Journal of Taibah University Medical Sciences (2017) 12(2), 150–156

Taibah University

Journal of Taibah University Medical Sciences

www.sciencedirect.com

Original Article

Mediating role of body mass index in knee osteoarthritis

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Received 21 September 2016; revised 5 November 2016; accepted 6 November 2016; Available online 17 February 2017

الملخص

أهداف البحث: تستكشف هذه الدراسة دور كل من محيط الركبة، ومؤشر كتلة الجسم والنطاق الحركي للركبة في التنبؤ بالفصال العظمي للركبة. وتهدف الدراسة إلى إيضاح الدور الوسيط الذي يلعبه مؤشر كتلة الجسم في التأثير على العلاقة بين العمر ومحيط الركبة، والألم في حالات الفصال العظمي للركبة، حسب ما تم قياسه باستخدام استبانة "استطلاع مخرجات الركبة".

طرق البحث: استخدم في هذه الدراسة تصميم السببية المقارنة. وتكونت الدراسة من ٦٦ مريضا يعانون من الفصال العظمي للركبة المصحوب بالأعراض ويقابلهم ٦٠ فردا مطابقا بدون أعراض.

النتائج: ارتبط مؤشر كتلة الجسم بشكل كبير وإيجابي مع كل من الألم ومحيط الركبة في مجموعة الفصال العظمي للركبة المصحوب بالأعراض. وتعني هذه النتيجة وجود علاقة بين الفصال العظمي للركبة ومؤشرات أخرى كالعمر ومحيط الركبة.

الاستنتاجات: تشير نتائج الدراسة إلى وجود مَعلَم هام في مجال إعادة التأهيل السريري، خاصة بالنسبة لأخصائيي العلاج الطبيعي، مما يعينهم على التخطيط والتعديل وتصميم المداخلات بشكل أفضل لتحسين الوضع الصحي لمرضى الفصال العظمي للركبة.

الكلمات المفتاحية: مؤشر كتلة الجسم؛ محيط الركبة؛ الفصال العظمي للركبة؛ النطاق الحركي للمفصل؛ إعادة التأهيل السريري

Abstract

Objective: This study explores the role of knee circumference, body mass index (BMI), and range of motion (ROM) in predicting knee osteoarthritis (KOA). The objective is to elucidate the mediating role of BMI in influencing the relationship between age, knee circumference and pain in knee osteoarthritis, as measured with the help of the knee outcome survey (KOS) questionnaire.

Methods: The design used in this study was causal comparative. The study consisted of 66 patients with symptomatic KOA and 60 matched asymptomatic individuals.

Result: BMI was significantly and positively correlated with both pain and knee girth for the symptomatic KOA group. This finding signifies a relationship between KOA and other indicators, such as age and knee circumference.

Conclusions: The results of the study would indicate an important milestone in clinical rehabilitation, especially for physical therapists, enabling them to plan, modify, and design interventions to improve the health status of KOA patients.

Keywords: Body mass index (BMI); Clinical rehabilitation; Knee circumference; Knee osteoarthritis (KOA); Range of motion (ROM)

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Peer review under responsibility of Taibah University.

Production and hosting by Elsevier

Introduction

Knee osteoarthritis (KOA) is a debilitating musculoskeletal disorder that is particularly common among older adults and characterized by the progressive degeneration of cartilage, as well as concomitant bone hypertrophy.[1] A

 http://dx.doi.org/10.1016/j.jtumed.2016.11.010

prevalence study in KSA has found that KOA affects a staggering 53% of males and 60.9% of females.[2] The most common implicating clinical features of KOA in any country are age[3] and pain.[4] Factors associated with osteoarthritis are well-researched and include vitamin D deficiency,[5] smoking habits, and even religious practice in Asia.[6] At the same time, BMI, age, previous knee injury is found to be associated with KOA disability. Restricted joint mobility, particularly flexion of the knee, is found to be a significant determinant of disability in KOA.[7]

