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Obesity Class and Clinical Response to Multidisciplinary Weight Management in Patients with Knee Pain: A Retrospective Study

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Abstract:

Objective: To determine the impact of reducing body mass index (BMI) and differences between obesity classes in obese patients with knee pain.

Methods: This retrospective research examined ninety-three obesity center patients with complete 9-month data, including monthly weight, BMI, Visual Analog Scale (VAS), and functional status assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) assessments, who were included in the analysis. Participants were classified as obesity class I (30.0-34.9 kg/m²), class II (35.0-39.9 kg/m²), or class III (≥40.0 kg/m²). We studied pain and function changes associated with percentage BMI decrease.

Results: Mean age was 50.3±11.0 years. Median BMI was 36.74 kg/m² (IQR: 33.94–40.75). All obesity groups had significant reductions in BMI, VAS and WOMAC scores, at month 9 compared to baseline (P<0.001). The magnitude of BMI reduction did not differ between groups (P=0.155). VAS and WOMAC improvements differed by category (VAS; P=0.009; WOMAC; P=0.004), with the smallest improvement in class III. Holm-corrected comparisons showed differences between class I and class III for VAS (P=0.007) and WOMAC (P=0.004), and between class II and class III for WOMAC (P=0.042). A weak association was observed between percentage BMI reduction and WOMAC improvement (rho=0.262; P=0.011), but not VAS improvement (rho=0.008; P=0.941).

Conclusion: BMI reduction was associated with improvements in pain and functional status over 9 months in patients with obesity and knee pain. However, symptomatic improvement was less pronounced in class III obesity despite a similar magnitude of BMI reduction. These findings suggest that obesity severity may influence clinical response and that patients with advanced obesity may require more individualized and comprehensive management strategies.

Keywords: Knee Pain, Obesity, Body Mass Index Reduction, Weight Loss, Pain Measurement

Obesity is more than excess body weight. It is a chronic and multifactorial condition influenced by genetic, biological, behavioral, and socioeconomic factors [1]. With the increasing incidence of obesity in the world, obesity is being seen in an increasing number of outpatient settings, and knee pain with reduced function is a common accompaniment. Knee pain is a common problem in

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obese patients in general outpatient settings [1, 2].

From a mechanistic viewpoint, it is believed that an increase in body mass might increase stress in the weight-bearing regions of the knee. However, there are other factors to be considered in obesity. For example, adipose tissue also has endocrine and proinflammatory activities [3, 4].

With regard to knee pain in general, it has been emphasized in various clinical guidelines that reduction of body mass index and exercise are the main non-pharmacological interventions in overweight and obese patients [5-7]. Furthermore, the efficacy of the reduction of body mass index (BMI) has been shown in the context of a randomized controlled trial to reduce knee pain and improve function [8]. However, the diversity of the content of the interventions and the population studied may lead to significant variation in the effect size. In the context of real-life practice, it is not clear which population benefits more from the intervention and the extent to which the benefits observed can be transferred to real-life conditions [9].

Therefore, this study aimed to evaluate changes in pain intensity and functional status after a multidisciplinary weight management program in patients with obesity and knee pain, and to examine whether clinical response differed across obesity classes.

METHODS

Study Design and Data Source

This retrospective observational study was based on a review of medical records from patients followed in an obesity center who were referred to the Physical Medicine and Rehabilitation (PMR) clinic for knee pain. Anthropometric data (body weight and BMI) as well as pain and functional assessments recorded during routine clinical follow-up were included in the analysis.

Participants

Medical records of patients followed in the weight management clinic between January 2022 and June 2023 were retrospectively reviewed. Patients who initiated follow-up during this period and completed nine months of follow-up were considered eligible for evaluation. Among those referred to the PMR clinic for knee pain, 185 patients had available knee radiographs and formed the screened population.

