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INFLUENCE OF GENDER ON PAIN, QUALITY OF LIFE, AND PHYSICAL ACTIVITY IN PATIENTS WITH KNEE OSTEOARTHRITIS

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Keywords

Pain

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ABSTRACT

Osteoarthritis is the most common cause of knee pain which contributes to adults' disability. Females have an increased risk of knee osteoarthritis. However, little is known about the gender influence in pain perception, quality of life (QOL), and physical activity. Hence, this study aimed to investigate the influence of gender on pain perception, QOL, and physical activity in patients with knee osteoarthritis. A cross-sectional study design with a total of 186 patients (mean age of 56.64 ± 6.49) with knee osteoarthritis were recruited. Pain intensity, level of physical activity, and QOL of patients were assessed using a visual analog scale (VAS), global physical activity questionnaire (GPAQ), and Short Form-36 (SF-36) questionnaire. Among the studied patients, 52% of patients with knee osteoarthritis had a relatively low level of physical activity with females representing the majority of them. Lower mean was observed in QOL and physical activity whereas pain intensity was higher in females compared to males ($p < 0.05$). Pearson correlation demonstrated a strong negative correlation between physical activity and pain ($r = -0.77$, $n = 186$, $p < 0.01$), and a weak correlation exist between physical activity and all domains of QOL except for the functional capacity and body pain. Majority of female participants with knee osteoarthritis exhibit poor QOL, physical activity, and increased pain intensity as compared to males. Clinicians need to be aware of the influence of gender in treating patients with knee osteoarthritis.

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1 Introduction

Osteoarthritis is the most widespread chronic degenerative musculoskeletal disease, leads to pain and physical disability in adult individuals (Alenazi et al., 2020). It is a disease that progresses over time in joints causing significant changes in the tissue architecture, its metabolism, and function (Primorac et al., 2020). It commonly affects the joints in the hands and weight-bearing joints including knees, hips, feet, and spine (Chinese Orthopaedic Association, 2010). There were approximately 8.5 million adults in the UK and 27 million US adults have clinical osteoarthritis (Dillon et al., 2006).

The primary burden of osteoarthritis is pain and physical impairments which significantly influence the quality of life (QOL) of individuals (Elliott et al., 2007; Boutron et al., 2008; Yildiz et al., 2010). Several risk factors such as pain, inaccuracy proprioception, and muscle weakness have been identified in the decline of physical function in osteoarthritis patients (Dunlop et al., 2005; Dekker et al., 2009). Studies have reported that lack of regular physical activity is one of the most predominant risk factors in deteriorating the functions of activities of daily living (ADL) in patients with osteoarthritis (Dunlop et al., 2010). It can be interpreted as a pattern of avoidance for certain patients with osteoarthritis who are likely to delay physical activity in fear of escalating pain in the injured joint (Steultjens et al., 2002; Somers et al., 2009).

Apart from the pain and functional limitation, osteoarthritis also affects an individual's psychological well-being which negatively affects the quality of life (Elizabeth & Rena, 2011; Sharma et al., 2016). Female gender is a major predisposing factor of knee osteoarthritis (Ferre et al., 2019). There is a dearth of research in this field, in which the effects of gender on pain severity, quality of life, and physical activity is uncertain. Therefore, the present studies aim to identify the influence of gender on pain, quality of life, and physical activity in patients with knee osteoarthritis and determining the relationship of physical activity with pain and quality of life.

2 Materials and Methods

A cross sectional study using the convenience sampling method was adopted. For this analysis 186 participants were recruited. The inclusion criteria were participants between the age of 40 to 60 years, who have been diagnosed with knee osteoarthritis and presented with complaints of knee pain for the past 6 months or more. Whereas, the exclusion criteria included participants with a known history of a traumatic knee injury, undergone knee replacement surgery, rheumatoid arthritis, central or peripheral nervous system disorder, or a condition that limits pre-mobility

status. Before collecting data, all participants were provided details about the intent and procedure of research, and written informed consent was taken. This study was approved by the Research and Ethics Committee of INTI International University.

All the eligible participants were given a form to fill that comprised of demographic details such as age, gender, occupation, level of physical activity, and pain assessment chart. The participants were screened for pain using the Visual Analog Scale (VAS). It is a 10cm continuous scale with one end representing the maximum intensity and the other end of no pain (Crichton 2001; Kahl & Cleland 2005). Participants were asked to measure their pain level at rest and during activity. The greatest benefits of VAS are the simplicity of its design and usage. Besides that, VAS is highly reliable with an intraclass correlation coefficient (ICC) between 0.71 to 0.99 (Kahl & Cleland 2005).

