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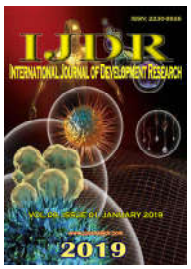

ORIGINAL RESEARCH ARTICLE OPEN ACCESS

RISK FACTORS OF HAND OSTEOARTHRITIS

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ABSTRACT

In this current work we studied the different risk factors of hand osteoarthritis in order to identify them including occupational and individual risk factors and to assess the effect or influence on the development of hand OA. The study sample consist of two groups. The 1st group (Case) were100 subjects with hand OA, (24) were males and (76) were females with mean age (59.92)±(7.96). The 2nd group (Control) were 100 subjects without hand OA, (36) were males and (64) were females with mean age (55.01)±(8.93). They were recruited from Ibin Sina Teaching Hospital rheumatology outpatient clinic. The study was conducted between January and June 2011. A detailed history was taken from each subject with clinical and radiological examination for bilateral hands. The patients were classified according to Kellegren and Lawrence grading criteria of hand osteoarthritis. The result was that housewives with homework activities for more than 10 years were at high risk of developing HOA. Smokers, post menopausal women, BMI (overweight, moderate obesity), increasing age, low educational level and previous hand trauma carry a risk for the development of HOA. The sports and leisure activities were not associated with the risk of HOA.

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INTRODUCTION

Osteoarthritis

Osteoarthritis (OA) is the most common joint disease worldwide. Among patients with OA, 80% have some degree of limitation of movement, and 25 % cannot perform the major daily activities of life (WHO 2003). Its high and growing prevalence and its moderate to severe impact on disability, also make OA an important condition in health policy concerns (Yelin 2003). It has been suggested that OA in general may predict shortened life expectancy, but studies concerning OA and mortality are scarce (Haara 2006).This disorder is characterized by defective integrity of the articular cartilage (Bagis *et al*. 2003), and can involve any joint but is most prevalent in the spine, hand, knee and hip joints. Although osteoarthritis is especially common in older age groups, it can also affect younger people with considerable economic impact on society (Kloppenburg. 2007). The risk of OA increases dramatically after the menopause. The main symptom of OA is pain and joint deformation, and it frequently leads to physical disability and social limitation.

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The involvement of different joints has different effects on function, the hip and knee being the most disabling sites (Bagis *et al*.2003). Although pain, reduced function and participation restriction can be important consequences of osteoarthritis, structural changes commonly occur without accompanying symptoms. Osteoarthritis is a metabolically active, dynamic process that involves all joint tissues (cartilage, bone, synovium/capsule, ligaments and muscle, In general, osteoarthritis is a slow but efficient repair process that often compensates for the initial trauma, resulting in a structurally altered but symptom-free joint.(Royal college of physician. Osteoarthritis, National clinical guideline for care and management in adults.2008).The heterogeneous nature of osteoarthritis and its slow disease course in the majority of patients complicates research on this disease and contributes to the lack of therapeutic strategies(Kloppenburg. 2007). Over the past decade, research in knee and hip osteoarthritis has received greater attention, leading to increasing knowledge of the pathogenesis of these osteoarthritis subtypes. This has resulted in strategies to prevent the disease (Kloppenburg. 2007). The pathogenesis of HOA is less intensively studied and is less certain.

Hand osteoarthritis

Definition and joints involved: Hand OA (HOA) is a heterogeneous disease with involvement of different joints, varying levels of symptoms and an erosive subset with radiographic central erosions (Haugen *et al.* 2011). OA is highly prevalent in hand joints and it may be an indicator of systemic OA. Previous studies have suggested an association between hand OA and OA in hip joint and OA in knee joint (Haara 2006). The commonest affected joints are the distal interphalangeal (DIP) followed by proximal interphalangeal (PIP) and the The 1st carpometacarpal (CMC), trapezioscafoid, and scafolunate intercarpal joints (Al-Arfaj and Al-Boukai 2002).

Prevalence of hand osteoarthritis: OA is highly prevalent in hand joints. Cross-sectional studies have estimated that the prevalence of radiographic hand OA in the Caucasian population among those over 65 years are ranging from 64 to 78% in men, and from 71 to 99% in women(Felson.2003). In Finns aged 30 years or over, the age-adjusted prevalence of radiographic hand OA was 39% in men and 40% in women. In the age group 60-69 years, the prevalence was 76% among men and 84% among women(Kärkkäinen 1985). According to the Framingham Study (Widrig *et al*. 2007), the prevalence of hand symptoms ranges from13% (men) to 26% (women). Some studies found OA of the hands to be more common than OA of the knee (Al-Arfaj and Al-Boukai 2002). Clinical hand osteoarthritis in study conducted in Tehran, the prevalence of hand OA in people aged 40-50 years was 2.2%, raising with age to 8.4% in people aged 50-60 years, and to 15.5% in those aged 60-70 years. The highest prevalence of hand OA, 22.5% was found in people aged > 70 years. Differentiation by gender showed that women had more hand OA than men(4.46% Vs. 1.35% respectively) (Davatchi F *et al*.2006). The prevalence of symptomatic thumb CMC OA among elderly Caucasians was 2% (right) and 3% (left) in men, and 5% in both carpometacarpal joints in women (Zhang Y *et al*. 2002). Of 1,041 subjects aged 71–100 years (36% men), the prevalence of symptomatic hand osteoarthritis was higher in women (26.2%) than in men (13.4%), compared with those without symptomatic hand osteoarthritis (Zhang Y *et al*.2002). In the USA, the estimated prevalence of radiographic OA of hands was reported to be 68.8% for females and 56.6% for males in the 55–64- year-old age group. In the Netherlands, the prevalence of grade 2 radiographic OA in the 60–69-year age group was reported to be 68.9–76.0% in females and48.9–51.7% in males. In Saudi Arabia study for the same age group were35% for females and 41% for males (Al-Arfaj and Al-Boukai 2002). Differences in the prevalence of hand OA among populations suggest site-specific differences in the prevalence of hand OA that may be attributed to genetic and environmental factors (Haara 2006).

Sex and age distribution: The factor most closely associated with the development of hand OA is age (Lawrence *et al*. 1966). The prevalence of OA increases with age with evident sex-specific differences. Before the age of 50 yr, the prevalence of OA in most joints is higher in men than in women, but hand OA is more prevalent among women (Solovieva *et al*. 2005).The effect of age on the risk of hand OA is even more evident and faster in women than in men (Kärkkäinen 1985, Hirsch *et al*. 2000). Even though radiological hand OA first appears at the MCP joints from the age of 25 years, the highest incidence of hand OA occurs after 45 years when OA develops in the IP joints and the CMC joint of the thumb (Allander 1974). The mechanism for this age-related development of hand OA is partially unknown. However, it is well known that the metabolic activity of the cartilage will decrease with age, limiting the regenerative mechanism of the cartilage (Kempson 1991). On the other hand, the decreasing of the metabolic activity with ageing diminishes the biomechanical properties of the cartilage, and thus the damage risk of the cartilage will increase. Even if getting older does not cause OA per se, disease incidence and prevalence increase dramatically with age. Thus, persons reaching old age with minimal or no radiographic evidence of disease are still at risk of developing OA within a short time. (Haara 2006).

