PATTERNS OF KNEE, HIP AND HAND OSTEOARTHRITIS IN KENYATTA NATIONAL HOSPITAL

A DISSERTATION TO BE PRESENTED AS PART OF THE FULFILLMENT OF THE AWARD OF DEGREE OF MASTER OF MEDICINE IN INTERNAL MEDICINE

UNIVERSITY OF NAIROBI

PRINCIPAL INVESTIGATOR: Abdirahman N. Hussein, MBBS (Amoud University)

RESIDENT, MMED, INTERNAL MEDICINE, UNIVERSITY OF NIROBI

DECLARATION

I certify that this dissertation is my original work and has not been presented for a degree in any other university.

Signed…… Date ……

Dr Abdirahman Nour

SHO, Internal Medicine, University of Nairobi

DEDICATION

I dedicate this work to:

My beloved wife, Dr. Nura, for her patience and support during the period of my training and writing this research project

My lovely daughter, Asha whose smile gave me the spirit to complete this research

SUPERVISORS

1. Dr. Omondi Oyoo; MBChB, MMed (UoN), FACR, FRCP (Edin)

   Consultant Rheumatologist; Senior Lecturer, Dept. Clinical Medicine & Therapeutics, UoN

   Signed…… Date ……

2. Professor M D Joshi; MBChB, MMED, Cert Trop Med, Cert ClinEpid, MPH-Epid, FACC.

   Associate Professor, Department of Clinical Medicine and Therapeutics, UoN

   Signed…… Date ……

3. Dr. Fred M. T. Otsyeno; MBChB, MMED, SICOT Dip, FCS (ECSA)

   Orthopaedic Surgeon, Kenyatta National Hospital

   Honorary Lecturer, Department of orthopedics, UoN

   Signed…… Date ……

4. Dr. Muriithi Mathenge; MBChB, MMED (Radiology)

   Consultant Radiologist, Lecturer, Dept of Diagnostic Imaging and Radiation Medicine, UoN.

   Signed…… Date ……

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ABBREVIATIONS

ACR	American College of Rheumatologists
ADA	American Diabetes Association
AIDS	Acquired Immunodeficiency Syndrome
ARA	American Rheumatism Association
ARC	Arthritis Research Campaign
BMI	Body Mass Index
DIP	Distal Inter-phalangeal Joint
GDF5	Growth Differentiation Factor 5
HIV	Human Immunodeficiency virus
JNC	Joint National Committee on the prevention and management of hypertension
KNH	Kenyatta National Hospital
NHANES	National Health and Nutrition Examination Survey
OA	Osteoarthritis
OAK	Osteoarthritis of the Knee
PIP	Proximal Inter-phalangeal Joint
SPSS	Statistical Package for Social Scientists
SSA	Sub-Saharan Africa
U. O. N	University of Nairobi
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

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ABSTRACT

Background

Osteoarthritis (OA) is a common and devastating joint disease. Its prevalence is increasing with an increase in life expectancy and the rising of epidemic obesity. A significant number of patients have a major degree of limitations in their daily activities. The risk of developing the disease increases with aging. Obesity (high body mass index) is not only a major risk factor for the development of OA of the knee, hip and hand but the progression of established disease. Maintaining an ideal weight reduces the incidence and the severity of the disease which will improve the quality of the life of patients living with the disease. On the other hand, joint replacement for severe OA is not feasible in the majority of the developing countries, hence emphasizing the need for the prevention of the disease through modifying the modifiable risk factors.

Objective of the study

We set out to determine the patterns of knee, hip and hand OA in patients attending Kenyatta National Hospital rheumatology and orthopedic outpatient clinics.

Methodology

This was a cross-sectional descriptive hospital based study which was carried out from 24th August to 21st of December 2012.Adults aged 18 years and above with a diagnostic label of knee, hip and hand OA were interviewed. Every participant was examined and their heights and weights were taken and BMI was calculated. Blood samples were taken for erythrocyte sedimentation rate (ESR). Data analysis was then done using statistical package for social scientists (SPSS) version 17.

Results

Two-hundred and one patients with knee, hip and hand OA were consecutively evaluated. There were 165 females and 36 males, with the mean age of 61.4 ±11.1. The mean BMI of the patients was 29.0 ±5 Kg/M^2 with a median duration of the disease before presentation for five years. Of the 201 patients studied, 77% had knee OA, 15% hip OA, 3% hand OA, and 5% combined knee and hip OA. Obese participants comprised 41.2% and overweight were 32.3%. There were 89(42.3%) patients with bilateral disease compared to 112(55.7%) with unilateral disease. Obese participants had higher prevalence of bilateral disease (52.4%) compared to participants with normal BMIs (26.5%).

Conclusion

Patterns seen in our study sample was similar to what has been reported in other studies in Africa and Europe. Obesity is prevalent in patients with knee and hip OA.

Introduction

Osteoarthritis is the most prevalent of chronic rheumatic disorders in the world(1). It is a metabolically active process that affects the joints. Key pathological features are progressive loss of the articular cartilage and remodeling of the adjacent bone with new bone formation. By the age of 65years, the majority of the people have radiographic evidence of OA (2). Up to 80% of patients have some limitation of their activities, and 25% are unable to perform major activities of daily living. OA is estimated to be the fourth leading cause of disability in most countries worldwide(3). Although OA can affect any joint, the joints mostly affected include hands, knees, hips and spine.(4). Worldwide, around 10% of the population who are 60 years or older have symptomatic problems attributable to OA (5). In USA, in 2005, a prevalence figure of 27 million US adults (aged >25 years) with some form of OA was reported by different sources (6), (4).In the developing countries, the disease prevalence is variable; some studies show lower prevalence rates while others show similar levels to those in developed countries(5).

OA of the knee, hip and hand are the most common forms of the appendicular OA (7). They are also a common source of pain and disability, especially in the elderly (8). Studies demonstrate that knee OA is associated with profound clinical and public health burden (7). In the developed world, in addition to being painful and disabling, OA has financial burden on the societies in terms of work absences, drug treatments and surgical procedures(9). The risk of developing OA increases with age. It is more common in women than men. The other risk factors for OA include obesity, joint injury, previous joint surgery and occupational bending and lifting (10). Of all these, obesity is the most powerful and modifiable risk factor for the development OA (11). Indeed, obesity is also strong risk factor for the development and progression of radiographic knee OA. Maintaining an ideal weight or BMI reduces the onset of knee OA (8). In patients with

established knee OA, the reduction in weight or BMI helps lessen the pain, reduce the disability and improve the quality of life (8)(9), (12). A Significant number of patients with OA attend KNH orthopedic and rheumatology clinics. Little if any is known about the characteristics of the disease encountered in KNH. The objective of this study is to determine the patterns of OA as well as the prevalence of obesity in patients with the disease.

Literature review

Osteoarthritis is a common clinical syndrome characterized by features which are related to abnormalities of articular cartilage. It is often defined by joint symptoms, by structural pathology (e.g. on X-ray), or by the combination of the two. The most important symptoms are joint pain and stiffness. The joint pathology is diverse. It includes focal damage and loss of articular cartilage, abnormal remodeling and attrition of subarticular bone, osteophytes (bone growth at the joint margins), ligamentous laxity, weakening of periarticular muscles, and in some cases synovial distension and inflammation(2).

Epidemiology

Musculoskeletal conditions are a major burden on individuals, health systems, and social care systems, with indirect costs being predominant. Increases in life expectancy and ageing populations are expected to make OA the fourth leading cause of disability by the year 2020(13). Epidemiologic studies on OA include estimates of its prevalence and incidence. It is estimated that approximately 10% of the world's population who are 60 years or older have symptomatic problems that can be attributed to OA (5). Collecting prevalence data from multiple sources arrived at a prevalence figure for 2005 of 26.9 million US adults (aged >25 years) with some form of OA (14).The prevalence in developing countries is inconsistent; some studies show lower prevalence rates while others show similar levels to those in developed countries. There are 3 main factors in the scope of the epidemiology of OA. These are gender, age, and disease location. The risk of OA increases considerably with each decade after the age of about 45 years (15).

