

## Review Article

# Occupation and sports participation as risk factors for the development and progression of knee osteoarthritis

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## ABSTRACT

Knee Osteoarthritis (OA) is a major cause of pain and disability worldwide. In majority of cases of knee OA the etiology remains unidentified, however, a number of systemic and local biomechanical factors have been associated with the increased risk of this disorder. These factors may determine the onset of knee OA and rapidity with which the disorder progresses. Occupation and sports participation are among the commonly implicated risk factors and have been studied in detail for their relationship with knee OA. An increased risk of knee OA has been observed in people who are involved in jobs requiring bending and kneeling of the knee joint. Likewise, persons who participate in sports involving excessive strain of the knee joint also carry a higher risk of development of this disorder in the later part of their life. In this review we present the data, obtained from original resources, determining the relationship between occupation and sports participation with the onset and progression of knee OA.

**Keywords:** Bending, Incidence, Job, Knee, Kneeling, Radiographic, Sports

## INTRODUCTION

Osteoarthritis (OA), is a chronic degenerative disorder of multifactorial etiology that has been described as a clinical syndrome of joint pain accompanied by varying degrees of functional limitation and reduced quality of life.<sup>1, 2</sup> OA of the knee is a major cause of impaired mobility, particularly among females.<sup>3</sup> The exact etiology of knee OA remains unidentified, nevertheless, it is believed that an interplay between multiple systemic and local factors is responsible for the disorder. While systemic factors are believed to increase the vulnerability of joints to injury, local factors, which are biomechanical in nature, critically affect the forces applied to the joint.<sup>4</sup> These factors act jointly within the joint and determine how fast the disorder progresses in the affected joint.<sup>5</sup> Multiple risk factors have been associated with the development and progression of knee OA and these include age, female gender, ethnicity, obesity, smoking,

race, genetics, past knee surgery or trauma and an occupation demanding heavy lifting, squatting or kneeling and sports acyivity.<sup>4,6</sup>

Evidence has accumulated that the disease is more common in people who have performed heavy physical work, particularly in those whose jobs involve kneeling or squatting. Similarly, several studies have suggested that persons with active participation in sports involving high impact on knee joint carry an increased risk of knee OA. We searched online resources for the original studies carried out to find the role of occupation and sports participation in the development of knee OA. A number of case control studies, cohort studies, radiological surveys, cross sectional studies, national and international survey reports exist that strongly establish that occupation and sports related stress increase the risk of knee OA. Although most reports regarding risk factors have evolved from Caucasian populations of high-income

countries the results can be generalized to the residents of low income regions as well.<sup>6</sup>

## OCCUPATIONAL FACTORS

A number of job related factors have been discussed in association with knee OA. These include carrying and lifting of heavy weights, and kneeling or squatting while performing various types of jobs. 15 to 30% of men are likely to develop radiographic knee OA as a result of job related activities.<sup>7</sup>

From the Framingham Heart Study, Felson and his coworkers studied subjects to evaluate the association of occupational physical demands and development of knee OA. Men who were involved in jobs comprising bending of knee and at least medium level of physical demands had increased rates of radiographic knee OA [Odds ratio (OR) of OA = 2.22, 95% CI 1.38, 3.58]. Among these men severe radiographic knee OA and bilateral radiographic knee OA was more prevalent, however, women executing similar kind of jobs were usually not associated with future radiographic OA.<sup>8</sup>

A population based case control study compared confirmed cases of knee OA to sex matched controls. The results suggested prolonged or repetitive bending of the knee is a cause of OA in the joint.<sup>9</sup> Evaluating the consequence of occupation on the development of knee OA a study examined, interviewed and investigated carpenters, floor layers, and compositors. The results of the study suggested that OR increases with the degree of kneeling work positions. In addition, positive dose-response relationship existed between exposure to knee-stressing activities and the number of workers self-reporting knee complaints. Two-to-three-fold risk of developing more severe knee complaints was observed at low-to-moderate exposure. A dose-response correlation also existed between knee-straining and radiologically diagnosed knee OA.<sup>10</sup>

A cross sectional survey of United States population found a significant exposure-response relationship between symptomatic knee OA and kneeling among men. A significant association was observed between severe knee OA and heavy lifting. The results of the study suggested that the enhanced exposure to activities related to occupational is accompanied by increased odds of symptomatic knee OA. The authors further suggested that risk of developing knee OA due to occupational hazards can be reduced by modifications to work methods.<sup>11</sup>

In women who accumulated kneeling and squatting >8,934 hours over life, an OR of 2.5 (95% CI, 1.4 to 4.7) was observed, while in men having 3,474 to 12,244 accumulated hours of kneeling and squatting over life, OR was 2.2 (95% CI, 1.2 to 3.8). In men who had accumulated above 12,244 hours of kneeling and squatting over life an OR of 2.5 (95% CI, 1.4 to 4.3) was reported. These interpretations supporter an association

of kneeling/squatting on the development of knee OA in both sexes.<sup>7</sup>

## SPORTS PARTICIPATION

Conflicting reports have appeared regarding the relationship of sports activities with the development and progression of knee OA. On one hand, some studies have suggested that the risk of OA enhances due to sports participation while on the other hand some studies could not establish any association.<sup>4</sup>