Inclusion Criteria

•Patients were included if they m*et* a*l*l of the following criteria:

•Follow-up in the weight management clinic between January 2022 and June 2023

•Completion of 9 months of regular follow-up

•Referral to the PMR clinic for knee pain evaluation

•Availability of knee radiographs

•Complete monthly follow-up data over the 9-month period

Exclusion Criteria

•Patients were excluded if any of the following conditions were present:

•Irregular or incomplete 9-month follow-up (n = 59)

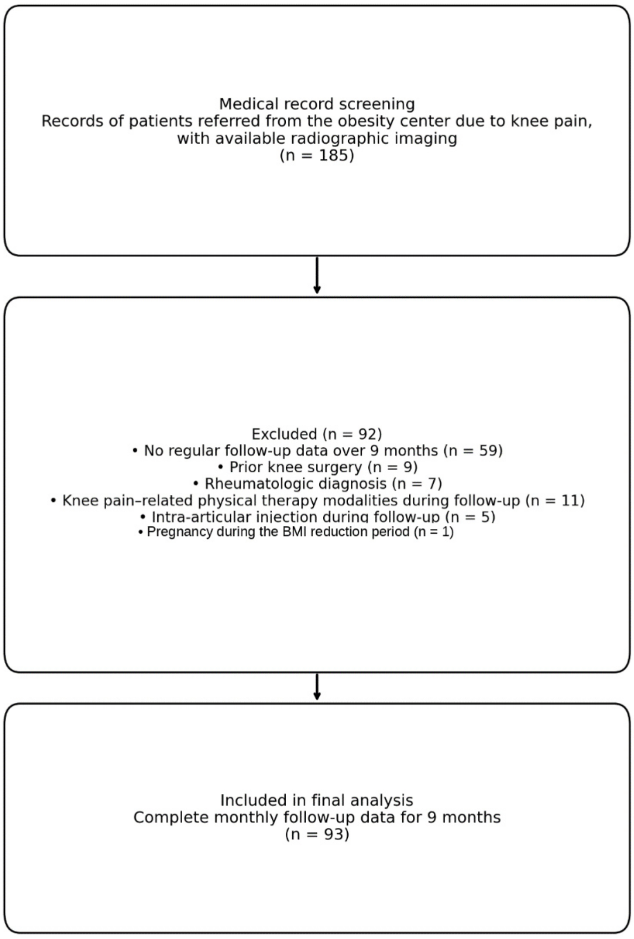

Figure 1. Flow diagram of patient selection.

•History of knee surgery (n = 9)

•Presence of a rheumatologic disease (n = 7)

•Receipt of physical therapy modalities for knee pain during follow-up (e.g., electrotherapy, ultrasound, hot packs) (n = 11)

•Intra-articular knee injection during follow-up (n = 5)

•Pregnancy during the BMI reduction process (n = 1)

Following eligibility assessment, 93 patients with complete 9-month follow-up data were available for the final analysis (Figure 1). These patients were subsequently categorized into three groups based on baseline BMI values:

Obesity class I: BMI 30.0–34.9 kg/m²

Obesity class II: BMI 35.0–39.9 kg/m²

Obesity class III: BMI ≥40.0 kg/m²

Radiographic Evaluation

As this study was based on retrospective records, complete standardized examination findings and detailed clinical histories were not available for every patient. For this reason, the American College of Rheumatology (ACR) classification criteria were not used for patient selection. Patients presenting with knee discomfort had their radiographs of the affected knees obtained from the hospital's information system and classified using the Kellgren-Lawrence (KL) system [10]. The research group's radiographic state was characterized and clinical results were supported by using KL grade as a secondary variable.

