Original Research Article

Socioeconomic Factors and Risk of Knee Osteoarthritis: A Case-Control Study

Altine Aliyu Nuradeen[1*], Abdulrasheed Bello Aliyu[2]

[1]Department of Orthopaedics and Trauma, Usmanu Danfodio University Teaching Hospital, Sokoto, Nigeria
[2]Department of Immunisation and Disease Surveillance, World Health Organisations (WHO), Kaduna, Nigeria

*Corresponding author: Abdulrasheed Bello Aliyu
Department of Orthopaedics and Trauma, Usmanu Danfodio University Teaching Hospital, Sokoto, Nigeria

Abstract

Background: The risk factor for knee osteoarthritis (knee OA) is multifactorial. Socioeconomic status is a risk factor that is commonly underreported. The study aims to find the relationship between socio-economic factors and knee OA, and the influence of these on gender. ***Methods***: This is a case-control study conducted at Orthopaedic Hospital Wamakko, Sokoto, North-Western Nigeria between January 2022 and December 2022. Adult patients aged >40 years with knee OA were included in the study. The data was collected via participants' interviews through a self-administered questionnaire. The risk factors for knee OA under consideration were occupation, educational level, and monthly income. Data were analysed using the SPSS version 23. The significant level was set at less than 5%. ***Results***: There were a total of 372 patients in the study, with 124 cases and 248 controls in a ratio of 1:2. The average age was 53.7±10.8 (range 40 to 88 years). There were 165(44.4%) males and 207(55.6%) females. For occupation, 201(53.7%) were unemployed, 60(16%) on business, 61(16.3%) were civil servants and 50(13.4%) worked as farmers. For education, 250(66.8%) had non-formal education, and 122(32.6%) had formal education. Most patients (237/57.8%) were high-income earners and 135 (41.7%) were low-income earners. The knee OA prevalence was 13.17% for males and 20.16% for females. In the case group, the majority were unemployed with 63 (50.8%) patients and the least were farmers with only 16 (12.9%). Non-formal education was the most common educational level among the cases with 89(71.8%), and low-income earners are also more common with 74(59.7%) compared with high-income earners with 61 (40.3%). There was a statistically significance result between socioeconomic status and knee OA (OR=0.334, CI=0.214-0.521, and P<0.0001). The odd ratio (OR) for low-income earners among females is 2.238 (CI=1.878-2.666) and p value<0.0001. The OR for non-formal education in low-income earners is 2.332 (CI=1.466-3.709) and p value<0.0001. ***Conclusion***: Low-income level was the most important predictor of knee OA in the study, and the female gender has the lowest income with higher knee OA risk and prevalence
Keywords: Socioeconomic factors, knee osteoarthritis, Income level, case-control study, gender income.

INTRODUCTION

The most common form of joint disease is osteoarthritis (OA) and it is associated with a high economic burden right from the onset of the disease process through the course of its management [1]. This burden arose from the effects of disability, associated comorbidities, and the high cost of treatment [1, 2]. A population-based study reported approximately 31 million adults which constitutes at least 13% of the adult population in the United States (US), were affected [3]. Although it has fewer effects on quality of life and per capita expenditures compared to Rheumatoid arthritis, the high prevalence of OA makes it a more costly disease with the need for more individual and organisational spending [4]. Among the various OA diseases, Knee

osteoarthritis (knee OA) remains the most common, particularly among the working class and ageing population. This further contributed to an increase in direct and indirect per capita costs in the management of this chronic debilitating disease [5].

There are various reported predisposing factors to knee OA, and among them are age, sex, genetic factors, exercise, trauma, obesity, occupation, and local knee factors. Other than these factors, socioeconomic factors such as educational level, occupation and income have been directly and indirectly linked to knee OA cause and management [6]. They are the factors that may inform individuals and society on adopting preventive measures for knee OA through full utilisation of health educational programmes and affordable financial means

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to better alter the course of knee OA disease and its management to reduce the severity of complications and improve the quality of life [7].

The 3 components of household income, education, and occupation being examined to assess Socioeconomic status (SES) are occasionally not directly proportional. For instance, one might be non-educated but may earn high from his business or farming work; conversely, the non-educated rich individual may not have the desirable healthy lifestyle needed for the prevention and management of a disease. All these factors have great influence on the aetiology and prevalence of knee OA but the one with the most impact on the severity and prevalence of the disease is yet to be popularly reported.

Incidence and prevalence of disease are often affected by factors such as age, sex, geographical location and economic level [8]. Knee OA prevalence is well known to increase with increasing age [9]. Furthermore, recent and past studies showed a higher prevalence of Joint and bone problems including osteoporosis and knee OA among females than in males [10]. However, it is still not clear whether true sex difference exists in terms of income and its influence on disease occurrence, disease course and its management.