Meanwhile, a global physical activity questionnaire (GPAQ) was used to assess the level of physical activity. It includes 16 questionnaires to identify physical activity at work, travel to and from places, and recreational activities. The physical activity level of each participant was measured using the metabolic equivalent of task-minute per week by combining the score of work, travel, and recreational MET-minutes/week (Herrmann et al., 2013). Participants were categorized into 3 levels, high > 6.0 MET-min/week; moderate between 3.0 to 6.0 MET-min/week; and low below < 3.0 MET-min/week (Bull et al., 2009). The GPAQ is found to be valid and reliable which demonstrated moderate to strong positive relationships ranging between 0.45 to 0.65 (Bull et al., 2009).

Short Form-36 (SF-36) was used for the assessment of the quality of life (Ware, 2000). It is a 36 item questionnaire that has been divided into 8 domains including physical functioning (10 elements), social functioning (2 elements), role limitations due to physical health (4 elements), role limitation due to emotional problems (3 elements), mental health (5 elements), energy and vitality (4 elements), bodily pain (2 elements) and general health (5 elements). Each item is recorded on a scale with values from 0 to 100 which corresponds to the worst and best health status respectively. Aggregate scores were compiled into a percentage. A greater score indicates better QOL (Ware Jr & John, 2000; Salaffi et al., 2005; Alkan et al., 2014). Each item has to carry equal weight. The SF-36 demonstrated high internal consistency (Cronbach's alpha ranged from 0.65 to 0.94) and excellent reliability (ICC between 0.75 to 0.97) (Heyland et al., 2000). Statistical software package SPSS (Version 25.0) was used to interpret data. The Kolmogorov-Smirnov test, Q-Q plot, and skewness ranging between -1 to 1 was used to check the assumption of normality. The T-test was used for the assessment of the mean of the two groups. The correlation between physical

activity and other factors were tested using Spearman's correlation analysis. The findings were defined at a confidence level of 95% with a significant level at $p < 0.05$.

3 RESULTS

Total 186 participants (91 males 95 females) were recruited with a mean age of 56.64 ± 6.49 . The sociodemographic data of participants with knee osteoarthritis are as depicted in Table 1. The highest percentage of participants were between the ages of 50 to 59 years, with most of them were Malay. Most of the participants complain of moderate-intensity (between 5 to 7) pain 65.6%, followed by mild intensity (between 1 to 4) of pain 28% and 6.5% with severe pain intensity (between 8 to 10).

3.1 Level of Physical Activity in Knee Osteoarthritis

This study demonstrated that almost more than half of participants (52%), presented with a low level of physical activity (< 3.0 MET-min/week), followed by 44% of participants with moderate physical activity (3.0 to 6.0 MET-min/ week) and 8% of participants with a high level of physical activity (> 6.0 MET-min/week). The mean score of the total GPAQ in MET-min per week was 936 ± 593 for males and 598 ± 265 for females with the highest mean in the work domain followed by recreation and transport as depicted in table 2. There is significant difference among genders for all the physical activity domain (p value < 0.001).

Table 1 Demographic characteristics of the participant with knee osteoarthritis

Variables	Participants (n= 186) n (%)
Age (mean $\pm$ SD)	56.64 $\pm$ 6.49
Age Range	
40-49	33 (17.7)
50-59	79 (42.5)
≥ 60	74 (39.8)
Gender	
Male	91(48.9)
Female	95(51.1)
Ethnicity	
Malay	131 (70.4)
Chinese	41 (22.0)
Indian	13 (7.0)
Others	1 (0.5)
Pain intensity (mean $\pm$ SD)	52.20 $\pm$ 15.05
Pain intensity range	
Mild (1 to 4)	52 (28.0)
Moderate (5 to 7)	122 (65.6)
Severe (8 to 10)	12 (6.5)

According to the SF-36 in measuring the QOL, the mental health domain achieves the maximal value for both males and females with mean + SD of 72.7 ± 7.6 and 70.3 ± 7.4 respectively, while the lowest domain in males is for general health status with a mean + SD of 42.9 ± 8.6 and functional limitation domain in females with mean + SD of 37.7 ± 16.7 .

Table 4 demonstrate statistical significant difference observed for functional capacity, $p = 0.019$, functional limitation, $p = 0.004$, bodily pain, $p < 0.001$, general health status 0.048 and mental health, $p = 0.029$. Examination of the mean scores indicates that there was remarkable QOL achieved for all the variables in males as compared to the females.

