Sociological Risk Factors in the Development of Knee Osteoarthritis among Women > 50 years Case-Control Study

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Abstract:

Background: Osteoarthritis is now firmly established as a public health problem. It is the most disabling diseases in many countries. Knee osteoarthritis is regarded as the most common form of the disease in adult. Elderly women are found to be more affected by this disorder. From the available evidences, it is now reasonable to consider this disease as one of the most important among the chronic non-communicable diseases and investigation for the risk factors that are associated with this disorder is very important.

Aim: To examine sociological risk factors in the development of symptomatic knee osteoarthritis for women > 50 years.

Study design: Case-control study, where 76 women with symptomatic knee osteoarthritis proved by clinical and radiological evidences were allocated as cases. Another 116 women proved to be without clinical or radiological evidence of knee osteoarthritis was allocated as controls.

Study period: 1st March 2007 to 1st December 2007.

Questionnaire: Including, assessment of sociological factors such as personal characteristics (social identity, personal habits and psychological make-up), life events (stress, social discontinuities and geographical mobility) and social context (economic factors, social disintegration, urbanization). In addition, body mass index, previous history of surgical operation, the use of contraceptive pills and the presence of one or more of chronic non-communicable diseases, were also gained.

Results: Regarding *Personal Characteristics*; unhealthy dietary behaviors appeared in this study to be highly associated with development of knee OA (OR= 7.19, P-value= 0.001, 95%C.I. = 2.08-18.60), the same thing was applied to women with personality type A (OR= 2.84, P-value= 0.009, 95% C.I. = 1.29-6.23). The habit of cigarette smoking appeared unexpectedly negatively associated with occurrence of knee OA (OR= 0.41, P-value=0.035 and 95%C.I. = 0.18-0.94). According to *Life Events*; stress was negatively associated with the development of knee OA (OR=0.24, p-value= 0.002, 95%C.I. = 0.10-0.59). The geographical mobility appears in this table to be protective against the development of knee OA (OR= 0.15, P-value= 0.000, 95%C.I. = 0.07-0.31). Dramatic change in economic factor, appeared to be negatively highly associated with the development of knee OA (OR= 0.12, P-value= 0.000, 95%C.I. = 0.04-0.34). Urban citizens, in this study appeared to be more prone to develop knee OA than rural citizens (OR= 3.04, P-value= 0.017, 95%C.I. = 1.22-7.57). General obesity (BMI > 25) is valid predictor for the development of knee OA (OR= 8.88, P-value= 0.000, 95%C.I. = 3.08-25.60). The presence of one or more of chronic non-communicable diseases appear to be associated with the occurrence of knee OA (OR=2.60, P-value=0.002, 95% C.I. = 1.43-4.72). Contraceptive pills users among women appear to be associated with the development of knee OA (OR= 3.21, P-value= 0.0001, 95%C.I. = 1.64-5.94).

Conclusion: Women with unhealthy dietary behavior, personality type urbanization, general obesity, with one or more of chronic non-communicable diseases and contraceptive pills users are at high risk of development of knee OA. Cigarette smoking, stress, geographical motilities and unexpected change in economic status appeared to be negatively associated with the occurrence of knee OA in women > 50 years.

Key words: Sociological risk factors, Knee, Osteoarthritis, Women, > 50 years.

Introduction:

Osteoarthritis (OA) is the most common joint disorder in the world. It is one of the most frequent causes of pain, loss of function and disability in adults. Considered previously as a degenerative disease that was an inevitable consequence of aging and trauma, osteoarthritis is now viewed as a metabolically dynamic, essentially reparative process that is increasingly amenable to treatment and prevention.

In the US it is second only to ischemic heart disease as a cause of work disability in over 50 years of age, and accounts for more hospitalizations than rheumatoid arthritis (RA) each year [1].

Although the prevalence of OA increases with age in both sexes, the knee joint in women is particularly susceptible to this insidious disease [2]. In women ages 55 to 64, the reported prevalence of radiographic OA in the knee is 7.5%; in women older than age 65, the prevalence increases dramatically to 20.3% [3]. Among persons age 65, the female-to-male ratio of OA prevalence in the knee ranges from 2:1 to 3:1[4]

Pathologically, OA is a condition of synovial joints characterized by focal cartilage loss and an accompanying reparative bone response. For many the plain radiograph remains the best means of assessment, with evidence of cartilage loss (joint space narrowing) and bone response (presence of osteophytes and sclerosis) being the main criteria. This definition, however, excludes joints with early minimal change, ignores tissues other than cartilage and bone, and omits consideration of biological consequences (symptoms and disability). Thus, better understanding of the causes of symptoms and disability is currently a key challenge [5].

