ASSOCIATION OF BMI WITH PATELLOFEMORAL PAIN SYNDROME IN FEMALE OF REPRODUCTIVE AGE

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ABSTRACT

Objective of study was to find out the association between BMI with Patellofemoral Pain Syndrome in females of reproductive age (15-49 years. An observational cross sectional study was carried out on 385 patients of Patellofemoral pain syndrome (PFPS) diagnosed through clinical examination by Clark's test and Eccentric step test in females of reproductive age. Participants were selected on the basis of inclusion and exclusion criteria by non-probability convenient sampling from the National Orthopedic Hospital, Gujrat during August to November 2022. After taking written consent, data were collected. All data were entered and analyzed using SPSS software version 24. Mean±S.D was calculated for descriptive analysis. Chi Square test, independent t-test, ANOVA, and Pearson's Correlation Co-efficient were applied for the statistical significance difference at 95% confidence interval.

Results: Average age ,body mass index (BMI) and visual analogue scale(VAS) of 385 females of reproductive age was found 34.16±7.96 years, 25.80±3.78 Kg/m^2 and 4.11±2.29 respectively.Association of Patellofemoral Pain Syndrome with age of participants, marital status,occupation and BMI was found statistically significant with p-value <0.05.was found strong positively statistically significant with p-value < 0.001 in Patellofemoral pain syndrome patients.

Conclusion: Higher BMI have strongly effect on the Patellofemoral Pain Syndrome in females of reproductive age. Increasing age was directly also associated with Patellofemoral Pain Syndrome.

***Keywords*:**Patellofemoral pain syndrome (PFPS), body mass index (BMI), anterior knee pain (AKP), knee pain, association

INTRODUCTION

Patellofemoral Pain Syndrome (PFPS), also identified as pain in the retro patellar (behind the patella) and peri patellar (around the patella) regions, among young people, is the most prevalent knee joint pathology.Pain that occurs during and after physical activity, during body weight loading of the lower extremities as in walking up and down stairs and squatting, and sitting with the knees flexed are the most common symptoms in PFPS patients. The symptoms are usually progressive, but can be acute, as in the case of trauma. They can be unilateral or bilateral, achy or sharp. Patellofemoral pain syndrome (PFPS) reports for one-quarter of all knee injuries seen in sports medicine hospitals. According to reports,nearly 25%–30% of all injuries seen in clinics and as much as 40% of clinical visits for knee issues are caused by PFPS. PFPS typically affects people between the ages of 10 and 35 years oldand it is characterized by a high level of activity.[1]

Patients aged 18 to 35 years from various hospitals in Lahore showed a greater prevalence of PFPS in women (21.53%) than men (16.58%).[2]Patellofemoral pain syndrome increased subchondral bone stress as a result of joint loading, or cartilage lesions in the patella or distal femur.[3]PFP has been associated with a variety of biomechanical, anatomical, and psychological factors. Particularly, decreased knee strength is a risk factor for PFPS, and decreased functional ability indicates a poor outcome for PFP patients after rehabilitation. Body composition measurements are another potential component that may be related to PFP but has received less attention. The body mass index (BMI) of young adults with PFP is higher than that of pain-free controls. Additionally, it has been demonstrated that having a poor long-term outcomes for Patellofemoral pain patients are clinically predicted by a higher BMI.[4]Prior exercise routine, prior fitness level, and a BMI of 25 or higher are risk factors that can cause overload and raise the risk of PFPS.[5]

The prevalence of developing Patellofemoral pain or lower-limb injuries has been correlated to the Body mass index. There is conflicting evidence concerning the relationship between BMI and PFP. However, according to the World Health Organization (WHO), states

that there is a broad consensus that any BMI that is larger or smaller than the normal Body Mass Index of the sample population is indicatesPatellofemoral pain syndrome. In addition to rise body weight will also put more strain on the Patellofemoral joint, leading to structural degeneration and increased joint stress. The relationship between Body Mass Index andPatellofemoral Pain Syndrome (PFPS) and Patellofemoral Osteoarthritis (PFOA) hasn't been thoroughly investigated. Obesity status is variable, so identifies whether Body Mass Index is a cause for PFPS and PFOA or is related with symptoms.[6] Long-term PFP in teenagers frequently progresses toPatellofemoral joint degenerative arthritis, with ageing Patellofemoral arthritis signs to be expected. [7]

ThePatellofemoraljointisimportantforkneejointfunction. This is because the Patellofemoral joint, which is liable of absorbing axial loads during daily activities and may be subjected to forces up to two to three times the body mass, increases extensor torque by 30% at the end of range of motion.[8]