Table 2 Physical activity level of participants with knee osteoarthritis

Physical activity domain (MET-Min per week)	Male (n=91) Mean $\pm$ SD	Female (n=95) Mean $\pm$ SD	Significant value p
Work	685 $\pm$ 685	478 $\pm$ 315	<0.001
Transport	24.1 $\pm$ 102	16 $\pm$ 66	<0.001
Recreation	226 $\pm$ 222	104 $\pm$ 150	<0.001
Total GPAQ	936 $\pm$ 593	598 $\pm$ 265	<0.001

Table 3 Participants who did not met recommended physical activity level according to age

Age (Year)	Male (n= 38) n (%)	Female (n = 58) n (%)	Both Sex (n = 96) n (%)
40-49	1(5.3)	3 (21.4)	4 (2.2)
50-59	8 (22.9)	22 (50.0)	30 (16.1)
≥ 60	29 (78.4)	33 (89.2)	62 (33.0)
Total	38 (41.8)	58 (61.1)	96 (51.6)

Table 4 Comparison of SF-36 score between gender among participants with knee osteoarthritis

Quality of life domains	Male (n=91) Mean $\pm$ SD	Female (n=95) Mean $\pm$ SD	Significant value p
Functional Capacity	52.2 $\pm$ 17.6	46.7 $\pm$ 14.0	0.019*
Functional Limitation	45.1 $\pm$ 17.9	37.7 $\pm$ 16.7	0.004*
Bodily Pain	55.8 $\pm$ 18.9	38.8 $\pm$ 13.7	0.001**
General Health Status	42.9 $\pm$ 8.6	40.7 $\pm$ 6.5	0.048*
Vitality	61.6 $\pm$ 11.3	58.7 $\pm$ 8.7	0.057
Social Aspects	71.3 $\pm$ 18.3	67.5 $\pm$ 15.3	0.123
Emotional Aspects	58.3 $\pm$ 21.4	55.7 $\pm$ 18.4	0.39
Mental Health	72.7 $\pm$ 7.6	70.3 $\pm$ 7.4	0.029*

p < 0.001**, p < 0.01*

Table 5 Comparison of pain intensity between gender

Pain Intensity	Male (n=91)	Female (n=95)	Significant value
	Mean $\pm$ SD	Mean $\pm$ SD	p
VAS	48.6 $\pm$ 16.2	55.6 $\pm$ 12.9	0.001**

p < 0.001**

Table 6 Relationship between physical activity with pain intensity and quality of life

Variables	Correlation coefficient <i>r</i>	Significant value <i>p</i>
Physical activity - Pain intensity		
VAS	- 0.777	<0.001**
Physical activity - QOL		
Functional Capacity	0.639	<0.001**
Functional Limitation	0.401	<0.001**
Bodily Pain	0.652	<0.001**
General Health Status	0.279	<0.001**
Vitality	0.257	<0.001**
Social Aspects	0.312	<0.001**
Emotional Aspects	0.241	<0.001**
Mental Health	0.234	<0.001**

p < 0.001**

3.3 Severity of pain in Knee Osteoarthritis

In terms of severity of pain, 65.6% of participants presented with moderate pain (between 5 to 7), followed by 28.0% of them with mild pain (between 1 to 4), and 6.5% complaints of severe pain (between 8 to 10). There was a statistically significant difference in pain intensity observed, $p < 0.001$ between genders as showed in table 5. Analysis of mean revealed a greater intensity of pain reported by females compared to males.

3.4 Relationship between physical activity and other parameters

The relationships between the level of physical activity with pain intensity and QOL was analyzed using Pearson's correlation as depicted in table 6.

between gender in participants who did not accomplish WHO recommendations for health ($p=0.150$). A strong negative correlation exists between level of physical activity and pain, which was statistically significant ($r = -0.777$, $n = 186$, $p < 0.001$). This indicates that with increase physical activity level, there is reduce in pain intensity. In terms of the relationship between physical activity and QOL, a weak correlation exists for all the domains except functional capacity and body pain which demonstrate a moderate positive correlation.

4 Discussion

The current study aimed to determine the influence of gender on pain, quality of life, and physical activity among adults with knee osteoarthritis. The research findings indicate that the prevalence of

knee osteoarthritis was greater in females as compared to males. osteoarthritis.

Similarly, previous studies have supported that females are at greater risk of osteoarthritis (Sowers et al., 2000; Srikanth et al., 2005; Hame & Alexander, 2013; Prieto-Alhambra et al., 2014; Ferre et al., 2019). This can be due to lower pain threshold and less tolerance to painful stimuli by females as compared to males (Chesterton et al. 2003; Riley et al. 1998). In addition to this, reduce in estrogen production due to menopausal changes can further accelerate the process of degeneration (Hame & Alexander, 2013). An earlier study has also documented an increased progression of cartilage degeneration and significant loss of tibial and patella cartilage in females than males (Eyre, 2004; Hanna et al., 2009). It has been reported that the rate of loss of cartilage at the tibia and patella in females is three to four times higher than in males (Hanna et al., 2009). Such findings show that females are more predisposed to osteoarthritis in the knee.