Clinical Follow-up

Patient care at the obesity center was delivered by a multidisciplinary team including an obesity physician, dietitian, psychologist, physiotherapist, and physiatrist. Consistent nutritional counseling, behavioral modification strategies, and weight management support were provided throughout follow-up. Patients attended monthly clinical follow-up visits, and body weight was measured at each visit using a calibrated digital scale. Two main tools were employed to assess symptomatic changes. The pain was measured using a conventional 10-centimeter Visual Analog Scale (VAS) continuum, where 0 denotes no pain at all and 10 denotes the most excruciating pain one could imagine [11]. We used the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), which has a validated Turkish version to assess the functional capability of the patient. This instrument assesses pain, stiffness, and physical function along 24 separate dimensions [12]. A scale from 0 to 4 is used to assess each parameter. Total scores are calculated by summing the subscale scores and range from 0 to 96. Higher WOMAC scores indicate worse functional status [13].

Rationale for the Follow-up Duration

Although there is no standardized follow-up period in weight management programs, the first 6 months are generally considered the intensive intervention phase, and it has been reported that BMI reduction may show a plateau tendency in the subsequent months [14–17]. For this reason, patients with a total of 9 months of regular follow-up, encompassing the 6-month intensive intervention period and a subsequent 3-month monitoring phase, were included in the study.

Changes in patients' VAS and WOMAC scores over the 9-month period were calculated. Percentage change calculations were performed as follows:

•Percentage reduction in BMI (%): (baseline BMI − 9-month BMI) / baseline BMI × 100 (Note: Positive values indicate BMI reduction.)

•Percentage improvement for VAS and WOMAC (%): (baseline value − 9-month value) / baseline value × 100 (Note: Positive values indicate improvement.)

Ethical Approval

This study was approved by an independent Institutional Clinical Research Ethics Committee (approval number: 1521, date: 19.08.2021). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was waived because of the retrospective nature of the study, and the analysis used anonymous clinical data.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics (version 22). The distribution of

TABLE 1. **Baseline Characteristics by Obesity Class**

Variable	Total (n=93)	Obesity class I (n=31)	Obesity class II (n=36)	Obesity class III (n=26)	P-value
Age (years)	50.3±11.0	50.8±10.6	48.8±11.3	51.9±11.3	0.429
Female, n (%)	77 (82.8%)	23 (74.2%)	30 (83.3%)	24 (92.3%)	0.195
Height (m)	1.61 (1.57–1.67)	1.63 (1.59–1.71)	1.61 (1.55–1.65)	1.61 (1.56–1.66)	0.100
Body weight (kg), baseline	99.3 (88.5–107.9)	87.4 (81.9–96.3)	95.4 (90.3–101.7)	113.2 (106.5–135.1)	**<0.001**
BMI (kg/m²), baseline,	36.74 (33.94–40.75)	32.84 (31.41–33.87)	36.95 (35.99–38.43)	44.38 (42.86–49.79)	**<0.001**
VAS (0–10), baseline	5 (4–7)	4 (3–6)	6 (4–7)	7 (5–8)	**0.002**
WOMAC (0–96), baseline	32.29 (20.83–47.92)	21.87 (14.58–31.77)	31.77 (20.83–46.09)	48.96 (33.85–60.42)	**<0.001**
Kellgren–Lawrence (KL) grade, n (%)					**0.018**
KL 0,	6 (6.5%)	2 (6.5%)	4 (11.1%)	0 (0.0%)	
KL 1	26 (28.0%)	9 (29.0%)	14 (38.9%)	3 (11.5%)	
KL 2	38 (40.9%)	16 (51.6%)	12 (33.3%)	10 (38.5%)	
KL 3	15 (16.1%)	3 (9.7%)	3 (8.3%)	9 (34.6%)	
KL 4	8 (8.6%)	1 (3.2%)	3 (8.3%)	4 (15.4%)	

Data are shown as mean±standard deviation or median (interquartile range: IQR) or n (%) where appropriate. BMI, body mass index, VAS, visual analog scale, WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

Unless otherwise stated. p values are from Kruskal–Wallis tests for continuous variables and chi-square tests for categorical variables.