Gender and hormonal factors: Female gender is strongly associated with hand OA according to previous studies. Above the age of 55 years, hand OA is more common in women, usually involving several joints, mostly the interphalangeals and the first metacarpal. Like severe knee OA symmetrical OA in distal interphalangeal joints has also been suggested to be a women's disease(Haara 2006).Female sex are well established risk factor for OA,and was strong independent predictor for symptomatic knee, hand, and hip OA. The underlying mechanism for this remains unclear, but it could be related to hormonal changes that may occur in, for example, chondrocytes, joint, ligaments, and shock absorbers or protectors, with aging in both sexes.(A. Andrianakos, *et al*.2006). Females are found to have more severe OA, more number of joints are involved, and have more symptoms and increased hand and knee OA. These observations and others reporting a painful form of hand osteoarthritis after the menopause suggest that loss of estrogen at the time of menopause increases a woman's risk of getting osteoarthritis (A Mahajan *et al*.2005). A case control study showed that in women with OA in hand, knee or hip joints, the rate of hysterectomy was twice as high as that of age-matched women with rheumatoid arthritis or with no joint disease (Spector *et al*. 1988). On the other hand, in the Chingford Study, there was a significant protective effect of HRT use for knee OA (odds ratio 0.31; 95% confidence interval 0.11-0.93). The effect was similar, but weaker for DIP OA. The protective effect of oestrogen is therefore unclear, but has important implications for the etiopathogenesis of OA, and indicates a possible therapeutic role for oestrogen in OA (Haara 2006).

Hand osteoarthritis and OA at other sites: There are few studies on the association between hand OA and other musculoskeletal diseases. However, there was a strong association between radiological hand OA and disc degeneration of the spine in a genetic epidemiological study of 1,583 individuals. One recent longitudinal study of Chingford women found that radiological knee and hip OA are important risk factors for the progression of lumbar spine disc degeneration (Haara 2006). Knee is most commonly affected by osteoarthritis, usually bilateral, often occurs in association with hand, on the other hand, previous reports also suggest strong associations between hand OA and OA in weight-bearing joints (A Mahajan *et al*. 2005). In the Study of Osteoporotic Fractures, an association was found between radiological hand and both unilateral and bilateral hip OA in older women (Hochberg *et al*. 1995). Furthermore, in the Baltimore Longitudinal Study of Aging there were associations between radiological OA in the DIP, PIP and CMC-joints and knee OA in men and women. The strength of

the associations increased with increasing disease severity. Particularly for the PIP site, there was a trend toward an increasing strength of association with increasing numbers of affected joints and bilateral knee OA (Haara 2006). Studies concerning the association between hand OA and OA in weight-bearing joints have usually been done using elderly subjects. However, an association was found between radiological OA in the dominant hand and OA in knee joints among Michigan black and white pre- and perimenopausal women aged less than 45 years (Sowers *et al*. 2000). In a recent Swedish retrospective study of 170 male and female patients, who had undergone isolated meniscectomy on the average 20 years earlier, it was found that the presence of radiographic hand OA was associated with an increased frequency of radiographic knee OA after meniscectomy (Englund *et al*. 2004). Therefore, it is suggested that hand OA may be a predictor of OA in weight-bearing joints. Furthermore, previous studies suggest that hand OA and particularly symmetric DIP joint OA are strongly related with generalised OA (GOA) (Haara 2006). GOA is a form of osteoarthritis, in which many joints are affected. According to Kellegren and Moore (1952), GOA exists if at least 3 joints or a group of joints are affected. Two previous large genetic epidemiological studies have shown that GOA is connected with a strong genetic background and heritability (Haara 2006).

Hand osteoarthritis and coexisting diseases: There are also few studies on the association between OA and other chronic diseases such as diabetes or cardiovascular diseases. However, such an association could be expected, because patients with OA seem to have an adverse profile of metabolic risk factors for coronary heart disease and diabetes (Haara 2006). However, in a large Swedish epidemiological study among the elderly, no associations between hand OA and diabetes, ischemic heart disease, hypertension, physical activity, triglycerides, cholesterol or blood glucose levels were found. Similarly, there was no association between hand OA and diabetes or hypothyroidism in a clinical study of geriatric patients.

Etiologye: Exact etiology is unknown and multiple factors interact to cause this disorder. Risk factors for HOA include female sex, increasing age over 40, menopausal status, family history, obesity, higher bone density, greater forearm muscle strength, joint laxity, prior hand injury and occupation or recreation-related usage.

Age : It is rare for HOA to develop before the age of 40, but after this age the incidence increases dramatically, especially in women.Age has been confirmed in many studies as one of the major risk factors for HOA(W Zhang *et al*. 2009).The highest incidence of hand OA occurs after 45 years when OA develops in the IP joints and the CMC joint of the thumb (Haara 2006).

Sex: Females are found to have more severe OA, more number of joints are involved, and have more symptoms and increased hand and knee OA. These observations and others reporting a painful form of hand osteoarthritis after the menopause suggest that loss of estrogen at the time of menopause increases a woman's risk of getting osteoarthritis, however few contrary reports are pouring in (A Mahajan *et al*.2005).

Obesity: Obesity is one of the most important risk factors for osteoarthritis (OA) in knee(s). However, the relationship between obesity and OA in hand(s) and hip(s) remains controversial and needs further investigation (Grotle *et al*. 2008). In a review, the association of obesity with hand osteoarthritis was regarded as conflicting.In a Finnish population study in both men and women, an independent association was found between body mass index and osteoarthritis in finger joints as well as in CMC1 joints. In a Danish population study, an association was seen between body mass index and CMC1 osteoarthritis(Kloppenburg. 2007). Hence increasing evidence suggests a relationship between obesity and hand osteoarthritis. Whether metabolic factors play a role in this relationship is unclear, as is whether weight loss can prevent hand osteoarthritis or slow progression of hand osteoarthritis (Kloppenburg. 2007).Large cross-sectional studies have failed to show a significant association between obesity and hand OA in either males or females whereas some prospective data have demonstrated that obesity predicted hand OA (Grotle *et al*. 2008). In a twin study among middle-age women, obesity was an important risk factor for the development of both knee and CMC OA, with significant increases of 9-13% in risk of OA per kg increase in body weight (Cicuttini *et al*. 1996). Although the mechanism by which obesity may predispose an individual to hand OA is unknown, previous findings strongly suggest that metabolic factors of obesity are of importance in hand OA. In contrast, however, no association was observed between incidence of obesity and hand OA in men in the Baltimore Longitudinal Study of Ageing. Also for women, no association was observed between the BMI and hand OA in the National Health Examination Survey (Haara 2006).

The association between overweight and hand osteoarthritis suggests that factors other than mechanical forces also play a role (Yusuf *et al*. 2009). Some possible links between overweight and osteoarthritis have been proposed, such as metabolic alteration, atherosclerosis and diabetes mellitus. Fat tissues secrete pro and anti-inflammatory adipo (cyto) kines, such as leptin, which was observed in synovial fluid obtained from osteoarthritic joints. The concentration of leptin in advanced osteoarthritic cartilage is significantly correlated with the BMI of the patients, and its level and pattern of expression were related to the grade of cartilage destruction.Obesity-associated atherosclerosis can also accelerated the osteoarthritis process by vascular disease in subchondral bone Finally, in diabetes mellitus, advanced glycation end-products(AGE) are formed and accumulated. AGE cross-links the damaged collagen network and leads to cartilage changes associated with osteoarthritis. This AGE formation is initiated by sugars and by lipids (Yusuf *et al*. 2009). On the basis of these previous studies, both metabolic and mechanical factors mediate the effects of obesity on joints. Furthermore, obesity is one of the few risk factors that appear to be important for both initiation and progression of OA at all joint sites (Haara 2006).

