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Descriptive Analysis of Patients with Knee Pain in Relation to Balance and Joint Proprioception

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Abstract

Objective: The objective of the present study was to analyze the prevalence of various factors in knee pain patients and to identify the association of knee pain with balance and joint proprioception in knee pain patients.

Methodology: This was a descriptive co-relational study design that was carried out from September 2018 to April 2019 with a convenient sample size of 75 patients having knee pain, aged between 30 and 65 years (both males and females). The patients were assessed for knee pain and disability by WOMAC questionnaire. For balance and joint Proprioception subjects were tested on the Y-Balance test and CPM (Continuous Passive Motion) machine.

Results: The present study concludes that the prevalence of knee pain was higher in women who were housewife's (47.4%). A significant inverse relationship was found between Balance and NPRS, Balance and WOMAC. A significant relationship was found between joint proprioception deviation and NPRS, joint proprioception deviation and WOMAC.

Conclusion: In the present study gender, older age, and greater BMI were associated with knee pain and disability. Housewife's had a higher possibility of knee pain. Knee pain was also linked with impaired balance and joint proprioception. Knowing specific risk factors of individuals with knee pain and possible association with each factor is important as it may help to develop specific treatment or management strategies.

Keywords: Knee pain; Balance; Proprioception

Introduction

Knee Pain (KP), one of the most common musculoskeletal conditions, is a leading cause of disability that reduces the quality of life (QOL) [1,2] and possesses a significant financial burden on the community, affecting a substantial number of populations. The 2018 world statistics report showed that the total population 40% of 60-year-olds suffers from severe joint pain, 80% of the population has a certain amount of movement restrictions and 25% cannot carry out daily activities. An estimated 25% of women over 50 in the UK have chronic knee pain, while over 29% of women over 65 in Italy suffer from knee pain. Some studies have estimated the prevalence of knee OA to be 44% in people aged 80 years and older. The age-adjusted prevalence of musculoskeletal pain is estimated to be 35.7% in women and 20.2% in men [3]. Knee pain is more common among Indians than among other ethnic groups with a prevalence of 31.8% [4].

The incidence of knee pain is very high in India, ranging from 22% to 39% in different parts of the country. About 45% of women over the age of 50 suffer from knee pain. In 2015, India is likely to notice an endemic of osteoarthritis, in which 80% of the country's population aged 65 or over suffers from wear and tear of joints. According to experts from the World Health Organization (WHO), 40% of these people are likely to suffer from knee pain, which will prevent them from performing their daily activities [3]. Under the Community Oriented Program for the Control of Rheumatic Diseases (COPCORD), 13.1% of Indian women had knee pain, compared to 11.1% of Malaysian women and 5.8% of Chinese women [5]. There are various constitutional and biomechanical risk factors related to knee pain like age, body mass index, knee injury, and knee alignment. The weakness of the quadriceps muscles can also lead to worsening knee pain [6]. Weak quadriceps are quick to fatigue, leading to poor muscle control [7] which increases damage to the knee cartilage. The strength of the quadriceps muscles is one of the internal factors that may affect the functioning of the muscles [8]. Prevalence of knee pain is often between the range of 10% to 60% depending upon certain constituents like age, occupation, and its definition [9]. A cohort study by Ingham et al. founded that the incidence of knee pain is 3.2% (32/1000 people) of the people above the age of 40 within the Nottinghamshire [10]. Knee pain, however, is not limited to older age; a study done on 967 schoolchildren, 19% of these aged 14-15 years reported having chronic knee pain [11]. People who do physically demanding work, such as carpenters, miners, and construction workers had a higher prevalence of knee pain compared to those

having physically less demanding work [12]. Several studies have recorded that activities like squatting and kneeling, are particularly linked with an increased risk of knee OA. Some prospective studies have supported the evidence that overweight has a role as a causative factor in knee pain. In NHANES III, increasing BMI was related to higher prevalence estimates for knee pain (12.1% in underweight vs. 55.7% in obesity class III) [13].

