Sports Participation, Demographic Factors and Knee Symptom Severity in Riyadh, Saudi Arabia

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Authors' contributions

The manuscript has been read and approved for submission by all the authors. All authors believe the presented manuscript is representative of their work. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Aims: to explore the prevalence of knee symptoms in the general population of Riyadh, Saudi Arabia, and evaluate the impact of sports participation and other demographic variables on the progression of knee symptoms in Riyadh, Saudi Arabia.
Study design: Cross-sectional study
Place and duration of study: A self-administered online survey was conducted in Riyadh, Saudi Arabia between September 2020 to March 2021.
Methodology: A total of 589 participants age 18 or older who reported concerns of knee symptoms and provided written informed consent were enrolled in the study. We excluded respondents who had undergone knee surgery (n = 16) and those diagnosed with rheumatoid arthritis or other types of arthritis (n = 25). We collected demographic information (eg, age, gender, types of engaged sports, sports participation hours, and frequency of participation per week) and knee symptoms and severity using the Lequesne index tool.
Results: Advanced age was significantly associated with a higher severity score (P < .001). We found a statistically significant association between body mass index and knee symptom severity.

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We noted no severe knee symptoms in participants engaging in weightlifting. Most participants (64.7%) reported that walking was their most frequent exercise, and knee symptoms were common. Of respondents who walk as their primary sport, 10.6% of them are considered disabled with a severe form of knee pain according to the Lequesne index (which uses the term "handicapped" rather than disabled).

Conclusion: Older and overweight respondents had a high prevalence of knee symptoms. Interestingly, the prevalence rates of individuals without knee symptoms did not differ regarding sport participation. Sports participation frequency did not change the prevalence or severity of knee symptoms, while longer exercise duration was associated with lower knee symptom severity rates.

ABBREVIATIONS

BMI : Body Mass Index.
OA : Osteoarthritis.

1. INTRODUCTION

Physical discomfort is a major health issue in which the individual suffers physically and psychologically, especially older community members [1]. Knee pain and its associated symptoms are progressive and multifactorial [2]. Osteoarthritis (OA) is the predominant cause of knee symptoms in the older population [3], defined as a chronic degenerative disease characterized by the focal loss of articular cartilage and marginal bone formation leading to a narrow joint space and osteophyte formation [4]. Involving the entire joint in addition to the articular surface [5]. Osteoarthritis is the most common arthritic condition worldwide [6,7], with multiple risk factors including female gender, obesity, prior joint injury, occupation, genetics, and most significantly, aging [8-10]. An anatomical study revealed that 60% of men and 70% of women who die in their 70s and 80s are affected by OA [6]. The economy is also affected by OA, with an estimated loss of billions of dollars due to the medical care provided and work productivity lost among OA patients [7].

Sports and physical activity injuries are the leading cause of knee symptoms in the middle-aged population [11]. A previous study showed that 23.3% of male college students in Riyadh report knee injuries due to sports activity [12]. Knee trauma plays a major role in developing knee OA over time, as the risk increases 3.86 times in individuals with previous knee trauma [13].

A simple phenomenon known as "wear and tear" can explain the rising statistics in knee OA, given that physical activity accelerates the development of OA. Participating in various sport types (eg, soccer, weightlifting, and wrestling) has a three to seven times higher prevalence of developing knee OA among participants [14]. Former male soccer players have a two to three times greater prevalence of all knee OA outcomes (eg, knee pain, radiographic knee OA, and total knee replacement) than men in the general population [15]. Unlike other joints (eg, shoulder, wrist), the knee joint is affected by mechanical force and age [2], yet there is a deficit in the literature regarding the relationship between force and age and their effect on knee OA.

Pain in the knee can originate from different disorders, including inflammatory and degenerative arthritis, bursitis, and injury to ligaments, cartilage, or other structures in and around the joint [16]. Knee pain in children and adolescents increases the risk of developing knee OA later in life [17,18]. A crucial aspect in managing knee symptoms in the general population is determining the various influences of different sports types on knee symptoms so that health care providers can implement appropriate preventive strategies. Thus, this study aims to assess the prevalence of knee symptoms in the general population and evaluate the association of age and practicing different types of sports on the severity of knee symptoms. This study's findings may enhance our awareness regarding the impact of both demographic factors and physical activity on the progression of knee symptoms.

