

The Prevalence and demographic factors of knee osteoarthritis in the Bozidun pastoral area of Xinjiang

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Abstract

Osteoarthritis is a major musculoskeletal diseases cause of disability in the middle-aged and older populations around the world. The prevalence of osteoarthritis was associated with factors such as genetic factors, living environment, and dietary habits. Xinjiang is the second largest pastoral region in China. The purpose of this study was to determine the prevalence of symptomatic knee OA in Bozidun Kirgiz township, Bozidun pastoral area, Xinjiang, in order to understand the risk factors that influence the onset and progression of knee OA in this location. This is a cross-sectional survey study conducted from November 11, 2020 to November 26, 2020 in Bozidun Kirgiz Township, Bozidun Pastoral Area, Aksu City, Xinjiang Uygur Autonomous Region. All residents of nine villages were surveyed, and a total of 2,138 people were included. The prevalence of knee OA was 23.1%, and the prevalence of KOA increased with age. The prevalence of OA increased significantly after the age of 40. Logistic regression analysis, female, advanced age, coronary heart disease, hypertension, pastoralism and previous history of fracture were independent risk factors for knee OA. The overall prevalence of knee OA in the pastoral areas of Xinjiang is significantly higher than in other provinces of China, with an increasing trend in prevalence with age and a higher prevalence in females than in males, where factors such as age, female, obesity and farmers may be related to the onset of knee OA.

1. Introduction

Osteoarthritis (OA) is one of the most common musculoskeletal diseases and a major cause of disability in the middle-aged and older populations around the world. It is estimated that approximately 250 million people worldwide suffer from knee OA^[1]. The prevalence of OA is associated with genetic factors, living environment and dietary habits. The prevalence of OA of the hand, knee, and hip in Europe and the United States is not significantly different^[2]. The prevalence of radiographic and symptomatic hand osteoarthritis and radiographic hip osteoarthritis was lower in Chinese compared to Caucasians^[3-4]. However, the prevalence of radiographic knee OA in Chinese men is similar to that of white men, while the prevalence of osteoarthritis of the knee appears to be higher in Chinese women than in other populations^[5-6]. With a population of 1.4 billion, the prevalence of OA varies between regions due to the level of socioeconomic development, environmental factors, lifestyle factors and health care utilisation of the population (7.0%), south-central China (7.8%) and north-western China (10.8%). Subjects living in the Southwest had the highest prevalence (13.7%), with higher prevalence^[7] in rural areas than in urban areas^[7].

Xinjiang is a multi-ethnic region in the heart of Asia and Europe, populated mostly by Han, Uyghur, Kazakh, and Kirgiz. Xinjiang is also the second largest pastoral region in China, with 11.5% of the workforce specialising in animal husbandry. However, there is a dearth of reports on the prevalence of knee OA in pastoral areas of Xinjiang, China. Therefore, the purpose of this study was to determine the prevalence of symptomatic knee OA in Bozidun Kirgiz township, Bozidun pastoral area, Xinjiang, in order to understand the risk factors that influence the onset and progression of knee OA in this location.

2. Methods

2.1 Participants

This is a cross-sectional survey study conducted from November 11, 2020 to November 26, 2020 in Bozidun Kirgiz Township, Bozidun Pastoral Area, Aksu City, Xinjiang Uygur Autonomous Region. All residents of nine villages were surveyed, and a total of 2,138 people were included. Inclusion criteria: age >18 years; permanent residence in Bozidun Pastoral Area; exclusion criteria: mobile population. A rheumatologist with experience in rheumatology administered questionnaires to the participating population and collected basic information on the patients including: age, gender, education level, smoking, alcohol consumption; joint symptoms, function, pain and trauma and past history (hypertension, diabetes, cardiovascular and cerebrovascular diseases, etc.). The study was approved by the ethics committee of the People's Hospital of Xinjiang Uygur Autonomous Region and all subjects signed an informed consent form. All methods were performed in accordance with relevant guidelines and regulations.

2.2. Measures

The American College of Rheumatology (ACR) 1995 criteria for **diagnosis and** treatment were used. Knee osteoarthritis (KOA) classification criteria (clinical criteria). Definition of risk factors age stratification (18-30, 31-40, 41-50, 51-60, ≥ 61); BMI [low weight (<18.5), normal (18.5 to 23.9), overweight (24 to 28), obese (>28)]; Education (illiterate, primary, middle, high school, high school and above); smoking (never, ever, always); alcohol consumption (never, ever, always);

2.3. Statistics analysis

SPSS 26.0 statistical software was used and Kolmogorov-Smirnov test for normality was applied to the measurement data, and all data were expressed using average \pm SD, if normally distributed; the count data were expressed as examples (%). Two groups of normally distributed measures were compared using the independent samples t-test, and two groups of non-normally distributed measures were compared using the two independent samples rank sum test; logistic regression was used to analyse risk factors. $p < 0.05$ was considered a statistically significant difference.

