

Research Article

Exercise and the Risk of Knee Osteoarthritis: A Case Control Study

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Abstract

Introduction: Knee Osteoarthritis (Knee OA) has multifactorial aetiological factors. The study aims to find the association between exercise and knee OA.

Methods: This case-control study was conducted at an Orthopaedic Hospital Wamakko located in Sokoto, North-Western Nigeria between January 2022 and December 2022. The cases with knee OA and unmatched controls were randomly selected. Detailed history of physical exercise was taken from each patient and were categorized as either exercising or not exercising.

Results: There was a total of 372 patients in the study comprising 124 cases and 248 controls in a ratio of 1:2. The average age was 53.7 ± 10.8 (range 40 to 88 years). There were 165 (44.4%) males and 207 (55.6%) females. A total of 44 (11.8%) patients do exercise while 328 (88.2%) do not do exercise. There was statistical significance between exercise and risk of knee OA (p value=0.0001, OR=4.3, and 95% CI=2.20 - 8.17). Male patients (36/9.7%) exercised more than females (8/2.2%), and this was statistically significant (p-value=0.0001, OR=6.94, 95% CI=3.13 to 15.41). Among the exercising groups, 36 (9.7%) were males, and only 8 (2.2%) were females. There were 28 (7.5%) cases and 16 (4.3%) controls who exercised. Of the 44 subjects exercising, 28 (36.4%) had knee injuries including unspecific knee pain (15/34%), Ligament injury (7/15.9%), meniscal injury (5/11.4%), and fracture (1/2.3%). Meanwhile, 16 (36.6%) subjects have no knee injuries. There was a statistical significance between exercise-associated knee injuries and risk of knee OA (p-value=0.001, OR=2.63, 95% CI=1.2-5.55). Following multivariate analysis of all the risk factors and knee OA, the findings were p-value=0.002, Adjusted OR (AOR)= 3.942, and 95% CI=1.68-9.26.

Conclusion: The study findings are consistent with exercise as a risk factor for Knee Osteoarthritis (knee OA) in the presence of exercise-associated knee injuries.

Keywords: Case control study; Knee osteoarthritis; Exercise; Physical activity; Knee sports injury; Exercise associated knee injury

Introduction

Knee Osteoarthritis (Knee OA) is the most common osteoarthritis [1]. It is a debilitating disease associated with pain and joint stiffness, and greatly limits individual's functional capacity [2]. The hallmark of the disease is involvement of the articular cartilage wear and tear with attempt at repair over the course of time [3]. This is more pronounced and progressive in the presence of repetitive trauma following continuous weight exertion on the knee joint [4]. Risk factors for knee OA include advanced age, obesity, female gender, repetitive trauma, previous knee injury, and abnormal knee joint loading [2-5]. There have been reports of increased knee OA prevalence in certain sports particularly football (soccer) and weight lifting [6]. While mild to moderate physical activities have been shown to reduce incidence of knee OA, vigorous exercise especially among sportsmen predisposes to repetitive knee joint trauma with subsequent high risk for knee OA development [7]. Generally, adequate literature relating exercise with knee is scanty, and there have been mixed views and findings on the effects of exercise on knee OA. However, more studies have reported a strong association between regular and recommended exercises and

decrease in the risk of knee OA [8].

The literature is also generally underreporting how various knee injuries resulting from exercise have effects on the increased knee OA prevalence. This hospital-based case-control study aims to find the association between exercise and knee OA; exercise-associated injuries and knee OA, and also the gender difference in exercise and the risk of knee OA.

Materials and Methods

This case-control study was conducted at an Orthopaedic Hospital Wamakko, a referral center located in Sokoto, North-Western Nigeria between January 2022 and December 2022. Ethical approval was obtained at the Ministry of Health Sokoto with Ref no. SMH/1580/V. IV before the study begins. The cases with knee OA and unmatched controls were randomly selected during the Outpatient Department (OPD) visits within the study period. Cases with knee OA were diagnosed using the American College of Rheumatology (ACR) criteria which include knee pain with at least three out of six criteria in the case group [9]. The inclusion criteria were adult patients aged >40 years with knee OA, and the exclusion criteria were infected knee, associated peri-articular fracture and postoperative knee disease. The method of data collection was by interviewing participants via the use of a reliable questionnaire. Questions regarding demographic features, other risk factors, Knee joint clinical presentations, and radiological features were taken. Detailed history of physical exercise was taken from each patient. Presence of exercise was recorded as physical activities that include regular sporting activities, long walk or low to moderate intensity running of more than 30 minutes per occasion, at least 2 times a week. Patients were categorized as either exercising or not exercising.

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Categorical variables were presented in the form of frequency and percentages. Data were analyzed using SPSS version 23. The univariate analysis was used to compute p-values through chi-square for the categorical variables. The independent association between exercise, exercise associated injuries and the risk of knee OA was considered positive if the exposure variables were significant at <5% level. Multivariate logistics regression was used to assess the association between the various factors and risk of knee OA.