2. MATERIALS AND METHODS

This cross-sectional study was conducted from September 2020 to March 2021 using a self-completed online survey. A total of 589 participants were enrolled in the study. The sample size was calculated using OpenEpi v.3 (Mini & Nobili, 2017), based on the following

parameters: confidence level of 95%, margin error of 5% and the general population size of Riyadh which is 7,400,000. Before collecting the data from the study population, the Imam Muhammad bin Saud Islamic University Research Ethics Committee's institutional review board in Riyadh city approved the study design. Respondents provided written informed consent to be included in the study.

The recruitment method was by targeting the study sample through contacting a local mobile service company to introduce the survey to the general population of Riyadh, Saudi Arabia. Targeting all age groups and different socioeconomic status individuals. After recruitment we applied the inclusion and exclusion criteria as mentioned.

The study population consisted of participants aged 18 years and above complaining of knee symptoms and provided a written informed consent. Study excluded respondents younger than 18 years (n=21), any who received previous knee surgery (n=16), and those diagnosed with any form of arthritis except OA (n=25). We collected data via a self-administered online questionnaire that included demographic variables (eg, age, gender, marital status, education, and job). No personal or identifying information was collected as part of the survey to protect respondents' privacy. The second section included questions regarding their levels of physical activity and most often practiced sport. The last section assessed the severity of knee symptoms based on the Lequesne index [19]. Since the native language of our study population is Arabic, we used a validated translated version of the Lequesne index [20]. The questionnaire was validated via a pilot study on 15 random participants to identify any content and language issues.

We used R software v 3.6.3 for statistical analysis, and we summarized the distribution of categorical variables using counts and percentages. For checkbox questions (eg, comorbidities and knee injuries), each response percentage was calculated from the total sample size. We used bar plots to visualize the responses. Chi-square tests of independence were used to assess factors associated with the knee symptom severity index. We classified respondents into six categories based on the Lequesne index, which uses the term "handicap": None, mild, moderate, severe, very severe, and extremely severe. Statistical analysis was performed using the Kruskal-Wallis test. We used Spearman's correlation to assess the association between self-rated knee function and Lequesne score. Hypothesis testing was performed at a 5% level of significance.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Descriptive statistics

589 respondents completed the study questionnaire, 24.1% of whom were aged 51 to 60 years, and 22.8% were aged 41 to 50 (Table 1). Respondents aged 18 to 30 years represented 32.8% of the study sample. Male and female respondents represented 49.7% and 50.3% of the sample, respectively. Saudis represented 96.9% of the respondents. The average weight and height of the included respondents were 77.3 kg and 166 cm, respectively. The average body mass index (BMI) was 27.9 kg/m2. University graduates represented 65.5% of the respondents, while respondents who completed only high school represented 32.3% of the study sample. 121 respondents (20.6%) were smokers, with 30.6% reporting an average smoking duration of one to five years. Respondents who reported smoking for >20 years represented 32.2% of the study sample. A majority of the respondents (63.7%) did not report any comorbidities. Walking was the most reported exercise (n = 282, 64.7%). Weightlifting was practiced by 13.8%, while running and football represented 5.5% of respondents each.

Among respondents, 23.3% were diagnosed with OA of the knee joint (Table 2). Many respondents (54.5%) had a first-degree relative with OA of the knee. A majority of the respondents (74.7%) exercised regularly, with 36.6% exercising once or twice per week and 38.2% exercising three to four times per week. Only 11.8% of the respondents reported exercising daily. A majority of respondents (68.4%) reported that they had been exercising for one to five years.

Regarding exercise duration, slightly more than half of the respondents (55.3%) reported exercising for 30 to 60 minutes, and 99 (22.5%) reported exercising for fewer than 30 minutes. 55% of the respondents rated their knee function as normal,and 37% rated their knee function as almost normal. Only 3.18% and 1.36% rated their

Table 1. Descriptive statistics (N = 589)