Classification and diagnostic criteria

The recognition of OA is complicated by multiple factors which include a lack of specific physical or laboratory findings and inconsistencies between symptoms and the results of radiographic examinations. As a result, OA is frequently diagnosed by an overall clinical impression based upon the patient's age and history, findings on physical examination, and radiographic findings. In order to overcome these difficulties, various criteria were developed to define OA. These definitions are based upon the joints affected. According to the diagnostic and therapeutic committee appointed by ACR, OA is defined as a heterogonous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone and at the joint margins (16).The standard definition, classification and the diagnosis of OA has been attempted using the traditional criteria and classification tree. These criteria were formulated according to the joints affected by the disease. OA was traditionally grouped into two categories based on the etiology.

1) Idiopathic form which occurs in patients with no known prior event or disease that led to the OA (16). Idiopathic OA can be localized commonly affecting the hand, knee, hip, feet and spine, or generalized where three or more joints are involved.

2) Secondary form: in this type of OA, patients have specific conditions that caused or enhanced the development of the disease.

Osteoarthritis of the knee

Osteoarthritis of the knee can be primary (idiopathic) or secondary. Traditional inclusion criteria and classification trees were developed to differentiate idiopathic knee OA from the other forms of arthritis (16). Traditional inclusion criteria can involve clinical (history and physical examination), clinical and laboratory or clinical and radiographs findings to classify subjects as having knee OA. The sensitivity and specificity for the knee OA depends on the criteria which is used (Appendix1 summarizes the traditional inclusion criteria for knee OA)(16).

Knee OA is the most common form of OA and affects females more than males (10). Based upon data from the Framingham OA study and the Johnston County OA Project, approximately 19–28% of adults aged 45 or older have knee OA (17). Data from the Framingham study showed that the prevalence of knee OA nearly doubles in patients aged 45 years or older compared with those 26 years or older (18). The study findings showed that 4.9% of women at least 26 years of age had knee OA compared with 4.6% of men. However, the gap increased to 7.2% versus 5.9%, respectively, in the 45 years or older group. In the Johnston County study this gap was also replicated, although a higher rate of knee OA for both men and women aged 45 years or older was observed (13.5%% vs 18.7% respectively). Radiographic knee OA was observed in 17.7% of African American participants aged 60 years or older compared with 14.8% of Mexican American and 11.9% of white participants in the same age group (both differences P <.01)(4) . The incidence of symptomatic radiographic knee OA in American women aged 70 to 89 years was 1% per year (19). Lifetime risk of symptomatic knee OA (OA) rises with increasing BMI, with a risk of 2 in 3 among those who are obese(7). Being both African American and female was associated with higher prevalence of radiographic knee OA (60%). Prevalence of knee OA in various studies is depicted in table1.

Table1. Prevalence studies on knee OA.

Author/year	Reference	Setting	Method	Age range(Y)	Prevalence	
					women %	men %
Kellgren and Lawrence 1958	(19)	UK	Radiographs	55-64	41	30
Davis et al, 1990	(6)	USA	Clinical	45-74	4	2
Felson, 1990	(20)	USA	Radiographs	70-79	36	31
			Clinical		13	8
Bagge et al, 1991	(21)	Sweden	Radiographs	79	53	44
			Clinical		18	5
Spector et al, 1991		UK	Clinical and radiographs	45-65	3	
Zhang et al, 2001	(22)	China	Radiographs	>60	3	22
			Clinical		15	6

Osteoarthritis of the hand

Osteoarthritis of the hand is a clinical diagnosis. The traditional format and classification trees are also used to classify patients as having hand OA. The best diagnostic method is using the traditional method which includes pain and other associated physical signs (Appendix 2)(20). Radiography is of less value than clinical examination in the classification of symptomatic OA of the hands. The prevalence of radiographically diagnosed hand OA increases steadily with age. In the age group of 40 to 49 years, 10% of subjects are affected, whereas in subjects older than 70 years, the prevalence is 90% in women and 80% in men. In a 10-year cohort study, the incidence for hand OA was significantly higher among women (5.6%) compared to men (2.5%)(21). The prevalence of symptomatic hand OA in Italy in subjects older than 65 years is only 15% (22). In the US, the incidence of symptomatic radiographic hand OA was about 0.5% per year (23).

Table2. Prevalence studies on Hand OA.

Author/year	Reference	Setting	Method	Age range (years)	prevalence Total%	women %	men %
Kellgren,1961	(28)	UK	Radiographs	40-49	10		
				>70		90	80
Lawrence 1966	(29)	UK	Radiographs	>15		29	22
Bagge et al 1992			Radiographs and clinical			26	9
	(21)	Sweden		70-79	92		
Bagge et al 1992	(21)	Holland		70-95	75		
Mannoni et al 2000	(26)	Italy	clinical	>65	15		

Osteoarthritis of the hip

Both traditional format and classification tree techniques were used to identify patients with hip OA. The traditional format combines pain with at least 2 of the following 3 criteria(24) (appendix 3).

1. Osteophytes (femoral or acetabular).
2. joint space narrowing (superior, axial, and/or medial),
3. ESR <20 mm/hour (Appendix 3)

The prevalence of OA of the hip at 55 years is much lower than that of knee and hand. The Johnston County study detected a higher rate of hip OA in women 45 years or older (9.3%) compared with men in the same age group (8.7%)(4). In the Caucasian population, the prevalence is about 3% to 6% compared with 1% or less in East Indians, Blacks, Hong Kong Chinese, and Native Americans(25). Prevalence of hip OA from various epidemiological studies is shown in Table3.

Table3. Prevalence studies on Hip OA.

Author/year	Reference	Setting	method	Age Range(Y)	prevalence		
					Total%	women %	men %
Kellgren and lawrence 1958	(19)	UK	Radiographs	>55		3	8
Danielsson 1966		Sweden	Radiographs	>55	3	3	3
Jerring et al, 1980	(32)	Denmark		>60		6	4
Lindberg 1985		Sweden		>55	3	3	3
Van saase et al 1989	(33)	Holland	radiographs	45-49	3		
Lawrence et al, 1989	(34)	USA	radiographs	55-64		3	3
				65-74		5	3
Cimmino et al,1996		Italy	radiographs	>50	24		

Osteoarthritis in Africa

The spectrum of rheumatic diseases in sub-Saharan Africa remains poorly defined. However, recent studies have suggested that rheumatic conditions are increasingly becoming the source of morbidity and mortality in sub-Saharan Africa even though the current focus is on other important causes such as infectious diseases (HIV/AIDS and malaria) and malnutrition (26). In Cameroon, 12,494 patients referred to the outpatient clinic of the department of Internal Medicine in a general hospital were studied. Around 536 patients (9.4%) were found to have rheumatic conditions. Among the patients with rheumatic diseases, 20.5% of them had OA of the limbs. The knee joint OA was the most common form (79%) with female predominance (69%) (26). In Togo, Oniankitan looked at the prevalence and topographic patterns of OA among the patients with rheumatic conditions. He examined the medical records of patients seen at the Lome Teaching Hospital, Rheumatology Clinic retrospectively. He found that among the 12251 patients studied, 1085 (8.9%) had appendicular OA. Majority of the patients (91%) had knee OA and the females comprised up to85% (27).

A similar study done in west Africa which also investigated prevalence and the patterns of the chronic rheumatic diseases found that OA was the most common form; and that the knee joint was the most common site of the disease; females being the dominant group(28). In Kenya, the rheumatic disorders are being frequently seen in the day to day clinical practice. A descriptive study examined 767 patients with musculoskeletal complaints in a rheumatology clinic in Nairobi. In this study, the spectrum of the rheumatic disorders was looked at. OA was found to be the most common rheumatic disorder (40%) among the patients with rheumatological complaints (29).

