



## Prevalence and Risk Factors of Knee Osteoarthritis in a Rural Community of Odisha: A Snap Shot Study

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### Abstract

**Background:** Osteoarthritis is a common disease of joint and the knee joint is mostly affected. The prevalence in India is 22-39%. Elder age group are more affected than younger age group. It affects female more than male. Knee OA is strongly associated with occupational activities that involves kneeling and squatting. Fruits, milk, meat, poultry are some protective dietary factors against knee OA. Paucity of community based surveys in Odisha, prompted authors to do a survey to find the prevalence and risk factors of knee OA in the rural community.

**Materials and Methods:** A cross sectional survey was conducted across five villages during September 2017 to February 2018. 299 subjects were selected by multistage sampling. A questionnaire containing sociodemographic profile, diet, ACR criteria and possible risk factors was administered to the subjects after written consent. Then data was analysed using SPSS software version 16.0

**Result:** Prevalence of knee OA was found to be 29.7% [95% CI: 24.4% - 34.8%]. The associated risk factors are age  $\geq 50$  years [ $p < 0.001$ ], female gender [ $p < 0.001$ ], BMI more than 27.5 kg/m<sup>2</sup> [ $p = 0.04$ ], lower SES [ $p = 0.03$ ], activity involving kneeling or squatting [ $p < 0.001$ ] etc. Regular fruit or vegetable consumption provide some protection against knee OA [OR=0.5; 0.3-0.9,  $p = 0.02$ ]. Farming as an occupation was found protective against knee OA [AOR=0.05; 0.009-0.301  $P < 0.001$ ].

**Conclusion:** Every third person in this community is having knee OA. Risk factors are advancing age, female gender, and occupational activities involving kneeling and squatting, obesity. Farmers have some protection against knee OA.

**Keywords:** Knee Osteoarthritis, ACR criteria, Prevalence, Risk factors, Community study, Multistage sampling.

### Introduction

Osteoarthritis is most common form of arthritis. It is a low grade inflammatory disease of synovial

joints characterized by progressive deterioration and loss of articular cartilage. It affects the entire joint including synovium, meniscus, and

periarticular ligament and subchondral bone leading to structural and functional changes<sup>[1]</sup>. Globally, osteoarthritis comes at eighth place in contribution to disability and OA of knee joint contributes nearly 80% of OA burden<sup>[2],[3]</sup>. The symptoms are pain in knee, swelling around knee joint, crepitus during active movement and stiffness of the joint<sup>[4]</sup>. Once the problem starts, the patient will suffer his whole life. In advance stage, patient may present with knee instability or knock knee or bow knee<sup>[4]</sup>. Most cases of OA have no known etiology and it is mostly related to ageing, which is one of the strongest non-modifiable risk factor for knee osteoarthritis<sup>[5], [6]</sup>. OA is also more common among women and knee OA is a major cause of mobility impairment particularly among them<sup>[5]</sup>. Other risk factors are obesity, occupation, dietary factors and physical activity<sup>[6]</sup>. Repetitive joint loading through kneeling and squatting have shown to be associated with increased risk of knee osteoarthritis<sup>[6]</sup>.

Prevalence of OA differs by country and ethnicity. Majority of the surveys on prevalence of OA had been conducted in European countries<sup>[7]</sup>. There are a hand count number of studies has been conducted in India and however the prevalence is found to be 22% to 39%<sup>[5],[8]</sup>. According to Chandra P. Pal et.al, prevalence of knee OA is found to be 28.7% in India. There is paucity of studies on knee osteoarthritis in India especially in Odisha.

### Aims and Objectives of the study

1. The current study is conducted to find out the prevalence of knee osteoarthritis [Knee-OA] in the rural community.
2. To study the socio-demographic and lifestyle related risk factors of knee-OA in the study subjects.

### Methodology

It is a community based cross-sectional study conducted in Kendrapara district, Odisha during September 2017 to February 2018. Sample size

was calculated to be 239, with Prevalence of knee OA of 28.7% in multicentric rural study in India<sup>[5]</sup>, absolute precision of 5.7% and 95% Confidence level. Multi-staged sampling was done. In Kendrapara district, one PHC area was randomly selected and out of the 12 villages covered by this PHC, 5 villages were randomly selected by the chit method. The house-hold list of the villages was obtained from the ASHA. Then using systematic random sampling, 60 households (taking into account the non- responders) from each village was selected and one person from each household interviewed after taking written informed consent.