3. Results

3.1 Prevalence of Osteoarthritis

A total of 2138 villagers were surveyed in this project, including 978 males with a mean age of 46.9 ± 13.9 and 1160 females with a mean age of 45.7 ± 13.0 . The ethnic groups were mainly Uyghur 1333 (62.3%), Kirgiz 721 (33.7%) and other 84 (4.0%) (Table 1). The prevalence of knee OA was 23.1 % (females are higher than males 20.8% was male and 25% was woman), and the prevalence of KOA increased with age. The prevalence of OA increased significantly after the age of 40s (Table 2).

3.2 Factors associated with osteoarthritis

The patients in the KOA group were older (56.6 ± 10.5 vs. 43.2 ± 12.7 years, $P < 0.001$) and BMI in the KOA group was significantly higher than that in the HC group. The patients with had a higher incidence of coronary heart disease (14.6% vs. 4.7%, $P < 0.001$), hyperlipidemia (7.5% vs. 3.3%, $P < 0.001$), hypertension (34.6% vs. 14.2%, $P < 0.001$), fractures (14.8% vs. 9.9%, $P < 0.001$). The osteoarthritis group had less education and worked mainly in Pastoralists . Smoking rates were lower in the osteoarthritis group than in the healthy controls (71.5% vs. 65.6%, $P < 0.001$), and alcohol consumption was lower in the KOA group than in the HC group (71.4% vs. 65.1%, $P < 0.001$). (Table 1)

Table 1

Demographic and clinical characteristics of the study population

Epidemiological features	KOA	HC	<i>P</i>
Gender (female)	58.8% (290/493)	52.8% (870/1645)	<0.05
Age	56.6±10.5	43.2±12.7	<0.001
Ethnicity			0.853
Uighur	61.5% (303/493)	62.7% (1030/1645)	
Kirghiz	34.4% (169/493)	33.5% (552/1645)	
Other	4.3% (21/493)	3.8% (63/1645)	
Past History			
Coronary heart disease	14.6% (72/493)	4.7% (77/1645)	<0.001
Hyperlipidemia	7.5% (36/493)	3.3% (55/1645)	<0.001
Hypertension	34.6% (171/493)	14.2% (234/1645)	<0.001
Cerebrovascular disease	2.8% (14/493)	11.3% (21/1645)	<0.05
Fractures	14.8% (74/493)	9.9% (161/1645)	<0.05
Diabetes	4.9% (23/493)	3.0% (50/1645)	0.081
Malignant tumours	0.2% (1/493)	0.1% (1/1645)	0.365
Fabric disease	9.5% (47/493)	8.3% (137/1645)	0.403
BMI			
Low weight	2.8% (14/493)	6.2% (102/1645)	<0.05
Normal	54.7% (270/493)	58.0% (954/1645)	
Overweight	27.4% (135/493)	25.7% (422/1645)	
Obesity	15.0% (74/493)	10.2% (167/1645)	
Smoking			
Never smoked	71.5% (351/493)	65.6% (1081/1645)	<0.001
Former smoker	7.5% (37/493)	3.0% (49/1645)	
Smoking all the time	21.1% (105/493)	31.4% (515/1645)	
Drinking			
Never drink alcohol	71.4% (352/493)	65.1% (1072/1645)	<0.001
Used to drink alcohol	13.6% (68/493)	5.8% (95/1645)	
Drinking all the time	14.8% (73/493)	28.8% (474/1645)	

Academic qualifications			
Illiterate	9.9% (49/493)	4.5% (74/1645)	<0.001
Primary Schools	56.5% (279/493)	31.5% (518/1645)	
Junior High School	29.0% (143/493)	51.9% (854/1645)	
High School	3.4% (17/493)	7.3% (120/1645)	
High School or above	1.0% (5/493)	4.8% (79/1645)	
Occupation			
Pastoralists	87.8% (433/493)	71.5% (1176/1645)	<0.001
Other	12.4% (61/493)	29.2% (480/1645)	