An organized approach to diagnosis is essential to differentiate OA from other forms of joint pain, which include but are not limited to rheumatoid arthritis, psoriatic arthritis, crystal deposition (gout), bursitis, and tendonitis. To increase the sensitivity and specificity of the OA diagnosis, the American College of Rheumatology recommends that data be gathered through clinical, laboratory, and radiographic examination [6].Clinical data should be established from a complete history and musculoskeletal physical examination of the lower extremities. Physical findings consistent with OA of the knee include joint effusion and crepitus, bony overgrowth or deformity, muscle wasting, altered joint attitude, and reduced range of motion. Difficulties in rising from a chair and climbing stairs, as well as reduced ambulation speed, are often observed in patients with OA of the knee. Laboratory examination includes synovial fluid analysis which can help in differentiating OA from other forms of joint pain. The existence of two of the following three findings in aspirated synovial fluid is considered predictive of OA in the knee: clear appearance, increased viscosity, and white blood cell count less than 2,000/ml. Other useful laboratory tests are serum measurement of rheumatoid factor and an erythrocyte sedimentation rate, because these can help confirm or rule out other possible causes of knee pain[6]. Radiographic examination of knee OA by weight-bearing postero-anterior radiograph is essential for accurate diagnosis, staging, and treatment of OA. The extent of compartmental involvement, joint space narrowing, osteophyte development, and any gross angular deformities.

Risk factors of knee OA: In addition to advanced age and female gender, several other risk factors for knee OA have been identified through both longitudinal and cross-sectional epidemiologic studies. Obesity is the strongest risk factor for OA; it is also a preventable cause of disease progression. There is also a racially disproportionate occurrence of OA in the knee. When adjusted for age and weight, the prevalence of knee OA is twice as high among black women as it is among white women. Major joint injury is thought to play a role in the long-term development of OA. Meniscal tears and cruciate ligament damage are two specific knee injuries linked to the development of OA. Osteoarthritic changes are attributed to perturb loading that causes pathologic stresses that are unequally distributed across the compartments of the knee. The OA changes are also thought to be caused by abnormal joint kinematics associated with accelerated wear of the joint cartilage. Overuse from frequent bending or kneeling may cause excessive load and wear on the knee joint. Two studies have demonstrated a possible protective effect of estrogen replacement therapy in the development and progression of knee OA [5, 7].

All the above, indicate that knee OA for women > 50 years can be regarded among the chronic non-communicable diseases and investigations through the way of life and habits (i.e. from cultural and sociological perspectives) can be very helpful in identifying more risk factors that are amenable for prevention and control of this dangerous disorders.

Subject & methods:

In order to achieve the aim of the present study, a case-control study design was adopted, 76 women with symptomatic knee OA were enrolled in this study as cases according to the following inclusion criteria:

-The participant must be a woman, her age more than 50 years.
-Suggestive history and positive clinical examination for knee OA.
-Positive finding for OA in the X rays examination of the knee joints.

Another 116 women were chosen as control for this study with the following inclusion criteria:

-The participant must be woman, her age more than 50 years.
-Negative history to any previous episode for knee joint pain, crepitus, and swelling.
-Negative X rays findings for knee OA such as decrease or absence of the joint space, osteophytes or any other abnormalities.

Un-paired sampling technique was used in this study, matching was done for age (± 5 years). Every woman in this study was interviewed by the researchers and the following questions to participants were answered in addition to the specific

anthropometric measurements such as, BMI. The presence of one or more of the chronic non-communicable diseases, the previous use of contraceptive pills, previous history of any surgical operation were all included in the questionnaire form.

Social factors in health and Disease [8]**:**

I – Personal characteristics:

A- Social identity:

Not modifiable; age, sex and heredity (family history of knee OA in primary relatives)

Modifiable; Marital status; occupation, and race.

B- Personal habits: Lifestyle, sedentary life style, smoking, alcohol consumption, Fatty, calorie and salt rich diets (unhealthy diets)

C- Psychological make-up:

Personality type A

Personality type B

II – Life Events:

A- Stress

B- Social Discontinuities:

Death of spouse change in marital status (divorce, recent marriage, single or widowed) Retirement and change in the job

Change of residence the born of new baby

C- Geographical mobility:

-Rural to urban, urban to rural of any type.