Statistically significant P-values are shown in bold.

continuous variables was assessed using the Shapiro–Wilk test and visual methods. Data were summarized as mean±standard deviation when normally distributed and as median (interquartile range) when not normally distributed. Categorical variables were presented as numbers and percentages. For comparisons between groups, the chi-square test was used for categorical variables. Due to distributional characteristics, intergroup comparisons of continuous variables were performed using the Kruskal–Wallis test. Percentage changes in BMI, VAS, and WOMAC were compared between groups using the Kruskal–Wallis test; when statistical significance was detected, pairwise comparisons were conducted using the Mann–Whitney U test, and multiple comparisons were controlled using the Holm correction. Changes between baseline and 9-month measurements were evaluated using the Wilcoxon signed-rank test. Associations between KL grade, percentage BMI reduction, and clinical response measures (percentage improvements in VAS and WOMAC) were examined using Spearman's rank correlation coefficient (rho). Partial Spearman correlations were performed to adjust for prespecified covariates (age, sex, KL grade, baseline outcome score, and percentage BMI reduction, as applicable). Multivariable linear regression models were fitted to evaluate whether percentage BMI reduction independently predicted percentage improvements in WOMAC and VAS; 95% confidence intervals were reported. Statistical significance was set at P<0.05.

RESULTS

Participants and Baseline Characteristics

A total of 185 records were evaluated. After applying the predefined exclusion criteria, 93 patients were included in the analysis (Figure 1). The mean age was 50.3±11.0 years, and 77 patients (82.8%) were female. There was no significant difference in age among baseline obesity classes (P=0.429), and sex distribution was similar across groups (P=0.195). Baseline symptom severity differed according to obesity class. The baseline VAS score was 4 (3–6) in class I, 6 (4–7) in class II, and 7 (5–8) in class III (P=0.002). Baseline total WOMAC scores were 21.87 (14.58–31.77), 31.77 (20.83–46.09), and 48.96 (33.85–60.42), respectively (P<0.001). Kellgren–Lawrence (KL) grading based on knee radiographs was performed in all included patients (n=93). The overall distribution was as follows: KL 0: 6 (6.5%), KL 1: 26 (28.0%), KL 2: 38 (40.9%), KL 3: 15 (16.1%), and KL 4: 8 (8.6%). The KL distribution differed significantly across obesity classes (P=0.018), with a higher proportion of advanced-stage disease (KL 3–4) observed particularly in the obesity class III group (Table 1).

Changes in VAS and WOMAC scores During the 9-Month Follow-up

After 9 months of follow-up, median body weight decreased from 99.3 (88.5–107.9) kg to 82.5 (74.7–90.3) kg (P<0.001), while BMI decreased from 36.74