Table 2

Prevalence of osteoarthritis of the knee after adjustment for age and sex

Age	Subjects, n	Knee OA,%		
		M	F	ALL
18~ 30	261	0.0	0.7	0.4
31~ 40	534	3.4	5.0	4.3
41~ 50	568	15.6	27.7	22.4
51~ 60	426	39	42.9	41.1
≥61	349	43.6	52.4	47.9
ALL	2138	20.8	25	23.1

3.3 Risk factors for knee osteoarthritis

The variables of age, female, BMI, pastoralism, smoking and alcohol consumption were included in separate one-way logistic regressions showing that female age, BMI, cardiovascular disease, hyperlipidemia, hypertension, cerebrovascular disease, fracture, smoking, alcohol consumption and pastoralism were all associated with knee OA, but after multi-factor logistic regression analysis, female (OR: 1.547, 95% CI: 1.072–2.234, P<0.05), advanced age (OR: 7.493, 95% CI: 5.627–9.976, P<0.001), coronary heart disease (OR: 1.639, 95% CI: 1.121–2.396, P<0.05), hypertension (OR: 1.457, 95% CI: 1.117 – 1.900, P<0.005), pastoralism (OR: 1.436, 95% CI: 1.041–1.982, P<0.05) and previous history of fracture (OR: 1.695, 95% CI: 1.203–2.389, P<0.05) were independent risk factors for knee OA (Table 3).

Table 3

The risk factors for knee osteoarthritis

Variables	Single factor			Multi-factor			4. Di sc us si on OA has
	OR	(OR 95% CI)	<i>P</i>	OR	(OR 95% CI)	<i>P</i>	
Women	1.273	1.038, 1.560	0.020	1.547	1.072, 2.234	0.020	
Age (>45)	9.159	6.999, 11.984	0.000	7.493	5.627, 9.976	0.000	
BMI							
BMI (18.5 ~ 23.9)	2.062	1.161, 3.663	0.014	2.151	1,161, 3.988	0.015	
BMI (24 ~ 27.9)	2.331	1.290, 4.210	0.005	1.944	1.030, 3,667	0.040	
BMI(28~)	3.228	1.733, 6.014	0.000	2.078	1.060, 4.071	0.033	
Coronary heart disease	3.483	2,482, 4.887	0.000	1.639	1.121, 2.396	0.011	
Hyperlipidemia	2.277	1.477, 3.511	0.000	1.228	0.752, 2.005	0.411	
Hypertension	3.202	2.541, 4.036	0.000	1.457	1.117, 1.900	0.005	
Cerebrovascular disease	2.260	1.141, 4.479	0.019	0.949	0.445, 2.023	0.892	
Diabetes	1.561	0.943, 2.585	0.084				
Fractures	1.628	1.211, 2.188	0.001	1.695	1.203, 2.389	0.003	
Smoking	0.775	0.622, 0.966	0.023	1.080	0.741, 1.574	0.688	
Drinking	0.755	0.606, 0.942	0.013	0.991	0.675, 1.456	0.964	
Pastoralists	2.878	2.153, 3.848	0.000	1.436	1.041, 1.982	0.027	

become a major public health challenge, and with the increasing ageing of the global population, this burden is gradually increasing, especially among women^[8]. The present study showed that the prevalence of knee OA in pastoralist areas of Xinjiang was 23.1%, significantly higher than in other regions of China. This may be associated with long-term exposure to kneeling or squatting and climbing in patients living in pastoralist areas. Verbeek et al. conducted a meta-analysis of case-control studies of osteoarthritis of the knee and found that exposure to kneeling or squatting, lifting and climbing all had an elevated risk, with a dominance ratio between 1.4 and 1.7^[9]. The pathogenesis of osteoarthritis of the knee in relation to work is not clear, but studies have shown that high knee flexion increases the risk of meniscal damage, which further increases the risk of knee OA^[10]. Herders in Xinjiang's pastoral areas graze their livestock between 1500-3600m above sea level for long periods of time and mainly engage in activities such as kneeling, squatting and climbing, which may be the main reason for the high prevalence of OA in herders.

Previous studies have shown that age is a major risk factor for OA pairs^[11-12]. The present study also confirms this finding. The prevalence of knee OA increases progressively with age, especially after 40, and is significantly higher in women than in men, although the exact pathogenesis is not known. The increase in adiposity and associated metabolic changes with age can lead to age-related inflammation, a chronic low-grade systemic pro-inflammatory state. Previous studies have shown that osteoarthritis is associated with low-grade systemic and local inflammation, so the chronic low-grade systemic pro-inflammatory state caused by ageing may be involved in the development of osteoarthritis^[13-15]. In addition, age-related changes in cellular functions such as: mitochondrial function, ROS levels and alterations in energy metabolism may be involved in the development of OA by interfering with cellular signaling and function^[16]. Therefore, further research into the mechanisms of ageing and OA and the development of targeted intervention programmes may help to delay or prevent the onset of OA.