Balance is an important factor in the activities of daily life. It is an intricate task involving neuromuscular processes. Knee pain can affect balance control through its effects on proprioceptive input, central information processing, and efferent output, stimulating proper muscles of extremities and tendons [14]. Proprioception refers to the perception of the joint and body movements as well as the position of the body, or body parts, in space [15]. Abnormal proprioception has been reported in conjunction with many disorders of the knee including osteoarthritis of knee joint [16], patello femoral pain syndrome (PFPS) [17] and anterior cruciate instability. In some studies, impaired proprioception was associated with the presence of pain [18] and knee pain was an important predictor of loss of balance. Therefore, the correction of the proprioceptive error should be planned and integrated as a serious defect. The positive effects associated with kinesthetic exercises and balance exercises (such as walking on the toes, retro walking, leaning sideways, balance board exercises, mini trampoline exercises, plyometric exercises, etc.) can be used in clinical practice, to improve the functional capacities of the patients. Cultural background, pain threshold, gender, older age, greater BMI, lifestyle, and other genetic factors are associated with knee pain and disability and explain why knee pain is more common in certain ethnic groups. Importantly, many environmental and lifestyle risk factors are reversible (obesity, muscle weakness) or avoidable (occupational or recreational joint trauma) with implications for primary and secondary preventions. There is a need to understand the natural history of knee pain through fluctuations in the pain experience, including changes in pain type and severity, and eventual progression to severe daily knee pain in some. By understanding the risk factors for the onset of knee pain as part of the spectrum of knee pain, we have the opportunity to focus, treat and control the symptoms of knee pain more effectively and efficiently, thus preventing the development of a disability. Therefore the purpose of the present study was to analyze the prevalence of various factors in knee pain patients and to identify the association of knee pain with balance and joint proprioception in knee pain patients.

Research Methodology

This was a descriptive co-relational study design that was conducted from September 2018 to April 2019 with a convenient sample size of 75 subjects, aged between 30 and 65 years (both males and females). Subjects were recruited from the HAHC hospital, Jamia Hamdard, New Delhi. They were well informed about the study and informed consent was obtained. The ethical consideration was obtained from the institutional ethical committee Jamia Hamdard, New Delhi. Subjects fulfilling the inclusion and exclusion criteria were recruited for the study i.e., patients with knee pain for more than 1 month (≥ 1 month), unilaterally or bilaterally were included in the study, while those with a history of neoplasm, trauma to the lower extremities in the past six months, any neurological conditions and hospitalization, or admission to a care facility for 3 days or more were excluded from the study. Demographic data (including age, gender, height, weight, BMI, and pain severity: 0-10 numerical rating scale) were recorded and knee pain was assessed by the WOMAC scale. Subjects were verbally reoriented instructed again before the test and testing procedures were carried out. The subjects were tested on the dynamic Y-Balance test and CPM (Continuous Passive Motion) machine for balance and joint proprioception respectively and 3 trials were taken. During YBT, the participants were barefooted and asked to reach with one foot in the anterior (A), posteromedial (PM), and posterolateral (PL) directions while standing on the other foot at the center. In each trial, subjects were asked to reach as far as they could with the reaching foot and then return to the starting point while still balanced on the stance limb. The maximum reach distance of the 3 formal trials in each direction was used for the analysis. Subjects' lower-limb lengths were bilaterally measured in the supine position from the anterior superior iliac spine to the distal part of the ipsilateral medial malleolus. The standard composite reach distance was calculated for each leg as the sum of the maximum reach distances (in cm) in the 3 directions divided by 3 times the limb length, then multiplied by 100.

The method used to assess proprioception was by the conscious awareness of passive joint position. It was performed using a CPM (Continuous Passive Motion) Machine with a handset button. The subjects were asked to close the eyes and 3 trials for a position of 45 degrees with a rest period of 10 seconds between each trial were given. Next, the knee joint was bought to a relatively extended position and let flexed by CPM machine. The subjects were asked to press the button on the handset when they so perceived the angle of 45 degrees. The perceived angle was noted and final measurements were recorded by calculating the deviation from 45 degrees.

Statistical analysis

Statistical Analysis of the collected data was performed by using software tool SPSS version 21.00 and to check the correlational analysis the statistical test Karl Pearson (r) was used.