A study evaluated 117 former top level male long-distance runners, soccer players, weight lifters and shooters, for clinical and radiographic knee OA. A high prevalence rate of knee OA was recorded among weight lifters (OR 12.9, 95% CI 1.47-113) and soccer players (OR 12.3, 95% CI 1.35- 111) in comparison to shooters. In soccer players, predominantly tibiofemoral joint was involved while in weight lifters patellofemoral joint was primarily involved. Although runners had a substantial increased relative risk of developing knee OA (OR 4.8) but no conclusive evidence was found suggesting that long-distance running could lead to premature knee OA among low BMI athletes who had started running at younger ages. The study found that the higher risk of knee OA in soccer players may be mostly due to injuries while loading and high body mass together may be responsible in weight lifters.<sup>12</sup> A national population based study on 2049 male athletes, who participated in international events between 1970 and 1990, reported that athletes from all kinds of competitive sports are more likely to require hospital care for knee OA.<sup>13</sup>

After adjusting for age, weight, and height differences, 1.6-3.6-fold increased risk of knee OA was observed in 157 female ex-elite middle and long-distance runners in a study. It was suggested that the development of knee OA in sportspersons is determined mainly by the duration of participation in sports activity and not the eliteness of the sport.<sup>14</sup> As compared to controls an increased risk was observed for knee OA requiring prosthetic surgery in men who had been active in sports. An increased relative risk in high exposure group compared to medium exposure is suggestive of an exposure-response relationship. High exposure to sports activity was found to be detrimental, however, low exposure and general recreational, moderate physical activity were not.<sup>15</sup>

A study in Sweden found knee OA related to different sports activities possibly explained by the increased risk of injuries due to sports.<sup>16</sup> Klusmann and coworkers observed that unapparent knee injury during sports activities may be a relevant factor for the development of symptomatic knee OA. In women having a cumulative sports activity of  $\geq 1,440$  hours over life OR of 2.5 (95% CI, 1.3 to 4.6) was observed, while in men who had performed sports activities for more than 3,232 hours over life, the OR was 2.6 (95% CI, 1.6 to 4.2) compared to subjects who had no sports activity.<sup>7</sup>

A longitudinal prospective study carried out to study the effect of physical activity related joint stress on knee and hip OA suggested that moderate type of sports activity does not escalate the risk of OA in absence of significant joint injury. It was concluded that in the absence of previous injury moderate physical activities are not detrimental to knee and hip joint health.<sup>17</sup> While exploring risk factors for symptomatic knee OA, Davson et al., were not able to find any relationship between sports related exercise and symptomatic knee OA among women. They further stated that the relation between knee OA and sports activity is still contentious as some studies have reported the relation.<sup>18</sup>

## DISCUSSION

Knee OA being the major cause of compromised mobility, significantly increases the burden on health systems and the economy. There has been a marked surge in the number of OA cases with the increase in the life expectancy. By the year 2050, 20% (130 million) world population will suffer from OA and one third of this population will be severely disabled by the disease.<sup>19</sup> Knee OA remains the most incident form of OA in both men and women.<sup>20</sup>

Occupational activities significantly increase the probability of development and progression of subsequent knee OA. Repeated execution of tasks by the workers, overloading of joint and exertion of the protective muscles of joints enhances the probability of OA in the involved joints. On investigation of different job tasks, those involving heavy lifting, squatting or kneeling were associated with high rates of knee OA. Crouching and squatting, increases the forces acting across the knee, more so if weight is lifted in these positions and twisting in such positions creates extra torsional stress.<sup>21</sup>

Sports participation exerts both contributing as well as protective effect for knee OA. It has been established that sportsperson who participate in competitive sports carry a greater risk of OA. Moderate running carries lower risk of subsequent OA, while sports activities involving high-intensity, acute and direct joint impact carry a significant risk of developing OA. The impact can be attributed to contact with playing surface, equipment or other participants leading to injuries of the knees. Frequent impact on joint and twisting of knee joints among soccer players has been linked to the joint degeneration.<sup>21</sup> In general light recreational exercises may provide a protection against early development of knee while sports activities that involve heavy impact on joint may act as a strong risk factor for the disorder.

## CONCLUSION

We conclude that risk factors implicated in the development and progression of knee OA significantly contribute in increasing the burden of disease.

Occupation plays a significant role in the development and progression of knee OA. Low and moderate intensity sports activities in the absence of previous joint trauma do not amplify the risk of knee OA. Presence of previous knee joint injury increases the risk even with the low or moderate intensity sports related activity.

While on the one side of spectrum there are certain risk factors that cannot be altered but on the other side adjustments may be made in modifiable risk factors, including occupation and sports participation, to reduce the burden of the disease.

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