Demographic variables	N (%)
Age:	
18 - 30 years	193 (32.8%)
31 - 40 years	68 (11.5%)
41 - 50 years	134 (22.8%)
51 - 60 years	142 (24.1%)
61 - 70 years	50 (8.49%)
>70 years	2 (0.34%)
Gender:	
Female	296 (50.3%)
Male	293 (49.7%)
Nationality:	
Non-Saudi	18 (3.06%)
Saudi	571 (96.9%)
Mean height (cm)	166 (9.58%)
Mean weight (kg)	77.3 (18.5%)
Mean BMI (kg/m^2)	27.9 (6.10%)
Education:	
Primary school	5 (0.85%)
Middle school	8 (1.36%)
High school	190 (32.3%)
University graduate	386 (65.5%)
Occupation:	
Office work	209 (36.1%)
University student	148 (25.6%)
I don't work	83 (14.3%)
Teaching	55 (9.50%)
Health care provider	39 (6.74%)
Field work	37 (6.39%)
Student	3 (0.52%)
Sports professional	2 (0.35%)
Other	3 (0.52%)
Smoker:	
No	466 (79.4%)
Yes	121 (20.6%)
How long have you been smoking?	
< 1 year	5 (4.13%)
1 - 5 years	37 (30.6%)
6 - 10 years	22 (18.2%)
11 - 20 years	18 (14.9%)
> 20 years	39 (32.2%)
Comorbidities:	
No	375 (63.7%)
Yes	214 (36.3%)

*Counts and percentages were used to summarize the distribution of categorical variables

knee function as abnormal and very abnormal. A total of 65 respondents (14.8%) had knee injuries due to sports. Regarding knee symptoms, 43.8% of the respondents did not report any knee symptoms. Sounds and crackling were reported by 32.1% of respondents.

3.1.2 Lequesne index

331 respondents completed the Lequesne index questionnaire; the index was exclusive to participants reporting knee symptoms (Fig. 1).

We found a skewed distribution for the Lequesne index with a maximum score of 16.5 and an average score of 4.48 ± 3.85. The severity of arthritis was categorized based on the final score. The median index score was 3, indicating that the overall score was <3 in 50% of the respondents and ≥3 in the remaining 50%.

Results showed that 13% had no handicap (i.e., a score of 0 on the Lequesne index), and 50.8% of the respondents had a mild handicap (i.e., a score of 1 to 4; Table 3). The handicap

Table 2. Exercise habits and knee problems reported by the respondents (N=589)

Question	N (%)
Have you ever been diagnosed with Osteoarthritis of the knee joint?	
No	452 (76.7%)
Yes	137 (23.3%)
Do you have a first-degree relative with Osteoarthritis of the knee joint?	
No	269 (45.7%)
Yes	320 (54.3%)
Do you/Have you ever exercised regularly?	
No	149 (25.3%)
Yes	440 (74.7%)
How often do you exercise a week?	
Once or twice	161 (36.6%)
3 - 4 times	168 (38.2%)
5 - 6 times	59 (13.4%)
Daily	52 (11.8%)
How long do you exercise daily?	
< 30 minutes	99 (22.5%)
30 - 60 minutes	239 (54.3%)
1 - 2 hours	98 (22.3%)
> 2 hours	4 (0.91%)
How long have you been exercising?	
1 - 5 years	301 (68.4%)
6 - 10 years	48 (10.9%)
11 - 15 years	22 (5.00%)
16 - 20 years	13 (2.95%)
> 20 years	56 (12.7%)
How would you rate your knee function in general when doing sporting activities?	
Normal	242 (55.0%)
Almost normal	163 (37.0%)
Abnormal	14 (3.18%)
Very abnormal	6 (1.36%)
Prevents me from doing sports	15 (3.41%)

Question	N (%)
Have you ever had a knee injury due to sports?	
No	375 (85.2%)
Yes	65 (14.8%)
Do you suffer from one of these knee problems?	
I don't have knee problems	258 (43.8%)
Swelling	9 (1.53%)
Pain	116 (19.7%)
Sounds or crackling	189 (32.1%)
Stiffness	17 (2.89%)

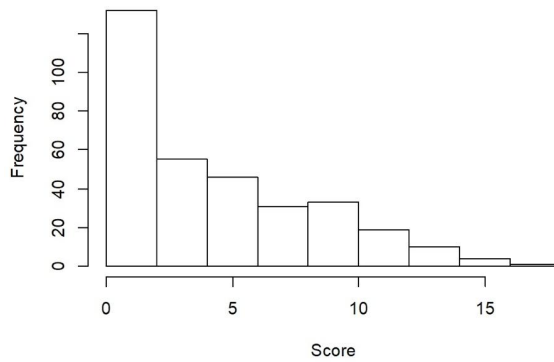*Counts and percentages were used to summarize the distribution of categorical variable*

