# Smoking and Obesity as Risk Factors For Knee Osteoarthritis

# Thesis

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**Physical Medicine, Rheumatology and Rehabilitation**

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# التدخين و السمنة كعوامل مؤثرة علي خشونة مفصل الركبة

## رسالة

توطئة للحصول علي درجة الماجستير في **الطب الطبيعي و الروماتيزم و التأهيل**

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Osteoarthritis (OA) is a common degenerative disease of joints. The major clinical features are pain and stiffness, leading to a decline in physical function. OA of the knee is a complex multifactorial disease. Risk factors are broadly divisible into those that are constitutional or genetic and those that are local and driven by biomechanical elements ***(Mounach et al., 2007)***.

Cigarette smoking has been associated with chronic musculoskeletal conditions. However, the effect of smoking on the pathogenesis and progression of symptomatic knee osteoarthritis has been unclear ***(Amin et al., 2007)***.

Obesity is associated with elevated risk for OA. The effect of biomechanical loading on cartilage may explain part of the increased risk for knee OA in overweight people ***(Pallu et al., 2010).***

This thesis was carried out to study the effect of smoking and obesity as risk factors for knee osteoarthritis on the disease progression.

We conducted our study on thirty patients with knee OA diagnosed according to ACR classification of OA of the knee **(**modified from ***Altman et al., 1986***).** Ten healthy subjects were included as a control group.

# List of Contents

# List of Abbreviations

| Abbreviation | Meaning |
|---|---|
| **ACR** | American College of Rheumatology |
| **BMI** | Body Mass Index |
| **BMP** | bone morphogenetic protein- |
| **COX** | Cyclooxygenases |
| **EULAR** | European League Against Rheumatism |
| **FGF** | Fibroblast growth factor |
| **IGF** | Insulin-like growth factor |
| **IL** | Interleukin |
| **IL1-B** | Interleukin 1 beta |
| **IL1-R1** | Interleukin 1 receptor 1 |
| **K/L** | Kellegren and Lawerence score |
| **KS** | Keratan sulfate |
| **LCL** | Lateral collateral ligament |
| **LIF** | Leukemic inhibitor factor |
| **MMPs** | Matrix metalloproteinases |
| **NO** | Nitric oxide |
| **NSAIDs** | Nonsteroidal anti-inflammatory drugs |
| **OA** | Osteoarthritis |
| **PCL** | Posterior cruciate ligament |
| **PG** | Prostaglandin |
| **TENS** | Transcutaneous electrical nerve stimulation |
| **TGF** | Transforming growth factor |
| **TNF** | Tumor necrosis factor |
| **TNF α** | Tumor necrosis factor alpha |

# List of Tables

# List of Figures

# Introduction

Osteoarthritis (OA) is a chronic degenerative disorder characterized by cartilage loss. Its prevalence is high, and it is a major cause of disability. Knee involvement is the commonest presentation of this disease all over the world ***(Das and Farooqi, 2008).***

The diagnosis of OA can usually be made relatively easily and confidently based on the history, examination as well as by plain radiography. A positive association between several occupational factors and knee OA has been observed in previous studies in populations of different ethnicity ***(Aziza et al., 2008).***

OA is caused by aberrant local mechanical factors acting within the context of systemic susceptibility. Systemic factors that increase the vulnerability of the joint to OA include increasing age, female sex, and possibly nutritional deficiencies. While epidemiological studies have shown a major genetic component to risk that is probably polygenic. In people at risk, local mechanical factors such as misalignment, muscle weakness, or alterations in the structural integrity of the joint environment (such as meniscal damage) facilitate the progression of the disease. Loading can also be affected by obesity and joint injury, both of which can increase the likelihood of developing OA or experiencing its progression ***(Peach et al., 2005 & Hunter and Felson, 2006).***

Smoking is an important risk factor in many diseases and studying its role as a risk factor in OA is important in increasing our knowledge of the epidemiology of the disorder ***(Deborah and Tim 1993).***

Body mass index is inversely associated with both patellar cartilage volume and patellar bone volume in middle-aged women without knee osteoarthritis ***(Hanna et al., 2007)***

# Aim of the Work

To study the effect of smoking and obesity as risk factors for knee osteoarthritis.