Results

In this study, a total of 75 subjects participated. Out of which, 29 were male and 46 were female as depicted in **Table 1.**

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Table 1: Gender distribution of the subjects that were included in the present study.

Gender	Frequency (n)	Percentage (%)
Male	29	39%
Female	46	61%
Total	75	

In the present study mean age of the participants were 49.59 ± 8.696 years, majority (36.8%) were in the age group 51-60 years, followed by (35.5%) were in the age group 41-50 years, as illustrated in **Table 2 and Figure 1.**

Table 2: Age wise distribution of the subjects included in the present study.

Age group (years)	Frequency (n)	Percentage (%)
31-40	13	17.30%
41-50	27	36.00%
51-60	28	37.30%
60-65	7	9.30%
Total	75	

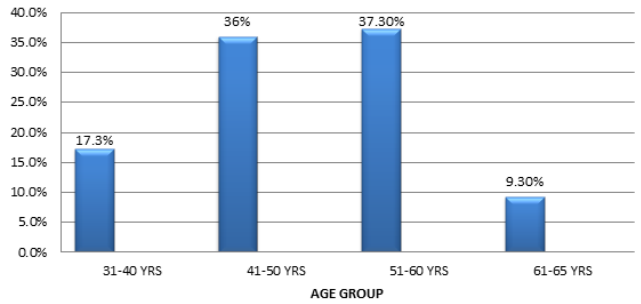

Figure 1: Depicting age wise distribution of the subjects that were included in the present study.

Out of 75 patients it was found that 60% were overweight and 12% belong to obese class I whereas prevalence of knee pain in patients with normal BMI accounts for 28%, as illustrated in **Table 3.**

Table 3: Distribution of Subjects in the present study according to their BMI.

BMI	Frequency (n)	Percentage (%)
18.5-24.9	21	28%
25.0-29.9	45	60%
30.0-34.9	9	12%
Total	75	

Among the study population, we found the prevalence of knee pain was higher in women who were housewives (47.4%), as illustrated in **Table 4 and Figure 2.**

Table 4: Prevalence of knee pain according to occupation.

Occupation	Frequency(n)	Percentage (%)
Teacher	3	4.00%
Beautician	2	2.70%
Housewives	36	48%
Shopkeeper	7	9.30%
Retired	5	6.70%
Field Work	4	1.30%
Sitting Job	12	16%
Driver	2	2.70%
Maid, Tailor, Policeofficer	1	1.30%
Total	75	

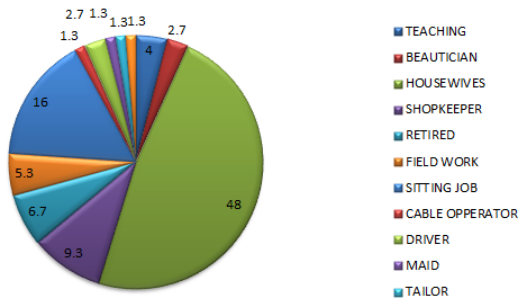

Figure 2: Depicting occupation distribution in the study population.

A Karl Pearson correlation test was used to analyze the relationship of NPRS, WOMAC with balance and joint proprioception. A significant relationship ($p \leq 0.05$) was found between Balance and NPRS ($r=-0.236$), Balance and WOMAC ($r=-0.232$). The coefficient of correlation (r) and (p) value for NPRS and WOMAC have been mentioned in **Table 5** and **Figures 3 and 4** below.

Table 5: Correlation of balance, NPRS and WOMAC scale.

