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Association of Obesity with Knee Joint Osteoarthritis in Females at a Tertiary Care Teaching Hospital

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ABSTRACT

Background: Osteoarthritis (OA) is a leading cause of disability, with knee OA being the most common manifestation. Obesity is a significant risk factor for the development and progression of knee OA, particularly in females. This study aimed to evaluate the association between obesity and knee OA in females at a tertiary care teaching hospital. **Methods:** This observational, cross-sectional study included 130 female patients aged 45-70 years who were diagnosed with knee OA. Participants were categorized based on their BMI into normal weight, overweight, and obese groups. A comprehensive medical history was taken, including family history of OA, menopausal status, and knee symptoms. A physical examination was performed to assess knee deformities, joint swelling, and quadriceps strength. The clinical diagnosis of knee OA was confirmed using established criteria, including knee pain, crepitus, and morning stiffness. **Results:** The study found a significant relationship between higher BMI and increased prevalence of knee OA. The obese group had the highest proportion of knee OA cases, followed by the overweight group. Additionally, symptoms such as knee pain, morning stiffness, and joint swelling were more prevalent among obese individuals. The association between obesity and knee OA was further supported by a strong family history of OA and a higher incidence of physical limitations, such as difficulty climbing stairs and performing daily activities. **Conclusion:** This study supports the growing body of evidence linking obesity with knee OA in females. Both mechanical

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overload and systemic inflammation due to excess weight contribute significantly to the development and progression of knee OA. Weight management and increased physical activity are crucial strategies for the prevention and management of knee OA. Future research should focus on long-term studies to explore the effects of obesity on knee joint health and evaluate targeted interventions.

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INTRODUCTION

Osteoarthritis (OA) is a prevalent cause of disability globally, with the knee being the most frequently affected joint, leading to chronic pain and impaired mobility [1]. As a degenerative joint disorder, OA develops due to a combination of genetic, mechanical, and metabolic factors. Its prevalence varies widely, ranging from 4% to 30%, depending on demographic characteristics and diagnostic criteria [2,3].

Obesity, defined by increased body weight or body mass index (BMI), is a key contributor to the onset and progression of knee OA [4]. Excess weight places additional mechanical stress on the knee joint, accelerating cartilage breakdown, while metabolic dysfunction associated with obesity may further exacerbate joint deterioration through systemic inflammation. Studies suggest that weight reduction significantly lowers the risk of symptomatic knee OA [5], and major clinical guidelines, including those from the American College of Rheumatology and the European League Against Rheumatism, recommend weight loss and physical activity as primary interventions for obese individuals with knee OA. However, these recommendations are largely based on expert consensus rather than high-quality meta-analyses of randomized controlled trials (RCTs) [6,7].

The link between obesity and knee OA is primarily explained by two mechanisms. The biomechanical hypothesis suggests that increased joint loading due to excess weight leads to cartilage wear and subchondral bone sclerosis. Meanwhile, the metabolic

hypothesis proposes that obesity-related systemic factors, such as inflammatory cytokines and adipokines, negatively impact cartilage health [8,9]. Numerous population-based studies have confirmed a strong correlation between obesity and OA of the tibiofemoral joint [10-14].

Radiographic findings indicate that obese women face a significantly higher risk—up to four times greater—of developing knee OA compared to non-obese women, with odds ratios (ORs) ranging from 2 to 9 across various studies. Furthermore, a dose-response relationship has been established, showing that an increase in BMI is directly linked to a higher likelihood of developing knee OA [11]. Longitudinal studies, including the Framingham Study, [4,15], the Chingford Study [16], and the Baltimore Longitudinal Study of Aging [17], have supported these findings.

Despite substantial evidence linking obesity to knee OA, further research is needed to understand the extent to which obesity contributes to disease burden, particularly among females. This study aims to investigate the association between obesity and knee OA in female patients at a tertiary care teaching hospital and evaluate its impact on disease severity and symptoms.

METHODOLOGY

Study Design: This observational, cross-sectional study aimed to assess the association between obesity and knee osteoarthritis (OA) among female patients at a tertiary care teaching hospital.

Study Site: The study was conducted in the Department of Physical Medicine and

Rehabilitation, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh.

Period of Study: The study was carried out over a one-year period, from October 2014 to September 2015.

Sample Size: A total of 130 female patients aged between 45 and 70 years were included in the study. Participants were categorized based on their Body Mass Index (BMI).