Pathogenesis of Osteoarthritis

Osteoarthritis is considered to be a result of articular joint failure. This is thought to be a consequence of complex of interplay of genetics, metabolic, biochemical, and biomechanical factors associated with inflammation. There are two main mechanisms which are currently believed to lead to the initiation of OA.

1. In the majority of the patients, the initiation of OA results from damage to normal articular cartilage by physical forces these can be either single events of macrotrauma or repeated microtrauma. Following this injury, the chondrocytes react by releasing degradative enzymes and there is evidence of inadequate repair responses.
2. Less commonly, primarily defective cartilage initially fails under normal joint loading and leads to OA.

Insights into the Risk Factors and Causes

OA is complex condition with multiple risk factors. The risk factors have long been identified for the incident OA and include genetics, overweight or obesity, age, female sex (17) and occupation related factors(30). They can be systemic and local and both act synergistically(2).

Genetics

The available evidence suggests that genetic factors have a major role in OA. Up to 40% of patients have genetic factors involved in the development of the disease (31). This genetic influence has also been estimated to be up to 65% in a recent twin study(32). The nature of the genetic influence in OA is speculative and may involve either a structural defect (that is, collagen), alterations in cartilage or bone metabolism, or alternatively a genetic influence (19) on

a known risk factor for OA such as obesity(33). The gene for GDF5, which encodes the growth differentiation factor 5, a bone morphogenetic protein expressed in skeletal and articular structures, has been associated with OA.

Age and Gender

The prevalence and incidence of radiographic and symptomatic OA increase sharply with age (2). This age-related increase is seen in all joints in which OA occurs, but is especially prominent in the joints most commonly affected, such as the knee, hip and hand. Female gender serves to magnify the age-related increase in the risk of OA occurrence in the hand and knee and multiple joints. After the age of 50, the prevalence and incidence of disease in these joints is significantly greater in women than in men (23).

Overweight and obesity

Obesity (a measure of relative weight) is a chronic metabolic disorder which has been proved to be associated with various co-morbidities such as coronary heart disease, cardiovascular diseases, hypertension, diabetes and musculoskeletal diseases. The role of overweight and obesity in incident OA as well as progression of the established disease has been extensively studied. A positive association between obesity and OA of the knee has been observed in cohort studies(34), case-control study (35) and cross-sectional studies. On the other hand, weight loss has been shown to reduce the incidence of knee OA in women in a cohort study(36)(37). The association between obesity, overweight, and BMI and a pattern of bilateral radiographic knee OA was even more marked after controlling for potential confounders mainly smoking and age (38).

A 2010 meta-analysis (39) that included 85 studies reported that individuals who are obese or overweight have almost three times the risk of incident knee OA compared with those with normal weight. Those who are overweight but not obese have 2.2 times the risk of developing knee OA compared with their normal weight counterparts. Furthermore, risk of incident knee OA appears to increase with increasing BMI, regardless of knee alignment. One twin study showed 9-13% increased risk for the onset of knee OA with every kilogram increase in body weight(32).

Obesity is prevalent in patients with knee OA. A prevalence figure of 70-80% of being overweight and obese (38) was recorded in patients with knee OA(40). Lifetime risk of symptomatic knee OA is about nearly 1 in 2 overall, more than 1 in 2 among those with history of a knee injury, and nearly 2 in 3 for obese persons(7). Therefore, Obesity is among the strongest and best established risk factors for knee OA(41), and clearly precedes the development of knee OA by many years (36).The WHO initiative on counteracting obesity also accepts OA as a consequence of obesity (42).

Although obesity has been persistently shown to be associated with knee OA, the available evidence on the role of obesity in the development of hip OA is not conclusive. However, the prevalence of overweight in patients requiring surgery for end-stage hip joint OA was reported in figures ranging from 43% (43)to 68% (44).In other studies, high BMIs were observed to a similar extent with respect to both unilateral and bilateral cases of hip OA. This is noteworthy because according to the NHANES findings of Tepper and Hochberg (45), obesity is associated more strongly with bilateral than with unilateral hip OA (38) .

The available evidence for a positive association between weight or BMI and hand OA is moderate (46). In a recommendation for the diagnosis of hand OA by a task force of the European League Against Rheumatism, obesity was described as a risk factor for hand OA (47).

Obesity and Osteoarthritis: Mechanism

The mechanisms relating overweight to OA are of 2 types. First, the joints support an increased dynamic stress that promotes cartilage disruption (19). Second, Obesity is associated with a variety of metabolic disturbances, which by themselves might be systemic risk factors for OA (38) .A possible culprit is insulin-like growth factor. A clinical observation indicating that factors other than mechanical stress are at play in the association between obesity and OA is that hand OA also is associated with overweight. Thus, the entirety of evidence suggests that weight is not only an important modifiable risk factor for incident OA but also for the reduction of the disease progression.

Metabolism

Hyperglycemia has been associated with increased frequency and severity of OA. Mean fasting plasma glucose levels in 1,026 patients with OA were significantly higher than that of normal controls (19). Hyperglycemia probably is related to the development of OA through changes of matrix macromolecules. In a recent study, diabetics were shown to be at risk for bilateral large joint OA. High serum cholesterol concentration was shown to be associated independently with radiographic knee and generalized OA(48).

Physical activity

Some sporting activities can be harmful to normal or OA joints. Prospective studies assessed the impact of jogging and exercise on the incidence of OA. Higher baseline frequency of subchondral sclerosis and knee osteophytes was documented in runners who exercise more than 200 minutes per week compared to their controls. However, no difference was observed in terms of symptoms (19). Professional athletes are most likely at higher risk for OA. Increased incidence of hip OA was observed in Marathon athletes. Obese elderly individuals who undertake heavy physical activity seem to be at particularly high risk for knee OA(49).

Injuries

Acute joint injuries, fractures and dislocations are potential causes of secondary OA because of changes in joint biomechanics. The association of these injuries with subsequent development of hip and knee joints OA has been the subject of many cross-sectional and case-control studies. Previous hip injury is an independent risk factor for hip OA with an OR of 4.3 (95% CI, 2.2-8.4) (50). Prospective studies showed that previous knee injury was a significant risk factor for the development of OA with a relative risk of 5.17 (95% CI, 3.07-8.71).

Occupational factors

There is accumulating evidence that certain occupations are associated with increased occurrence of OA. Occupations that require kneeling, squatting, repetitive knee bending and carrying heavy loads substantially increase the risk of later development of OA of knee and hip. Higher prevalence of knee OA was observed in floor layers and carpenters although only in the age group older than 50 years(51). Farming is the only occupation that has been consistently shown to associate with hip OA (farmers had an OR of 9.3 (95% CI, 1.8-33.8) of the disease) (52).

Repetitive tasks that involve a pincer grip increase the risk of hand OA, particularly in the DIP joint(53).

Time trends in osteoarthritis

There is uncertainty regarding the prediction of future changes in the incidence and prevalence of OA. As incidence and prevalence go up with increasing age, extending life expectancy will result in greater numbers with OA. The burden will be the greatest in developing countries where life expectancy improvements are expected but access to the surgical therapeutic modalities for severe hip and knee OA like arthroplasty and joint replacement are not readily available (5).

Justification of the study

Osteoarthritis is a prevalent rheumatic disorder with considerable morbidity and incapacitation. This is predominantly due to increasing aging and obesity. The burden of the disease is potentially modifiable by reducing the modifiable risk factors. We do not have local data documenting the prevalence, patterns, as well as the risk factors contributing to the disease encountered in KNH.

Research question

What is the magnitude of osteoarthritis in Kenyatta National Hospital?