Fig. 1. Histogram of the distribution on Lequesne index

Table 3. Distribution of Lequesne index (N=331)

	Mean score
Lequesne Index	4.48 (SD, 3.85)
Pain or discomfort	1.89 (SD, 1.87)
Maximum distance walked	1.35 (SD, 1.48)
Activities of daily living	1.24 (SD, 1.40)
Score (category):	
None	43 (13.0%)
Mild	168 (50.8%)
Moderate	48 (14.5%)
Severe	42 (12.7%)
Very severe	24 (7.25%)
Extremely severe	6 (1.81%)

*Abbreviation: SD, standard deviation.

was classified as moderate, severe, very severe, and extremely severe in 14.5%, 12.7%, 7.25%, and 1.81% of the respondents, respectively.

We found a statistically significant association between self-rated knee function and Lequesne index (P < 0.05; Fig. 2). Pairwise comparisons (using Mann-Whitney test) showed that the median score was significantly lower in respondents with normal knee function than respondents with any of the other three statuses. Spearman's correlation test revealed a statistically significant association between self-rated knee function and Lequesne index (r = 0.27, P < .001). Spearman's correlation revealed a statistically significant association between BMI and Lequesne index (r = 0.22, P < .001; Fig. 3).
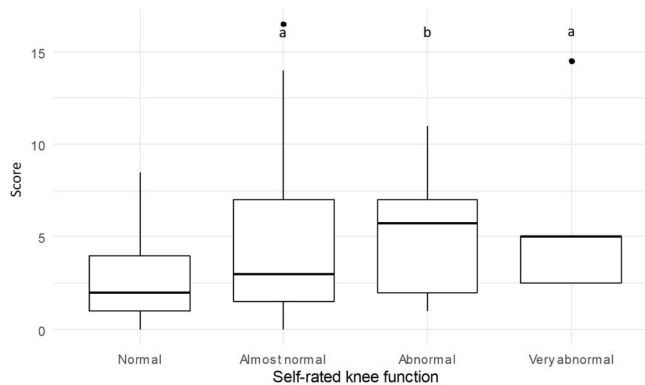

**Fig. 2. Association between self-rated knee function and Lequesne index aP < 0.05, bP < 0.01
All groups were compared to the normal group using the Mann-Whitney test**

Table 4. Demographic factors associated with the severity of osteoarthritis index (Lequesne index)

Demographic factor	Lequesne index score				P	N
	None, n=301 (%)	Mild, n=168 (%)	Moderate, n=48 (%)	Severe, n=72 (%)		
Age:						
18 - 30 years	114(59.1%)	60 (31.1%)	9 (4.66%)	10 (5.18%)	<.001	589
31 - 40 years	30 (44.1%)	17 (25.0%)	9 (13.2%)	12 (17.6%)		
41 - 50 years	52 (38.8%)	51 (38.1%)	13 (9.70%)	18 (13.4%)		
51+ years	105 (54.1%)	40 (20.6%)	17 (8.76%)	32 (16.5%)		
Gender:						
Female	113 (38.2%)	91 (30.7%)	35 (11.8%)	57 (19.3%)	<.001	589
Male	188 (64.2%)	77 (26.3%)	13 (4.44%)	15 (5.12%)		
Mean BMI (kg/m^2)	27.4 (5.82)	27.6 (4.95)	30.4 (10.5)	29.2 (5.35)	0.004	589
Education:						
Primary school	1 (20.0%)	2 (40.0%)	0 (0.00%)	2 (40.0%)	0.036	589
Middle school	1 (12.5%)	5 (62.5%)	2 (25.0%)	0 (0.00%)		
High school	91 (47.9%)	57 (30.0%)	20 (10.5%)	22 (11.6%)		
University graduate	208 (53.9%)	104 (26.9%)	26 (6.74%)	48 (12.4%)		
Smoker:						
No	225 (48.3%)	133 (28.5%)	43 (9.23%)	65 (13.9%)	0.006	587
Yes	76 (62.8%)	33 (27.3%)	5 (4.13%)	7 (5.79%)		
Comorbidities:						
No	202 (53.9%)	120 (32.0%)	28 (7.47%)	25 (6.67%)	<.001	589
Yes	99 (46.3%)	48 (22.4%)	20 (9.35%)	47 (22.0%)		
Do you have a first-degree relative with Osteoarthritis of the knee joint?						
No	145 (53.9%)	83 (30.9%)	20 (7.43%)	21 (7.81%)	0.019	589
Yes	156 (48.8%)	85 (26.6%)	28 (8.75%)	51 (15.9%)		
Have you ever been diagnosed with Osteoarthritis of the knee joint?						
No	284 (62.8%)	118 (26.1%)	25 (5.53%)	25 (5.53%)	<.001	589
Yes	17 (12.4%)	50 (36.5%)	23 (16.8%)	47 (34.3%)		