Since increase in body weight and related metabolic factors could lead to an increase in mechanical demand and excessive stress on the knee's articular cartilage, which would cause degeneration. This population has become more prone to developing knee osteoarthritis and PFPS in recent years, particularly in developing nations. The link between greater Body Mass Index and the onset of Patellofemoral Pain Syndrome is debatable, despite the possibility of a link between body mass and mechanical joint overload. In spite of this connection,losing weight may slow the progression of joint deterioration and improve pain and function in the knee, according to a conservative treatment approach.[9]And the current study was to find the association of BMI with Patellofemoral Pain Syndrome in females of reproductive age (15-49) years.

METHODOLOGY

Design, study population, setting and duration of study

An analytical cross-sectional study was conducted on 385 Patellofemoral pain syndrome patients diagnosed through diagnostic test. All data were collected from National Orthopedic Hospital of Gujrat for May to September 2022.

Sampling Technique and Sample size calculation

Non-probability, convenient sampling technique was applied for the selection of participants. Sample size calculation was done using below maintained formula.

$$n = (Z\ (1-\alpha/2))^{2}\ (P)(1-P)/(d)^{2}$$

In formula, Z (1-α/2) = 1.96 at 95% confidence interval. It was standard normal variate at 5% significance level, p = 0.5, which was expected proportion founded on previous study, d = absolute error or precision or marginal error was 5%

$$n = (1.96)^{2}\ (0.50)\ (0.50)/(0.05)^{2}$$

$$n = 384.16 = 385$$

At least 385 participants were required within 5% precision.

Participants

Females of reproductive aged 15 to 49 years were selected as a study population .[10]Knee pain in the front or behind the patella region brought on by the following at least twice: prolonged sitting, stair climbing, squatting, walking, orany additional useful activitythatstressesthePatellofemoraljoint(PFJ)inflexion and symptoms lasting 6 weeks or longer[11] were included. Females who had undergone any type of spinal or lower limb surgery, osteoarthritis, back, hip, ankle, or foot pain reported by the patient, pregnant women with 2nd and 3rd trimester and all other circumstances, such as tibiofemoral pathologies, that could result in anterior knee pain were excluded from the study.

Consent and ethical approval

Ethical approval was done by the institutional review board (IRB) of university of Lahore, Punjab, Pakistan. Informed consent was taken from the study participants.

Data collection Procedure

Participants were selected who were fulfilled the inclusion and exclusion criteria. A pre-test and self-structured proforma was used to collect necessary demographic data information like age, body mass index, occupation and marital status. For Body Mass Index calculation, weight in Kg was divided by height in (m^2) squared. Height and weight were measured through

measuring tape and weight machine respectively. Visual analogue scale (VAS) was used to assess the pain intensity or severity. In the visual analogue scale, 0 indicates no pain, 1 to 3 indicates minor pain, 4 to 6 indicates moderate pain, and 7 to 10 indicates severe pain. PFPS patients are diagnosed through clinical examination using the Eccentric Step Test and the Clarke's Test.

Eccentric Step Test: The test was completed by the participants barefoot. The 15 centimeter-high step. The participants were instructed to take as slow and smooth a step down from the step as possible while standing on step with their hands on their hips. Participants maintained a hand-on-hip position throughout the entire test. The test was repetitive using the other leg after participants completed it on one leg. The test was deemed positive for PFP if a participant complained knee pain while performing it.

Clarke's Test: The participants were positioned supine with both knees supported by pillows in order to achieve the required degree of knee flexion (10°–20°).In a relaxed state, the patient was instructed to compress the quadriceps muscle after the assessor distally pressed patella (withtheirhandsonthetopedgeofthekneecap). The Clarke's test was deemed positive for PFP if patient's pain was replicated through the procedure.

Participants who tested positive on both tests were considered to have Patellofemoral Pain Syndrome, while those who had negative tests on either test were considered to be at high risk for PFP, and those who had negative results from both tests were considered to have no Patellofemoral Pain Syndrome.

Statistical Analysis

All data were entered and analyzed using SPSS software version 24. Mean±S.D were calculated and displayed in tabular form for descriptive analysis. Chi Square test, independent t-test, ANOVA, and Pearson's Correlation Co-efficient were applied for the statistical significance difference at 95% confidence interval. All results were calculated at 955 confidence interval and p-value <0.05 was considered as significant value.