		NPRS	WOMAC
Balance	*r*	-0.236*	-0.232*
	p	0.041	0.045

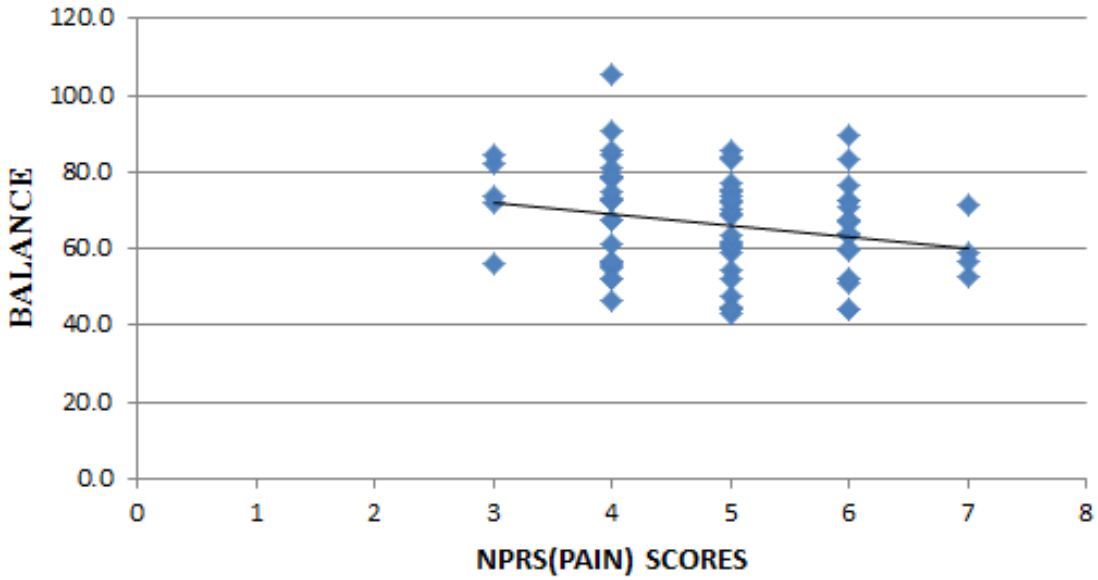

Figure 3: Correlation between balance and NPRS.

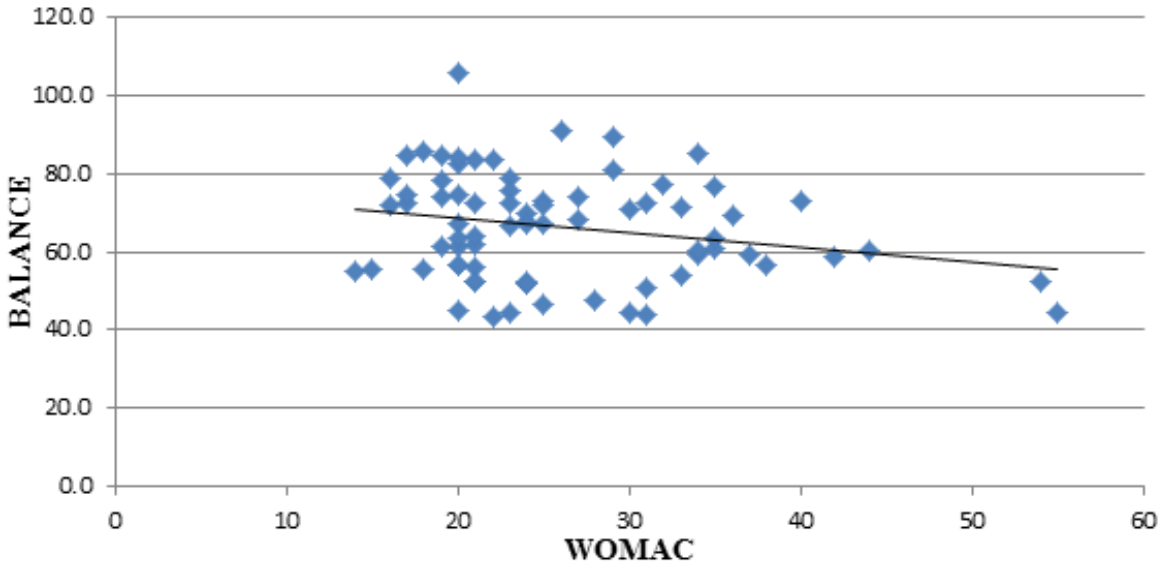

Figure 4: Correlation between balance and WOMAC.

A significant relationship ($p \leq 0.05$) was found between joint proprioception deviation and NPRS ($r=0.284$), joint proprioception deviation and WOMAC ($r=0.291$). The coefficient of correlation (r) and (p) value for NPRS and WOMAC have been mentioned in **Table 6** and **Figures 5 and 6** below.