Results

Table 1 shows the demographic features of the study subjects. There was a total of 372 patients in the study comprising 124 cases and 248 controls in a ratio of 1:2. The average age was 53.7 ± 10.8 (range 40 to 88 years). There were 165 (44.4%) males and 207 (55.6%) females. A total of 44 (11.8%) patients do exercise while 328 (88.2%) do not do exercise. There was statistical significance between exercise and risk of knee OA (p value=0.0001, OR [Odd's Ratio] = 4.3, and 95% CI [Confidence Interval] = 2.20-8.17). Male patients (36/9.7%) exercised more than females (8/2.2%), and this was statistically significant (p-value=0.0001, OR=6.94, 95% CI=3.13-15.41) (Table 2). Among the exercising groups, 36 (9.7%) were males, and only 8 (2.2%) were females. There were 28 (7.5%) Cases and 16 (4.3%) controls who exercised. Of the 44 subjects exercising, 28 (36.4%) had knee injuries including unspecific knee pain (15/34%), Ligament injury (7/15.9%), meniscal injury (5/11.4%), and periarticular fracture (1/2.3%). Meanwhile, 16 (36.6%) subjects have no knee injuries (Table 3 and Figure 1). There was a statistical significance between exercise-associated knee injuries and risk of knee OA (p-value=0.001, OR=2.63, 95%=1.2-5.55). Following multivariate analysis of all the risk factors and knee OA, the findings were p-value=0.002, Adjusted OR (AOR)=3.942, and 95% CI=1.68-9.26.

Discussion

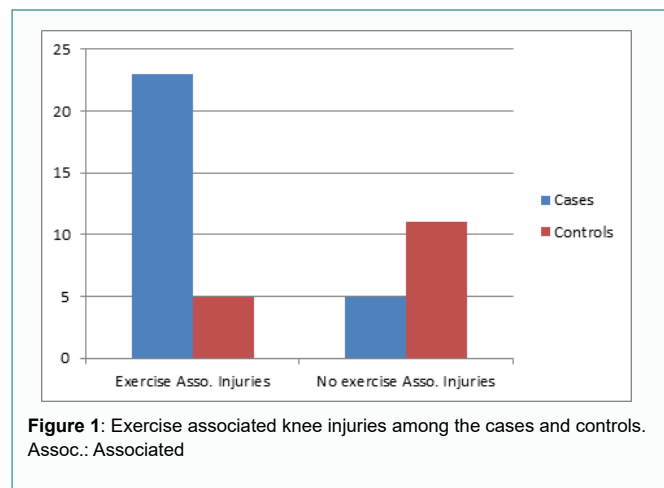
In this study, there is a positive association between exercises and

Table 1: Socio-demographic characteristics of the respondents.

Variables	Cases	Control	Total
Age (years)			
40.00-49.00	50(35.2)	92(64.8)	142(100)
50.00-59.00	41(35.3)	75(64.7)	116(100)
60.00-69.00	20(27)	54(73)	74(100)
70.00-79.00	8(25.8)	23(74.2)	31(100)
80.00+	5(55.6)	4(44.4)	9(100)
Gender			
Female	49(29.7)	116(70.3)	165(100)
Male	75(36.2)	132(63.8)	207(100)
Ethnic group			
Hausa/Fulani	116(33.2)	233(66.8)	349(100)
Others	8(34.8)	15(65.2)	23(100)
Occupation			
No occupation	63(31.3)	138(68.7)	201(100)
Business	26(43.3)	34(56.7)	60(100)
Civil servant	19(31.1)	42(68.9)	61(100)
Farmer	16(32)	34(68)	50(100)
Education			
Non-formal education	89(35.6)	161(64.4)	250(100)
Formal education	35(28.7)	87(71.3)	122(100)
Income (monthly \$)			
Low Income	74(52.6)	61(47.4)	135(100)
High Income	50(23.1)	187(76.9)	237(100)
Marital status			
Married	104(31.9)	222(68.1)	326(100)
Single	17(42.5)	23(57.5)	40(100)
Divorced/Widowed	3(50)	3(50)	6(100)

Table 2: Association between Exercise and knee OA (n=372).

Category	Exercise (%)	No Exercise (%)	P (<5%)	OR	95% CI
Case	28 (7.5)	96 (25.8)	0.0001	4.3	2.20-8.17
Control	16 (4.3)	232 (62.4)			
Male	36 (9.7)	129 (34.7)	0.0001	6.94	3.13-15.41
Female	8 (2.2)	199 (53.5)			



knee Osteoarthritis (Knee OA). The prevalence of knee OA among those who exercised was 7.5%. Exercise-associated trauma was a strong risk factor for knee OA (OR), and was most likely the reason for exercises being a risk factor for knee OA in our study findings. The higher number of male gender exercising (9.7%) resulted in higher prevalence of exercise-related knee OA among male cases. This was the case because the study showed fewer females engaged in exercise (2.2%) than males. After taking other risk factors into consideration, the result of logistic regression further showed exercise as an independent risk factor for knee OA. The unspecific pains following knee trauma during exercise prevailed over other associated knee injuries like ligament and meniscal tears. The repeated loading and continuous micro-cartilage tear may represent the pain without solid conclusion on clinical and radiological diagnosis. This phenomenon occurring on the joint cartilage has been one of the aetio-pathologic pathways in the development of knee OA [10].