Objectives

Broad objective:

To determine the characteristics of OA in KNH

Specific objectives:

- To determine the prevalence of joint specific OA in KNH orthopedic and rheumatology clinics
- To describe the socio-demographic characteristics of patients with specific joint OA
- To determine prevalence of overweight/obesity in patients with specific joint OA

Methodology

Study design and site

The study was a cross-sectional descriptive study which was carried out in the rheumatology and orthopedic outpatient clinics of the Kenyatta National Hospital during the period between August and December 2012.

Study population

The study population consisted of those patients who had a diagnostic label of knee, hip and hand OA according to ACR criteria and were on follow up in the rheumatology and orthopedic outpatient clinics of KNH.

Inclusion criteria

- 13 years and above
- Confirmed to have OA
- Written informed consent

Exclusion criteria

- A rheumatologic diagnosis other than specific joint OA
- History of involved joint surgery
- History of involved joint trauma

Sample size determination

The prevalence of symptomatic OA is around 10% worldwide(5).In Africa, It has been shown that around 9%-20% of patients with rheumatic disorders(27)(29) have OA. Based on this available data, and using prevalence of 10%, the minimal sample needed was 138 patients. The sample size was determined using the fisher's formula below.

$$N = \frac{Z^2 Pq}{d^2}$$

Where

N = Minimum sample size,

Z= Normal standard deviation 95% confidence interval

(Z = 1.96),

P = was the estimated prevalence of OA from previous studies

q= 1 – Prevalence and d= Margin of error (0.05)

N: (1.96)2(0.1X0.9)/0.05 138

Screening and recruitment

The primary investigator reviewed the files of the patients on follow up in the orthopedic and rheumatology clinic outpatients during the study period to identify the patients with diagnostic label of knee hip or hand OA. The ACR criteria for the concerned joints were applied and those who met the case definition were then approached and informed consent was sought after full explanation of the consent. All the patients were seen after the primary doctor review.

Data collection

A total of 2100 patients were screened for eligibility of recruitment. Among them, 1842 (88%) patients were from the orthopedic clinic while 12% were from the rheumatology clinic**.** Of the 2100 patients, 1890 (90%) were excluded from the study as they were not eligible for recruitment. Ten patients (0.5%) had secondary OA, while the rest had rheumatological diagnosis other than OA. The remaining 210 (10%) patients were eligible for recruitment but nine of them declined the consent. As an entry point of recruitment into the study, participants had to fulfill the diagnostic criteria for different joints (appendices1, 2, 3). Full history and through physical examination including anthropometric examination were conducted as per the study proforma (appendix4) by the principal investigator and the research assistants who were trained clinical officers.

Socio-demographics data was collected including name, age, gender, marital status, education, family history and level of physical activities. Body weight and height were obtained during the physical examination. Body mass index was calculated as a measure of weight relative to the height by dividing the weight in kilograms (kg) by the squared height in meters (m). In both men and women, normal weight was defined as a body mass index between 18.5 Kg/M^2 -25 Kg/M^2, overweight as 25 Kg/M^2 or more but less than 30 Kg/M^2, and obesity as 30 or more Kg/M^2.

Then all the knee and hip joints radiographs for patients with knee and hip OA respectively were obtained. The radiographs were read by the consultant radiologist. The radiographic features were part of the diagnostic criteria for knee and hip (appendices 1, 2).

Laboratory

Two milliliters of blood was removed from anticubital vein of participants with hip OA, for erythrocyte sedimentation rate (ESR). Westergren ESR analysis method was used to process the sample. Standard operating procedures for specimen handling and storage were adhered to, to minimize pre analytical sources of error. Results were accepted only if the control values were within the expected range.

Data management and statistical analysis

Data collected during the study was verified, cleaned and entered into software data management program Statistical Package for Social Scientists (SPSS) version 17.0.

Statistical analysis was done during the analysis of the data using (SPSS) version 17.0. Statistical significance to establish the prevalence of the specific joint OA as well as to identify risk factors associated with OA was determined using fisher's exact test for nominal variables and t-test for continuous variables. Continuous data e.g. age, weight, height, BMI was presented as means, standard deviations, and medians. Categorical data such as gender, physical activities, family history and smoking habits were presented in proportions, frequencies and percentages.

Ethical consideration

The study was carried out after approval by the department of Internal medicine (U.O.N) and KNH ethics committee. All eligible patients, or their caregivers in the case of minors, were explained to in detail the purpose of the study, in lay terms. Confidentiality was maintained at all times. Patients were free to withdraw from the study at any point and they were not discriminated against after withdrawal. Only subjects who gave informed consent were enrolled in to the study. All participants signed informed consent form (appendix 7).

Quality Assurance

The research assistants underwent training by the principal investigator on how to apply the questionnaire and take the anthropometric measurements to ensure standardization.

Case Definitions/outcome variables

1. **Knee OA**: was defined on the basis of clinical and radiographic findings. The subject must have

   Knee pain plus at least one of the following three features

   1. Age more than 50 yrs
   2. Stiffness of less than 30 minutes
   3. Crepitus on active motion

   Plus

   Radiographic evidence of osteophytes

The sensitivity and specificity of this method is 91% and 86% respectively

2. **Hip OA**: The subject was classified as a patient with hip OA when the following were met.

   Hip pain for most of the days of prior month and at least 2 of the following 3 features

   1. ESR of less than 20 mm/hour
   2. Radiographic femoral or acetabular osteophytes
   3. Radiographic joint space narrowing

This classification method has a sensitivity of 89% and specificity of 91%

3. **Hand OA**: subjects was classified as case of hand OA with the following features

   Hand pain, aching or stiffness

   And

   3 or 4 of the following features

1. Hard tissue enlargement of 2 or more of the 10 selected joints.
2. Hard tissue enlargement of 2 or more DIP joints.
3. Fewer than 3 swollen metacarpo-phalangeal joints.
4. Deformity of at least 1 of the selected joints.

The 10 selected joints were: The second and third distal interphalangeal, the second and third proximal interphalangeal and the first carpo-metacarpal joints of both hands.

The classification method is the traditional with a sensitivity and specificity of 94% and 87% respectively.

The hard tissue enlargement is Heberden's nodes in DIP joints or Bourchard's nodes in PIP joints.

Cigarette smoking

This was defined as use of cigarettes, pipes or cigar in the last 12 months. The number of cigarettes smoked was calculated using the pack-year formula as indicated: Pack years = (No of cigarettes smoked/20) x number of years smoked

Obesity and BMI

BMI, defined as the individual's body weight in kilograms divided by the square of his or her height in meters, producing the unit of $kg/m^{2,}$(54) was calculated from the available height and weight. Body mass index was used as a measure of total body obesity. Height was measured to the nearest 0.5cm using a metal measuring tape against a wall and a flat headboard at right angles to the wall. Weight was calculated using a good quality bathroom scale with the subject in light clothing and without shoes. Subjects, depending on their BMIs were classified as the following groups (WHO classification)