Genetic factors: Although the multifactor nature of hand OA is well recognized, genetic factors have been found to be strong determinants of the disease (Haara, 2006). A strong genetic component in hand OA was suggested to be present in the development already in the 1940s. Early studies by Stecher in 1947 showed that Heberden's nodes of the fingers were three times as common in the sisters of 64 affected subjects as in the general population. They concluded that these lesions were inherited as a single autosomal dominant gene with a strong female predominance (M Cicuttini, D Spector, 1996).

Nodal generalized osteoarthritis is a polyarticular form of osteoarthritis characterized by Heberden's nodes occurring mainly in women of perimenopausal age (A Mahajan *et al*. 2005). A study of hereditary transmission reported that Heberden's nodes are transmitted as a dominant trait in women and a recessive trait in men.Hormonal factors are suggested because of the sex difference. Furthermore, hand OA often affects multiple joints and is frequently considered to be general OA (GOA). It is also suggested that all cases are probably affected by both genetics and the environment, with a continuous distribution between the extremes of predominantly genetic or predominantly environmental. Thus, the risk factors for hand OA are controversial (Miura, *et al*. 2008). In 1990, Knowlton *et al* reported a non-glycine, second position, autosomal dominant Arg-Cys mutation of COL2A1 in an American family with inherited generalized OA and minor chondrodysplasia. COL2A1 and vitamin D receptor gene polymorphism may also be included within genetic risk profile(A Mahajan *et al*.2005). The influence of heredity in hand OA has been observed and studied in a variety of ways, including the assessment of relative risk in siblings, aggregation in families, and disease concordance in twins. Stecher in 1941 noted a hereditary disposition for hand OA expression, with a twofold excess of disease in mothers and a threefold excess in sisters of patients with Heberden's nodes compared with unrelated controls. Kellegren and colleagues noted similar estimates. A classic twin study of hand OA in women showed a higher concordance of Heberden's nodes and radiographic disease in monozygotic twins when compared with dizygotic twins with both hand and knee disease(L Ishimori, *et al*. 2010). Hand OA has also been connected with linkages on chromosome 2q but there are also conflicting results. Another chromosome linked to hand OA is 11g. Genes suggested to be associated with hand OA include: aggrecan, insulin-like growth factor-1 (IGF-1), matrilin-3, collagen type XI (Haara 2006) and vitamin D receptor (VDR) (Solovieva *et al*. 2005a) Genes may operate differently in different genders, at different body sites, and on different disease features within body sites. OA in general is a complex disease, and understanding its complexity should help us find the relevant genes, and new pathways and drug targets (Haara 2006).

Mechanical stress and workload (role of occupations): Mechanical stress and workload are not as important risk factors for hand OA as for OA in weight-bearing joints. The relationship between hand osteoarthritis and mechanical factors is unclear (Kloppenburg. 2007). However, repetitive work loading of the hand joint has been proved to be a risk factor also for hand OA (Stecher 1947). In the classical surveys of coal miners, Lawrence (1977) showed that they had more hand OA than Dockers, who in turn had more hand OA than office workers. In three different occupational groups in a Virginia textile mill, women whose jobs required a fine pincer grip, with increased force across the distal interphalangeal joints, had significantly more distal interphalangeal joint OA than those whose work required a repeated power grip (Haara 2006). In a recent comparative study, the prevalence of moderate finger OA was higher among the female teachers compared with the female dentists, but in severe finger OA, the prevalence was significantly elevated among the dentists compared with the teachers (odds ration 2.61; 95% confidence interval 1.03-6.59). The authors conclude that hand use may have a protective effect on finger joint OA, whereas continuing joint overload may lead to joint impairment (Solovieva *et al*. 2005b). One longitudinal study concerning the association between hand OA and grip strength found that maximal grip strength in men increased the risk of OA in the PIP, MCP and CMC joints, but not with DIP-joints. Opposite results were found in a cross-sectional Tasmanian population study, where hand OA associated with low grip strength. However, further adjustment of the results suggested that the osteoarthritic associations with grip strength were largely mediated by pain. Therefore, it was assumed that OA symptoms were the reason for low grip strength (Haara 2006). There is evidence, based on one study, that a paralysed hand has no radiological hand OA at all (Stecher 1947). Furthermore, it has been suggested that hand OA is more common in the dominant hand than in the non-dominant hand, but there are also opposite findings (Lane *et al*. 1989, Solovieva *et al*. 2005b). Lawrence described a higher prevalence of hand osteoarthritis in professions demanding strenuous manual work. On the other hand, Caspi *et al*. 2001 found no relation with occupational workload or housekeeping tasks. Recently, Solovieva *et al*. 2005b compared hand osteoarthritis in dentists, performing extensive bimanual work, with teachers. The prevalence of osteoarthritis (Kellegren/Lawrence grade 2 or more) in any finger joint and in any DIP joint was higher among teachers. The relative risk of more severe osteoarthritis (grade 3 or more) in the right-hand thumb and the index and middle fingers was increased among dentists. Hence it is suggested that hand use may have a protective effect on finger joint osteoarthritis whereas continuing joint overload may lead to joint impairment (Kloppenburg. 2007).

Hypermobility: Interestingly, hypermobility of the hand joints might also be a mechanical risk factor. A positive association between hypermobility of the CMC-joint and CMC OA was shown. In contrast, a recent family-based study demonstrated a joint-protective effect of hypermobility on radiographic OA of PIP joints. Therefore, mechanical stress, workload and joint laxity are thought to be important, potentially modifiable factors in the development of hand OA (Haara 2006). In conclusion, mechanical factors seem to play a role in the development of hand osteoarthritis. The effect of mechanical factors seems to be different between finger and CMC1 joints. The balance between use and overuse is as yet unknown. How mechanical loading leads to osteoarthritis is also unclear. More insight is necessary before preventive strategies can be directed at mechanical factors.(Kloppenburg. 2007).

Joint injury: A major joint injury can alter the biomechanics of the joint by increasing stress across particular areas of the joint, and often dramatically increases the risk of OA (Felson 2003). Furthermore, joint cartilage and other joint structures are often damaged by sudden injuries such as fractures or ligamentous tears (Felson 2003). The association between injuries and hand OA has been studied less, even though Stecher and Karnosh (1947) observed the role of trauma in the development of hand OA almost 50 years ago. However, in a population-based study in Tasmania, they found that self-reported digital fracture was associated with prevalence of hand OA (odds ratio 2.42; 95% confidence interval 1.22 - 4.83), and particularly with severe DIP joint disease. There is a clear interplay between systemic factors and local injury factors in the development of OA. As a systemic factor, ageing limiting the regenerative mechanism of the cartilage and joint injury as a local risk factor increase the development of the OA process in the elderly (Haara 2006).