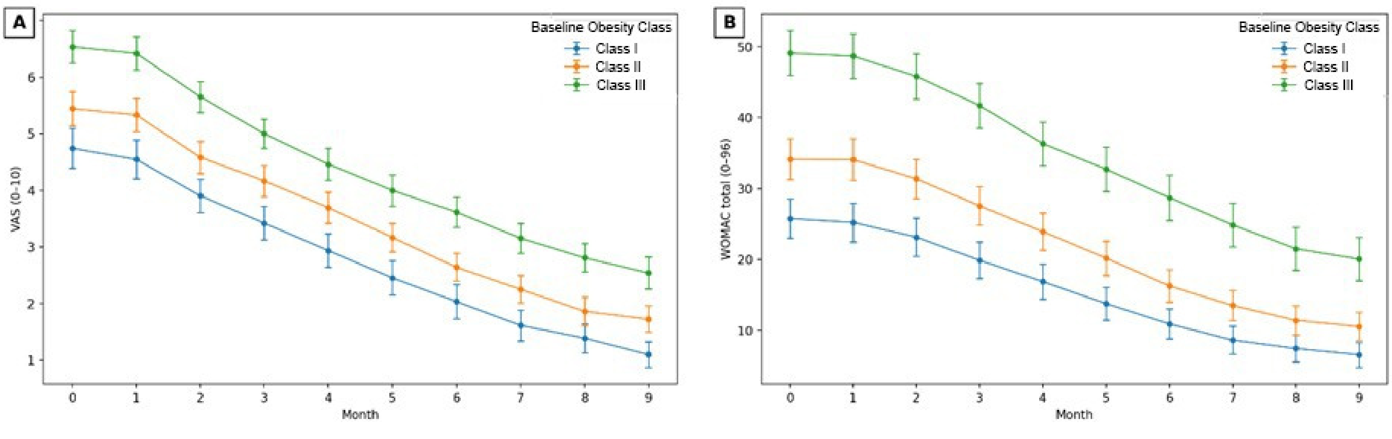

Figure 2. **Changes in (A) VAS and (B) WOMAC scores over 9 months by baseline obesity class.**

TABLE 2. Month-9 Outcomes and Percent Improvements by Obesity Class (Primary Outcomes)

Variable	Total (n=93)	Obesity class I (n=31)	Obesity class II (n=36)	Obesity class III (n=26)	P-value	ε^2
Body weight (kg), month 9	82.5 (74.7–90.3)	73.9 (70.0–84.3)	80.0 (74.9–85.4)	96.1 (88.8–117.7)	**<0.001**	
BMI (kg/m²), month 9	30.52 (28.37–35.20)	27.69 (26.83–28.86)	30.61 (29.88–32.07)	37.12 (35.88–42.12)	**<0.001**	
VAS (0–10), month 9	2 (1–2)	1 (0–2)	2 (0–2)	2 (2–3)	**<0.001**	
WOMAC (0–96), month 9	7.29 (3.12–14.58)	4.17 (2.08–6.77)	6.77 (3.12–13.54)	17.70 (7.29–29.69)	**<0.001**	
BMI reduction (%)	15.49 (12.09–18.78)	14.09 (10.98–17.87)	16.20 (14.14–19.11)	15.12 (11.02–19.26)	**0.155**	0.019
VAS improvement (%)	71.43 (60.00–85.71)	80.00 (66.67–100.00)	66.67 (57.14–100.00)	66.67 (50.00–71.43)	**0.009**	0.082
WOMAC improvement (%)	77.77 (66.14–86.00)	79.98 (75.45–90.71)	77.95 (66.65–87.30)	66.85 (49.37–78.22)	**0.004**	0.101

Data are shown as median (interquartile range: IQR). BMI, body mass index, VAS, visual analog scale, WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

P-values are from Kruskal–Wallis tests; ε^2 denotes Kruskal–Wallis effect size (reported for percent-change outcomes). Post-hoc pairwise comparisons (Holm-adjusted): VAS improvement, class I vs III (P=0.007); WOMAC improvement, class III vs I (P=0.004) and class III vs II (P=0.042).

Statistically significant P-values are shown in bold.

(33.94–40.75) kg/m² to 30.52 (28.37–35.20) kg/m² (P<0.001). Pain severity assessed by VAS decreased from a median of 5 (4–7) to 2 (1–2) (P<0.001). The total WOMAC score decreased from 32.29 (20.83–47.92) to 7.29 (3.12–14.58) (P<0.001) (Table 2).

Graphs illustrating monthly changes in VAS and WOMAC scores according to obesity class are shown in Figure 2.

BMI Reduction and Clinical Response According to Obesity Class

During the 9-month follow-up, the percentage of BMI reduction did not differ significantly between groups: 14.09% (10.98–17.87) in class I, 16.20% (14.14–19.11) in class II, and 15.12% (11.02–19.26) in class III (P=0.155) (Table 2).

In contrast, the percentage improvement in VAS differed across obesity classes (P=0.009; ε^2=0.082). In Holm-adjusted pairwise comparisons, the percentage improvement in VAS was higher in class I (80.00% [66.67–100.00]) compared with class III (66.67% [50.00–71.43]) (P=0.007); other pairwise comparisons were not significant (Table 2).