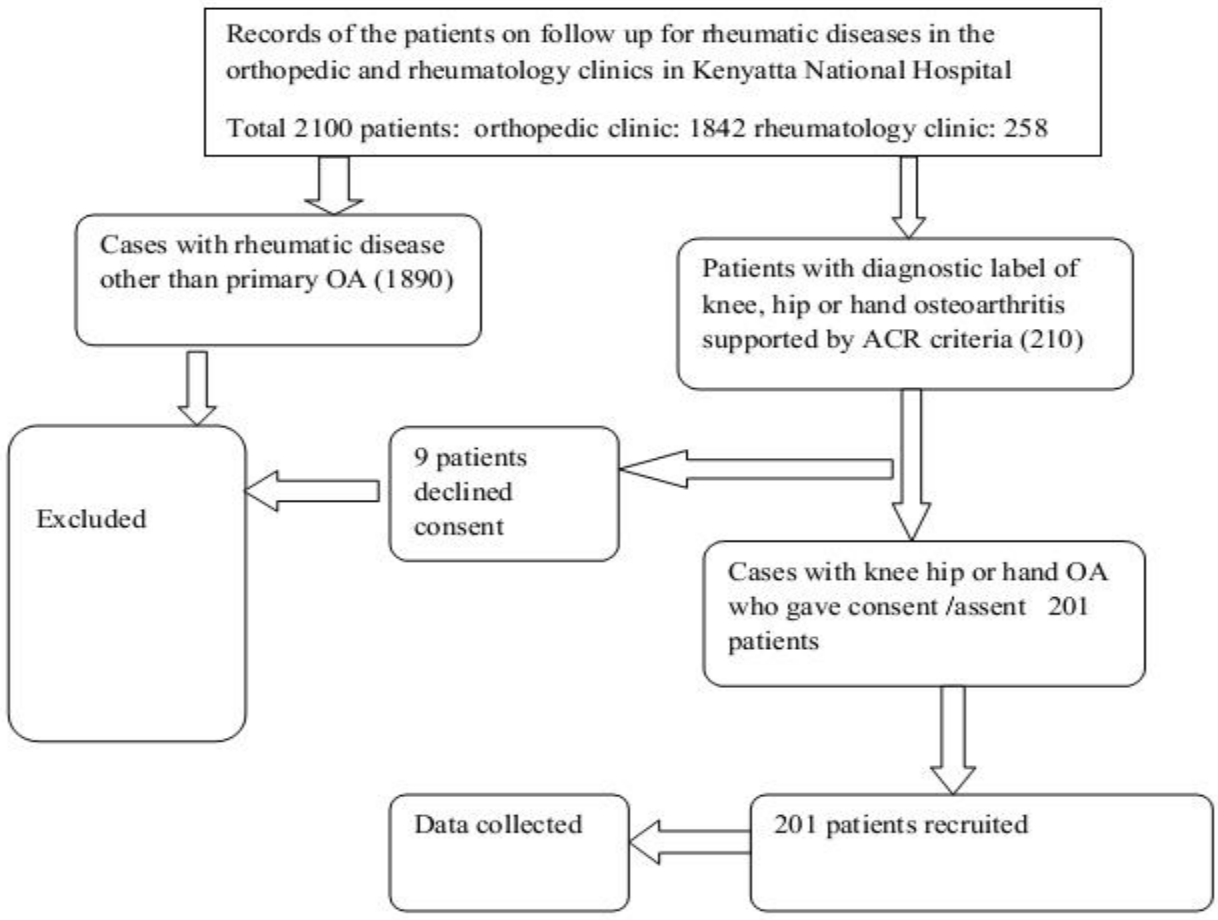
- Under weight: BMI less than 18.5 kg/m2
- Normal-weight 18.5 to 24.9 kg/m2
- Overweight 25 to 29.9
- Obese Class1 30 to 34.9 kg/m2
- Obese Class 2 35 to 39.9 kg/m2
- Obese Class 3 equals or exceeds a BMI of 40 kg/m2

Physical activities

Physical activities were categorized as light, moderate or heavy. The following activities were regarded as light intensity and included standing, ironing and leisurely walking. The moderate category included such activities as lifting or carrying light objects, sweeping/mopping and vacuuming as well as brisk walking. “Heavy” activities ranged from lifting or carrying objects greater than five pounds, mowing with a nonpower mower, gardening with heavy tools, shoveling, digging, chopping wood, brisk cycling, and other strenuous sports or recreation (Appendix 6).

Results

Between the periods of August to December 2012, the files of 2100 patients attending the rheumatology and orthopedic clinics in Kenyatta National Hospital for various rheumatic diseases were consecutively screened for a diagnostic label of OA of knee, hip and hand. The medical records of 210 patients were found to have been labeled as knee, hip or hand OA. The consent of the patients was sought and then they were subjected to ACR classification criteria for their respective joint disease. Patients with the diagnostic label of the concerned joints had to fulfill the diagnostic criteria of ACR as an entry point for recruitment into the study. All the 201 patients whose data was analyzed fulfilled the ACR criteria. Nine patients declined the consent.Figure1 shows flow chart of screening and recruitment process.



Socio-demographic characteristics

Females comprised 82.1% of the study sample. The mean age (SD) of the participants was 61.4 years (11.1) years. The age range was 29-95 years. Median duration of the disease from the time of diagnosis was five years (interquartiles of 2-8yrs). Sixty two percent of the participants were married and 75.1% of them had attended primary and secondary school. Sixty-seven percent of the study participants had some form of employment (Table1). The participants, who had been engaged in moderate to heavy physical activities before their diagnoses, were 88% while 41.8% of the participants reported arthritic problems in their parents or siblings (Table2).

Patterns of osteoarthritis of knee hip and hand

The prevalence of the knee, hip and hand OA was 9.6% (95% CI 8.4-10.9%). Of the 201 patients studied, 77% had knee OA, 15% hip OA, 3% hand OA and 5% had combined knee and hip OA, figure 3. Half of the participants with knee OA had bilateral knee joint involvement whereas 27.5% of the patients with hip OA had bilateral OA. Participants with knee OA were older (mean 62.1 years) than participants with hip OA (mean 59.8 years), P=0.309. The female to male ratio of patients with knee OA was 5.7:1 whereas the ratio for the hip OA was 2:1.

Obesity and osteoarthritis of knee, hip and hand

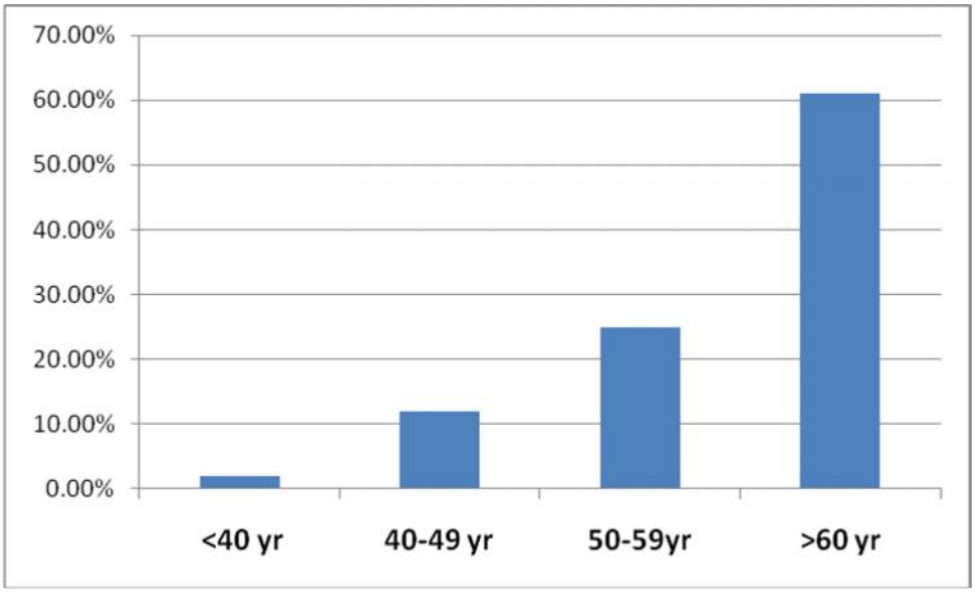
The obese participants were 41.0% while 32.0% were overweight, figure 4. Obese participants were more likely to be women than overweight and normal weight participants. The mean body mass index of patients with knee OA was 29.8kg/M^2 whereas that for hip OA was 24.5Kg/M^2 P <0.001. Obesity was more prevalent in participants with knee OA (45.3%) than in patients with hip OA (10.3%) P <0.001 Table 2.

There were 89 (44.3%) patients with bilateral disease and 112(55.7%) patients had unilateral OA.The prevalence of bilateral OA was higher in obese (52.4%) and overweight (44.6%) participants than in participants with normal weight (26.5%) P value 0.007 figure 5.