The presence of an ageing population and the rise in the number of obese individuals have contributed to the escalating prevalence of knee OA [11, 12]. The high expenditure in the treatment of knee OA is mostly related to the cost allocated to medications, and surgeries mainly in the form of total knee replacement and continuous rehabilitation [13].

With all these economic burdens associated with knee OA disease prevalence in society, the role of socioeconomic factors in the aetiology and management of knee OA cannot be overemphasised. This global issue affects every society in both developed and underdeveloped nations. It is however; more pronounced in the underdeveloped world where the health system is still operating sub-optimally and the poverty level is widespread with a consequence of lack of quality healthcare service and increased disease burden. Furthermore, socioeconomic factors associated with knee OA have been shown to be the least reported factors in knee OA from a scoping literature review [14].

It is on this background that this case-control study on the relationship between socioeconomic factors and the risk of knee osteoarthritis measured by the three variables of educational level, income level, and occupation was conducted. The study also examined which among the 3 sub-factors has the greatest impact on knee OA and its prevalence, and the relationship between income, gender and knee OA.

MATERIALS AND METHODS

A case-control study was conducted at Orthopaedic Hospital Wamakko, a major referral centre in Sokoto, North-Western Nigeria between January 2022 and December 2022. The ethical approval was secured from the Ministry of Health Sokoto with Ref no. SMH/1580/V.IV. The cases with knee OA and unmatched controls were randomly selected during clinic visits within the study period. Cases with knee OA were diagnosed using the American College of Rheumatology (ACR) criteria which include knee pain with at least three out of six criteria in the case group (15). The inclusion criteria were adult patients aged >40 years with knee OA, and the exclusion criteria were the presence of knee infection, post-peri-articular fracture and postoperative knees. The data collection was made via participants' interviews with the use of a reliable self-administered questionnaire. Questions regarding demographic features such as age, sex, occupation, address, marital status educational level, and monthly income were noted. Other associated risk factors for knee OA such as family history, exercise, smoking, and alcohol intake were also asked and noted down. This was followed by Knee joint clinical presentations and detail of radiological findings to identify and classify cases. The knee clinical examination focussed on the evidence of knee OA including knee deformity and the presence of previous scar.

The influencing factors for knee OA under consideration in this study were occupation, educational level, and monthly income. The occupation was classified as no occupation, business, civil servant and farmer; the education level was classified either as non-formal or formal; and monthly income as low income or high income; those with low income earned below $35 per month while those with high income earned above $35 per month. This was according to the Nigerian minimum wage salary and the dollar exchange rate at the time of data collection [16].

Data were analysed using the SPSS version 23. The categorical variables were presented in the form of frequency and percentages. Initially, univariate analysis was used to compute p-values through chi-square for the categorical variables and student t-test for the numerical variables. Then multivariate logistic regression model was used to assess the association between the various risk factors and knee OA. The independent association with the risk of the knee was considered positive if the exposure variables were significant at less than 5% significant level.

RESULTS

Tables 1 to 3 summarised the important findings of the results. There were a total of 372 patients in the study with 124 cases and 248 controls in a ratio of 1:2. The average age was 53.7±10.8 (range 40 to 88 years). There were 165(44.4%) males and 207(55.6%) females.

Among the patients, under occupation 201(53.7%) were unemployed, 60(16%) do business, 61(16.3%) were civil servants and 50(13.4%) worked as farmers. For education, 250(66.8%) had non-formal education, and 122(32.6%) had formal education. Most patients (237/57.8%) were high-income earners and 135 (41.7%) were low-income earners. The knee OA prevalence was 13.17% for males and 20.16% for females.

In the case group, the majority were unemployed with 63 (50.8%) patients and the least were farmers with only 16 (12.9%). Non-formal education was the most common educational level among the cases with 89(71.8%), and low-income earners are also more common with 74(59.7%) compared with high-income earners with 61 (40.3%) (Table 1 & 2).

There was a statistically significance result between socioeconomic status and knee OA (OR=0.334, CI=0.214-0.521, and $P<0.0001$). The odd ratio (OR) for low-income earners among females is 2.238 (CI=1.878-2.666) and p value<0.0001. The OR for non-formal education in low-income earners is 2.332 (CI=1.466-3.709) and p value<0.0001

Table 3 provides results for the logistics regression of the three socioeconomic factors taken into consideration in this study.