Table 6: Correlation between joint proprioceptive deviation, NPRS and WOMAC scale.

	Value	NPRS	WOMAC
Joint proprioception Deviation	*r*	0.284*	0.291*
	p	0.013	0.01

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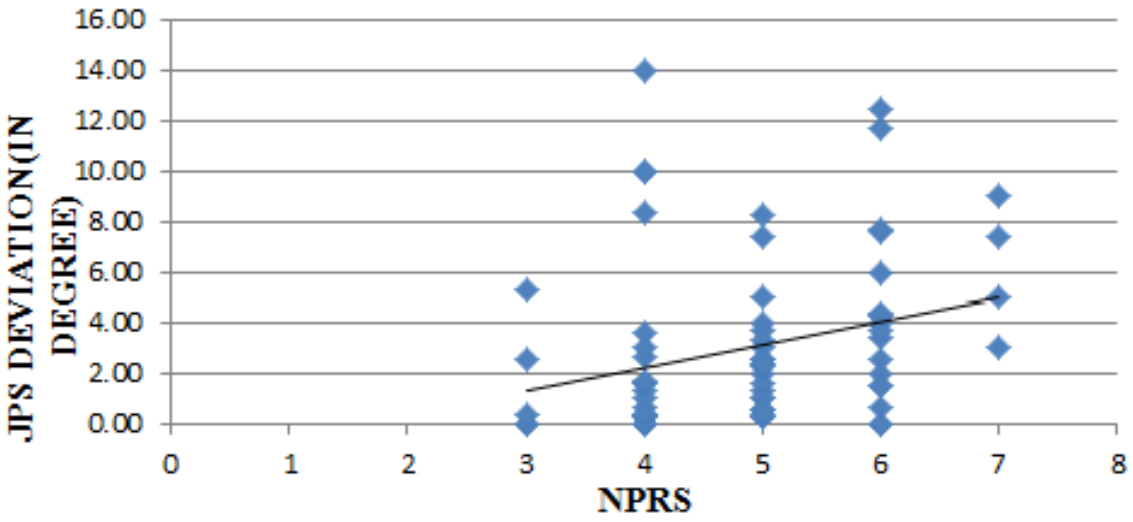

Figure 5: Correlation between JPS deviation and NPRS scale.