Table 1: Socio-demographic characteristics of study subjects (N:201)

Variable	**Frequency (%)**
Age	
Mean (SD)	61.4 (11.1)
Min-max	29-95
Gender	
Male	36 (17.9)
Female	165 (82.1)
Marital status	
Married	133 (66.2)
Single	7 (3.5)
Widowed	48 (23.9)
Divorced	13 (6.5)
Employment	
Unemployed	26 (12.9)
Employed	41 (20.4)
Self-employed	95 (47.3)
Retired	39 (19.4)
Education	
Primary	85 (42.3)
Secondary	66 (32.8)
College	22 (10.9)
None	28 (13.9)
Smoking	
Smoker	2 (1.0)
Nonsmoker	199 (99.0)

Figure 2: The Age Distribution of the Participants



N: 201

Figure 3: Distribution of joint diseases in 201 OA patients

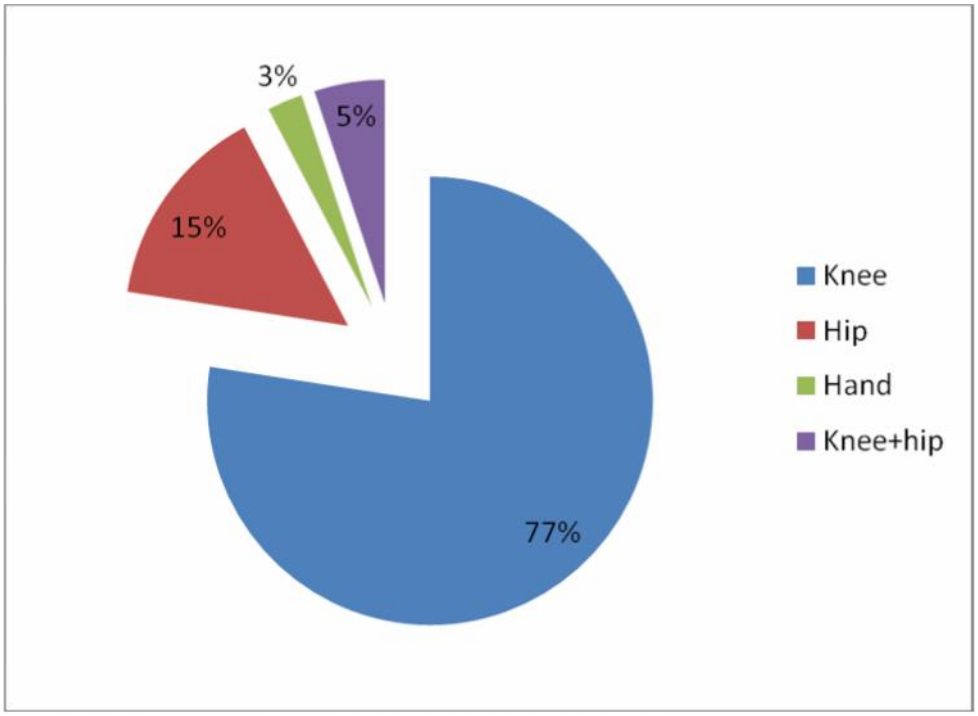
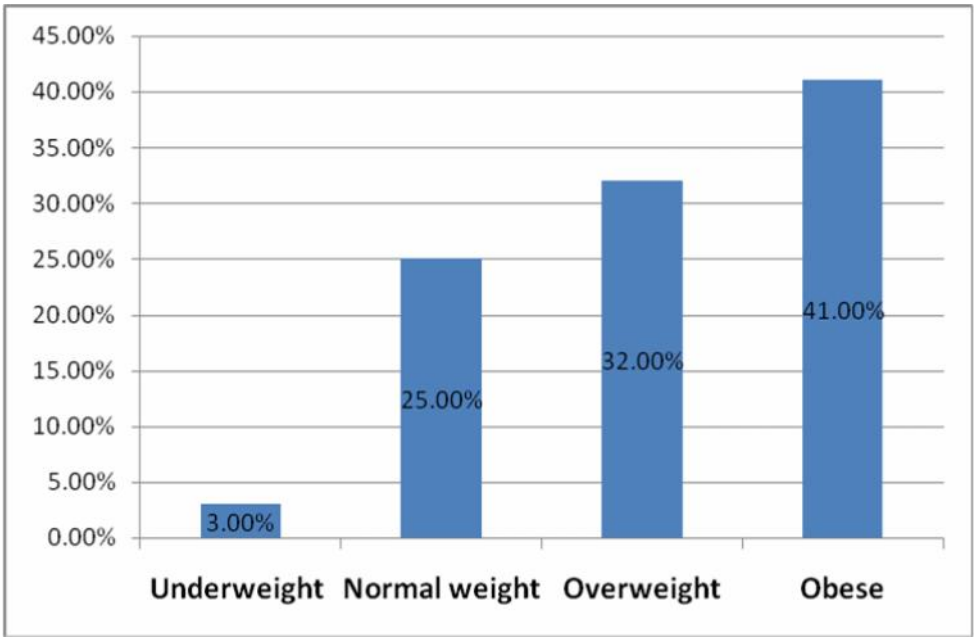


Figure 4: BMI distribution of the participants with OA



No: 201

Figure 5: Comparison of BMI distribution in cases of unilateral and bilateral OA

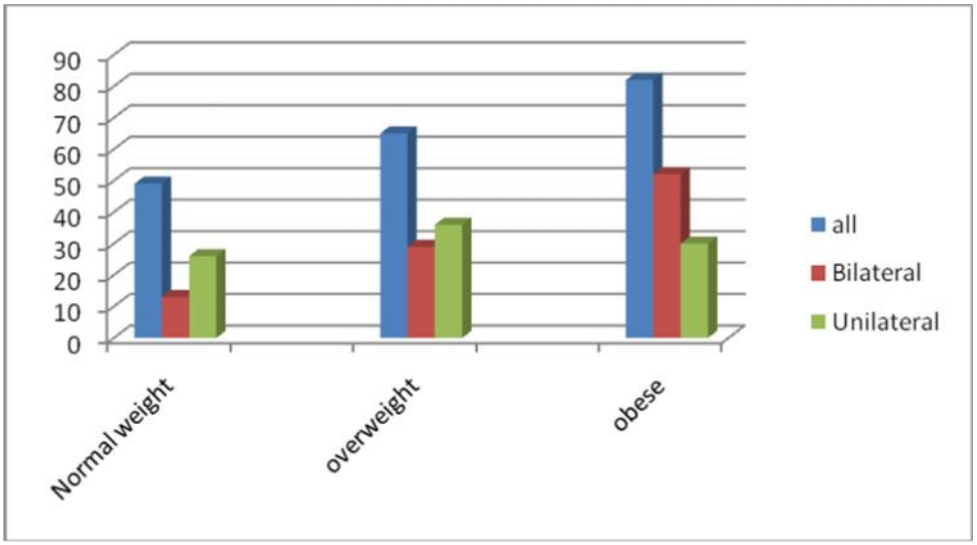


Table 2: Distribution of variables according to knee and hip OA

Variable	Knee	Hip	OR (95% CI)	P value
Age	62.1 (10.3)	59.8 (13.6)	-	0.309
Sex				
Male	21 (13.9%)	10 (34.5%)	1.0	
Female	130 (86.1%)	19 (65.5%)	3.3 (1.3-8.0)	0.013
Smoking				
Smoker	2 (1.4%)	0 (0.0%)	-	1.000
Nonsmoker	139 (98.6%)	29 (100.0%)		
Family history				
Yes	57 (37.7%)	2 (6.9%)	8.2 (1.9-35.7)	0.001
No	94 (62.3%)	27 (93.1%)	1.0	
Physical activity				
Light	16 (10.6%)	3 (10.3%)	1.0	
Moderate	93 (61.6%)	19 (65.5%)	1.0 (0.3-3.8)	0.991
Heavy	42 (27.8%)	7 (24.1%	1.1 (0.3-4.9)	0.875
BMI				
Normal	31 (20.7%)	17 (58.6%)		
Underweight	1 (0.7%)	2 (6.9%)	0.3 (0.0-3.2)	0.305
Overweight	50 (33.3%)	7 (24.1%)	3.9 (1.5-10.5)	0.007
Obese	68 (45.3%)	3 (10.3%)	12.4 (3.4-45.6)	<0.001

Discussion

Magnitude of OA

Studies on magnitude of OA in sub-Saharan Africa are limited. However, there are few studies which evaluated the spectrum of rheumatic diseases in the region. In Kenya, one study set out to assess the extent of rheumatic diseases(29). No study in Kenya directly looked at the magnitude of OA in hospital settings. This cross-sectional descriptive study is the first of its kind to shed a light on some of the characteristics of OA, specifically knee, hip and hand OA, in rheumatology and orthopedic outpatient clinics of single referral hospital in Kenya, Kenyatta National Hospital.