In this study, an ACR criterion [9][using history and clinical examination] was used to diagnose knee osteoarthritis. A questionnaire was prepared containing sociodemographic profile, dietary habits, ACR criteria and possible risk factors. In this study Socio-economic status was assessed using Udai Pareek scale<sup>[10]</sup>. The questionnaire was validated by translating into local language reviewed by a group of experts. All the subjects aged more than 18 years and residing in this area for minimum 6 months were included in the study. Subjects with above knee amputation, paraplegia, hemiplegia or monoplegia were excluded from the study.

All the statistical analysis was done with SPSS software version 16.0. The results are expressed as Mean  $\pm$  Standard deviation (SD) and frequency (in percent). Normally distributed quantitative and categorical variables are compared using student's t test and Chi square test respectively. A 'p-value of  $< 0.05$ ' was considered statistically significant. Logistic regression is used for calculating adjusted odds values.

### Results

Out of 300, one questionnaires was incomplete. So, final study sample size becomes 299. Among them, 106(35.4%) were female and 193(64.6%) were male.

In this study, 40% (114/299) of the people complained of pain in knee. Among them 78%

(89/114) fitted into the criteria of knee OA. The overall prevalence of knee OA was found to be 29.7% [95% CI: 24.4% - 34.8%]. Other symptoms were morning stiffness, crepitus during active movement etc. Apart from pain in knee, 77.5% of knee OA population had morning stiffness for less than 30 minutes, 61% had tenderness over knee, 51% had crepitus during active movement and few people had bony enlargement as shown in Table 1.

People older than 50 years of age had a higher prevalence of 83.3% as compared to 6.5% in younger age group. The odds of having knee OA in older group was 69.6 [32.0 – 151.2, 95% CI] as compared to younger age group ( $\leq 50$  years). The difference in the mean age of the subjects with knee-OA ( $55.4 \pm 12.2$  years) and without knee-OA ( $48.4 \pm 17.03$  years) was significant,  $p=0.001$ . Prevalence was found to be high among females (43.9%) compared males (22.2%), which was significantly different with 'p' value  $<0.001$  and  $OR = 2.6$  [1.6 - 4.4]. This study showed lower socio-economic status being significantly associated with high prevalence of knee OA with  $OR=1.7$  [1.0-2.9] and  $p$  value  $=0.03$ . High prevalence was found among people with  $BMI > 27.5 \text{ kg/m}^2$  [ $OR=2.3$ ; 0.9-5.4,  $p$  value  $=0.04$ ]. No association was found between height, weight of

subjects and Knee OA. Prevalence was very high among people doing activity involving kneeling or squatting as part of their occupation (54.5%) with a 'p' value  $<0.001$  and  $OR=6.6$  [CI: 3.8 – 11.4]. Disease burden was found to be significantly higher among farmers. [Table 2]

The people who were taking fruits or vegetables at least three servings a day were associated with decreased risk of knee OA which was significant with  $OR= 0.5$  [0.3-0.9] and  $p$  value  $= 0.02$ . Daily intake of tea was associated with increased risk of knee OA. No association was found between smoking, alcohol consumption and knee OA. [Table 3]

The factors which were significantly associated with knee OA in univariate analysis were included in the logistic model. The AORs for the risk factors like age group  $>50$  years, female gender, and activity involving kneeling and squatting were 135.6 [40.2 – 457], 16.4 [4.1-85.1] and 105.5 [16.7- 664.9] respectively. The AORs for the protective factors like regular intake of fruit or vegetables, farming occupation were 0.33 [0.11-0.96] and 0.05 [0.009-0.3] respectively. [Table 2, 3]

**Table 1** Symptom profile of subjects having knee OA as per ACR criteria

Symptoms	Knee OA present [n=89]	Knee OA absent [n=210]
Pain in knee	89[100%]	25[12%]
Morning stiffness less than 30 min	69[77.5%]	9[4%]
Crepitus on active movement	45[50.56%]	4[2%]
Tenderness over knee	55[61.79%]	2[1%]
Bony enlargement	10[11.2%]	0[0%]
Palpable warmth over knee	5[5.6%]	12[5.7%]