The percentage improvement in WOMAC also differed between groups (P=0.004; ε^2=0.101). In the class III group, the WOMAC improvement percentage (66.85% [49.37–78.22]) was lower than in class I (79.98% [75.45–90.71]; P=0.004) and class II (77.95% [66.65–87.30]; P=0.042), whereas no significant difference was observed between class I and class II (Table 2).

Associations Between KL Grade, Symptom Burden, and Clinical Response

KL grade was positively correlated with age (Spearman rho=0.609, P<0.001). Increasing KL grade was associated with greater baseline symptom burden (baseline VAS: rho=0.374, P<0.001; baseline WOMAC: rho=0.458, P<0.001). In unadjusted analyses, an inverse association was observed between KL grade and WOMAC improvement percentage (rho=−0.372, P<0.001). However, after adjustment for age, sex, percentage BMI reduction, and baseline WOMAC score, this relationship was attenuated and no longer statistically significant (partial Spearman rho=0.155, P=0.138) (Table 3).

TABLE 3 Correlation and Regression Analyses of KL Grade and BMI Reduction in Relation to WOMAC and VAS Improvement

	Method/model	Effect	P-value
KL grade vs age	Spearman correlation	0.609	**<0.001**
KL grade vs WOMAC improvement (%)	Spearman correlation (crude)	-0.372	**<0.001**
KL grade vs WOMAC improvement (%)	Partial Spearman (adjusted for age, sex, BMI reduction (%), and baseline WOMAC)	0.155	0.138
BMI reduction (%) vs WOMAC improvement (%)	Spearman correlation (crude)	0.262	**0.011**
BMI reduction (%) vs WOMAC improvement (%)	Partial Spearman (adjusted for age, sex, KL grade, and baseline WOMAC)	0.205	**0.049**
BMI reduction (%) predicting WOMAC improvement (%)	Multivariable linear regression (adjusted for age, sex, KL grade, and baseline WOMAC)	β=0.717 (95% CI 0.279 to 1.156)	**0.001**
BMI reduction (%) vs VAS improvement (%)	Spearman correlation (crude)	0.008	0.941
BMI reduction (%) vs VAS improvement (%)	Partial Spearman (adjusted for age, sex, KL grade, and baseline VAS)	-0.105	0.315
BMI reduction (%) predicting VAS improvement (%)	Multivariable linear regression (adjusted for age, sex, KL grade, and baseline VAS)	β=0.015 (95% CI -0.619 to 0.649)	0.962

BMI, body mass index, KL grade, Kellgren-Lawrence grade; VAS, visual analog scale, WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

All analyses were performed in the study sample (n=93). ρ indicates Spearman correlation; partial ρ indicates partial Spearman correlation. β values are unstandardized and represent the change in outcome improvement (percentage points) per 1% BMI reduction. Covariates: age (years), sex (male = 1, female = 0), KL grade (0-4), and baseline outcome score (WOMAC total or VAS, as applicable). % BMI reduction = (baseline BMI - month-9 BMI) / baseline BMI × 100. Improvement (%) = (baseline value - month-9 value) / baseline value × 100. Statistically significant P-values are shown in bold.

Relationship Between BMI Reduction and Clinical Response

Percentage BMI reduction showed a weak positive correlation with percentage improvement in WOMAC (Spearman rho=0.262, P=0.011). This association persisted after adjustment for age, sex, KL grade, and baseline WOMAC score (partial Spearman rho=0.205, P=0.049) (Table 3). Consistently, in multivariable linear regression analysis with HC3 robust standard errors, percentage BMI reduction remained an independent predictor of percentage improvement in WOMAC (β=0.717, 95% CI: 0.279 to 1.156, P=0.001) (Table 3). The research found no connection between weight loss percentage and VAS improvement percentage during unadjusted statistical evaluations (rho=0.008, P=0.941) and the adjusted analysis failed to show any independent relationship (P>0.05). Linear regression similarly showed no independent predictive effect for VAS improvement (β=0.015, 95% CI: −0.619 to 0.649, P=0.962) (Table 3).