Our sample population was middle-aged and elderly, predominantly females and literate with majority of them having formal education. The findings of our study suggest that the prevalence of knee, hip and hand OA is approximately 9.6% among the rheumatic diseases encountered in Kenyatta national hospital rheumatology and orthopedic clinics. The prevalence figures reported for OA varies from 8.9-40%.

Oniankitan et al looked at the prevalence and topographic patterns of OA in Togo and screened the medical records of 12251 in a retrospective study(27). Among the screened files, he found 1085 patients (8.9%) had appendicular OA. His study sample mean age was 50 years at onset of the disease with a mean duration of 4.4 years. In his study, knee OA was the most common site (91%) with 85% of knee OA patients being females. The mean age of our study participants was 61 years (SD 11). Majority of our patients had knee OA (77%) with most of them being females and median duration of the disease for five years. In contrast to our study findings, Oniankitan's patients were younger and the proportion with knee OA was higher. Possible explanation for this difference is that, his study included both primary and secondary OA.

Singwe-Ngandeu al examined the spectrum of rheumatic diseases in 12494 patients attending a general hospital in Cameroon(26). He found that 536 (9.4%) patients had rheumatic disease. Around 20.5% of patients with rheumatic disease had OA. Apart from the knee and hip, the other osteoarthritic joints studied were wrist, metacarpo-phalangeal, shoulder and ankle. OA in these joints was mainly secondary.

Oyoo O looked at the extent of rheumatic diseases in a rheumatology clinic in Nairobi by examining 767 patients with musculoskeletal complaints. He found that 40% of them had OA. Majority of the patients were females (67%). The discrepancy in reporting different figures of prevalence of the disease lies in methodology employed by the different studies. For example, in our study, we included the patients who had only primary OA of specific joints. Other studies included both primary and secondary OA. The least affected joint was hand (3%). This low prevalence figures were also reported in other studies from Africa(28). This is in contrast to the studies from Europe and America where higher rates of hand OA was reported. C Janet et al (55)studied 500 patients with symptomatic limb OA. They had a total of 847 affected joints. The most commonly involved were knee and hand (41.2% and 30% respectively). The reason for this difference could be attributed to the fact that radiographic hand OA is much more common than the symptomatic disease. In our study the traditional format was used to make the diagnosis of hand OA. This format is purely clinical and for the diagnosis of symptomatic hand AO.

Our study demonstrated that up to 41% of the participants reported family history of arthritic problems. The available evidence suggests OA has a genetic component which modestly contributes to the development of the disease. The development in molecular biology led to this kind of discovery. The genetic influence is usually reflected in the disease running in certain

clusters of families. Figures ranging between 20% to 65% of family history of the disease were reported in several studies(56),(33),(19).

Obesity and Osteoarthritis

Obesity is a chronic metabolic disease that is increasing in prevalence. It poses serious risk for the development of many serious diseases including diabetes mellitus, hypertension, heart disease and musculoskeletal diseases. The evidence linking obesity to OA as a cause has been accumulating. The risk of developing knee or hip OA in subjects with overweight and obese has been reported in many studies. However the epidemiologic evidence was stronger for knee than hip OA. We observed high prevalence of overweight and obesity in this study (32.0% and 41.0% respectively) with a mean BMI of 29 Kg/M^2 (5.9). Forty four percent of the participants had bilateral disease. There was clear trend showing that bilateral OA increased from 26.5% in participants with normal weight to 52% in obese patients signifying that obese patients have higher risk of bilateral disease. Up to 45.3% of patients with knee OA were obese compared to only 10.3% of patients with hip OA.The findings are in accordance with what Sturmer et al reported in a cross-sectional study which looked at the association between obesity and OA of the knee and hip in a sample of 809 patients and found that 31% were obese and 46.4% were overweight. In his study, 85% of the patients had bilateral disease. The figures of bilateral OA were higher in his study due to the fact that he did x-ray of all the contralateral joints of the symptomic osteoarthritic joint. This high prevalence of overweight and obesity in knee and hip OA brought questions whether it is a causal or consequence. However, there is overwhelming evidence that obesity precedes the incidence of OA by so many years particularly the knee OA. There are many well-designed studies over the last three decades which have borne out a statistically significant link between obesity and OA occurrence. For example D Coggon et al, in

a population-based case control study in UK assessed the risk of knee OA attributable to obesity. He compared 525 patients with sex and age matched controls and found the odds ratio for developing OA was 0.1 (95% CI 0.0-0.5) with a BMI was less than 20 versus 13.6 (95% CI 5.1-36.2) when BMI was more than 36(57).

March and Bagga showed that the risk for knee OA increased by 36% for every 2 units of BMI (5 kg) of weight gain. BMI of more than 30 Kg/M^2 increased the risk for knee OA approximately20-fold. Although these studies show that OA of knee is consistently related to obesity, there have been conflicting results regarding the relationship of body weight to the development of OA of the hip. For example, Cooper and colleagues conducted a study on 611 patients (210 men, 401 women) and matched them with case controls. The enrolled patients were on waiting lists for total hip arthroplasties. Patients with BMI of more than 28 had 1.7 increased fold for developing hip OA compared to those with BMI of less than 24.5(59).Cooper and colleagues concluded that obesity and hip injury are important risk factors for OA that might be amenable to primary prevention. However, Spector and Tepper and Hochberg did not find any relationship between body weight or body mass index and the occurrence of hip OA. Saville and Dickson found no difference in the average body weight of patients with primary or secondary OA of the hip compared with control subjects.

The role of weight loss

Given that weight gain is associated with increased OA incidence, weight loss should lead to reduction in incidence of OA. Coggon and colleagues, pointing to their research results, demonstrated that lowering BMI to the normal range (20-24.9) would reduce the number of OA

cases by more than 50%(57). In addition, reducing the weight by 5 kg or until the BMI was within the recommended normal range, 24% of surgical cases of knee OA might be avoided.

Felson cited the Framingham OA Study(58), which concluded that a loss of 5 kg reduced OA risk by more than 50%; also in that study, a weight loss of 1 reference BMI range reduced male symptomatic knee OA by 21.4% and overall female knee OA by 33%.

Messier and colleagues found that a weight loss of 5% over 18 months in obese adults with knee OA resulted in an 18% improvement in function alone and in a 24% improvement in function when exercise was added. Last, according to a review by Gelber, hip OA would decrease by 25% if obesity were eliminated.

Our study has several limitations. First, we may have underestimated the magnitude of OA. We focused on the primary OA of specific joints. Secondly, our sample population is from a tertiary health care facility may not truly reflect the magnitude of the disease in this setting.

Conclusion

Osteoarthritis is a prevalent rheumatic disease. Obesity is a major risk factor for OA not only in terms of incidence and progression, but it is also a modifiable risk factor. In this descriptive study, we report high prevalence figures of overweight and obesity in our sample population living with OA. As the patient's life expectancy improves and epidemic obesity continues to grow, the prevalence of OA will continue to rise. The disability associated with the disease and difficulty in accessing the modalities of treatment including surgery and the associated costs makes its prevention of paramount.

