Demographics, Daily Sleep Hours, Body Mass Index, and Comorbidities in Overweight People

Ayesha Amjad, Saeed Bin Ayaz*, Fawad Rahman**, Ahmad Jamal, Naureen Tassadaq***, Sonia Iqbal,

Department of Medicine, University of Lahore, Gujrat Campus Gujrat Pakistan, *Department of Rehabilitation Medicine, Combined Military Hospital, Jhelum/National University of Medical Sciences (NUMS) Pakistan, **Department of Medicine, Combined Military Hospital, Multan/National University of Medical Sciences (NUMS) Pakistan, ***Department of Rehabilitation Medicine, Fauji Foundation Hospital, Rawalpindi Pakistan

ABSTRACT

Objective: To explore the association of knee pain intensity with demographics, body mass index, daily sleep hours and comorbidities in overweight people.

Study Design: Cross-sectional study.

Place and Duration of Study: Different Clinics of Wazirabad City, Pakistan, from Oct 2020 to May 2021.

Methodology: People with knee pain for >1 month and a body mass index of ≥25 kg/m2 were included and questioned regarding variables of interest. The pain was graded according to the Numerical Rating Scale.

Results: Of 335 individuals (mean age: 31±7 years), 189(56.4%) were males, and 199(59.4%) were married. The mean systolic and diastolic blood pressures were 124.4±7.9 mmHg and 85.3±7.2 mmHg, respectively. The mean sleep hours were 7±0.8 hours, while the mean body mass index was 30.1±2 kg/m². The mean pain score was 2.8±1. Pain intensity had a significant positive correlation with age ($p<0.001$), body mass index ($p=0.041$), systolic and diastolic blood pressures ($p<0.001$ each). Similarly, pain intensity was significantly higher in people who were married ($p<0.001$) or had diabetes mellitus or hypertension ($p<0.001$ each).

Conclusion: Knee pain intensity increases with age, body mass index, and systolic and diastolic blood pressure, and it decreases with increasing sleep hours.

Keywords: Blood pressure, Body mass index, Diabetes mellitus, Hypertension, Pain intensity, Pain measurement.

INTRODUCTION

Obesity-related knee pain is a complicated illness that increases patient morbidity and mortality while also putting a financial strain on the healthcare system.[1] Knee pain affects two out of every three obese people, and the problem becomes more common as BMI rises.[2] It has been reported that over 50% of the individuals who require total knee replacement for knee pain due to advanced knee osteoarthritis (OA) are obese.[3,4]

The association of obesity with knee pain is less actively evaluated in Pakistan.[5] In a study by Khalid et al. regarding the occurrence of OA among knee joint pain patients in Bahawalpur City, it was found that 60% of the patients were obese.[6] In obese people with knee pain, there are, however, multiple other factors that can aggravate or alleviate pain intensity. Some of the factors mentioned in the literature are calorie intake, exercise, history of trauma, and gender of the individual.[7,8] To our knowledge, such an elaborate evaluation only exists in Pakistan. To address this

aspect, we have conducted this research to find the association of auxiliary factors in determining knee pain intensity in obese and overweight people. The exploration involved the association of knee pain intensity with age, marital status, diabetes mellitus (DM), hypertension, BMI, systolic and diastolic blood pressures (BP), and hours of daily sleep. Understanding the relationship between these characteristics is important since it will aid in the development of effective interventions for Pakistan's obese population suffering from knee pain.

METHODOLOGY

The cross-sectional study was conducted Different Clinics of Wazirabad City, Pakistan from October 2020 and May 2021 after approval from the Ethical Committee and written consent from all respondents. The sample size was calculated through an online sample size calculator taking the anticipated mean of Group-1 as 5.31±2.45,[8] anticipated mean of Group-2 as 6.35.[8]

Inclusion Criteria: Individuals aged 20 to 45 years who had a BMI of ≥ 25 kg/m² and had knee pain for over a month.

Exclusion Criteria: Individuals with knee pain due to knee injuries, tumours, and surgery were excluded from inclusion.