DISCUSSION

This study examined the effect of BMI reduction on pain and functional status in obese patients with knee pain. At the end of the 9-month follow-up, significant BMI reduction was observed in all three obesity classes; in parallel, reductions in VAS scores and improvements in WOMAC scores were detected.

Although the percentages of BMI change were similar across groups, the differentiation of clinical response according to obesity severity suggests that the effect of weight management cannot be explained solely by the amount of BMI reduction. One possible explanation for this differentiation is that baseline symptom burden and functional reserve may shape treatment response [7,18–20]. In addition, the marked heterogeneity in patient characteristics, symptom severity, and comorbid conditions in real-life cohorts makes it an expected finding that clinical response may differ between groups despite similar BMI reduction [9, 20].

In our study, the mean age of participants was approximately 50 years, and most participants were women. This demographic profile is consistent with epidemiological data reporting that the burden of obesity-related knee complaints and knee osteoarthritis becomes more pronounced in middle age and may be more frequently observed in women [4, 21, 22].

At baseline evaluation, although there were no differences in age or sex between groups, higher baseline VAS and WOMAC scores and more advanced KL grades were observed with increasing obesity severity. This finding is consistent with studies confirming that weight gain increases symptom burden and that mechanical load triggers structural progression [24–26].

For people who are overweight or obese, controlling their weight and getting enough exercise are very important for controlling knee pain [5–7]. Many studies talk about a possible dose-response relationship between changes in body weight and knee symptoms. Some studies have found that losing weight when you have knee pain can improve both pain and function at the same time. However, other studies have found that this relationship may have threshold effects or plateau tendencies [9, 18]. Riddle and Stratford performed a cohort study demonstrating that alterations in body weight of 5% or less lead to significant changes in pain and functional outcomes, whereas patients who reduced their body weight by 10% or more exhibited superior clinical results [18]. A recent meta-analysis also suggests that reductions in BMI of more than 7% are linked to more consistent improvements in pain and functional outcomes [27]. In our study, patients lost an average of about 15% of their BMI over nine months, and their pain and function both got a lot better. Our findings are largely in line with these previous reports. Interestingly, however, the strength of this association fluctuated based on the specific clinical metric being evaluated. The percentage of BMI reduction had a stronger link to improvements in WOMAC scores than it did to changes in VAS scores in our study.

This stronger link between BMI reduction and functional improvement compared with pain outcomes may partly reflect differences in the way these measures capture clinical change. WOMAC is a multidimensional instrument reflecting both daily function and pain components, whereas VAS is more unidimensional and more sensitive to perceptual fluctuations. Therefore, functional changes may be more clearly captured by WOMAC, while pain perception may exhibit a more layered structure [23, 28]. This interpretation may also explain why the association between BMI reduction and WOMAC improvement was more evident than that observed with VAS.

In our study, although percentages of BMI reduction were similar across groups, clinical improvement became more limited with increasing obesity severity. This finding is consistent with studies reporting that knee symptoms may follow a more complex and treatment-resistant course as the degree of obesity increases [25, 29]. In class III obesity, a higher burden of comorbidities may be one of the factors adversely affecting symptom control and functional gain. In addition, reductions in aerobic capacity and increases in movement limitation associated with greater obesity severity may contribute to more limited functional improvement, even when BMI reduction is achieved [25, 29]. Considering these factors, it is expected that clinical gains may not be of the same magnitude across groups, even when similar levels of BMI reduction are attained. Finally, it should be considered that the observed differences may be related not only to the amount of BMI reduction but also to process variables such as the manner in which weight management is implemented and the patient's behavioral response.