Recommendations

From our study findings, we do recommend primary and secondary prevention programs aimed at reducing obesity. Secondly, we recommend studies to assess the impact of weight reduction in patients with OA. Finally, we need programs aimed at decreasing childhood obesity and therefore preventing obese children from becoming obese adults.

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Appendices

Appendix 1: Diagnostic Criteria for knee osteoarthritis

Clinical and laboratory	Clinical and radiographic	Clinical
Knee pain +	Knee pain +	Knee pain +
At least 5 of 9:	At least 1 of 3	At least 3 of 6
1. Age >50 years	1. Age > 50 years	1. Age > 50 years.
2. Stiffness <30 minutes	2. Stiffness < 30 minutes.	2. Stiffness < 30 minutes.
3. Crepitus	3. Crepitus.	3. Crepitus.
4. Bony tenderness	+	4. Bony tenderness.
5. Bony enlargement	Osteophytes	5. Bony enlargement.
6. No palpable warmth		6. No palpable warmth.
7. ESR <40mm/hour		
8. RF<1:40		
9. SF OA		
	91% sensitive	
92% sensitive	86% specific	95% sensitive
75% specific		69% sensitive

ESR: Erythrocyte sedimentation rate, RF: Rheumatoid factor, SF OA synovial fluid signs of OA (clear, viscous or WBC < 2000 cells/mm3).

Appendix 2: Diagnostic Criteria for hip osteoarthritis

Combined clinical and radiographic classification criteria for Osteoarthritis of the hip

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Hip pain

and

At least 2 of the following 3 features

1. ESR < 20 mm/hour.
2. Radiographic femoral or acetabular osteophytes.
3. Radiographic joint space narrowing (superior, axial, and/or medial)

This classification method yields a sensitivity of 89% and a specificity of 91%.

Appendix 3: Diagnostic Criteria for hand osteoarthritis

Classification criteria for osteoarthritis of the hand, traditional format

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Hand pain, aching, or stiffness

and

3 or 4 of the following features

1. Hard tissue enlargement of 2 or more of 10 selected joints.
2. Hard tissue enlargement of 2 or more DIP joints.
3. Fewer than 3 swollen MCP joints.

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4. Deformity of at least 1 of 10 selected joints.

The 10 selected joints are the second and third distal interphalangeal (DIP), the second and third proximal interphalangeal and the first carpometacarpal joints of both hands. This classification method yields a sensitivity of 94% and specificity of 87%.

Appendix 4: Study proforma

I. Sociodemographics data

A. Serial number ☐

B. Age ☐

C. Sex female ☐ male ☐

D. Marital status

Married ☐ Single ☐ Widowed ☐ Divorced ☐

E. Current status of employment

Unemployed ☐ employed ☐ self-employed ☐ retired ☐

F. Level of formal education

Primary ☐ secondary ☐ college ☐ none ☐

G. Smoking Smoker ☐ Nonsmoker ☐

Smoker: no of sticks/day ☐ number of years/ pack years ☐

Former smoker:

Number of yrs of abstinence ☐ pack years ☐

II. Medical History/Physical Examination

A. Duration of the OA

Month ☐ year ☐

B. Family history

Yes ☐ No ☐

a. Parental of OA yes ☐ No ☐

b. Sibling history Yes ☐ No ☐

C. Physical activity category

a. Light intensity ☐

b. Moderate ☐

c. Heavy ☐

III. Physical Examination

A. Vital signs

BP 1st ☐ 2nd ☐ average ☐ PR ☐

Temp ☐ RR ☐

B. Anthropometrics

Weight ☐ Height ☐ BMI ☐

IV. Disease patterns

A. Joint involvement

Knee ☐ hip ☐ hand ☐

Knee Bilateral ☐ Hip bilateral ☐ Generalized ☐

B. **Musculoskeletal examination and history (ACR criteria for OA of specific joints)**

I. Knee joint

Knee pain yes ☐ No ☐

1. Age more than 50 yrs yes ☐ No ☐
2. Stiffness of less than 30 minutes yes ☐ No ☐
3. Crepitus on active motion yes ☐ No ☐

4. Radiographic findings

Evidence of osteophytes Yes ☐ No ☐

II. Hand joint

Hand pain, aching or stiffness: yes ☐ No ☐

a. Hard tissue enlargement of 2 or more of the selected joints.

Yes ☐ No ☐

b. Hard tissue enlargement of 2 or more DIP joints.

Yes ☐ No ☐

c. Fewer than 3 swollen metacarpo-phalangeal joints.

Yes ☐ No ☐

d. Deformity of at least 1 of the selected joints.

Yes ☐ No ☐

III. Hip OA

a. Hip pain in the most of the days of the prior month before the diagnosis

Yes ☐ No ☐

b. Radiographic evidence of

- Acetabular Osteophytes yes ☐ No ☐
- Femoral osteophytes yes ☐ No ☐
- Joint space narrowing yes ☐ No ☐

c. ESR of less than 20 mm/hour Yes ☐ No ☐

The 10 selected joints are the second and third distal interphalangeal (DIP), the second and third proximal interphalangeal and the first carpometacarpal joints of both hands.

Appendix 5: Physical activities

Light intensity category or equivalent

- Standing
- Ironing
- Leisurely walking.

Moderate category or equivalent

- Lifting or carrying light objects
- Sweeping/mopping/vacuuming
- Brisk walking.

Heavy activities or equivalent

- Lifting or carrying objects greater than five pounds,
- Mowing with a nonpower mower
- Gardening with heavy tools
- Shoveling
- Digging
- Chopping wood, brisk cycling, and other strenuous sports or recreation.

Appendix 6: Consent explanation

Introduction

This research study is being conducted by Dr Abdirahman Nour at the Kenyatta National Hospital to describe the magnitude of osteoarthritis in KNH. The study is looking at how common this disease is in patients attending KNH orthopedic and rheumatology clinic; which joints are commonly affected; the sex distribution and body mass indices of the patients living with the disease.

Procedures

You will be asked to complete a questionnaire. The questionnaire consists of about 12 questions and will take approximately 10 minutes. Questions will include details about your age, gender and disease duration. Then you will be physically examined, particularly on your affected joints. Your weight and height will be taken and your blood pressure will be measured. If you have hip disease (OA), 2 milliliters of blood will be removed from your anticubital fossa for analysis.

Risks/Discomforts

There are minimal risks for participation in this study. However, you may feel a bit of pain on removing 2 mls of blood from your hand.

Benefits

There are no direct benefits to subjects. However, it is hoped that your participation will help researchers learn more about the magnitude of this disease in KNH and hence for a better guidelines on its management.

Confidentiality

All information provided will remain confidential and will only be reported as group data with no identifying information. All data, including questionnaires will be kept in a secure location and only those directly involved with the research will have access to them. After the research is completed, the questionnaires will be destroyed.

Compensation

Participants will not receive any monetary compensation for participating in the study.

Participation

Participation in this research study is voluntary. You have the right to withdraw at anytime or refuse to participate entirely without any fear of victimization.

Questions about the Research

If you have questions regarding this study, you may contact Dr AbdirahmanNour call 0722311273 or email: abdirahmanduso@hotmail.com

Appendix 7: Consent form

Study number…… Sex……

Name…… Age...……

I……hereby consent to take part in this research study **Patterns of Knee, Hip and Hand Osteoarthritis in KNH.**

The nature of this study has been explained to me by Dr. Abdirahman /his assistant. I have been assured that participation in this study is voluntary and will not negatively affect my medical care, and that any information obtained will be treated as confidential.

Signed/thumbprint……..

On this day and date……..

Witness…….

Date……

Investigator's Statement

I, the investigator, have provided an explanation on the purpose and implications of the above research study to the participant.

Signed…….

On this day and date…….