RESULTS

Average age of 385 females of reproductive age participants was observed 34.16±7.96 years, average BMI was calculated25.80 ± 3.78 Kg/m^2 and average pain intensity that was measured using VAS and found 4.11 ± 2.29 shown in **Table 1.**

In **Table 2** shows association of Patellofemoral Pain Syndrome (PFPS) with demographic characteristics of participants. Association of PFPS with age group of participants, marital status, occupation of participants and body mass index were found statistical significant difference with p-value <0.05 however area of participants was statistical significant with PFPS .

Table1. Descriptive analysis of participants

Variables	Mean±S.D
Age of Participants (Years)	34.16±7.96
Weight (Kg)	69.18±10.46
Height (feet)	5.37±.199
Body Mass Index (Kg/m^2)	25.80±3.78
Visual Analogue Scale (VAS)	4.11±2.29

In **Table 3** the result shows that the Patellofemoral pain syndrome (PFPS) was categorized in three categories; Confirm PFP (Both Clark's test and Eccentric step test positive), High risk PFP (Only one test positive Clark's test or Eccentric step test), and no risk of PFP (Both Clark's test and Eccentric step test negative) was compared with age, BMI and VAS by ANOVA and was found statistically significant with p-value <0.05.

DISCUSSION

The study included 385 females from National Orthopedic Hospital of Gujrat with age group of 15 to 49 years. PFPS diagnosed through Eccentric Step Test and Clark's Test. The self-structured perfoma was conducted to find out the association of BMI with PFPS. The weight and height were recorded using weight machine and measuring tape. The values and answer of Performa were encoded in SPSS software and details of analyzed data were discussed.

Prevalence of Patellofemoral pain syndrome is increasing in both genders, but females were chosen for this study because they have a higher risk of this disease than males.

ZoyaMujahid studied with her colleagues to evaluate the prevalence of Patellofemoral Pain syndromein both sexes between the ages of 18 and 35. They concluded that Patients aged 18 to 35 years from various hospitals in Lahore showed a higher prevalence of PFPS in females (21.53%) than males (16.58%).[2]Females are more likely than males to experience anterior knee pain.[2] Females have a higher prevalence of Patellofemoral pain syndrome, that's why we choose females as our population.

Table2: Association of Patellofemoral Pain Syndrome with Demographic characteristic

Demographic Data		Patellofemoral Pain Syndrome, n(%)			Total n(%)	Chi square	P-value
		Confirm PFP (Both test +ve)	At high risk (only one test +ve)	No PFP (Both test -ve)			
Age Group of Participants (Years)	15- 21	12(6.5)	5(12.8)	8(4.9)	25(6.5)	28.9	<0.001*
	22-28	33(17.9)	17(43.6)	25(15.4)	75(19.5)		
	29-35	39(21.2)	9(23.1)	50(30.9)	98(25.5)		
	36-42	53(28.8)	7(17.9)	45(27.8)	105(27.3)		
	43-49	47(25.5)	1(2.6)	34(21.0)	82(21.3)		
Marital Status	Single	39(21.2)	16(41.0)	29(17.9)	84(21.8)	9.93	0.007*
	Married	145(78.8)	23(59.0)	133(82.1)	301(78.2)		
Area of Participants	Rural	38(20.7)	8(20.5)	38(23.5)	84(21.8)	0.44	0.802
	Urban	146(79.3)	31(79.5)	124(76.5)	301(78.2)		
Occupation of Participants	Students	21(11.4)	7(17.9)	16(9.9)	44(11.4)	22.5	0.004*
	Teachers	24(13.0)	4(10.3)	23(14.2)	51(13.2)		
	House wives	99(53.8)	12(30.8)	78(48.1)	189(49.1)		
	Medical staffs	14(7.6)	12(30.8)	17(10.5)	43(11.2)		
	Tailors	26(14.1)	4(10.3)	28(17.3)	58(15.1)		
Body Mass Index(Kg/m^2)	Under (<18.5)	7(3.8)	1(2.6)	12(7.4)	20(5.2)	30.32	0.000*
	Normal	32(17.4)	8(20.5)	60(37.0)	100(26.0)		

	(18.5-24.9)						
	Over (25-29.9)	114(62.0)	21(53.8)	56(34.6)	191(49.6)		
	Obese (>30)	31(16.8)	9(23.1)	34(21.0)	74(19.2)		
Total		184(100)	39(100)	162(100)	385(100)		

*" indicates the statistical significant difference

Table 3: Mean comparison Age, BMI and VAS of Participants in Patellofemoral Pain Syndrome