The non-probability consecutive sampling was employed. Respondents were included per inclusion criteria. Their height and weight were measured to assess their BMI. The measurements for height and weight were taken in centimetres and kilograms, respectively. All participants were instructed to dress in light clothing and remove their shoes. The weight was measured using the Certeza GS 808 Digital Bathroom Scale. A simple height measurement scale was used to determine the height. Individuals with a BMI of 25-29.9 kg/m² were classified as overweight, while those with a BMI over 30 kg/m² were classified as obese. Then, we asked them about knee pain and graded it according to the Numerical Rating Scale. The pre-designed structured questionnaire was used to record the information. After the initial interview, systolic and diastolic blood pressure (BP) recordings were taken using a Stand-Type Mercurial Sphygmomanometer after sitting in a relaxed position for ten minutes. People were considered to have hypertension if they either had a BP measurement of $\geq$ 140 mmHg systolic and $\geq$90 mmHg diastolic BP or were currently using antihypertensive medications. DM was diagnosed if the participants had a clear-cut history of DM verified by a registered medical practitioner's notes or had laboratory reports showing fasting blood glucose level of $\geq$126 mg/dL (7.0 mmol/L) or 2 hours post-load glucose level of $\geq$200 mg/dL (11.1 mmol/L) during an Oral Glucose Tolerance Test.

The statistical software Statistical Package for Social Sciences v 20.0 was used to analyse the data (IBM Corp., Armonk, NY, USA). Mean, standard deviation, frequencies and percentages were used for descriptive analysis. Pearson's correlation analysis was carried out to assess the correlation. Independent sample t-test was applied to explore the inferential statistics. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

Three hundred thirty-five individuals were (mean age: 31±7 years; range: 21-44 years) included. The male respondents were 189(56.4%), (Table-I). From the study sample, 199 (59.4%) were married. 28(8.5%) people had DM, while 39(11.9%) people had hypertension.

The mean systolic BP was 124.4±7.9 mmHg (range: 110-150 mmHg), and the mean diastolic BP was 85.3±7.2 mmHg (range: l 60-110 mmHg). The mean sleep hours were 7±0.8 hours (6-10 hours), while the

mean BMI was 30.1±2 kg/m² (range: 18.1-35.5 kg/m²). One-hundred and eighty-four (54.9%) people were overweight, while 151 (45.1%) people were obese. The mean pain score, according to NRS, was 2.8±1 (range: 1-6). 139(41.5%) respondents had knee stiffness, and 52 (15.5%) had knee swelling.

Table-I: Socio-Demographic Characteristics of the Study Sample (n=335)

Variables	Sub-variables	n(%)
Gender	Male	189(56.4)
	Female	146(43.6)
Marital Status	Single	136(40.6)
	Married	199(59.4)
Body Mass Index	Overweight	184(54.9)
	Obese	151(45.1)
Diabetes Mellitus	Yes	28(8.5)
	No	303(91.5)
	Missing	4
Hypertension	Yes	39(11.9)
	No	296(88.4)
Knee swelling	Yes	52(15.5)
	No	283(84.5)
Knee stiffness	Yes	139(41.5)
	No	196(58.5)

On correlation analysis, pain intensity had a significant positive correlation with age (*p*<0.001, r=0.400), BMI (*p*=0.041, r=0.112), systolic and diastolic BP (*p*<0.001 each, r=0.411 and 0.299 respectively), and a negative correlation with the hours of sleep per day (p =0.028, r=-0.120) (Table-II). Similarly, pain intensity was significantly higher in people who were married (*p*<0.001) or had DM or hypertension (*p*<0.001 each) (Table -III).

Table-II: Correlation of Knee Pain Intensity with Age, BMI, Systolic and Diastolic Blood Pressure and Daily Hours of Sleep (n=335)

Variables	r-value	*p*-value
Age	0.4	<0.001
Body Mass Index	0.112	0.041
Systolic Blood Pressure	0.411	<0.001
Diastolic Blood Pressure	0.299	<0.001
Hours of sleep per day	-0.120	0.028

Table-III: Comparison of Pain Intensity with Gender, Marital Status, Diabetes Mellitus, and Hypertension (n=335)

Variables		Pain Intensity Score	*p*-value
Gender	Male	2.77±1.009	0.844
	Female	2.86±0.987	
Marital status	Married	3.04±1.086	<0.001
	Single	2.48±0.740	
Diabetes Mellitus	Yes	3.93±3.9	<0.001
	No	2.71±0.944	
Hypertension	Yes	3.87±0.978	<0.001
	No	2.67±0.915	

DISCUSSION

Like other non-communicable diseases, i.e. diabetes and hypertension, obesity is now becoming an emerging epidemic in Pakistan. Obesity is a known risk factor for producing knee pain and knee osteoarthritis, and thus, women are expected to have more knee pain and knee pain with higher intensity than men.[9] Umar et al.[10] studied the effects of obesity on the development of knee pain and other disabilities related to obesity in Nigerian individuals. They noted that the females were mostly affected, with a ratio of 6:1 to males. In our study, however, we could not find a significant difference in pain intensity among men and women.