D- Catastrophic events: such as terrorist events.

III – Social Context:

A- Economic factors:

- Unemployment.
- Very high employment
- Sudden job descend.
- Sudden loss of huge money.

B- Social disintegration

- Living alone, or with family

C- Urbanization:

- Urban or rural
- Crowding index

Then the Odd ratio was then calculated for every risk factors of the concern in this study with its p-value. Special statistical analysis (Excel, Windows XP) was used to examine the effect for results in this study.

Results:

The mean ages of the study population was 54.4 years for cases and 56.8 years for controls. The results of examining social risk factors in the development of symptomatic knee osteoarthritis appeared as the following:

Table (1) shows the distribution of cases and controls according to personal characteristics and reveals in regarding to social identity that positive family history (which is one of un-modifiable risk factor) was found to be not associated with the development of symptomatic knee OA, the same thing was applied to sedentary life styles. The habit of cigarette smoking appeared unexpectedly negatively associated with occurrence of knee OA (OR= 0.41, P-value=0.035 and 95%C.I. = 0.18-0.94). Regarding unhealthy dietary habits (rich fatty, calorie and salt intake), this risky behavior appeared to be highly associated (OR= 7.19, P-value= 0.001, 95%C.I. = 2.08-18.60) with the development of knee OA. Finally psychological make up, personality type A, appeared also to be associated with the occurrence of knee OA (OR= 2.84, P-value= 0.009, 95% C.I. = 1.29-6.23).

Table (1): Distribution of the study population according to personal characteristics

Factor	Cases N=76		Controls N= 116		O R	P-value	95 % C.I.
	No.	%	No.	%			
Positive family history	36	47.4	55	47.4	0.998	0.995	----------
Sedentary life	52	68.4	70	60.3	1.42	0.256	0.78-2.60
Active smoking	8	10.5	26	22.4	0.41	0.035	0.18-0.94
Alcohol consumption	0	0.00	0	0.00	-----	------	-------
Rich fatty, calorie and salt intake	42	55.26	17	14.65	7.19	0.0001	2.08-18.60
Personality type A	67	88.2	84	72.4	2.84	0.009	1.29-6.23

Table (2) indicates that stressful life events were negatively associated with the development of knee OA (OR=0.24, p-value= 0.002, 95%C.I. =0.10-0.59), social discontinuities was found to do nothing in the occurrence of knee OA. The geographical mobility appears in this table to be protective against the development of knee OA (OR= 0.15, P-value= 0.000, 95%C.I. = 0.07-0.31).

Table (3) reveals the effect of social context in the occurrence of knee OA, where dramatic change in economic factor, appeared to be negatively highly associated with the development of knee OA (OR= 0.12, P-value=0.000, 95%C.I. = 0.04-0.34). Social disintegration appeared in this study to have no impact in the causation process of knee OA. Urban citizens, in this study appeared to be more prone to develop knee OA than rural citizens (OR= 3.04, P-value= 0.017, 95%C.I. = 1.22-7.57). Lastly, women employed outside home appeared not to be prone for any risk in the development of knee OA.

Table (2): Distribution of the study population according to life events

Factor	Cases N=76		Controls N=116		OR	P-value	95% C.I.
	No.	%	No.	%			
Stress	60	79	109	94	0.24	0.002	0.10-0.59
Social discontinuities	29	38.2	37	31.9	1.32	0.372	0.72-2.43
Geographical mobility	8	10.5	52	44.8	0.15	0.000	0.07-0.31

Table (3): Distribution of the study population according to social context

Factor	Cases=76		Controls=116		OR	P-value	95% C.I.
	No.	%	No.	%			
Economic factor	3	4	30	25.9	0.12	0.000	0.04-0.34
Social disintegration	11	14.5	12	1o.3	1.47	0.389	0.61-3.53
Urban	70	92.1	92	79.3	3.04	0.017	1.22-7.57
Employment	14	18.4	19	16.4	1.15	0.714	0.54-2.43

Table (4) indicates that general obesity (BMI > 25) is valid predictor for the development of knee OA (OR= 8.88, P-value= 0.000, 95%C.I. = 3.08-25.60). The presence of one or more of chronic non-communicable diseases appear to be associated with the occurrence of knee OA (OR=2.60, P-value=0.002, 95% C.I. = 1.43-4.72). Contraceptive pills users among women appear in this table to be associated with the development of knee OA (OR= 3.21, P-value= 0.0001, 95%C.I. = 1.64-5.94). Previous surgeries are not among threats in the occurrence of knee OA.