Results of the current study suggested that the highest percentage of participants were between the age of 50 to 59 years and with age beyond 60 years there is decreased in the incidence of osteoarthritis. A similar trend was also observed in the previous study (Prieto-Alhambra et al., 2014). Osteoarthritis progress rapidly in females during menopause aged between 55 to 60 years and gradually decline in the elderly. While for males, the incidence of osteoarthritis has increased gradually until the last stage of life (Prieto-Alhambra et al., 2014).

In terms of physical activity, the present study demonstrated that most of our participant did not achieve the guidelines for physical activity suggested by the World Health Organization (WHO) which is a minimum of 150 minutes of moderate-intensity of physical activity per week or 75 minutes of vigorous intensity of physical activity per week achieving 600 MET-min per week. It is notable, that the prescribed amount of physical exercise was not reached by a large percentage of participants and the incidence of knee osteoarthritis increases with age.

The outcome of the present study was further strengthened by previous studies which found females are insufficiently active in comparison with males (Troiano et al. 2008; Hamrik et al. 2014; Sparling et al. 2015). Factors that hinder the patient with knee osteoarthritis involve physical activity is not due to the onset of disease or pain but due to external factors such as time constraints and non-prioritization of physical activity (Mesci et al., 2015). In other cases, pain related fear has also contributed to immobility in a later stage, leading to inactivity (Steultjens et al., 2002). It is important to maintain regular physical activity to minimize and prevent functional and mobility-related disability and reducing the like hood of developing severe cardiovascular disease, metabolic

disorder, perception deficit, osteoporosis, and muscle weakness (Rosenberg et al., 2011; McPhee et al. 2016; Chen et al., 2017).

The present study revealed that patients with knee osteoarthritis have overall impaired QOL primarily in the functional limitation domain. Similar results were obtained in a previous study which demonstrated patients with knee osteoarthritis had a significantly poorer quality of life (Salaffi et al., 2005). Besides that, physical health components showed significantly lower scores than the mental health component in the present study. This was consistent with other studies that reported the subscales related to physical health had relatively lower scores compared with the components of mental health (Lam & Lauder, 2000; Zakaria et al. 2009). Our study also demonstrated statistically significant difference in functional capacity, $p = 0.019$, functional limitation, $p = 0.004$, bodily pain, $p < 0.001$, general health status 0.048 and mental health, $p = 0.029$. Examination of the mean scores indicates that there was a greater quality of life for all the variables in males as compared to the females. The gender disparity in influencing the quality of life could be due to mechanical, environmental, and psychosocial factors such as employment, education, physical activity, muscle power, and pain coping skills (Rapp et al. 2000; Adamson et al. 2003; Dunlop et al. 2005).

In the present study, we noted that almost 65.6% of participants with knee osteoarthritis complain of pain. Pain is the hallmark symptom of osteoarthritis which limits the function and reduces the QOL (Dominick et al. 2004; Ayis & Dieppe, 2009; Neogi 2013). It is the important precursor of physical disability and key symptom that influences the decision making of the patient with knee osteoarthritis in seeking medical treatment (Neogi, 2013). The findings of this study also suggest a remarkable difference between gender in pain perception ($p < 0.001$). Such results were comparable to prior research with women experiencing greater pain than men owing to lower pain threshold and tolerance to painful stimuli (Riley et al., 1998; Keefe et al., 2000; Chesterton et al., 2003; Tonelli et al., 2011). Present study findings can have significant implications for clinicians in treating pain. Clinicians might need to be aware that treatments may have different effects on pain perception when treating women versus men with knee osteoarthritis (Keefe et al., 2000).

In regards to the relationship between the QOL, pain, and level of physical activity the present study demonstrates a low positive correlation between QOL and physical activity in knee osteoarthritis patients. Current results were found to be consistent with the systemic reviews which have shown the positive correlation between regular physical activity and health-related QOL (Bize et al., 2007; Klavestrand & Vingard, 2009). In terms of the relationship between pain and physical activity, the present study reported a strong, negative correlation between pain and

physical activity, which indicates that with increase physical activity level, there is reduce in pain intensity. These results were similar to a study done by Wilkie et al. (2007) which reveals a strong association of knee pain with restricted mobility outside the home. Inactive patients were avoiding some movements or activities due to fear of pain although there was no real physical cause of pain over their knees (Steultjens et al., 2002). Hence, patients with knee osteoarthritis may develop progressive loss of physical function, the decline in QOL, and became dependent on their ADL (Loza et al., 2009).

Conclusion

In summary, present study reports greater numbers of female participants with knee osteoarthritis have relatively poor physical activity and quality of life and increase pain intensity as compared to males. This highlights the needs of clinicians to be aware of the gender influences in managing patients with knee osteoarthritis.

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Conflict Of Interest

The author(s) declare(s) that there is no conflict of interest.

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