Have you ever had a knee injury due to sports?						
No	205 (54.7%)	107 (28.5%)	30 (8.00%)	33 (8.80%)	0.004	440
Yes	21 (32.3%)	27 (41.5%)	11 (16.9%)	6 (9.23%)		
Do you suffer from one of these knee problems?						
I don't have knee problems	258 (100%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	<.001	589
Swelling	0 (0.00%)	7 (77.8%)	0 (0.00%)	2 (22.2%)		
Pain	7 (6.03%)	47 (40.5%)	17 (14.7%)	45 (38.8%)		
Sounds or crackling	36 (19.0%)	105 (55.6%)	28 (14.8%)	20 (10.6%)		
Stiffness	0 (0.00%)	9 (52.9%)	3 (17.6%)	5 (29.4%)		

Data were summarized using counts and percentages for categorical variables and mean (standard deviation) for continuous variables.
Statistical analysis was performed using Chi-square test of independence
Statistical analysis was performed using one-way ANOVA for BMI
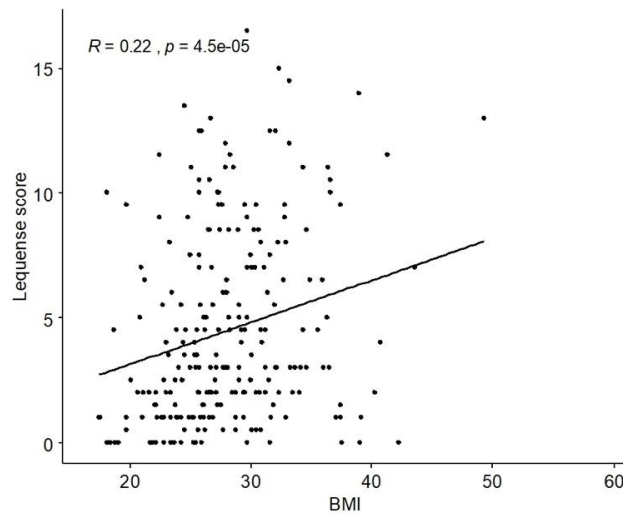*Abbreviations: ANOVA, analysis of variance; BMI, body mass index*

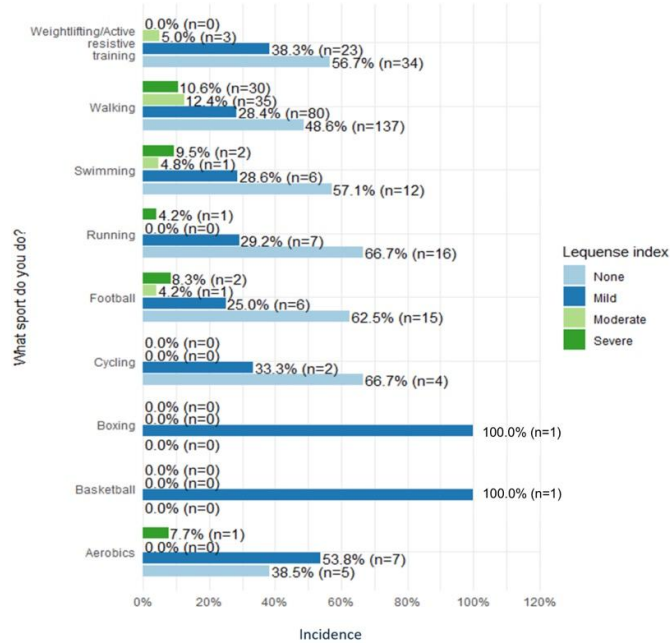**Fig. 3. Correlation between BMI and lequesne score Abbreviation: BMI, body mass inde**

Fig. 4. Lequesne index based on the most frequently practiced sport

3.1.3 Factors associated with handicap (Lequesne index)

We used the chi-squared test of independence to assess factors associated with the Lequesne index. The Lequesne index was recorded as follows: none, mild, moderate, and severe (severe, very severe, and extremely severe). We calculated BMI and recorded respondent age so that respondents older than 50 years are analyzed as one group.