Smoking: The effect of smoking in the aetiology of OA is not clear, but in the Framingham study, lower rates of radiological

knee OA in male and female smokers compared with non-smokers were reported (Felson *et al*. 1989). In another population study in Turkey, the rate of symptomatic knee OA was significantly lower in smokers than non-smokers (Kacar *et al*. 2003). In contrast in the Chingford study, no clear protective effect of smoking on hand or knee OA in women was found. There was no association between hand OA and smoking in the Tasmanian population study (Jones *et al*. 2002). It is not known whether smoking affects cartilage, bone, or both.

Vitamins C and D: There is some evidence of a protective effect of vitamins C and D on the progression of OA in weight-bearing joints, but the association between hand OA and these vitamins has been studied less. Vitamin C or (ascorbic acid) has a multitude of functions within cartilage. For example, it protects against damage by reactive oxygen species and serves as a cofactor for enzymes contributing to type II collagen synthesis (Felson 2003). On the other hand, sufficient vitamin D is necessary for active bone turnover, which may be critical in OA (Felson 2003). In the Framingham study, it was found that a high intake of vitamin C may reduce the risk of cartilage loss and disease progression in people with knee OA. In the same study subjects, a similar protective effect on knee OA progression of high levels and intakes of vitamin D was noticed (Haara 2006). However, one recent genetic study failed to find an association between VDR gene polymorphisms and OA in hand, hip or knee joints. In contrast, in a recent study VDR gene polymorphism was associated with symmetrical hand OA, and the association was modified by calcium intake (Solovieva *et al*. 2005a). Therefore, it is suggested that vitamin intake may also be beneficial for patients with hand OA, but it is unclear whether the protective effects are mediated by genes. (Haara 2006)

Menopause: OA strikes women more often than men and it increases in prevalence and incidence after menopause. Females are found to have more severe OA, more number of joint are involved, have more symptoms and increased hand and knee OA. Many experimental, clinical and epidemiological studies suggest that loss of estrogen at the time of menopause increases a woman's risk of getting osteoarthritis and use of HRT did seem to be associated with not only relieving of symptoms but also reduced rate of progression of osteoarthritis (A Mahajan *et al*. 2005). On the contrary few studies have proposed that estradiol mediates the damage to cartilage tissue and estrogen is chondro destructive suggesting that HRT is associated with a higher prevalence of clinical OA. The study examining postmenopausal estrogen (PME) use and prevalence of clinical osteoarthritis (OA) at the hand, knee, and hip indicated, significantly larger proportion of women who used PME for at least 1 year had hip and hand OA compared with women not using PME (4.1% vs. 1.1%), indicating PME is associated with a higher prevalence of clinical OA Furthermore, polymorphisms in estrogen receptors have been suggested to play important roles in the pathopysiology of osteoarthritis. Polymorphisms in the ERalpha gene are suggested to be associated with radiographic OA of the knee, and in particular with osteophytosis, in both elderly men and elderly women. The study of (Jin *et al*. 2004) confirmed these findings. Thus, findings regarding a correlation between estrogen and OA are inconsistent and inconclusive and range from estrogen protecting against OA to detrimental to cartilage. In conclusion menopause is associated with the onset and progression of osteoarthritis in women and HRT can render help in such patients but with the current level of evidence, it cannot be recommended as a first-line treatment (A Mahajan *et al*. 2005).

Pathogenesis

Although the etiology of OA is incompletely understood, the accompanying biochemical, structural and metabolic changes in the joint cartilage has been well documented. It is now known that cytokines, mechanical trauma and altered genetics are involved in pathogenesis and that these factors can initiate a degenerative cascade that results in many characteristic alterations in the articular cartilage in OA. Normal hyaline cartilage is composed of chondrocytes embedded in extracellular matrix which in turn is constituted by water, type II collagen and proteoglycan (A Mahajan *et al*.2005). The cartilage remains stable with active degeneration and regeneration occurring in equilibrium. Whatever is the triggering event, it leads to matrix and cartilage degeneration on one hand and active chondrocyte replication with enhanced biosynthesis on the other hand. This leads to a state of homeostasis, known as compensated OA, in which both repair and degeneration are balanced. After a few years, the reparative process is exhausted. This leaves cartilage degradation unopposed leading to progressive OA. More recently it has become apparent that OA is a disease process that affects the entire joint structure, including (Fig. 1) Previously OA has been considered as a degenerative disease, the inevitable accompaniment of ageing, with wear and tear as the principal pathogenic mechanism. However, to date it seems to be a complex combination of both degenerative and regenerative processes, where also muscles, tendons, ligaments, bone, and anatomical variability are involved. OA is a disease of the whole joint (Haara 2006). Cartilage, synovial membrane, Subchondral bone, ligaments and periarticular muscles. This ultimately results into inflammation, pain and structural damage leading to loss of function (A Mahajan *et al*. 2005).

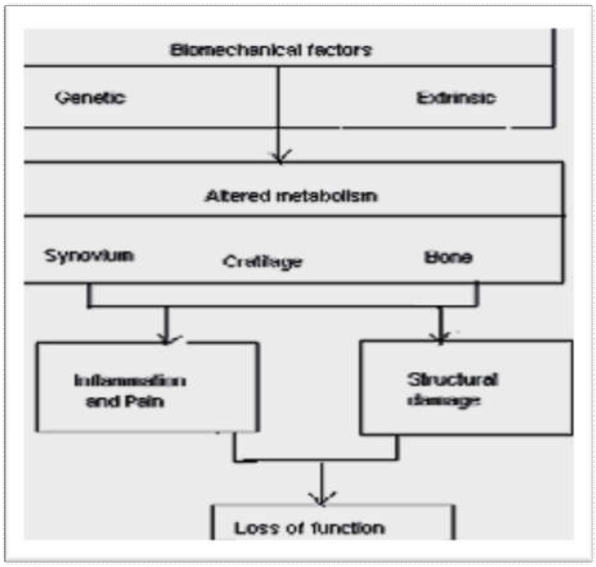

Fig. 1. Biomechanical Factor

In view of the present theories on the pathogenesis of OA, both systemic and local factors affect the likelihood of OA development in a joint (Arokoski *et al*. 2000, Felson 2003) (Figure 2). It is thought that the systemic factors (age, gender, genes, hormones etc.) establish the foundation for cartilage

properties but that the local biomechanical factors (degree of joint loading, joint trauma, elevated weight-bearing on account of overweight, joint deformity etc.) have a crucial influence on the final qualities of articular cartilage, its well being, or breakdown. Thus, local biomechanical factors determine the site and severity of OA (Figure2).