**Table 2:** Demographic and Anthropometric risk factors of study population, N=299.

Parameter	Knee OA present [n=89]	Knee OA absent [n=210]	OR [95% CI]	'p' value	Adjusted odds ratio with 95% CI, 'p' value
Age ( in years) (Mean $\pm$ SD)	55.39 $\pm$ 12.19	48.43 $\pm$ 17.03	—	0.001	-
Age Groups >50 years $\leq$ 50 years	75 14	15 195	69.64[32.0-151.2]	<0.001	135.6 [40.2 - 457] ,<0.001
Sex Female Male	46 43	60 150	2.6[1.6 – 4.4]	<0.001	16.4 [4.1 – 85.1] ,<0.001
SES Lower Middle	55 34	100 110	1.7[1.0-2.9]	0.03	0.53 [0.182 – 1.55] , 0.24
Height (in cm) (Mean $\pm$ SD)	159.89 $\pm$ 9.39	160.63 $\pm$ 9.02	—	0.52	—
Weight(in KG) (Mean $\pm$ SD)	54.42 $\pm$ 11.59	52.82 $\pm$ 11.83	—	0.28	—
BMI(in KG/M2) (Mean $\pm$ SD)	21.29 $\pm$ 4.22	20.41 $\pm$ 4.02	—	0.09	—
BMI $\geq$ 27.5kg/m <sup>2</sup> <27.5 kg/m <sup>2</sup>	11 78	12 198	2.3[0.9 – 5.4]	0.04	0.95 [0.14 – 6.1] , 0.96
Occupation Farmer other	46 43	52 158	3.2[1.9 – 5.4]	<0.001	0.05 [0.009 – 0.301] , 0.001
Activity involving kneeling/squatting (at least 2hr per day)  Yes No	  60 29	  50 160	  6.6[3.8-11.4]	  <0.001	  105.5[16.7-664.9] , <0.001

**Table 3:** Dietary habits and life style factors in study population

Parameters	Knee OA present [n=89]	Knee OA absent [n=210]	OR [95% CI]	p Value	Adjusted odds ratio with 95% CI, 'p' value
Diet Nonveg Veg	79 10	194 16	0.6 [0.2-1.4]	0.31	—
Meat/Fish ( $\geq$ twice a week) Yes No	82 7	194 16	0.966 [0.3-2.4]	0.94	—
Fruit/vegetables ( $\geq$ 3 servings a day) Yes No	31 58	104 106	0.5 [0.3-0.9]	0.02	0.33[0.11-0.96] , 0.04
Tea Daily No	15 74	145 65	2.2 [1.1-4.1]	0.01	2.08[0.6-7.1] ,0.23
Tobacco Current users Non users	54 35	117 93	1.2 [0.7-2.0]	0.42	—
Smoking Daily Non-users / occasional users	17 72	28 182	1.5 [0.7-2.9]	0.20	2.8[0.6-12.7] , 0.16
Alcohol Regular users Non users	5 84	22 188	0.5 [0.1-1.3]	0.18	0.17[0.01-1.9] ,0.15

## Discussion

Osteoarthritis is a disease of great clinical significance and knee being the mostly affected joint. So, many surveys had been conducted on this in Western countries, but in India there is hand count no of studies. A study conducted by Chandra P. pal et.al reported prevalence of knee OA to be 28.7% in India<sup>[5]</sup>. Present study also revealed that almost every third person in this rural community is having knee OA. But the prevalence of knee OA could be still higher than what is reported in this study owing to use of ACR criteria whose sensitivity is 89%[9]. Subjects beyond 5<sup>th</sup> decade are more commonly associated with knee OA in this study. The association of age group and knee OA in this study is in congruence with the previously conducted studies<sup>[6],[11]</sup>. People older than 50 years are almost 70 times at a greater risk for having knee-OA as compared to the younger age group. This may be due to age related changes in joint.