Table (4): Distribution of the study population according to other variables

Anthropometric measures	Cases=76		Controls=116		OR	P-value	95% C.I.
	No.	%	No.	%			
BMI > 25	73	96.1	85	73.3	8.88	0.000	3.08-25.60
CNCDs	51	67.1	51	44.00	2.60	0.002	1.43-4.72
Contraceptive pills usage	31	40.8	21	18.1	3.21	0.0001	1.64-5.94
Previous surgery	41	54.00	47	40.5	1.72	0.068	0.96-3.08

Discussion:

Osteoarthritis is now firmly established as a public health problem. There have been advances in defining the disorder and measuring its component features clinically, radio-graphically, and by other investigative techniques. The descriptive epidemiological characteristics of osteoarthritis as it affects various joint sites have been elucidated, and the risk factors for prevalent disease are clearly understood for the knee joints. Epidemiological information on the rate of progression of the disorder at these joint sites and the determinants of this progression remain less detailed. Various risk factors have been found which are useful in identifying those with the greatest risk of developing OA, especially knee OA, and among those with OA, those with a high risk of progressive disease. Some of the strongest and best-established risk factors—including older age, female gender, congenital joint malformation, prior knee injury, and a family history of OA—are not themselves amenable to modification. However, these characteristics

may still be useful for targeting those most in need of prevention and treatment.

Most studies indicate that the prevalence and incidence of radiographic and symptomatic OA of knee increase sharply with age. This age-related increase is seen in all joints in which OA occurs, but is especially pronounced in the joints most commonly affected, such as the knee, hip and hand. The relationship between age and the risk of OA is probably mediated by age-related increases in a variety of systemic and local biomechanical risk factors [9, 10]. These include excess joint loading from obesity, impaired neuromuscular joint protective mechanisms (e.g. impaired muscle function and peripheral neurological responses) and increased joint instability (e.g. ligamentous laxity). Joint tissues also become more vulnerable to the effects of biomechanical insults with age. The resistance and reparative capacity of cartilage may decrease with age due to a reduced anabolic response to growth factors, loss of chondrocytes, and thinning of the cartilage plate. It is likely that the specific local and systemic factors involved in the age-related increase in disease differ at each joint site[11, 12, 13]. In this study, the age as a risk factor was beyond measure, because matching of cases and control was based on the factor of age (± 5 years) and all cases and controls were women > 50 years. In addition to that, the gender factor was also immeasurable one, because the study intended to examine sociological risk factors that are related to female gender only (both cases and controls were women) since, each gender has different behaviors, lifestyles, and expectations especially in Eastern Islamic societies where gender difference is still one of main characteristics of those societies.

Many studies suggest that multiple genes are likely to be involved in OA susceptibility, and that environmental factors also have an important influence on disease expression. The evaluation of candidate genes for OA susceptibility has focused on genes encoding type II collagen (the major form of collagen in articular cartilage), for other structural proteins of the extra-cellular cartilage matrix, the vitamin D and estrogen receptor genes, and for bone and cartilage growth factors[14,15,16]. Genome-wide scans have also identified a number of promising OA susceptibility loci that point to currently unspecified genes residing on chromosomal regions that do not harbor the primary candidate genes evaluated so far [17, 18, 19]. In this research, family history appeared to be not associated with the development of knee OA. This may be due to that sample size appropriate for a case-control study not suitable for estimating such an important risk factor. Thus, another cross-sectional or cohort study may illustrate such factor as an important contributor in the occurrence of knee OA.

Unhealthy dietary behaviors such as high intake of salt, calorie and fat diets appeared in many studies to be associated with many health problems. Alongside its contribution to obesity (unhealthy dietary behavior), lack of antioxidants that is associated with Western type of diets (a lot of salt, carbohydrates and fat intake) is found to be as a main contributor to the development of OA in different types of joint in the body[20]. This goes in consistence with the results of this study, where unhealthy dietary behavior is found to be highly associated with the occurrence of knee OA in women > 50 years.