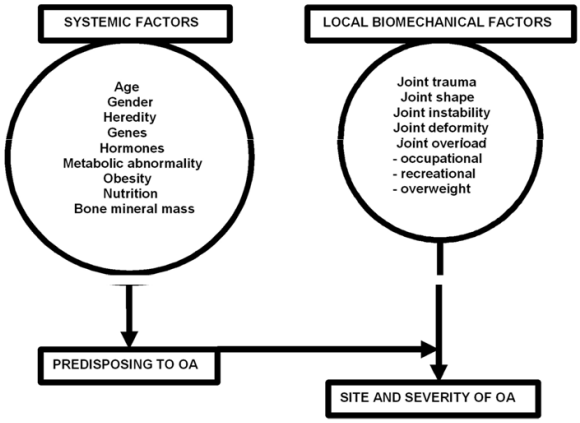

Fig. 2. Schematic representation of the pathogenesis of OA (Arokoski *et al.* 2000, Felson 2003)

Symptoms and signs: Typical symptoms of HOA are pain on usage, with only mild morning or inactivity stiffness that affects only or a few joints at any given time. The symptoms of hand are usually intermittent and involve characteristic sites (DIP, PIP joints, base of thumb and index and middle MCP joints) when these classic features are present in adults over 40 years, the clinical of HOA can be made with confidence. Typical signs of HOA are Heberden's and Bouchard's nodes, or bony enlargement with or without deformity affecting the characteristic target joints example include lateral deviation of the IP joints and subluxation and adduction of the base of the thumb(Barclay, Murata.2008). The most frequent signs of the CMC joints were bony enlargement, tenderness, pain on movement, functional limitation, and deformity, respectively (Davatchi F *et al*. 2011).

ACR (American college of rheumatology) criteria: The most commonly used clinical diagnostic system for hand OA uses the criteria of the American College of Rheumatology (Altman *et al*. 1990), which is reliable for symptomatic disease, and is also usable in clinical practice. American College of Rheumatology criteria for the classification and reporting of hand OA (Altman *et al*. 1990). Modified from (Felson 2003):

1. Hand pain, aching, or stiffness for most days of prior month.
2. Hard tissue enlargement of ≥ 2 of 10 selected hand joints*.
3. Fewer than 3 swollen MCP joints.
4. Hard tissue enlargement of 2 or more DIP joints.
5. Deformity of 2 or more of 10 selected hand joints*.

Selected hand joints are the second and third DIP and PIP and first CMC of both hands. OA is present if items 1,2,3,4 or items 1,2,3,5 are present. Sensitivity and specificity are 92% and 98%, respectively (Haara 2006).

Radiological manifestations: The radiographic features of hand OA based on the most often used radiological grading system developed by (Kellegren and Lawrence 1952) and illustrated in the Atlas of Standard Radiographs (Kellegren 1963) include:

1) The formation of osteophytes on the joint margins or in ligamentous attachments;
2) The periarticular ossicles, chiefly in relation to distal and proximal interphalangeal joints;
3) The narrowing of the joint space associated with sclerosis of Subchondral bone;
4) The cystic areas with sclerotic walls situated in the subchonral bone;
5) The altered shape of the bone ends. (Haara 2006).

Kellegren and Lawrence criteria: Each distal interphalangeal (DIP), proximal interphalangeal (PIP), thumb interphalangeal (IP) and metacarpophalangeal (MCP) joint of both hands was graded separately, and classified for the presence of OA using the modified Kellegren and Lawrence system. The classification criteria were:

- Grade 0: No OA(normal finding);
- Grade 1: Doubtful OA (finding possibly slightly abnormal);
- Grade 2: Mild OA (a single radiographic sign indicative of OA, slight to moderate lowering of the joint space, sometimes subluxation, minimal osteophytes, degeneration cysts or slight marginal sclerosis, each of the latter signs without a clear narrowing of joint space but little if any additional pathology)
- Grade 3: Moderate OA (considerable narrowing of joint space with additional degenerative pathology as indicated in grade 2, no destruction of the joint)
- Grade 4: Severe OA (joint space destructed or poorly visible with various advanced degenerative changes).

Figure 3. Hand radiographs of a 57-year-old woman, who has osteoarthritis of Kellgren's grade 2-4 in distal interphalangeal joints (I-IV) of both hands (symmetrical DIP OA).(Haara 2006)

Symptomatic hand osteoarthritis prevalence and association with radiographic hand OA: Radiographic osteoarthritis, the most frequently studied subtype of osteoarthritis, is very common in the hand; prevalences up to 64% for men and 76% for women have been reported for distal interphalangeal (DIP) joints(Kloppenburg. 2007). Nevertheless, the prevalence of symptomatic hand osteoarthritis is a more relevant indicator of the proportion of patients in need of treatment. The prevalence of symptomatic hand osteoarthritis in people over 70 years of age was 13.4% for men and 26.2% for women (W Zhang *et al*. 2009).

Figure 4. Hand radiograph of a 47-year-old woman, who has osteoarthritis of Kellgren's grade 3 in carpometacarpal joint of the left thumb (thumb carpometacarpal OA)

Figure 5. Hand radiograph of a 60-year-old man, who has osteoarthritis of Kellgren's grade 4 in proximal interphalangeal joint (IV) of the right hand (OA in any finger joint) (Haara 2006)

Correlation between clinical manifestation and radiological features: The relation between radiographic signs and clinical symptoms of hand osteoarthritis have been investigated recently in more detail by associating severity, location and extensiveness of radiographic hand osteoarthritis with different levels of pain and disability. In the Rotterdam study (S Dahaghin *et al*.2005), a population based study in subjects of 55 years of age and older, 67% of women and 54.8% of men had radiographic osteoarthritis in at least one hand joint. Of all participants, 14.2% suffered from pain in the right hand and 5.8% had some disability [Stanford Health Assessment Questionnaire (HAQ)] in the right or left hand. Hand pain and disability showed odds ratios of 1.9 (95% confidence interval (CI) 1.5–2.4) and 1.5 (95% CI 1.1–2.1), respectively, with radiographic osteoarthritis. There was a dose–response relationship between the number of joints with radiographic osteoarthritis and hand pain. Radiographic osteoarthritis in the thumb base and the MCP joints showed the highest association with hand pain and disability, respectively. (Kloppenburg. 2007). In the Copenhagen Osteoarthritis Study, a population based study investigating osteoarthritis of CMC1 in the right hand of those aged 45 years and older, osteophytes were seen in 20.7% of participants; 19.4% reported pain in the thumb when wringing out a dishcloth. A dose–response relationship was demonstrated between radiographic CMC1 osteoarthritis and pain. Subchondral sclerosis, independently of joint space width, osteophytes and cysts, was related to pain (Kloppenburg. 2007). The association between radiographic osteoarthritis and clinical symptoms was systematically reviewed. From 1966 to 2005, 16 studies investigated this association (S Dahaghin *et al*. 2005). Although comparison of the studies was difficult, the authors concluded that there is evidence of a positive association between radiographic hand osteoarthritis and hand pain. Also, an association between hand pain and the severity of radiographic hand osteoarthritis or increasing number of radiographic hand osteoarthritis joints was suggested (Kloppenburg. 2007).