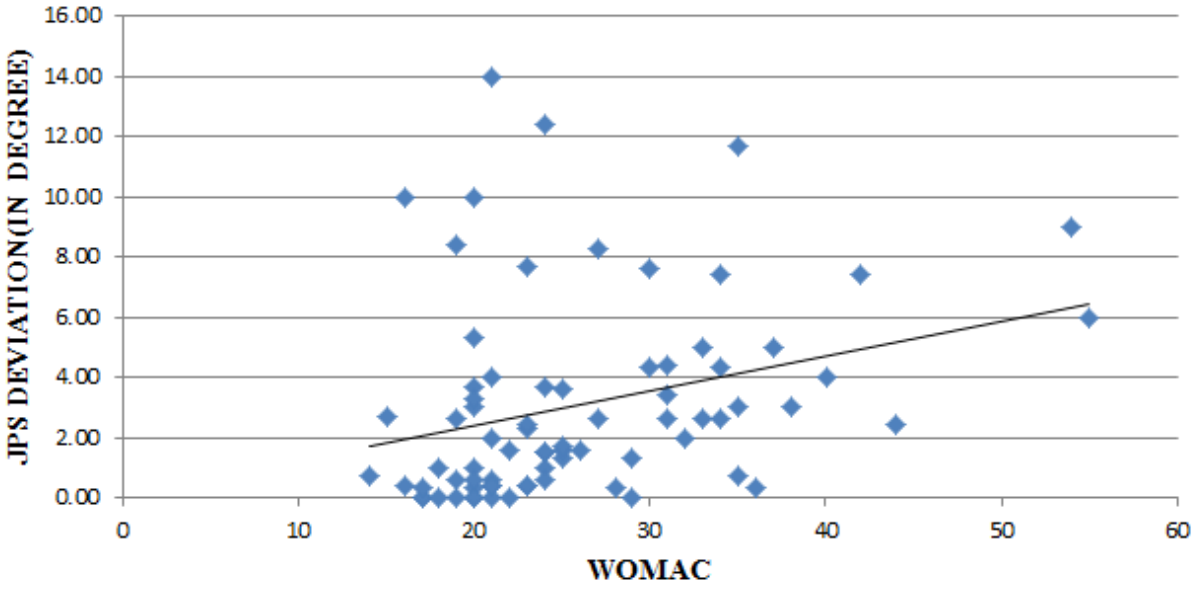

Figure 6: Correlation between JPS deviation and NPRS.

Discussion

In the present study, **Table 1** estimates that out of 75 participants, the prevalence of knee pain was higher in women (61%) than in men (48%), consistent with other previous studies. The study by Kim et al. on the prevalence of knee pain and its impact on the quality of life and physical function of the elderly Korean population. The result showed that the prevalence of knee pain was high in women as compared to men. Women are also more sensitive to pain [19]. The study by Cepheda et al. found that pain thresholds are lower for women than for men. Ms. Swati Pal conducted a study and the conclusion based on the results of the study was the majority of women, 128 (64.0%) had moderate knee pain, while 50 (26.3%) of the subjects had mild knee pain, only 12 (6%) had severe knee pain, while 10 (5.26%) had no knee pain [3]. This study is consistent with the study by Vidita Divan et al.

Table 2 concludes that among 75 patients aged 30 to 70, the maximum number is in the 51-60 age group (37.3%), followed by the 41-50 age group (36%). The results are consistent with another cross-sectional study by NHANES-I, which stated that the prevalence of knee pain increases with age and is slightly higher in women. This change, seen in age group and gender, in patients with knee pain may be associated with certain factors specific to the knee joint. Sex hormones, other psychosocial and biomechanical factors may also be responsible for this increased perception of knee pain in women compared to men.

In the present study **Figure 2,** revealed that the prevalence of reported knee pain was higher in overweight patients (60%) with a BMI of 24.5 to 29.5 kg/m^2 and 12% of those in obesity class 1 with a BMI of higher 30.0 to 34.9 kg/m^2. In comparison, only 28% of patients with knee pain have a normal BMI. Increased BMI was independently associated with knee pain and disability. High BMI is a risk factor for a knee injury and OA because it is believed that increased axial load and inflammatory adipocytokines contribute to joint degeneration. A low BMI reduces joint pressure and slows cartilage destruction, resulting in more flexibility in mobility. Jinks et al. (2008), in their study, predictors of the occurrence and progression of knee pain in adults in the community also indicated that the occurrence of severe knee pain was most closely associated with obesity (OR 2.9, 95% CI 1.7, 5.1) [20].

In this population group, the employment schedule, **Figure 3,** shows that the majority of patients complaining of knee pain are housewives (47.4%). Very few studies have attributed this trend. Housewives have an important role in uplifting the society. The working, living and social architecture in rural areas differ from developed or urban areas and the homemakers being the nucleus of the family are exposed to very different stress and their health impact. They are more involved in work such as housekeeping and cleaning, washing clothes and dishes, worship. While doing these daily household chores, there is monotonous cross-sitting and squatting. They perform many functions that cause ergonomic stress and fatigue of muscle groups, which can cause knee pain. Mishra et al. carried out a study on prevalence and risk of musculoskeletal pain in rural homemakers of north India and results stated that the prevalence of musculoskeletal pain among homemakers was found to be 40.9% and more than 60% of these could not be diagnosed without specific studies. In general, hormonal changes that occur during menopause are a more complex and stressful process for women. The menopause marks the end of women's reproductive functions and also exposes them to new health problems such as heart disease and osteoporosis [21]. Results from our study are also consistent with the COPCORD survey, which suggests that housewives report more pain in the musculoskeletal system, and maybe due to recurrent household chores and psychological stress. However S C O'Reilly (2011), A Study of Occupation and Knee Pain: A Community Study states that an increased risk of knee pain is evident among miners, builders, and carpenters [12]. Amin et al. conveyed a study and concluded that men with regular occupational squatting and kneeling and lift heavily are more likely to have adverse outcomes of cartilage morphology on the patella femoral joint. When carrying heavy objects, the knee strain caused by squatting and kneeling is further increased. Not only does the load on the joint increase with strong lifting, but the contact area of the patella femoral joint increases with flexion, which is greater when the load is applied than when the load is removed [22] **(Tables 3 and 4).**