We found that knee pain was significantly associated with being married. Bindawas *et al*.[11] yielded the opposite results and found that knee pain was significantly more common in unmarried people. Similarly, MacLellan *et al*.[12] observed that being divorced had a positive correlation with knee pain in 915 obese people with a mean BMI of > 50 kg/m^2.

Our third observation was a positive association of pain intensity with BMI. In a 14-year study in the United Kingdom, researchers examined the link between BMI and knee pain in 594 women.[13] They found that higher BMI at the start and finish of the study and changes in BMI over 15 years were significant predictors of knee pain at the end of the study, regardless of radiographic knee osteoarthritis. Leyland *et al*.[14] conducted a study that intended to check the relative risk towards knee replacement associated with obesity along with the occurrence of knee OA. The subjects enrolled were followed for more than two and half years. The attributable risk was calculated as 31% associated with knee pain progressing to knee OA and, finally, knee replacement. A Dutch study, Predicting Knee Pain and Knee Osteoarthritis among Overweight Women, concluded that pain intensity significantly correlated with BMI.[15] A recent French study also found a dose–response relation between BMI and the clinical consequences of knee OA.[16]

We found a higher pain intensity in participants who had hypertension than those who had a normal BP. In addition, a positive relationship was found between knee pain intensity and systolic and diastolic BP values. Earlier, a meta-analysis found a significant association of hypertension with symptomatic knee OA.[17] The prevalence of diabetes mellitus (DM) is another factor linked to greater pain severity in obese patients. In a similar study, Eitner and colleagues found that OA individuals with DM had worse knee pain and more physical and mental difficulties than those who did not have DM.[18] Another study found that despite controlling for medication use, increasing haemoglobin A1C levels (a measure of average blood glucose over time) were linked to increased pain severity in individuals with localised OA.[19] Our study also had comparable results. As a systemic condition, DM may enhance systemic inflammation, which could explain why patients with knee OA have more severe pain than those who do not have DM. In individuals with DM and end-stage knee OA, a recent study discovered more inflammatory markers in the synovial fluid, including interleukin-6 (IL-6) and higher synovitis scores.[20]

Finally, hours of sleep per day were negatively correlated with knee pain intensity in our study. The related medical literature gives evidence for and against the association of knee pain with sleep hours. MacLellan *et al*.[12] discovered a link between knee pain and the amount of hours spent sleeping. In a study by Cho *et al*.[21] knee pain was found to have a negative relationship with sleep length. Jeong *et al*.[22] however, could not find any independent association of sleep duration with OA-related knee pain.

CONCLUSION

The intensity of knee pain in our sample increased with age, BMI, and systolic and diastolic BP, while it decreased with increasing sleep hours during the day. Moreover, knee pain intensity was on the higher side in married people and people with DM and hypertension. Based on these findings, more research will be required into the cause–effect link between knee pain and the factors above.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

AA & SBA: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

FR & AI: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

NT & SI: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Flego A, Dowsey MM, Choong PF, Moodie M. Addressing obesity in the management of knee and hip osteoarthritis - weighing in from an economic perspective. BMC Musculoskelet Disord 2016; 17: 233. https://doi.org/10.1186/s12891-016-1087-7.

2. Badley EM, Wilfong JM, Yip C, Millstone DB, Perruccio AV. The contribution of age and obesity to the number of painful joint sites in individuals reporting osteoarthritis: a population-based study. Rheumatology 2020; 59(11): 3350-3357. https://doi.org/10.1093/rheumatology/keaa138.

3. Salih S, Sutton P. Obesity, knee osteoarthritis and knee arthroplasty: a review. BMC Sports Sci Med Rehabil 2013; 5(1): 25. https://doi.org/10.1186/2052-1847-5-25.

4. Seaman DR. Weight gain as a consequence of living a modern lifestyle: a discussion of barriers to effective weight control and how to overcome them. J Chiropr Humanit 2013; 20(1): 27-35. https://doi.org/10.1016/j.echu.2013.08.001.

5. Chang J, Liao Z, Lu M, Meng T, Han W, Ding C, et al. Systemic and local adipose tissue in knee osteoarthritis. Osteoarthritis Cartilage 2018; 26(7): 864-871. https://doi.org/10.1016/j.joca.2018.03.004.

6. Khalid MU, Akhtar MAB, Akhtar MHB. Frequency of osteoarthritis among patients of knee joint pain. J Sheikh Zayed Med Coll 2015; 6 (4): 885-887.

7. Lerman SF, Finan PH, Smith MT, Haythornthwaite JA. Psychological interventions that target sleep reduce pain catastrophizing in knee osteoarthritis. Pain 2017; 158(11): 2189-2195. https://doi.org/10.1097/j.pain.0000000000001023.