Women have also been recognised as a risk factor for knee OA. The present study also shows that women are an independent risk factor for knee OA, but the underlying mechanisms are unclear. Although the association of oestrogen with osteoarthritis was proposed as early as 1925, there is currently controversy regarding the association of oestrogen with osteoarthritis. Some studies have suggested that oestrogen can inhibit type II collagen catabolism, enhance glycosaminoglycan synthesis, antioxidant effects and reduce metalloproteinase synthesis involved in cartilage protection^[17-19], while other studies have shown that oestrogen has the potential to increase chondrocyte apoptosis through other studies suggest that estrogen is involved in the development of osteoarthritis by increasing chondrocyte apoptosis, inhibiting proteoglycan synthesis, increasing pro-inflammatory factors, and increasing metalloproteinase synthesis and cartilage destruction^[20-25].

The present study shows that BMI is an independent risk factor for knee OA, which is consistent with the findings of previous studies^[26-27]. It is now generally accepted that obesity is associated with the development of knee OA and that increased abnormal loading of weight-bearing joints is a major factor in the progression of knee OA, and a recent population-based cohort study conducted in the Netherlands also showed that obesity-related mechanical stress is the most important risk factor for osteoarthritis of the knee^[28]. Obesity can also be involved in the pathogenesis of OA through inflammatory pathways. Studies on the etiology of obesity-associated arthritis in animal models generally agree that inflammation is the main cause of obesity-associated arthritis, and Larranaga Vera A et al showed that high fat diet induced synovial lipodystrophy increased synovitis in osteoarthritis in mice^[29-31]. A homogeneous diet with a high intake of meat products and high calorie intake in Xinjiang pastoral areas may contribute to the high prevalence of knee OA.

In addition to the above factors, coronary heart disease and hypertension were found to be independent risk factors for knee OA in this study. Up to now some studies have suggested an association between OA and atherosclerosis-related diseases, and some common co-pathogenesis of osteoarthritis and cardiovascular disease, such as fat metabolism and the innate immune system have been suggested^[32]. A meta-analysis showed that one or more of these co-morbidities or other chronic diseases, such as

diabetes or cardiovascular disease, predicted a worse prognosis for OA^[33]. However, the exact mechanisms need to be further explored.

The effects of smoking and alcohol consumption on knee OA have been controversial. Some studies have shown that smoking prevents the development of osteoarthritis and reduces chondrocyte catabolism when nicotine concentrations are close to those of smokers, thus suggesting that smoking may have a protective role in the development of OA^[34-36], but some studies have concluded that smoking is not relevant in osteoarthritis of the knee^[37]. Some studies have suggested that alcohol consumption is a protective factor for osteoarthritis of the knee^[38-39]. However, some clinical studies have found a significant association between excessive alcohol consumption and OA, while low and moderate alcohol consumption is not associated with the development of knee OA^[40]. This study did not find a correlation between smoking and alcohol consumption and knee OA. This may be related to the low prevalence of smoking and alcohol consumption in the local population, and the fact that smoking and alcohol consumption were not quantified in this study may lead to some discrepancies in the findings.

Limitations of the current study: this is a cross-sectional study and cannot show the causal link between influencing factors and the disease; secondly, this survey was only conducted in Bozidun Township, Xinjiang region, and a large scale survey study is still needed to investigate the overall disease situation and its influencing factors in other pastoral areas of Xinjiang.

It is clear from this survey that the overall prevalence of knee OA in the pastoral areas of Xinjiang is significantly higher than in other provinces of China, with an increasing trend in prevalence with age and a higher prevalence in females than in males, where factors such as age, female, obesity and pastoralists may be related to the onset of knee OA.

Declarations

Data availability

The datasets associated with the current study are not publicly available but is provided by the corresponding author on reasonable request only.

Declaration of Competing Interest

The authors declare that they have no conflicting financial interests.

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Author contributions

LW and JS designed the report. XW, ZL, MM, YF, YS, XM, CY, JK, QW, GZ, YW and JD collected the clinical data. LW contributed to revising the manuscript. XW wrote the manuscript and data analysis. All authors contributed to the article and approved the submitted version.

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