Literature till now showed that gender plays a major role in osteoarthritis development. Women are mostly affected than men<sup>[5],[8],[11]</sup>. Present study also showed the same result with a high prevalence among females and three times the propensity of having knee-OA as compared to males. This could be explained by its multifactorial association (hormonal factors, anatomical factors like narrow femur, thinner patella in female) as reported in other studies<sup>[5]</sup>. This study also found that subjects belonging to lower socioeconomic status are almost twice at risk of developing knee OA. But after adjusting other confounders, no direct contribution found. Some studies reported increased prevalence among lower socioeconomic status<sup>[5]</sup>.

Obesity is strongly associated with knee OA. Many surveys had estimated it and several hypotheses behind this were also created<sup>[6],[13]</sup>. One hypothesis subjects that, "abdominal fat release some pro-inflammatory factors like interleukin-6 (IL-6), C-reactive protein (CRP) and plasminogen activator inhibitor type-1 (PAI-1), which adversely affect the joints and lead to

OA<sup>[13]</sup>. Current study also showed higher prevalence among population with high BMI ( $>27.5 \text{ kg/m}^2$ ). But adjusted OR did not show any significant association. This can be explained by the lower prevalence of obesity among the subjects.

Since obesity has a direct role in development of knee OA, many researchers had conducted studies to find out dietary risk factors and any modifications that may delay or decrease knee OA. A study conducted by Sanghi D et.al. Showed that people taking lower amount of vitamin D and vitamin C were at risk of knee OA. They also reported that fruits, milk, meat, poultry are some protective dietary factors against knee OA<sup>[14]</sup>. In the current study, the risk of having knee-OA among the subjects who are taking regular fruits or vegetables was found to be decreased to one third.

A cross-sectional study conducted by Yi Zhang et.al. reported a positive association between smoking and knee OA, where as another study reported inverse association<sup>[15],[16]</sup>. However Current study did not found any significant association between smoking and knee OA. People habituated with tea found to have high prevalence. But, after adjusting other risk factors no direct contribution found. Present study did not find any association between meat, fish, tobacco intake and alcohol with knee OA.

Several studies had shown strong relationship between occupation and knee OA. Occupational activities that demand physical load on joint like squatting, kneeling, weight lifting etc. are likely to contribute knee OA<sup>[17]</sup>. A population based case-control study showed no association between farming and knee OA, where as another in another survey M Rossignol et.al. found a positive association<sup>[18],[19]</sup>. In this study population farming as an occupation is found to be a protective factor. This may be due to strong quadriceps gained by farmers by regular physical activity. No other occupation was found to be contributing to knee OA. This could be because of inadequate representation of other occupations.



In a survey, Yuqing Zhang et.al. reported a strong association between kneeling, squatting with knee OA[20]. This survey was also revealed a strong association between them. Studies revealed that during squatting, the contact force on the joint increases which may aggravate osteoarthritis development<sup>[21]</sup>.

This community based survey is the first of its kind to have taken into consideration so many risk factors at a time in this setting. But still there are few factors like family history, sedentary life style and history of injury which could have been better explored. So we would like to suggest that a longitudinal cohort study that can be planned, which would demonstrate the effects of such factor on knee-OA. The study also revealed that almost two third of population with knee pain had knee OA. So, appropriate steps should be taken for their assessment.

### Conclusion

Prevalence of knee OA was unexpectedly as high as 29.7% in rural community of Odisha. Higher age, female sex and activities involving kneeling or squatting appear to be predictive of knee OA independently. Regular fruit and vegetable intake and farming as an occupation provide some protection against knee OA development.