# Osteoarthritis

Osteoarthritis (OA) is the progressive degeneration of articular cartilage and subsequent joint space narrowing. OA leads to pain, loss of motion, instability, and physical disability, thus impairing quality of life (Fig.1) ***(Martel-Pelletier and Pelletier, 2010).***

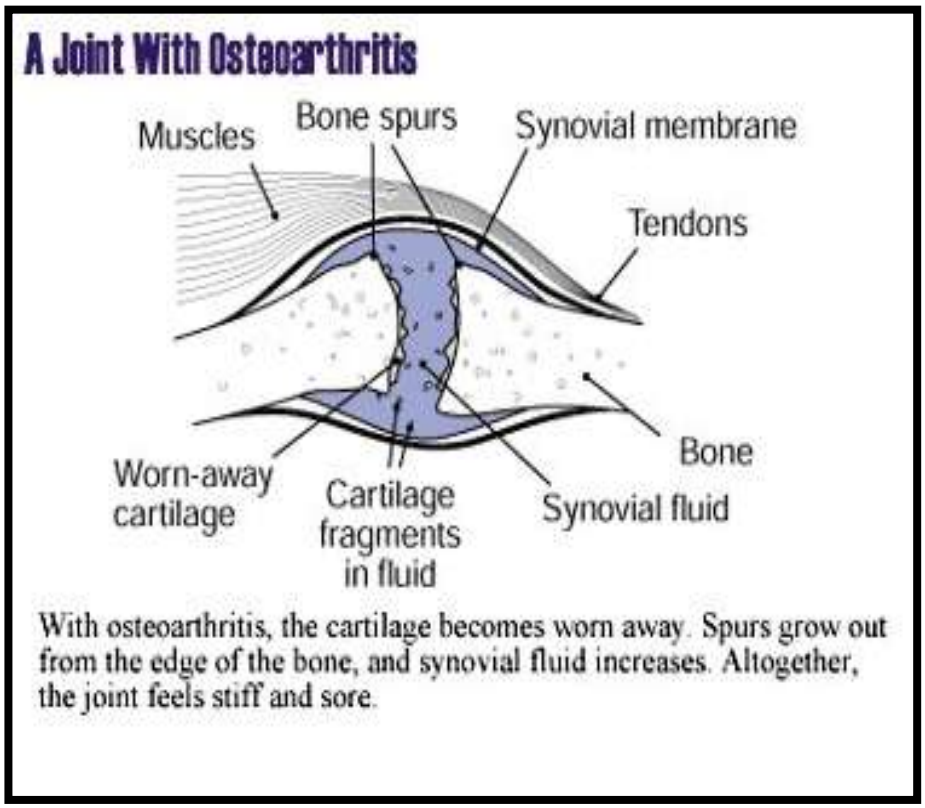


**Fig. (1):** Joint with osteoarthritis ***(Lawrence et al., 1989).***

OA is the most common form of arthritis and the leading cause of disability among older adults. As one part of weight-bearing peripheral and axial joints, knee is the most commonly affected by osteoarthritis. The underlying disease processes of knee OA (Fig. 2) involve cartilage degeneration, proliferation and remodeling of subchondral bone structure ***(Chen et al., 2010).***