Personality type A, appeared in this study to be associated with development of knee OA in women > 50 years. This type of personality is also an important contributor and risk factor in the occurrence of ischemic heart diseases. Little is known about the mechanism of action of such risk factor, but the new field of neuro-hormonal immunology appears to be promising in illustration of this relation in the future. Moreover, Gupta et al[21] found the same result of this study and added that even symptoms of knee OA will be more severe in women with personality type A than those with type B.

Sedentary life behaviors, in this work, appeared to be associated with development of OA, but statistically were not significant. Regular exercise, in addition to facilitating weight control, alone or in combination with dieting, improves several metabolic abnormalities related to both obesity and other joint problem. Significant association between knee OA and sedentary life styles was found in the work of Kristiann et al [22], who found that women with sedentary life are about 4 folds increased risk of knee OA than those with active movement. The study of geographical motilities suggesting this idea, where it was found to be a significant protective factor against development of knee OA.

Cigarette smoking in many researches appeared to increase severity of symptoms that are associated with knee OA. Because smoking may disorder the cells and inhibit cell proliferation in the knee cartilage, may increase oxidant stress, which contributes to cartilage loss, and may raise carbon monoxide levels in arterial blood, contributing to tissue hypoxia (insufficient blood oxygenation), which could impair cartilage repair[23].

Unexpectedly, in this work, cigarette smoking appears to be negatively associated with the development of knee OA. This appears to be not a matter of great concern, since cigarette smoking is still not significant factor in the occurrence of knee OA, instead of that, cigarette smoking worsen symptoms and prognosis of knee OA.

Stress in this study appeared to be significantly negatively associated with the development of knee OA. Actually, stress is very difficult to be assessed, since it is more subjective symptom and the reaction to it differ considerably in different humans. Okma and Hopman [24] found in their study that the onset and symptoms of knee OA will be more severe if they are associated with stressful life events. Gretchen et al [25] found that, reaction to stress will differ considerably in different population with knee and other forms of OA. Nevertheless, this point of concern needs to be more extensively evaluated in other researches. Social discontinuities again, in this study showed non-significant association with occurrence of knee OA. The same thing was applied to social disintegration.

Xie et al [26] found in his multi-ethnic urban Asian population study that urbanization alone is an undependable risk factor in the development of knee OA. Almost, the same results where obtained from this study regarding urbanization. Employment outside home for women in this work appeared not to be associated with the occurrence of knee OA. Moreover, economic factor (such as sudden gain or loss of huge deal of money) showed significant negative association with the development of knee OA, this result goes in consistence with results of Marcel and Peter [27], who they found that OA occurs more frequently with both social class IV and V (more affluent) than all other social classes.

Obesity is among the strongest and best established risk factors for knee OA, clearly precedes the development of knee OA by many years, and hastens structural worsening of existing knee OA [28]. There is some evidence that weight loss reduces the risk of subsequent development of knee OA. The primary mechanism for the association of obesity with knee OA is likely to involve the effect of excess weight on overloading of knee joints during weight-bearing activities, causing breakdown of cartilage and damage to ligaments and other support structures. Metabolic factors associated with obesity including circulating adipocytokines, adiposity-linked glucose and lipid abnormalities, and chronic inflammation may also play a role the pathogenesis of OA. Elevated levels of blood glucose and C-reactive protein (CRP), which are elevated in obesity, are associated with the risk of knee OA and its progression in women [29,30]. In this study, significant association was found between obesity as a risk factor in the development of knee OA in women >50 years.

Persons with chronic non-communicable diseases (such as diabetes, hypertension, ischemic heart diseases, cerebro-vascular accident and cancers), actually have had many risk factors with them in the course of development of such diseases. Many of these risk factors are clearly risk factors for OA in general. Accordingly, significant association in this work between the presence of chronic non-communicable diseases and knee OA was found. Similar results were also obtained by the work of Tim et al [31]. The history for previous surgical operations, in this work, appeared not to be correlated with the incident of knee OA.

Disease protection inferred from observational studies of estrogen users may be misleading, since estrogen use is associated with a healthy lifestyle. Estrogen users are also more likely to have osteoporosis, which is associated with a reduced risk of OA [32]. Evidence for a protective effect of estrogen use is more consistent for OA defined by radiographic changes alone than for symptomatic or clinical OA, suggesting the possibility of different effects of estrogen on structure and symptoms. The only data from a randomized, placebo-controlled clinical trial indicated no difference in knee OA-related symptoms between women receiving estrogen plus progestin compared to placebo [33]. In the present study, significant association was found between contraceptive use among women and the occurrence of knee OA.

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