Table 1. Prevalence of radiographic and symptomatic osteoarthritis in older adults

	Radiographic osteoarthritis (%)	Sympotmatic osteoarthritis (%)
Knee (Peat *et al*. 2001)	25	13
Hip (Croft; * Lau *et al*. 1996)	11	5
Hand (Wilder *et al*. 2006)	41	3

Treatment of hand osteoarthritis: Currently, several symptom-modifying strategies for hand osteoarthritis are used in clinical practice, such as paracetamol, NSAIDs, occupational devices and intraarticular injections. Studies evaluating the efficacy and safety of these therapies are, however, scarce. Three systematic reviews evaluating therapeutic trials in hand osteoarthritis have been published The most recent study systematically reviewed all randomized controlled trials (RCTs) on pharmacological and non pharmacological therapies in patients with hand osteoarthritis published between 1966 and August 2004. Surgical interventions were not included. After an extensive literature search only 31 RCTs could be analyzed; 28 involved a symptom-modifying therapy and five a structure- modifying therapy. A variety of treatments were evaluated, the most frequent of which were oral NSAIDs (8 RCTs), topical NSAIDs or acetylsalicylic acid (5 and 2 RCTs respectively), occupational therapy interventions (4 RCTs), and glycosoaminoglycan polysulphate and chondroitin sulphate (5 RCTs). For all of these treatments it was concluded that there is at least some evidence of efficacy. Effect sizes were not reported. Publication bias was suspected. A meta-analysis could not be performed. Generally the RCTs were of low quality. Recently, three RCTs were published on intra-articular injections in an osteoarthritic CMC1 joint, compared intra-articular corticosteroid injections with placebo and found no clinical benefit. In two studies comparing intra-articular corticosteroid injections with hyaluronic acid injections, pain relief was seen in both treatment arms. More studies evaluating intra-articular injections, including placebo arms, are needed. In conclusion, there is a lack of high quality RCTs in hand osteoarthritis. (Kloppenburg2007). Intra-articular hyaluronic acid derivatives are also used, while physiotherapy and other supportive care have been shown to improve function. Topical use of NSAIDs reduces systemic adverse effects particularly in the gastro intestinal tract and meta-analysis of 86% placebo controlled studies 10,160 patients confirmed the benefits of this topical agents while Ibuprofen gel 5% have been shown to be effective in musculoskeletal injuries, tendinitis, general osteoarthritis of the knee and finger joints (Widrig *et al*.2007).

Aim of the study: The general aim of this study was to investigate hand OA assessed from hand radiographs to identify the risk factors in developing hand osteoarthritis including (individual and occupational) risks in Mosul population sample of women and men aged 40 years and over. The goal objectives are: **1-**To assess the risk factors and evaluate their impact on the development and progression of hand OA, specially occupations and homework related factors. **2-**To plan a preventive strategies of these risks in order to reduce the prevalence and incidence of hand OA in the community.

Patients and methods:- Study design: The study was conducted as a case control study at the rheumatology outpatient clinic in Ibin Sina Teaching Hospital.

Period of study: The period of data collection and radiological and lab work was six months started at first of January 2011 and completed by the end of June of the same year.

Study population: The sample of the study included 2 groups; the 1st group was 100 patients with hand OA,(24)were males and (76) were females. The 2nd group was 100 patients without hand OA,(36)were males and (64) were females. The 1st group (case group) consisted of 100 patients complaining from hand pain, aching, stiffness for most days of prior month; they were collected from Ibn Sina rheumatology outpatient clinic and their mean age was(59.92)±(7.96). The 2nd group (control group) consisted of 100 patients without hand pain, aching or stiffness. They were attending Ibn Sina rheumatology outpatient clinic for other complaints. Their mean age was (55.01)±(8.93).

Case definition: Inclusion criteria: Patient included in the case group in this study were those fulfill the clinical criteria of HOA diagnosis, complaining from symptoms of hand pain, aching and stiffness the prior month. They were graded according to ACR criteria and they must have radiological evidence of hand osteoarthritis according to kellegren and lowrence grading criteria of hand osteoarthritis (Grade2 and more was considered significant in at least one joint).They had no history of other rheumatolgical diseases and they underwent full rheumatological examination.

Exclusion criteria: Patients excluded from this study were those with chronic rheumatic diseases causing hand pain who were later found to have their symptoms explained on other basis like: 1-RA. 2- Sero-negative spondylo arithropathy like psoriatic arthritis patients, gout and pseudo gout. 3-Infectious arthritis. 4-Acute trauma to the hand or surgery. 5-Fibromyalgia

General information and history:A questionnaire form was filled for every patient through direct interviewing by the investigator himself including the patient's age, sex, occupation, educational level, smoking history, BMI, work history(current & previous), previous trauma history if present, leisure time activities, home works (household chores), recreational activities, sport history, family history, menopausal history, the association with coexistent diseases(diabetes, hypertension and hyperlipidimia) and OA at other sites(knee, hip and spine). Similar questionnaire for the control group was conducted.

BMI was calculated as weight in kilograms divided by square of height in meters. The internationally accepted range of BMI in adults are; underweight (<18.5); normal (18.5-24.9); overweight (25.0-29.9); obese (30-39.9) and extreme obese (>40).

Clinical examination:-Clinical examination of both hands and wrists was conducted for all patients including the presence of joints swelling, erythema, deformity, skin ulcer, tenderness and muscle wasting and the deformities like Heberden's nodes involving DIP joints, Bouchard's nodes involving PIP joints, joint subluxation, instability, shape, mal alignment, crepitus and joint effusion was done. We have examined the hand joints for the presence of any limitation (restriction) in ROM of hand joints involved in our study. The joints involved in our examination are: 1st CMC joints, MCP joints, 1st IP joints, PIP joints and the DIP joints. Examination of the grip and pinch strength was conducted using blood pressure sphygmomanometer and the readings were recorded to assess the power of the hands.

Laboratory investigations:- All patients were sent to the ESR, CRP and RF. To calculate the upper limit of the ESR for men, divide the age by (2), for women add (10) to the age and divide by (2).

Radiology:- X-Ray of both hands and wrists (PA view) for all patients was done and was conducted at the radiological unit at Ibin Sina outpatient clinic, and the X-Ray films was evaluated by a radiologist. Typical features include joint space narrowing, osteophyte formation, subchondral bone sclerosis and subchondral cyst and erosion (erosive hand OA). The severity of hand OA on the basis of radiology depend on Kellegren-Lawerence grading criteria which include; grade(0) no OA, grade(1) doubtful OA, grade(2) minimal OA, grade(3) moderate OA, grade(4) severe OA. OA was considered to be present if the grade was 2 or more in at least one of the joints.

Statistical data analysis: We applied statistical analysis to: Correlate the disease severity according to the clinical scores and the radiological grading system. To find out the contribution of various occupations and behaviors with the risk of OA. The statistical analysis of data was carried out using: Chi-Square test of independence to determine the significances of differences between categorical variables. P-values < 0.05 were considered to be statistically significant.

Table 1. Gender distribution of the case and the control group

Sex	Case	Control	*P-value
	No.(%)	No.(%)	
Male	24(24.0)	36(36.0)	
Female	76(76.0)	64(64.0)	0.064
Total	100(100.0)	100(100.0)	0.064

*Chi-square test was used

There were 100 patients with hand OA and 100 control subjects. The two groups were matched, regarding their sex distribution (patients: 24 males & 76 females, control 36 males and 64 females) with a non significant difference(P= 0.064). There was a very highly significant difference (P-<0.001) between the females and males among the study group i.e. the HOA is more common in females than males in the study group.

