous studies have reported inconsistent associations between insomnia and metabolic parameters, including lipid profile, with some studies demonstrating relationships with selected markers and others reporting inconsistent or null findings [59,60]. Interestingly, a randomized crossover study in healthy adults with habitual adequate sleep demonstrated paradoxical effects of experimentally induced mild sleep restriction on lipid metabolism, including lower LDL cholesterol and higher HDL cholesterol levels [61]. Therefore, it is possible that the metabolic consequences of insomnia symptoms depend on specific clinical phenotypes, particularly when insomnia co-occurs with short sleep duration [62,16].

Previous studies suggest that depressive and anxiety symptoms, as well as food addiction, may adversely affect weight management outcomes [57,63,64]. In this context, the identification of insomnia symptoms in adults with overweight and obesity may have clinical relevance beyond the assessment of sleep itself. The presence of insomnia symptoms may serve as a clinically relevant marker of psychiatric and behavioral burden, including depressive and anxiety symptoms, maladaptive eating behaviors, and poorer health-related quality of life, rather than of metabolic dysfunction. Routine assessment of insomnia symptoms in patients with excess body weight may therefore provide clinicians with valuable information extending beyond traditional metabolic and somatic evaluation. This may be particularly relevant in internal medicine and primary care settings, where obesity management is often focused on somatic and metabolic complications, while limited consultation time may restrict comprehensive psychiatric assessment [65,66]. A brief clinical interview supported by validated screening instruments, such as the AIS, may help identify patients with insomnia symptoms who could benefit from further psychological or psychiatric evaluation [67,68]. Increasing awareness

of sleep disturbances among clinicians involved in obesity management may therefore facilitate a more comprehensive and patient-centered approach to care [62].

Strength and limits

Strengths of this study include the comprehensive assessment of psychiatric, behavioral, and somatic correlates of insomnia symptoms in a clinical weight management population using validated instruments across multiple clinically relevant domains. Insomnia symptoms were also analyzed using both the AIS cutoff and continuous AIS scores.

Several limitations of the present study should be acknowledged. First, the cross-sectional design precludes conclusions regarding causal or temporal relationships between insomnia symptoms and psychiatric or somatic characteristics. Second, the relatively small sample size and recruitment from a single tertiary referral center may limit the generalizability of the findings and introduce selection bias. The predominance of female participants may also limit the applicability of the results to men. In addition, the study population was heterogeneous with respect to BMI and pharmacological treatment, which may have influenced the analyzed clinical and metabolic parameters. Furthermore, insomnia symptoms were identified using the AIS rather than a formal clinical diagnosis. Although the AIS cutoff score of ≥8 has demonstrated good diagnostic accuracy [26], classification in the present study was based on questionnaire-defined insomnia symptoms rather than clinically confirmed insomnia disorder. Finally, the study focused on insomnia symptoms and selected domains of psychopathology. Future studies should include a broader range of psychiatric disorders and sleep disturbances and preferably employ longitudinal designs to better characterize the relationships observed in the present study.

What is already known on this subject?

Insomnia symptoms are more prevalent among individuals with excess body weight than in the general population. Insomnia symptoms are also positively correlated with the risk of psychiatric disorders, particularly depression and anxiety. However, it remains unclear whether insomnia symptoms reflect the clinical burden of obesity, including its psychiatric, behavioral, and metabolic manifestations.

What this study adds?

This study comprehensively examines psychiatric, behavioral, and somatic correlates of insomnia symptoms in adults with overweight or obesity referred for weight management. Insomnia symptoms were associated with greater psychiatric and behavioral burden and poorer health-related quality of life, whereas no clear associations

were observed with BMI, diabetes, hypertension or metabolic parameters. These findings suggest that insomnia symptoms may serve as a clinically relevant marker of broader psychiatric and behavioral burden in patients seeking weight management treatment.

5. Conclusion

In conclusion, insomnia symptoms in outpatients with overweight and obesity were strongly associated with psychiatric and behavioral burden, including daytime sleepiness, depressive and anxiety symptoms, food addiction, and poorer health-related quality of life, whereas no clear associations were observed with BMI, diabetes, hypertension or metabolic parameters. These findings suggest that insomnia symptoms may represent a clinically relevant marker of broader psychiatric and behavioral burden in this population and support routine screening for insomnia symptoms in obesity management programs.

6. Statements and declarations

Author contributions

Martyna Lis: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing - original draft, Visualization, Project administration, Validation

Magdalena Woźniak: Conceptualization, Methodology, Investigation, Data curation, Writing – review & editing, Supervision, Project administration, Resources, Validation

Marta Cudzik: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing - original draft, Project administration, Validation, Visualization

Zofia Rogowska: Methodology, Data curation, Formal analysis, Writing - original draft, Visualization

Monika Lenart-Lipińska: Conceptualization, Methodology, Investigation, Data curation, Writing – review & editing, Supervision, Project administration, Resources, Validation

Beata Matyjaszek-Matuszek: Conceptualization, Methodology, Writing – review & editing, Supervision, Resources, Validation

Adam Wichniak: Conceptualization, Methodology, Writing – review & editing, Supervision, Validation

Przemysław Bieńkowski: Conceptualization, Methodology, Formal analysis, Software, Writing – review & editing, Supervision, Project administration, Resources, Validation

Ethics approval and consent to participate

This study was approved by the Bioethics Committee at the Medical University of Lublin, Poland (KE-0254/153/05/2023, 25.05.2023) and was performed in accordance with the Declaration of Helsinki. Informed consent was obtained from all individual participants included in this study.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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