Longitudinal studies have observed that obesity is one of the most important risk factors in KOA.[8] Researchers have yet to explore fully the compounding effects of many other variables, but knee pain and age are more important determinants of functional impairments in elderly subjects than the disorder's severity.[9] KOA is viewed as a disease affecting older persons, but recent evidence suggests that obesity and traumatic knee injury are documented as risk factors for KOA in younger persons.[10] Research has also shown that the severity of KOA relates to a decrease in ROM.[11] ROM is a defining feature of KOA as it also contributes to developing activity limitations. Clinical presentation of osteoarthritis is characterized by pain, edema, morning joint stiffness, muscular atrophy, and instability.[12] Knee circumference measures the articular volume and it quantifies the extension of the edema making it possible to measure the effectiveness of physical therapy intervention.[13] Obesity is also found to increase the development and progression of KOA.[14,15] Manninen et al.[16] reported that for every standard deviation increase in BMI (3.8 kg/m^2) there is a 40% increase in the risk of developing KOA. Along with patient age, being overweight is significantly associated with KOA, potentially leading to an increase in the risk of developing arthritis by between two- and seven-fold.[17,18] KOA is prevalent in countries in the Gulf region because of their ageing populations and growing obesity rates.[24] The disorder frequently results in increased girth through inflammation[19] and influences patients' ROM. To develop an understanding of the mediating role of BMI, the study uses mediation analysis. There is a dearth of research studies in KSA that establish the mediating effect of BMI in understanding KOA. A Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADL) is considered a common tool professionals use to measure the health status of KOA patients.[20] The KOS-ADL is also used to measure the KOS-ADL knee function in asymptomatic healthy adults during daily activities of living and sports.

This study has three objectives. The primary objective is to establish the reliability and validity of the KOS-ADL questionnaire commonly used in evaluating the Saudi Arabian population's health. The second objective is to elucidate the effects of age, BMI, ROM and girth on the KOS-ADL of KOA patients while comparing age and BMI with perceived knee function in healthy unrestricted individuals. As a third objective, this study attempts to understand the specific role of BMI as a mediator in influencing the relationships between these variables and KOA pain.

Materials and Methods

Study design and sample characteristics

The study had 126 participants. Group 1 consisted of 66 consecutive patients with symptomatic KOA between the ages of 24 and 75 years and Group 2, the control group, which consisted of 60 asymptomatic individuals matched with age. The researcher selected the subjects for Group 1 after obtaining their informed consent and checking the inclusion and exclusion criteria. The inclusion criterion was referral from the physician with X-ray evidence of degenerative changes in the knee and confirmation by physiotherapy examination. Exclusion criteria included patients who had traumatic injuries other than KOA. Group 2 consisted of individuals who have had no prior history of lower extremity injury or pain. King Khalid University Research Ethical Committee Board reviewed and approved this causal comparative study. The proposed model of the study is provided in Figure 1.

Measures

The study took in information regarding the participants' ages, height (in centimetres) and weight (in kilograms). Moreover, the study calculated BMI by weight in kilograms divided by height in metres squared. The BMI was then categorized as normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2) and obese ($\geq$30.0 kg/m^2) according to the World Health Organization's (WHO) classification.[21] Participants also completed a self-reported questionnaire in the form of the Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADL). The assessment was generally considered valid for the assessment of both the symptoms of KOA and physical function disability in patients with KOA.[22] It contained eight questions concerning the following symptoms: pain, stiffness, swelling, giving way, weakness, buckling, slipping and limping. There were eight questions regarding functional limitations: walking, ascending and descending stairs, standing, kneeling, squatting, sitting, and rising from a chair. The responses to the assessment were graded on a scale of 0–5, where 5 indicated no limitation and 0 indicated a high level of both symptoms and functional limitations.[22,23] Asymptomatic adults then filled the KOS-ADL perceived knee function form and were exempted from filling out the symptoms section of the questionnaire.

For Group 1, the patient's worse knee was the 'index' knee. Researchers/therapists in the study assessed the girth of the index knee in the supine position with the hip in a neutral

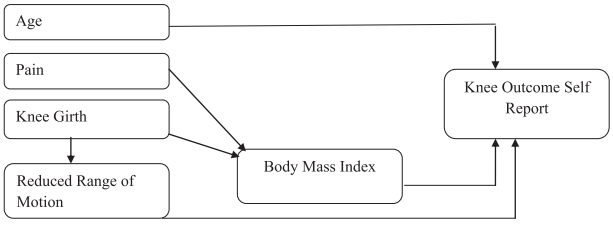

Figure 1: The study model.