Numerous studies relate exercise with the risk of knee OA [7,11]. Exercise is generally believed to protect against early knee OA, reduces symptoms in the presence of the disease and prevent rapid knee OA disease progression [11,12]. There has been varying opinions on which type of exercise is best for knee OA protection and symptoms relief. Mild to moderate exercises with energy expenditure of about 1000 kcal (4200 kJ) per week equivalent to walking for 1 hour 5 days a week has been shown to be associated with significant health benefits [13]. It is recommended for both the young and elderly for a better health condition, and prevention and management of some chronic diseases. Research by Lee PG et al. [14] reported a recommended exercise guideline for older adults comprising at least 150 minutes of moderate aerobic exercise activity or 75 minutes of high-intensity aerobic activity and muscle-strengthening activities of at least two days per week. An interesting systemic review by Mineiro L et al relating the effects of exercise on the older women with osteoporosis also found that exercise impacts on postural balance, increased isometric strength of knee flexors and extensors, and reduces the number of falls especially with use of multi-modal approach to training for at least 12 weeks in this group of patients [15]. One of the contentious issues

Table 3: Exercise associated knee injury among the exercising subjects (n=44).

	No Injury	Unspecific knee pain	Ligament Injury	Meniscal Injury	Fracture	Dislocation
No (%)	16(36.4%)	15(34.0%)	7(15.9%)	5(11.4%)	1(2.3%)	0(0%)

has been the influence of exercise among sportsmen on the knee OA occurrence. While low intensity exercise is generally known to be protective against knee OA, vigorous and high-intensity exercises among the career sports people may be a risk factor for knee OA particularly with the long-term and intermittent knee injury and continuous loading to the weight-bearing joint [16]. In a systematic review of associating certain sports with knee OA, sports such as football (OR = 3.5), long-distance running (OR = 3.3), weight lifting (OR = 6.9), and wrestling (OR = 3.8) had an increased prevalence for knee OA [17]. The study findings revealed that even with no previous history of injury, football (soccer or American football) has increased risk for knee OA.

Overall, this study showed higher prevalence of knee OA among females than males. However, the exercise-related knee OA was more among the males largely due to high engagement of males in sporting activities and sports that are high-intensity and more vigorous [17-19]. Exercise in obese individuals may confer additional risk of knee OA as found in some studies [20]. The benefit of exercise in obese people as it relates to weight reduction and knee OA prevention has been reported [21]. The difficulties and challenges of regular exercise and the type of exercise that is recommended for knee OA in obesity is high because presence of knee pains from excessive weight-related loading can lead to reluctance in attaining the acceptable exercise level that is needed for prevention and treatment of the knee OA disease [22]. Whether individual is obese or not, presence of knee OA is a usual deterrent to a regular exercise especially at an advanced stage when pain relief is difficult to achieve. This in turn leads to either obesity in non-obese or persistent obesity thereby adding more to the severity of the knee OA symptoms [23]. At this stage of the disease, Total Knee Arthroplasty (TKA) may be the best option of treatment to alleviate pain and enable the affected individual resume normal exercise activity [24]. Another factor to consider is patients' selection for TKA because, presence of morbid obesity may influence the outcome of the surgical procedure thereby posing a limited option of treatment for the orthopaedic surgeon [25]. One of the mandatory recommendations for the weight reduction is exercise, and this may be quite challenging for the morbid obese individuals with all the associated comorbidities to comply with the exercise instruction. In this regard, a randomised study reported a recommended type of exercise for this class of obese patients [26].

For the prevention of knee OA and its disease progression, exercise with other non-operative management options like physiotherapy, use of pharmacologic agents and avoidance of knee trauma play a significant role in reducing the disease burden and improve the quality of patients' life [27]. Health educational program on obesity avoidance through dietary control and regular exercise is also vital to knee OA prevention and treatment [28]. The target for prevention of knee trauma-related osteoarthritis should be more on the high-risk sports such as football and other knee loading related sports. Early and appropriate treatment of knee injuries by the expert with view to reasonable non-sporting activity interval and good rehabilitative measures can restore the affected knees to near non-injury states [29].

The limitations of this study being it a case-control study include recall bias. This is because it is a retrospective study, cases tend to recall their problems more than the control and the tendency to forget

some important information for the study is there. The interviewer may also treat cases and control differently during interview but this is minimized by random allocation without knowing which class the patients belong. Although an association between exercise and knee OA was established, the small number of exercising groups may not be adequate enough to generalize the study in larger population. Therefore, more sample size is required to produce more generalizable result.

Conclusion

The study findings are consistent with exercise as a risk factor for knee Osteoarthritis (knee OA) in the presence of exercise-associated knee injuries among sports men. The recommended low to medium intensity exercise offers protective effects on knee OA in the absence of knee injuries and other factors such as obesity. Therefore, recommended routine exercises with the aim to reduce weight and improve knee function and knee injury avoidance are important in knee OA disease prevention and treatment.

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