Statistical analysis was performed using responses from 331 respondents who completed the Lequesne questionnaire (Table 4). The analysis revealed that higher age was significantly associated with a higher severity score (P < .001), as shown by the percentage of respondents with a severe handicap, which was higher in respondents aged older than 51 years compared to the remaining groups.

Regarding type of sports practiced by the participants in association of Lequesne index severity score, the most sport with No knee symptoms was running and cycling (66.7%). Whereas the group with no severe form participants was weightlifting/active resistance training (Fig. 4).

The percentage of respondents with no handicap was highest for respondents aged 18 to 30

years. The percentage of female respondents with a severe handicap was higher than male respondents (P = .001). The average BMI was significantly different across patients with various severity (P < 0.05). Respondents with moderate and severe handicaps had significantly higher BMI than respondents with no handicap (P < 0.05 for both comparisons). The presence of comorbidities was associated with the severity of handicap (P < .001). The prevalence of severe handicap was higher in respondents with comorbidities than those with no comorbidities. Family history was also associated with the severity of handicap (P < 0.05). Respondents diagnosed with OA of the knee joint had a higher prevalence of severe handicap than respondents who were not diagnosed with such condition (P < .001).

Results showed a statistically significant association between the Lequesne score and exercising regularly (P < .001; Table 5). Respondents who exercised regularly had a lower prevalence of severe handicap (15.7%) than those who did not (40.2%). Respondents who exercised more than four times per week had a higher prevalence of no handicap than the remaining two groups. Respondents who practiced for < 30 minutes had a higher prevalence of severe handicap (26.8%) than respondents in the remaining two groups.

Table 5. Association between Lequesne index and exercise habits

Exercise habits	Lequesne index score				P-value	N
	None, n=301 (%)	Mild, n=168 (%)	Moderate, n=48 (%)	Severe, n=72 (%)		
Do you/Have you ever exercised regularly?						
No	75 (50.3%)	34 (22.8%)	7 (4.70%)	33 (22.1%)	<.001	58
Yes	226 (51.4%)	134 (30.5%)	41 (9.32%)	39 (8.86%)		9
How often do you do exercise a week?						
Once or twice	82 (50.9%)	50 (31.1%)	20 (12.4%)	9 (5.59%)	0.214	44
3 - 4 times	81 (48.2%)	55 (32.7%)	12 (7.14%)	20 (11.9%)		0
> 4 times	63 (56.8%)	29 (26.1%)	9 (8.11%)	10 (9.01%)		
How long do you exercise daily?						
< 30 minutes	49 (49.5%)	24 (24.2%)	11 (11.1%)	15 (15.2%)	0.021	44
30 - 60 minutes	116 (48.5%)	77 (32.2%)	26 (10.9%)	20 (8.37%)		0
1+ hours	61 (59.8%)	33 (32.4%)	4 (3.92%)	4 (3.92%)		
How long have you been exercising?						
1 - 5 years	148 (49.2%)	94 (31.2%)	34 (11.3%)	25 (8.31%)	0.262	44
6 - 10 years	29 (60.4%)	15 (31.2%)	2 (4.17%)	2 (4.17%)		0
11 - 15 years	11 (50.0%)	8 (36.4%)	0 (0.00%)	3 (13.6%)		
16 - 20 years	7 (53.8%)	5 (38.5%)	1 (7.69%)	0 (0.00%)		
> 20 years	31 (55.4%)	12 (21.4%)	4 (7.14%)	9 (16.1%)		

*Data were summarized using counts and statistical analysis was performed using Chi-square test of independence

Table 6. Association between body mass index and severity of Lequesne index score

Index score:	BMI					P-value
	< 18.5, n=15 (%)	18.5 - 24.9, n=161 (%)	25 - 29.9, n=241 (%)	30 - 34.9, n=122 (%)	35+, n=50 (%)	
None	9 (60.0%)	98 (60.9%)	116 (48.1%)	53 (43.4%)	25 (50.0%)	0.001
Mild	4 (26.7%)	46 (28.6%)	70 (29.0%)	35 (28.7%)	13 (26.0%)	
Moderate	0 (0.00%)	7 (4.35%)	25 (10.4%)	11 (9.02%)	5 (10.0%)	
Severe	2 (13.3%)	10 (6.21%)	30 (12.4%)	23 (18.9%)	7 (14.0%)	

*Statistical analysis was performed using Chi-square test for linear trend

The analysis showed a statistically significant association between BMI and the severity of Lequesne index score (P = .001). The prevalence of severe handicap was higher in respondents with higher BMI than respondents with low BMI, which indicates that higher BMI is associated with higher severity (Table 6).