In this study, a multidisciplinary, patient-centered, and monthly follow-up model was applied, in which psychological assessment, nutritional counseling, and individualized exercise were delivered together within the same program. Energy usage, pain management, and everyday movement patterns may all be affected by this integrated framework. Incorporating a psychological component is also therapeutically important, since obesity-related anxiety, fluctuations in motivation, and social avoidance may interfere with weight control [30, 31]. At the center of this approach is a monthly follow-up plan. This structure supports regular communication, makes small steps forward easier to recognize, and may improve adherence over time.

The ideas of systematic monitoring and regular contact are highly valued in intensive lifestyle modification programs, and monthly visit-based follow-up is in line with them [32]. However, rehabilitation literature has increasingly emphasized multicomponent approaches for knee pain and related musculoskeletal problems. These approaches usually combine weight management, exercise, and behavioral modification [33]. In this respect, the clinical improvements observed in this trial may also reflect benefits that can emerge through routine follow-up practice.

Strengths and Limitations

One strength of the study is that it draws on real-world data collected during monthly follow-up visits. Patient care involved a multidisciplinary team including an obesity physician, dietitian, psychologist, physiotherapist, and physiatrist. In daily clinical practice, structured feedback and planned follow-up may help support behavioral change during treatment.

This study has certain limitations. First, there was no control group, and the retrospective, record-based design limits causal interpretation. In addition, the findings may be influenced by the fact that the cohort consisted of individuals with obesity who were first evaluated in an obesity clinic and then referred to the physiatry clinic because of knee pain. Because this study had a retrospective, record-based design, information regarding factors that may influence clinical response was limited to what had been documented in the patients' medical files. Although analgesic medication use was noted as absent in the available records, the retrospective nature of data collection limited our ability to verify medication exposure in detail. In addition, psychosocial factors and detailed comorbidity profiles were not consistently available and therefore could not be included in the analysis. These factors may influence pain perception, functional outcomes, adherence to treatment, and the magnitude of clinical response; therefore, this limitation should be considered when interpreting the findings. Self-reported pain and exercise ratings are useful, but they should be interpreted cautiously. Symptoms may vary over time, and responses can also be shaped by mood or other psychosocial factors. Because the follow-up period was limited to nine months, it is not clear whether the health-related and weight-related benefits would persist over the longer term.

CONCLUSION

Overall, patients with obesity and knee pain showed reductions in pain and improvements in functional status over the 9-month follow-up, alongside a decrease in BMI. Although the magnitude of BMI reduction was similar across obesity classes, symptomatic improvement was less pronounced in class III obesity. These findings suggest that obesity severity may influence the extent of clinical response. Longer prospective studies with a comparator group are needed to determine the durability of these improvements and to clarify the extent to which they are directly attributable to BMI reduction.

Ethics Approval and Consent to Participate

This study was approved by the Adana City Training and Research Hospital Clinical Research Ethics Committee (Decision No: 1521; date: 19.08.2021). All procedures were conducted in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments. Informed consent was waived because of the retrospective nature of the study, and the analysis used anonymous clinical data.

Data Availability

All data generated or analyzed during this study are included in this published article. The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

Authors' Contribution

Study Conception: EÇD, MÇB, NAB; Study Design: EÇD, MÇB, NAB; Supervision: EÇD, MÇB, NAB; Funding: N/A; Materials: EÇD, MÇB, NAB; Data Collection and/or Processing: EÇD, MÇB, NAB; Statistical Analysis and/or Data Interpretation: EÇD, MÇB; Literature Review: EÇD, NAB; Manuscript Preparation: EÇD; and Critical Review: EÇD, MÇB, NAB.

Conflict of Interest

The author(s) disclosed no conflict of interest during the preparation or publication of this manuscript.

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Generative Artificial Intelligence Statement

The author(s) declare that no artificial intelligence-based tools or applications were used during the preparation process of this manuscript. The all content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles.

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