The result of the study, **Table 5** also shows that there is a significant inverse correlation (r=-0.236) between balance and knee pain (NPRS) and a significant inverse correlation (r=-0.232) between balance and WOMAC score. This inverse relationship between knee pain and balance can be described by the fact that knee pain can reflexively inhibit muscle activity around the knee, which can affect motor responses during posture control. Hicks C (2020) and others conducted a study, they identified various medical, psychological, sensory, balance, and mobility factors associated with knee pain and found that the presence of knee pain doubled the risk of multiple falls in community aging. Dookung et al. examined the effects of quadriceps strength, proprioception of the joints and functional balance in 65 to 75 year-old women with knee osteoarthritis, concluded that knee pain was linked with weaker quadriceps and lower balance ability [23]. Balance function decreases as the disease progresses, which may be due to fatigue of the musculoskeletal system and worsening of the motor system.

Table 6 shows a positive and significant correlation (r=0.284) between the deviation of joint proprioception and knee pain (NPRS) and a significant positive correlation (r=0.291) between the deviation of joint proprioception and the WOMAC score. Nociceptive stimulation and pain can directly interfere with the central processing of proprioceptive inputs and are therefore consistent with the abnormal proprioception recorded in people with clinical knee pain. Some studies indicate that the decrease in knee proprioception reported in people with clinical knee disorders, such as patella femoral pain syndrome, may not be described simply by the presence of acute nociceptor stimulation and pain. Other research suggests that joint proprioception may affect perceptions of knee pain during the test. However, although pain is a permanent feature in many muscle conditions, the effects of nociceptive and pain stimulation on knee joint proprioception are difficult to exclude from other features such as inflammation and muscle stiffness.

Therefore, the information obtained from this study may be important in understanding the natural history of knee pain, including incidence in a community. It is important to identify specific risk factors for people with knee pain and their possible association with each factor, as this can help develop specific treatment or management strategies. Knee pain is a common musculoskeletal condition and causing discomfort and disability in patients over many years. People suffering from chronic knee pain have a loss of function, with a growing problem with walking, climbing stairs, and other functions of the lower limbs. Balance and joint sense are important elements in carrying out these activities. Therefore, it is important to know the prevalence of knee pain patients in our community and to know whether balance and joint sense are affected by knee pain. So that early diagnosis can be made and appropriate treatment can be provided. This study will provide a new field of a holistic approach to the evaluation and management of knee pain. The present study is limited by the context of the sample size considered. Not all possible risk factors for knee pain such as (knee malalignment, synovitis, and level of physical activity) were taken into consideration. Knee alignment (i.e., hip-knee-ankle angle) is a major determinant of load distribution. Changes from the neutral alignment of the hips, knees, and ankles will affect load distribution at the knee. Accordingly, it can be assumed that

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knee misalignment may be at a risk factor for knee pain. Also, there is evidence from other sources that lack of physical activity increases the chances of functional decline, and general aerobic exercise prevents deterioration in physical functioning at the knees. Our study was confined to measure the impact of psychological factors, whereas a recent study implies that general psychological factors such as optimism and pessimism may affect the physical functioning of older people with knee pain. The method of examining joint proprioception with continuous passive motion (CPM), although the near-technical sound is used as an alternative to passive motion assessment, there was hip flexion occurring concurrently, which despite being checked to be normal may have been a variable.

Conclusion

In the present study gender, older age, and greater BMI were associated with knee pain and disability. Housewife's had a higher possibility of knee pain. Knee pain was also linked with impaired balance and joint proprioception. Knowing specific risk factors of individuals with knee pain and possible association with each factor is important as it may help to develop specific treatment or management strategies.

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