Table 2. Age distribution of the case and the control group

Age (Years)	Case	Control	*P-value
	No.(%)	No.(%)	
40-55	21(21.0)	52(52.0)	0.000
55-65	46(46.0)	27(27.0)	0.000
>65	33(33.0)	21(21.0)	0.000
Total	100(100.0)	100(100.0)	0.000

*Chi-square test was used

The mean age the patients and control group was comparable (59.92±7.96 Vs 55.01±8.93) with a P-value of (0.000). There were a significant relationship between the risk of hand OA and increasing age (P=0.000). All of the study group were symptomatic patients with hand OA and fulfilled the ACR criteria either (1,2,3,4 or 1,2,3,5 criteria). Radiological assessment of the severity of the disease showed that 57% of them had minimal OA (grade 2), 41% had moderate OA (grade 3) and 2% had severe OA (grade 4).

Table 3. Comparison of the educational level between the patients and control

Education	Case	Control	*P-value
	No.(%)	No.(%)	
Illiterate	52(52.0)	36(36.0)	0.023
Can read & write	25(25.0)	20(20.0)	0.397
Primary level	10(10.0)	8(8.0)	0.621
Secondary level	11(11.0)	22(22.0)	0.036
High education(college)	2(2.0)	14(14.0)	0.002
Total	100(100.0)	100(100.0)	0.003

*Chi-square test was used

The educational level was inversely related to the risk of hand OA (P=0.002). 52% of the patients compared with 36% of the control group were illiterate (P=0.023) while only 2% of the patients were university graduates compared with 14% of the control (P=0.002).

Table 4: Different occupations and their relation between cases and control group

Occupation	Case	Control	*P-value
	No.(%)	No.(%)	
Housewife	45(45.0)	26(26.0)	0.005
Retired	39(39.0)	42(42.0)	0.666
Laborer	1(1.0)	4(4.0)	0.174
Employee	9(9.0)	16(16.0)	0.134
Others	6(6.0)	12(12.0)	0.138
Totals	100(100.0)	100(100.0)	0.027

*Chi-square test was used

Housewives were at high risk of hand OA (45% of the patients Vs 26% of the control). No significant difference was noticed when we grossly considered retired people, laborers, employees and others.

Table 5. Different leisure time activities and their relationship between cases and control groups

Leisure time activity	Case	Control	*P-value
	No.(%)	No.(%)	
Low level <2hr/wk	50(50.0)	37(37.0)	
Moderate level 2-4hr/wk	40(40.0)	45(45.0)	
High level > 4hr/wk	10(10.0)	18(18.0)	
Total	100(100.0)	100(100.0)	0.104

*Chi-square test was used

No significant relationships were found between various leisure activities and the risk of development of hand OA (P=0.104).

Table 6. Sport activities and their relationship to cases and control group

Sport	Case	Control	*P-value
	No.(%)	No.(%)	
Yes	5(5.0)	23(23.0)	
No	95(95.0)	77(77.0)	
Total	100(100.0)	100(100.0)	0.000

*Chi-square test was used

Similarly no particular sport was noticed to be related to the risk of developing hand OA (95% of cases had no sport activity Vs 77% of the control group).

Table 7. The menopausal stages and their relationship to the cases and control group

Menopause	Case	Control	*P-value
	No.(%)	No.(%)	
Amenorrhea	5(5.0)	0(0.0)	
Post menopause	71(71.0)	43(43.0)	
Pre menopause	0(0.0)	21(21.0)	
Total	100(100)	100(100)	0.000

*Chi-square test was used

More women from the study group were postmenopausal 71 out of 76 (93.42%), compared with 43 out of 64 (67.18%) of the control group.

Table 8. Different smoking status and their relationship with cases and control group

Classification of smoking	Case	Control	*P-value
	No.(%)	No.(%)	
Never smoked	71(71)	51(51)	0.004
Current smoker >20 cigarettes/day	24(24)	10(10)	0.008
Current smoker <20 cigarettes	5(5)	9(9)	0.268
Quit smoking	0(0)		0.003
Passive smoker	0(0)	21(21)	0.498
Total	100(100)	100(100)	0.000

*Chi-square test was used

Current smoking was found significantly associated with the risk of hand OA (24 patients of the cases were current smokers more than 20 cigarette/day Vs 10 subjects of the control group) (P=0.008).

Table 9. The association of previous trauma to the development of HOA

Trauma	Case	Control	*P-value
	No.(%)	No.(%)	
No trauma	66(66)	87(87)	
hand trauma	34(34)	13(13)	
Total	100(100)	100(100)	0.001

*Chi-square test was used

Previous hand trauma was also associated with the risk of subsequent hand OA. 34% of the patients compared with 13% of the control had history of hand trauma (P=0.001).

Table 10. Different BMI levels and their association with HOA

BMI	Case	Control	*P-value
	No.(%)	No.(%)	
Normal 18-25	10(10)	16(16)	0.207
Overweight 25-30	26(26)	40(40)	0.035
Obese 30	0(0)	0(0)	
Mild obesity 30-35	31(31)	26(26)	0.434
Moderate obesity 35-40	27(27)	11(11)	0.004
Sever obesity >40	6(6)	7(7)	0.774
Total	100(100)	100(100)	0.021

*Chi-square test was used

Patient with hand OA were more likely to be overweight (P=0.035) but, the association with obesity was not clear. Significant association was found between moderate obesity and the hand OA (27 patients the case group compared to 11 of the control group) (P=0.004).

Table 11. Association of hypertension, diabetes mellitus and hyperlipidimia with HOA

Diabetes	Case	Control	*P-value
	No.(%)	No.(%)	
Yes	25(25)	28(28)	
No	75(75)	72(72)	
Total	100(100)	100(100)	0.631
Hypertension			*P-value
Yes	41(41)	39(39)	
No	59(59)	61(61)	
Total	100(100)	100(100)	0.773
Hyperlipidimia			*P-value
Yes	23(23)	26(26)	
No	77(77)	74(74)	
Total	100(100)	100(100)	0.622

*Chi-square test was used

No association was noticed between hand OA and the presence of diabetes mellitus, hypertension and/or hyperlipidemia.

Table 12a. Hip and Knee pain in association with HOA

Hip pain	Case	Control	*P-value
	No.(%)	No.(%)	
Yes	51(51)	13(13)	
No	49(49)	87(87)	
Total	100(100)	100(100)	0.000
Knee pain			*P-value
Yes	90(90)	69(69)	
No	10(10)	31(31)	
Total	100(100)	100(100)	0.000

*Chi-square test was used

Patients at risk of developing hand OA had associated hip and knee pain (OA) (P-0.000) compared with the control group. Regarding the association of hand OA with other sites, we found significant association with hip pain(51% Vs 13% of the control) and knee pain(90% Vs 69% subjects of the control group).

Table 12b. Low back and Neck pain in association with HOA

LBP	Case	Control	*P-value
	No.(%)	No.(%)	
Yes	86(86)	69(69)	
No	14(14)	31(31)	
Total	100(100)	100(100)	0.193
Neck			*P-value
Yes	79(79)	72(72)	
No	21(21)	28(28)	
Total	100(100)	100(100)	0.256

*Chi-square test was used

There is no association between hand OA cases with LBP and neck pain compared with the control group (P=0.193, 0.256 respectively).

Table 13. Effect of the duration of housewife activities on the risk of HOA

Female	Case	Control	*P-Value
	No.%	No.%	
Homework for 10hrs\day for > 10 ys	59(78)	35(55)	
Total	76(100)	64(100)	0.004

*Chi-square test was used

Fifty nine (59) housewife out of the total 76 female of the study group had more than 10 years of regular homework activities for more than 10 hours per day(78%). This is compared with 35 of the total 64 females of the control group (55%) (P=0.004).