Table 1: Socio-demographic characteristics of the respondents

Variables	Patients' category n(%)		
	Cases	Control	Total
Age (years)			
40.00-49.00	50(35.2)	92(64.8)	142(100)
50.00-59.00	41(35.3)	75(64.7)	116(100)
60.00-69.00	20(27)	54(73)	74(100)
70.00-79.00	8(25.8)	23(74.2)	31(100)
80.00+	5(55.6)	4(44.4)	9(100)
Gender			
Female	49(29.7)	116(70.3)	165(100)
Male	75(36.2)	132(63.8)	207(100)
Ethic group			
Hausa/Fulani	116(33.2)	233(66.8)	349(100)
Others	8(34.8)	15(65.2)	23(100)
Occupation			
No occupation	63(31.3)	138(68.7)	201(100)
Business	26(43.3)	34(56.7)	60(100)
Civil servant	19(31.1)	42(68.9)	61(100)
Farmer	16(32)	34(68)	50(100)
Education			
Non-formal education	89(35.6)	161(64.4)	250(100)
Formal education	35(28.7)	87(71.3)	122(100)
Income (monthly $)			
Low Income	74(52.6)	61(47.4)	135(100)
High Income	50(23.1)	187(76.9)	237(100)
Marital status			
Married	104(31.9)	222(68.1)	326(100)
Single	17(42.5)	23(57.5)	40(100)
Divorced/Widowed	3(50)	3(50)	6(100)

Table 2: Sex distribution of socioeconomic status

Exposure	Cases and control (n=372)			Cases only (n=124)			P value
	Male	Female	Total	Male	Female	OR	
Occupation							
No occupation	49	152	20	12	51	6.59	0.001
Business	46	14	60	19	7	0.647	0.311
Civil servant	36	25	61	9	10	1.476	0.330
Farmer	34	16	50	9	7		
Education							
Non-Formal	99	151	250	33	56	1.316	0.006
Formal	66	56	122	16	19		

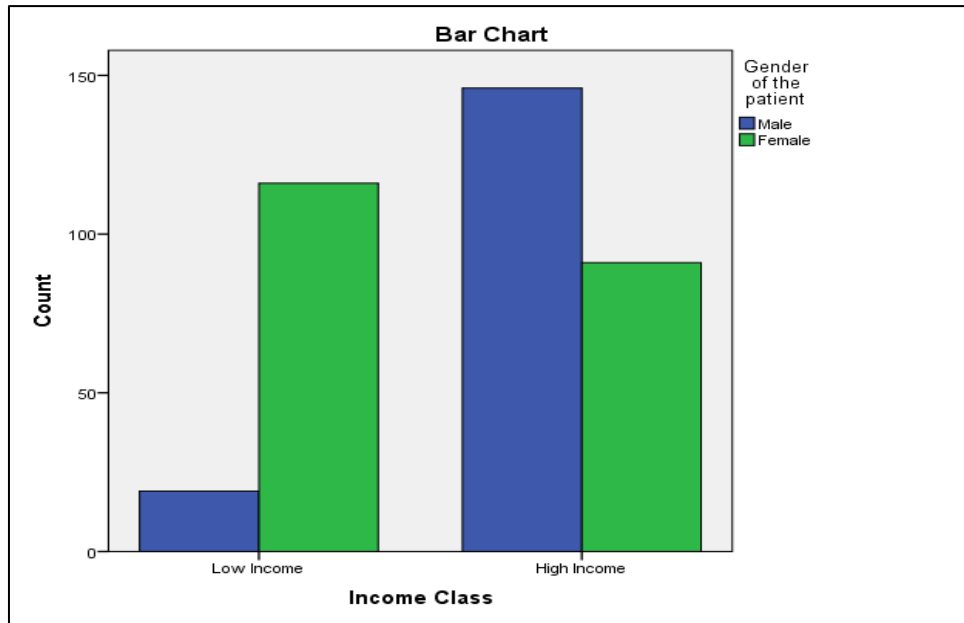| Exposure	Cases and control (n=372)			Cases only (n=124)			P value
	Male	Female	Total	Male	Female	OR	
Income							
Low Income	19	116	135	11	63	2.238	0.0001
High Income	146	91	237	38	12		

Figure 1: Income distribution between gender groups (n=372)

Table 3: Variable in the equation from logistic regression

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I for EXP(B)	
								Lower	Upper
Step 1[a]	Gender	-.294	.321	.838	1	.360	.745	.397	1.398
	Education	-.386	.366	1.113	1	.292	.680	.332	1.392
	Occupation			6.978	3	.073			
	No occupation	1.002	.383	6.852	1	.009	2.723	1.286	5.767
	Business	.732	.490	2.238	1	.135	2.080	.797	5.429
	Civil Servants	.402	.394	1.041	1	.308	1.495	.690	3.237
	Income_Class(1)	-1.812	.296	37.419	1	.000	.163	.091	.292
	Constant	.310	.362	.732	1	.392	1.363		