Sampling Technique: Participants were selected using a purposive sampling technique, ensuring the inclusion of a representative group of female patients diagnosed with knee osteoarthritis (OA).

Female patients aged 45 to 70 years who were diagnosed with knee OA based on clinical and radiographic findings were included. Patients with secondary OA, inflammatory arthritis, or neurological conditions affecting gait or joint function were excluded from the study. All participants provided written informed consent before participation.

Data Collection: A detailed medical history was obtained from each participant, including information on family history of OA, menopausal status, the onset and duration of knee pain, aggravating and relieving factors, and other affected joints. Additionally, physical activity levels and associated daily limitations, such as difficulty climbing stairs, were assessed.

RESULTS

Table 1: Baseline Characteristics of Study Participants

Parameters	Mean \pm SD
Age	51.9 \pm 7.8
Height	1.56 \pm 0.74
Weight	84.97 \pm 16.26

Table 1 summarizes the baseline characteristics of the study participants. The mean age was 51.9 \pm 7.8 years, indicating that middle-aged and older females were the primary subjects. The mean height was 1.56 \pm

A comprehensive physical examination was conducted, focusing on joint swelling, knee deformities, and quadriceps strength. Knee osteoarthritis (OA) was diagnosed based on clinical criteria, including knee pain occurring most days of the month, crepitus on active joint motion, morning stiffness lasting over 30 minutes, and bony enlargement of the knee joint.

Data Analysis: The study aimed to assess the association between BMI and the prevalence of knee OA. Frequencies and percentages were calculated for key variables such as BMI, OA symptoms, and associated clinical factors (e.g., family history, joint swelling, pain, and deformity). The data were analyzed using descriptive statistics and cross-tabulation to explore the relationship between obesity and OA.

Ethical Approval: This study was approved by the Institutional Ethics Committee of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. All participants provided written informed consent before enrollment, ensuring their confidentiality and voluntary participation. Participants retained the right to withdraw from the study at any time without consequence. The study was conducted by the ethical principles outlined in the Declaration of Helsinki (1964) and its subsequent amendments.

0.74 meters, and the mean weight was 84.97 \pm 16.26 kg, suggesting a high prevalence of excess body weight.

Table 2: Association Between Body Mass Index (BMI) and Osteoarthritis (OA) Prevalence.

BMI	Osteoarthritis		
	Yes	No	Total
Normal	4	14	17
Overweight	23	9	29
Obese	75	5	74
Total	102	28	130

Table 2 illustrates the relationship between BMI categories and the prevalence of knee osteoarthritis (OA) among the study participants. Out of the total 130 patients, 102 (78.5%) were diagnosed with OA, while 28 (21.5%) did not have the condition. The prevalence of OA was lowest among participants with a normal BMI, where only 4 out of 17 (23.5%) were affected. In contrast, the prevalence increased significantly among

overweight individuals, with 23 out of 29 (79.3%) having OA. The highest prevalence was observed in the obese category, where 75 out of 74 (98.6%) were diagnosed with OA, indicating a strong association between obesity and knee OA.

Table 3: Distribution of Clinical Variables Among Patients with Osteoarthritis

Variables	Frequency		Percentage	
	Yes	No	Yes	No
Family h/o OA	90	12	88.2	11.8
Menopause	83	18	82.2	17.8
Pain in knee joint, Morning Stiffness, Crepitus	102	0	100.0	0.0
Joint Swelling	89	13	87.3	12.7
Radiating Pain	77	25	75.5	24.5
Difficulty in climbing stairs	102	0	100.0	0.0
Weak quadriceps	75	27	73.5	26.5
Deformity in knee joint	44	57	43.6	56.4

Table 3 shows the distribution of clinical variables among the patients with knee osteoarthritis (OA). A significant proportion of the participants, 90 (88.2%), had a family history of OA, highlighting the potential genetic influence on the development of the condition. The majority of participants, 83 (82.2%), were postmenopausal, which suggests that hormonal changes may also contribute to the onset of OA. All participants (102, 100%) reported experiencing knee pain, morning stiffness, and crepitus, which are hallmark symptoms of OA. Furthermore, 89 (87.3%) participants experienced joint swelling, indicating inflammation as a common feature of the disease. Radiating pain

was reported by 77 (75.5%) patients, suggesting that the condition also affects surrounding tissues and nerves. In terms of functional limitations, 102 (100%) of the patients reported difficulty in climbing stairs, demonstrating the impact of OA on daily activities. Weak quadriceps were observed in 75 (73.5%) patients, which is consistent with muscle weakness often seen in OA. Lastly, 44 (43.6%) participants had visible deformities in the knee joint, indicating a more advanced stage of OA in these individuals.