3.2 Discussion

Osteoarthritis's prevalence is positively associated with aging, as shown in many earlier studies [21,22] that attribute most knee symptoms in elders with OA [3]. This makes age a significant risk factor in developing knee symptoms. Interestingly, this study's participants'

ages did not play a role in developing knee symptoms because there is a relatively equal distribution of knee symptoms in individuals older than and younger than 50 years (45.9% and 50.5%, respectively). However, a significant number of participants in the age group older than 51 years reported having a severe form of knee symptoms, which is consistent with the finding of Miranda et al. in their study regarding risk factors associated with knee pain, which revealed that as age increases, the risk of persistent severe knee pain increases correspondingly [23].

An interesting result in the data is that 61.8% of female respondents reported concerns of knee

symptoms compared to only 35.8% of male respondents. This aligns with similar differences according to gender reported in the literature [12,23]. However, Chan et al. found no significant difference in the prevalence of knee symptoms between female (6.18%) and male (6.72%) participants [24]. This inconsistency may be due to differences in age groups, as Chan et al.'s study focused on undergraduate students with a mean age of 20.9 years. Other studies did not target a specific age in their sample recruitment [12,23].

Contrary to expectations that repetitive mechanical stress can contribute to microscopic trauma and stiffness in the knee joint, which may cause knee pain [25], there were no significant differences in the number of individuals reporting concerns of knee symptoms nor the severity of knee symptoms concerning the frequency of sport participation in our data. However, the duration of sports practice showed a pattern consistent with a protective effect to developing knee symptoms, given that the highest group of participants not reporting concerns from knee symptoms were individuals exercising more than one hour per day. Additionally, this group was the least affected by the moderate and severe form of knee symptoms according to the Lequesne index. Hahn et al.'s results support the hypothesis of duration having a protective effect on developing knee symptoms, given their report that the prevalence of knee pain decreased by the number of weekly hours of tennis practice [12].

Participants with a history of knee injury due to sports are at high risk of developing knee symptoms, as 67.7% of injured individuals developed knee symptoms in our study. This is in good agreement with a previous study stating that history of prior sports injuries in the knee can be a strong predictor of knee pain incidence [22]. Variations in severity on the type of sport were noted in the present study. However, the single most striking feature was attributed to weightlifting, where none of the sports' practicing athletes reported concerns of severe knee pain. Walking can be considered a low level of joint loading sports activity, according to Buckwalter [26]. Therefore, individuals with knee symptoms should consider walking as a sport due to its low impact properties on the knee joint; this explains the high number of walkers with knee symptoms (51.4%).

The knee joint is considered a weight-bearing joint, so being overweight is assumed to cause OA by increasing the joints' mechanical stress. The results of earlier studies support this statement [27,28]. Adding to the disease of OA, overweight individuals may lack physical fitness [22]. As expected, BMI showed a significant association with the prevalence of knee symptoms and the severity of arthritis. These values correlate well with reports in the literature [29,30].

4. LIMITATIONS

Our study has two important limitations. Our study had a limited variability in sport types, which made it difficult to investigate the significant relationships between different types of sport and their effect on the knee joint. Secondly, we had a small number of older respondents, which could be due to the study sample recruitment technique using an online questionnaire. However, our results have established the foundation for future studies to evaluate the causal relationship between knee symptoms and general demographic factors related to sport participation.

4. CONCLUSION

We designed the present study to determine the effect of different sports and associated factors and other demographic information on the knee joint regarding the type of symptom and severity. Age and BMI have a significant effect on developing knee symptoms. The prevalence of knee symptom-free individuals did not differ regarding sport or non-sport participation. Further research in this field around the role of sports participation and general demographic details is warranted to help address knee symptoms and diagnoses to develop specific prevention strategies.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Source of support: no financial support was received from any organization for the submitted work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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