Variables		Sum of Squares	df	Mean Square	F	P-Value
Age of Participants (Years)	Between Groups	1245.129	2	622.564	10.280	<0.001*
	Within Groups	23134.611	382	60.562		
	Total	24379.740	384			
Body Mass Index(Kg/m^2)	Between Groups	216.323	2	108.162	7.823	<0.001*
	Within Groups	5281.858	382	13.827		
	Total	5498.181	384			
Visual Analogue Scale	Between Groups	1463.720	2	731.860	500.319	<0.001*
	Within Groups	558.784	382	1.463		
	Total	2022.504	384			

"*" indicates the statistical significant difference

Out of 385 females of reproductive age, the result shows that the Patellofemoral Pain Syndrome was categorized with in three categories; Confirm PFP (Both Clark's test and Eccentric test positive), High risk PFP (Only one test positive Clark's test or Eccentric test), and no risk of PFP (Both Clark's test and Eccentric test negative) was compared with age , BMI and VAS, that showed the positive strong association that was statistically significant with p-value <0.001.Another study shows same results, there was a significant correlation between BMI and Patellofemoral pain syndrome with p-value ($p < 0.001$).[12]

According to Kim D Foss and colleagues demonstrated that there was no change in BMI among adolescents who developed Patellofemoralpain(PFP) and those who did not developed Patellofemoral pain (PFP) in adolescent females. There was no significant correlation between adolescent females likelihood of developing PFP and their comparative body composition or body weight to height.[13] But in our study Body Mass Index is strongly associated with PFP in females of reproductive age.

According to result of this study increasing age (29-42) years and high BMI is also strongly linked with PFP in reproductive age female. According to previous study it was reported thatPFP is a common knee disorder in young people. In aside from gender, overweight appears to increase the risk of PFP development. Additionally, an increased risk of PFP is strongly correlated with increasing age.[14]

Harvi F Hart et al found that adults with Patellofemoral pain and Patellofemoral Osteoarthritis had greater Body mass index than healthy controls, but not adolescents with PFP. They also noticed statistical patterns ($P<0.10$) indicating that having greater Body mass index is related with the development of Patellofemoral pain in adults. There was no significant relationship found among body mass index and treatment outcomes in adults with Patellofemoral pain. They conclude that PFP and (Patellofemoral Osteoarthritis)PFOA have higher BMI, but not adolescents with PFP.[6]

A study was conducted on general Chinese population that was discovered the connection between BMI and PFP. They showed that age, gender and Body mass index had no significant relationship with PFP. In our present study, population of female reproductive age showed that BMI is statistical significant and strongly associated with PFP.[15] Another study found significant height differences between overweight and obese participants, as well as weight and Body mass index differences between normal weight participants and both overweight and obese participants. The relationship among Body mass index values and specific questionnaires and subjective scale scores was not clear. They concluded that recreational runners with greater BMI values are more likely to experience anterior knee painthan in people with normal Body mass index values.[16]

In previous study, for pain during rest and effort, as well as AKPS, there was no statistically significant difference existed among groups.They used same pain assessment scale that we did in our study. They came to the conclusion that in women with PFPS, BMI has no impact on pain intensity or function.[9] But in our present study high BMI have impact on pain intensity in female of reproductive age with Patellofemoral pain syndrome.

Previous research showed that the relationship among Body Mass Index and Patellofemoral Pain has been inconsistent. Several studies have demonstrated a connection among a greater Body Mass Index and clinically significant PFP, while other studies haven't. Lower BMI was linked, according to two studies, to knee pain.[17,18,19]Theories that suggest a connection between an increase in Body Mass Index and Patellofemoral Pain, include BMI's relationship to reduced knee joint space and BMI's relationship to greater q-angle in the lower extremity.[20]

In a cross sectional study[21], it was demonstrated that there was no link between BMI and decreased bone mineral density. BMI is strongly linked to the chance of developing chronic degenerative conditions like osteoarthritis (which PFP could be a precursor to).[22]Additionally, greater Body Mass Index is linked to common orthopedics disorders in adults.[23]Non-probability sampling was used to selected the participants that was the main weakness of the current study

CONCLUSIONS

According to the findings of this study, Body Mass Index was associated with Patellofemoral pain syndrome (PFPS) in females of reproductive age. Increasing age was directly associated with the increasing risk of Patellofemoral Pain Syndrome.Management of Patellofemoral pain syndrome in females by maintaining the activity level or athletic training routine, maintaining healthy body weight and lifestyle, by reducing the work load on joints, by doing daily stretching exercises, we can avoid of having risk of PFPS otherwise symptoms can worse.

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