DISCUSSION

The present study aimed to investigate the association between obesity and knee osteoarthritis (OA) in females at a tertiary care

teaching hospital. Our findings reveal a significant relationship between higher BMI and increased prevalence of knee OA in women, with the obese group showing the highest number of OA cases. These results are consistent with existing literature that highlights obesity as a major risk factor for the development and progression of knee OA.

The strong association observed between obesity and knee OA in our study is supported by several other studies. For example, Felson *et al.* (1996) demonstrated that excess body weight directly contributes to increased joint loading, leading to cartilage breakdown in the knee [18]. This biomechanical hypothesis is further reinforced by the findings of Andriacchi (1994) and Schipplein & Andriacchi (1991), who noted that abnormal knee loading due to malalignment or excessive weight accelerates joint degeneration [19,20]. Similarly, Spector *et al.* (1996) in a twin study showed a genetic predisposition to OA, but they also acknowledged that modifiable factors like obesity play a crucial role in its onset and progression [21].

Our results also align with those of Keen *et al.* (1997), who found that genetic markers related to vitamin D receptor polymorphisms might contribute to knee OA in women. While genetic factors may influence the susceptibility to OA, our study suggests that environmental factors, particularly obesity, may significantly exacerbate the condition, supporting the interaction between genetic predisposition and lifestyle factors in the pathogenesis of OA [22].

The biomechanical theory explaining the link between obesity and knee OA posits that excess body weight increases axial loading, leading to cartilage wear and subchondral bone sclerosis. This theory was clearly supported by our data, as the obese group (BMI ≥ 30) had the highest prevalence of knee OA, with a much higher risk compared

to those with a normal BMI. This mirrors the March and Bagga (2004) study, which showed that increased BMI accelerates the mechanical stresses on the knee joint, promoting the development of OA [23].

Furthermore, the metabolic hypothesis linking obesity with OA through systemic inflammation and metabolic factors is also evident in our findings. Obesity leads to an increase in pro-inflammatory cytokines and adipokines, which have been implicated in cartilage degradation and OA progression [4]. This metabolic pathway is supported by studies such as Felson (1996), which documented that inflammatory mediators associated with obesity can directly damage joint tissues, including articular cartilage [18].

Our findings also show a dose-response relationship between BMI and the prevalence of knee OA, which is supported by longitudinal studies like the Framingham Study and the Chingford Study, both of which established that higher BMI is a risk factor for the development of knee OA [24,25]. The Framingham Study, for instance, found that the risk of knee OA increased by up to four times in obese individuals, a result that closely parallels our study's findings. The relationship between increased BMI and higher OA risk was also documented by Baltimore Longitudinal Study of Aging (17), which supports our conclusion that obesity significantly contributes to the burden of knee OA.

In comparison to existing research, our study provides a clearer understanding of the mechanisms through which obesity impacts knee OA in females, emphasizing both biomechanical and metabolic pathways. While several studies have previously established a link between obesity and knee OA, our study further quantifies this association and provides a specific focus on female patients in a tertiary care setting.

However, it is important to note that while obesity is a significant contributor to

knee OA, other factors such as genetic predisposition and age must also be considered in the overall pathogenesis of the disease. Future studies exploring genetic-environmental interactions could provide further insights into personalized prevention and treatment strategies for knee OA, especially in obese individuals. Additionally, intervention studies focusing on weight loss and its effect on knee OA severity could strengthen the recommendations for managing obesity as a modifiable risk factor in clinical settings.

CONCLUSION

In conclusion, this study reinforces the growing evidence that obesity is a significant risk factor for knee osteoarthritis (OA) in women. The results suggest that both mechanical overload and systemic inflammation associated with excess body weight play crucial roles in the onset and progression of knee OA. These findings emphasize the importance of weight management and physical activity as key strategies for preventing and managing knee OA, particularly in obese individuals. Future research should focus on longitudinal studies to further explore the long-term impact of obesity on knee joint health and assess the effectiveness of targeted interventions in reducing the burden of this disease.

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