DISCUSSION

Osteoarthritis (OA) is the most common joint disorder in the adult population, and hand joints are those most often affected by it(S. Solovieva et al. 2005). The recognition of potentially modifiable risk factors could lead to preventive strategies or elucidate targets for novel therapies (Kloppenburg. 2007). In our study multiple risk factors have been investigated and studied and their influence on the development of HOA have been evaluated; like aging, female gender, obesity (constitutional factors), on the other hand biomechanical risk factors like joint injury, occupational and recreational usage have also been assessed. In the present study regarding sex distribution no related difference was found between the study group and the control and this disagrees with other studies. While there was very high significant difference between females and males among the study group and this is in agreement with other studies. Differentiation by gender showed that women had more hand OA than men)(Davatchi F et al.2006)(W Zhang et al.2009). Female gender is strongly associated with hand OA, and above the age of 55 years HOA is more common in women (Haara 2006). Our study showed that old aged (> 55 years) are more susceptible to develop HOA. This is in line with the other studies. The factor most closely associated with the development of hand OA is age (Lawrence et al. 1966). Age has been confirmed in many studies as one of the major risk factors for hand OA(W Zhang et al.2009). The decreasing of the metabolic activity with ageing diminishes the biomechanical properties of the cartilage, and thus the damage risk of the cartilage will increase(Haara .2006). In our study, we found that 81% of the case group fulfilled 1,2,3,4 of ACR criteria, 19% fulfilled 1,2,3,5 of ACR criteria. According to Kellegren-Lawrence radiological assessment of the severity of the disease 57% of the case group have minimal OA (Grade 2), and so the level of sever OA(2%) and moderate OA(41%) are lower than minimal OA in the cases. The present study showed that low educational levels are considered risk factor for hand OA, and the risk is inversely related with a high level group, other studies also approved this fact. Our explanation is that low educated level group are more prone to heavy work and village work for long period, and the related mechanical stresses have excess impact on hand finger joints with consequent development of hand OA. It is of interest that significantly higher frequency of manual occupations was found among subjects with a low level of education (30.6%) than among subjects with a high level of education (3.3%) (A. Andrianakos

et al. 2006). Regarding occupations, the present study shows that being a housewife is a risk factor, while other occupations, laborers and employees are not a risk factor for hand OA. Housewives homework activities more than 10 hours per day for more than 10 years is considered a risk factor, the more the duration of homework activities the more increasing the risk of hand OA and this is in line with other studies. Studies of occupational groups exposed to repetitive use of upper extremities have shown an increased hand OA (Miura et al.2008). Nakamura et al.1993, reported that the incidence of Heberden's nodes was significantly higher among school cooks than preschool cooks and municipal workers. These findings support the concept that workload is an etiological factor in the pathogenesis of hand DIP joint OA. On the other hand employees have low hand loading and such they are in less risk of hand OA.

Laborers constitute small percentage in the study (1%) and they need further studies in their places of work. In this study poor correlation was found between various leisure activities and the risk of hand OA this is disagreement with the other studies. Our explanation is that 50% of our study group cases were of low level of leisure activities and this might have poor influence on the development of HOA. Similarly poor correlation was noticed between various sports and the risk of HOA. This might be explained that most of the study group(95% of cases Vs 77% of control) had no sport activities. In the present study, menopause was found strongly associated with risk of developing HOA. This is in agreement with other studies, Above the age of 55 years, hand OA is more common in women, usually involving several joints, mostly the interphalangeals and the first metacarpal (Lawrence 1977). While in another study, in the Tasmanian population (Cooley et al. 2003), it was noted that both current and ever use of hormonal therapy was associated with an increased prevalence of Heberden's nodes (HN) and with severity of HN and DIP OA. Depending on the previous studies the role of menopause and estrogen hormone is unclear. Regarding smoking in this study we found that smoking is a risk factor for HOA. A recent study found that smoking did not protect against the development of radiologically confirmed OA in the knee, hand, foot and cervical spine (Wilder et al. 2003). In one study smoking has been found risk factor for CMC joint in women were as the opposite seen in men this finding is, however, far from being conclusive because of the small number of female smokers. One previous study revealed no obvious protective effect of smoking on hand OA in women (Haara et al.2004) The effect of smoking on hand OA is still controversial and need further studies. In the present study, trauma is a risk factor for development of HOA. This is in line with the other studies. Major direct injury particularly if resulting in a fracture of articular surface is considered a cause of osteoarthritis (A Mahajan et al.2005).

Regarding BMI in our study, overweight and moderate obesity were risk factors for hand OA, but the relationship was not linear, since severe obesity was not significantly associated with hand OA. Studies evaluating hand OA have assessed X-ray proven osteoarthritis or been cross-sectional, or both, and results have not been as strong or as consistent as those from knee osteoarthritis(A. Oliveria et al.1998).There exist a lot of evidence of an association between hand OA and obesity (Haara.2006). In the present study, no association was found between HOA and other chronic diseases like diabetes, hypertension and hyperlipidimia. One recent study found that hypertension was associated with OA in the CMC-joints, but not with OA in the IP-joints among 639 patients scheduled for either hip or knee replacement because of advanced OA (Kessler et al. 2003). Therefore, it seems that the association between hand OA and other chronic diseases remains partially unclear(Haara 2006). Regarding the association of hand OA with OA at other sites, in our present study there were significant correlation of hand OA with hip or knee pain(or OA). This is in line with other studies. The concept of GOA was first reported by Kellegren and Moore in 1952. They found a relation between Heberden's nodes and polyarticular OA, which was called the nodal type. Its characteristic features are common in elderly women: bilateral knee OA; bilateral OA of the DIP, PIP, and carpometacarpal (CM) joint of thumb; and spine OA; but rarely hip OA or wrist OA (Miura et al.2008). The knee is most commonly affected by osteoarthritis, usually bilateral, often occurs in association with hand osteoarthritis especially in women. The hip is more associated with nodal OA (A Mahajan et al.2005). While the LB, neck had no association with HOA in our study.

Conclusion

From the results of the present study it may be concluded that there are various risk factors for hand OA, which might have strong influence over the hand finger joints for prolonged period of time which might predispose for the development of hand OA. Housewives (homework activities) for more than 10 years were considered strong risk factor for hand OA. Smoking, post menopause, BMI (overweight, moderate obesity), ageing, low educational level and previous hand trauma are also considered risk factors for the development of HOA. The role of the other occupations, sport and leisure activities were considered unclear. Retired people are less likely to develop HOA. In our study, the diagnosis of hand OA follow the clinical ACR criteria for diagnosis while the severity was assessed and evaluated using Kellegren-Lawrence radiological grading scale.

Recommendations

- The doctors should inform their patients that weight control and avoidance of obesity is useful in the prevention of OA, probably hand OA.
- Housewives should be instructed to decrease the overloading of their hands to diminish the risk of developing hand OA.
- Education of the population specially subjects with low educational level to the potential risks of hand OA.
- Prevention strategies for hand OA need more epidemiological studies to know the exact etiology of this disabling disease.

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