8. Alenazi AM, Alshehri MM, Alothman S, Alqahtani BA, Rucker J, Sharma N, et al. The Association of Diabetes with Knee Pain Severity and Distribution in People with Knee Osteoarthritis using Data from the Osteoarthritis Initiative. Sci Rep 2020; 10(1): 3985. https://doi.org/10.1038/s41598-020-60989-1.

9. Tanzil S, Jamali T. Obesity, an emerging epidemic in Pakistan-a review of evidence. J Ayub Med Coll Abbottabad 2016; 28(3): 597-600.

10. Umar A, Adelowo OO, Okpapi JO, Omuya UB. Effect of obesity on self-reported pain and functional disability in patients with knee osteoarthritis in Zaria, North Western Nigeria. Sub-Saharan Afr J Med 2018; 5(2): 52-58. https://doi.org/10.4103/ssajm.ssajm_10_18

11. Bindawas SM, Vennu V, Stubbs B. Longitudinal Relationship Between Knee Pain Status and Incident Frailty: Data from the Osteoarthritis Initiative. Pain Med 2018 ;19(11):2146-2153. https://doi.org/10.1093/pm/pnx296.

12. MacLellan GA, Dunlevy C, O'Malley E, Blake C, Breen C, Gaynor K, et al. Musculoskeletal pain profile of obese individuals attending a multidisciplinary weight management service. Pain 2017 ; 158(7): 1342-1353. https://doi.org/10.1097/j.pain.0000000000000918.

13. Goulston LM, Kiran A, Javaid MK, Soni A, White KM, Hart DJ, et al. Does obesity predict knee pain over fourteen years in women, independently of radiographic changes? Arthritis Care Res 2011; 63(10): 1398-406. https://doi.org/10.1002/acr.20546 .

14. Leyland KM, Judge A, Javaid MK, Diez-Perez A, Carr A, Cooper C, et al. Obesity and the Relative Risk of Knee Replacement Surgery in Patients With Knee Osteoarthritis: A Prospective Cohort Study. Arthritis Rheumatol 2016; 68(4): 817-825. https://doi.org/10.1002/art.39486.

15. Landsmeer MLA, Runhaar J, van Middelkoop M, Oei EHG, Schiphof D, Bindels PJE, et al. Predicting Knee Pain and Knee Osteoarthritis among Overweight Women. J Am Board Fam Med 2019 ; 32(4): 575-584. https://doi.org/10.3122/jabfm.2019.04.180302.

16. Raud B, Gay C, Guiguet-Auclair C, Bonnin A, Gerbaud L, Pereira B, et al. Level of obesity is directly associated with the clinical and functional consequences of knee osteoarthritis. Sci Rep 2020 ; 10(1): 3601. https://doi.org/10.1038/s41598-020-60587-1.

17. Zhang YM, Wang J, Liu XG. Association between hypertension and risk of knee osteoarthritis: A meta-analysis of observational studies. Medicine 2017; 96(32): e7584. https://doi.org/10.1097/MD.0000000000007584.

18. Eitner A, Culvenor AG, Wirth W, Schaible HG, Eckstein F. Impact of Diabetes Mellitus on Knee Osteoarthritis Pain and Physical and Mental Status: Data From the Osteoarthritis Initiative. Arthritis Care Res 2021; 73(4): 540-548. https://doi.org/10.1002/acr.24173.

19. Alenazi AM, Obaidat SM, Alshehri MM, Alothman S, Gray C, Rucker J, et al. Type-2 Diabetes Affects Joint Pain Severity in People with Localized Osteoarthritis: A Retrospective Study. Pain Med 2020; 21(5): 1025-1031. https://doi.org/10.1093/pm/pnz299.

20. Eitner A, Pester J, Vogel F, Marintschev I, Lehmann T, Hofmann GO, et al. Pain sensation in human osteoarthritic knee joints is strongly enhanced by diabetes mellitus. Pain 2017 ; 158(9): 1743-1753. https://doi.org/10.1097/j.pain.0000000000000972.

21. Cho Y, Jung B, Lee YJ, Kim MR, Kim EJ, Sung WS, et al. Association between sleep duration and osteoarthritis and their prevalence in Koreans: A cross-sectional study. PLoS One 2020 ; 15(4): e0230481. https://doi.org/10.1371/journal.pone.0230481.

22. Jeong JN, Kim SH, Park KN. Relationship between objectively measured lifestyle factors and health factors in patients with knee osteoarthritis: The STROBE Study. Medicine 2019; 98(26): e16060. https://doi.org/10.1097/MD.0000000000016060.

....