a. Variable(s) entered on step 1: Occupation, Education, Income_Class

DISCUSSION

The result of the study showed there is a strong link between socioeconomic factors and knee OA occurrence and prevalence. The female gender has been shown to be vulnerable to a lack of proper education, good occupation and better income. These differences in gender social status have been reported by many studies indicating variability in incentives and certain rights [17]. This is more pronounced in developing nations because the rate of gender discrimination and rights denial is high [18]. The social economic factors play a major role in knee OA prevalence and management. In terms of aetiology, the adoption of recommended lifestyle by individuals may reduce knee OA burdens in society based on certain risk factors such as regular exercise, recommended dietary intake to avoid the risk of obesity, stopping smoking and less alcohol consumption, and knee trauma prevention [19]. Reyes C et al., reported a high prevalence of hand, hip and knee OA among inhabitants of deprived areas due to the increased prevalence of obesity in this population [20]. However, the obesity factor may also play a role in the increased incidence of knee OA even among the well-to-do society because of taking excess fat from fast food and reluctance to partake in regular exercise [21]. This is particularly common among females who are unemployed and are not engaged in any physical activities [22].

Access to these recommendations may be hampered by low socioeconomic status, and this may be

more pronounced among the female gender for the reasons already mentioned. The burden and complications of knee OA are more likely to be high when this social class is affected because of the high cost and chronicity in the management of the disease [23, 24]. This is commonly encountered in places where the health system is moribund and health insurance is not fully established to care for the vulnerable and the people that are mostly affected by the disease [25].

Patients' education level influences the informed choice of both preventive and curative aspects of a disease. Educational level affects both the disease occurrence and course including the modalities of its management. The tendency to abide by health advice and policy is there, and this stands as an independent factor in determining disease occurrence and progression by the past and present research reports [26, 27]. Health education and health programmes are more acceptable and utilised by the educated person because these are routinely obtained through the process of acquiring knowledge. Having full awareness of the disease and its consequences helps an individual to be health conscious, and strive to adopt preventive measures and take the necessary steps in treating a disease [28]. Knee OA is known to be common among some family members, with previous knee trauma and obesity as risk factors. Preventing knee OA or mitigating its presence by adopting what is recommended can only be achieved when an individual is well-informed and ready to comply with management directives [28, 29]. In places where low education level in society prevails, the incidence and severity of knee OA are high particularly where female education is not given due priority [30, 31].

Closely related to the education is the occupation. Although one may be educated but not employed in a labour market or not having any business person or job that brings means of sustainability. The emphasis on occupation can be related to education especially when employed as a skilled manager in which remuneration is high and enables one to afford disease preventive measures and treatment. Additionally, the available health insurance is easily covered by such social class people, and this greatly influences the disease prevalence and its course [32]. Many underdeveloped and developing countries' health systems do not possess robust health insurance schemes that ensure wider and universal health service coverage. This makes personal income more important in getting health services [32, 33]. The disturbing trend occurs mostly among women who are mostly unemployed and are heavily reliant on their spouses to settle their health bills. The rise in unemployment in certain regions of the world despite having many educated graduates or being employed in non-managerial jobs with no reasonable remuneration to cater for the chronicity of knee OA is a major public health concern [34]. This is more disturbing in a system where segregation based on gender is common and can greatly affect knee OA and its long-term management.

Despite being educated and gainfully employed, the role of income in predicting disease cause and course is overwhelmingly important, especially in countries where out of pocket the major means of accessing good healthcare services [35]. The cost of knee OA care is high, ranging from expensive medications taking over a long period to disease chronicity and eventual costly knee arthroplasties in some selected patients [36].

An important finding in this study was that income as the main socioeconomic factor for risk of knee OA and its high prevalence in women compared to men. This was also the case even among men with low incomes compared to those with high incomes. A study by Lee JY *et al*., however, found low education to be a more influential socioeconomic factor for the risk of OA and knee pain irrespective of the subject's occupational and income status [31].

Although a high educational level may not necessarily correlate with good occupation and high income, a good education can influence good decision-making in disease prevention and also alter the course of disease through the full utilisation of public enlightenment strategies and adopting a healthy lifestyle. In the absence of a reasonable income even with a good educational background, the cost of adopting the recommended healthy lifestyle may be compromised; likewise the cost of knee OA treatment including expensive medications and the eventual knee arthroplasty surgery.

CONCLUSION
Assessing the Socioeconomic factors on the development of knee OA could be challenging based on the information obtained from the study subjects. Although in this study, the use of formal and non-formal education, low and high-income levels, and different occupational types were employed, no clear common and universal criteria were available to classify these factors. The dynamics in the economy and differences in cultural practice may distribute these factors unevenly, and one factor may become more influential than the other depending on location, social behaviours and standard of healthcare facility and services.

The research findings demonstrated the role of socioeconomic factors in knee OA risk and prevalence with low income level being the most important predictor compared with educational level and occupation. The female gender has the lowest income level with higher knee OA risk and prevalence.

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