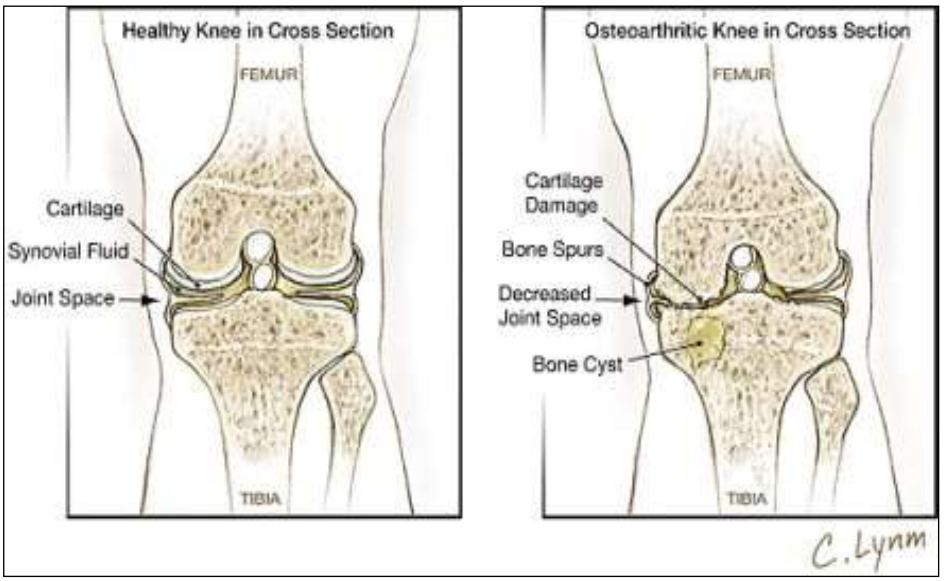


**Fig (2):** Knee osteoarthritis ***(Parmet et al., 2003*)**.

# Anatomy of the Knee Joint

The knee is a modified hinge joint consisting of the tibia, femur and patella. The primary plane of motion is extension and flexion **(Smith, *2003).***

The fibrous layer and synovial membrane are adjacent on each side, but they part company centrally to accommodate intercondylar and infrapatellar structures that are intracapsular (inside the fibrous layer) but extra-articular excluded from the articular cavity by synovial membrane ***(Agur and Dalley, 2009).***

## Articular surfaces of the knee joint:

The tibiofemoral joint is a complex synovial joint that has two surfaces:

### *Tibial surface:*

The proximal tibial surface slopes posteriorly and downwards relative to the long axis of the shaft. The tilt which is maximal at birth decreases with age. The posterior surface, distal to the articular margin, displays a horizontal, rough groove to which the capsular and posterior parts of the medial collateral ligaments are attached. The antromedial surface of the tibia is a rough strip. The medial patellar retinaculum is attached to the medial and anterior condylar surfaces, which are marked by vascular foramina ***(Standring and Richard, 2005).***

The medial articular surface is oval and longer than the lateral tibial condyle. Around its anterior, medial and posterior margins, it is related to the medial meniscus, and the meniscal imprint is wider behind, narrower antromedially. The surface is flat in the posterior half with the more anterior surface sloping upwards 10 degree. Much of the posterior surface is covered by the meniscus, so that overall a concave surface is presented to the medial femoral condyle. Its lateral margin is raised as it reaches the inter-condylar region ***(Standring and Richard, 2005).***

The lateral condyle overhangs the shaft posterolaterally above a small circular facet for articulation with the fibula. The articular surface is more circular and coapted to its meniscus ***(Standring and Richard, 2005).***

## ***Femoral surface:***

The articular bodies of the femur are its lateral and medial condyles. These diverge slightly distally and posteriorly, with the lateral condyle being wider in front than at the back while the medial condyle is of more constant width. The medial condyle is larger than the lateral (outer) condyle due to more weight bearing caused by the center of gravity being medial to the knee ***(Platzer and Werner, 2004).***

## ***The Patella:***

The patella is the largest sesamoid bone in the body. The patella is imbedded in the tendinous insertions of the quadriceps muscles, which converge to form patellar tendon or ligamentum patellae ***(Smith, 2003).***

The three paired facets (superior, middle, and inferior) on the posterior surface of the patella articulate with the patellar surface of the femur successively during *(1)* extension, *(2)* slight flexion, *(3)* flexion, and the most medial vertical facet on the patella *(4)* articulates during full flexion with the cresenteric facet on the medial margin of the intercondylar notch of the femur ***(Agur and Dalley, 2009).***

## **The menisci:**

The knee joint menisci are a pair of wedge shaped semilunar cartilages which are interposed between the femoral condyles and tibial plateaux. They measure approximately 35 mm in diameter and are attached to the joint capsule by their thick convex-shaped peripheral rim ***(Messner and Gao, 1998).***

The lateral and medial menisci differ in their sizes and attachments. The medial meniscus is smaller and attaches to the joint capsule on its entire peripheral edge, while the lateral meniscus is larger and does not attach to the capsule on the posterolateral region; this makes the medial meniscus less mobile and prone to tearing **(*McMahon and Skinner, 2003).***