**Conflicts of interest:** There are no conflicts of interest.

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### Reference

1. Lian W, Liu H, Song Q, Liu YQ, Sun LY, Deng Q, Wang SP, Cao YH, Zhang XY, Jiang YY, Lv HY. Prevalence of hand osteoarthritis and knee osteoarthritis in Kashin-Beck disease endemic areas and non Kashin-Beck disease endemic areas: A status survey. *PloS one*. 2018 Jan 10;13[1]:e0190505.
2. Radha MS, Gangadhar MR. Prevalence of knee osteoarthritis patients in Mysore city, Karnataka. *Int J Recent Sci Res*. 2015 Apr;6[4]:3316-20.
3. Singh AK, KAlAivAni M, KriShnAn A, AggArwAl PK, Gupta SK. Prevalence of osteoarthritis of knee among elderly persons in urban slums using American College of Rheumatology [ACR] criteria. *Journal of clinical and diagnostic research: JCDR*. 2014 Sep;8[9]:JC09.
4. Kaur R, Sharma VL, Singh A. Prevalence of Knee Osteoarthritis and its Correlation in Women of Rural and Urban Parts of Hoshiarpur [Punjab]. *Journal of Postgraduate Medicine, Education and Research*. 2015 Jan 1;49[1]:32.
5. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. *Indian journal of orthopaedics*. 2016 Sep;50[5]:518.
6. Plotnikoff R, Karunamuni N, Lytvyak E, Penfold C, Schopflocher D, Imayama I, Johnson ST, Raine K. Osteoarthritis prevalence and modifiable factors: a population study. *BMC Public Health*. 2015 Dec;15[1]:1195.
7. Cho HJ, Morey V, Kang JY, Kim KW, Kim TK. Prevalence and risk factors of spine, shoulder, hand, hip, and knee osteoarthritis in community-dwelling Koreans older than age 65 years. *Clinical Orthopaedics and Related Research®*. 2015 Oct 1;473[10]:3307-14.
8. Chopra A, Patil J, Billempelly V, Relwani J, Tandle HS. Prevalence of rheumatic diseases in a rural population in western India: a WHO-ILAR COPCORD Study. *The Journal of the Association of Physicians of India*. 2001 Feb;49:240-6.
9. Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K, Christy W, Cooke TD, Greenwald R, Hochberg M, Howell D. Development of criteria for the classification and reporting of osteoarthritis: classification of osteoarthritis of the knee. *Arthritis &*

- Rheumatology. 1986 Aug 1;29[8]:1039-49.
10. Singh T, Sharma S, Nagesh S. Socio-economic status scales updated for 2017. International Journal of Research in Medical Sciences. 2017 Jun 24;5[7]:3264-7.
  11. Ajit NE, Nandish B, Fernandes RJ, Roga G, Kasthuri A, Shanbhag D, Goud BR. Prevalence of knee osteoarthritis in rural areas of Bangalore urban district. Internet Journal of Rheumatology and Clinical Immunology. 2014 Jan 6;1[S1].
  12. Hame SL, Alexander RA. Knee osteoarthritis in women. Current reviews in musculoskeletal medicine. 2013 Jun 1;6[2]:182-7.
  13. Souza IF, Oliveira Neta RS, Gazzola JM, Souza MC. Elderly with knee osteoarthritis should perform nutritional assessment: integrative literature review. Einstein [São Paulo]. 2017 Jun;15[2]:226-32.
  14. Sanghi D, Mishra A, Sharma AC, Raj S, Mishra R, Kumari R, Natu SM, Agarwal S, Srivastava RN. Elucidation of dietary risk factors in osteoarthritis knee—a case-control study. Journal of the American College of Nutrition. 2015 Jan 2;34[1]:15-20.
  15. Zhang Y, Zeng C, Wei J, Li H, Yang T, Yang Y, Deng ZH, Ding X, Lei G. Associations of cigarette smoking, betel quid chewing and alcohol consumption with high-sensitivity C-reactive protein in early radiographic knee osteoarthritis: a cross-sectional study. BMJ open. 2016 Mar 1;6[3]:e010763.
  16. Zhang Y, Zeng C, Li H, Yang T, Deng ZH, Yang Y, Ding X, Xie DX, Wang YL, Lei GH. Relationship between cigarette smoking and radiographic knee osteoarthritis in Chinese population: a cross-sectional study. Rheumatology international. 2015 Jul 1;35[7]:1211-7.
  17. Palmer KT. Occupational activities and osteoarthritis of the knee. British medical bulletin. 2012 Apr 26;102[1]:147-70.
  18. Holmberg S, Thelin A, Thelin N. Is there an increased risk of knee osteoarthritis among farmers? A population-based case-control study. International archives of occupational and environmental health. 2004 Jun 1;77[5]:345-50.
  19. Rossignol M, Leclerc A, Hilliquin P, Allaert FA, Rozenberg S, Valat JP, Avouac B, Coste P, Savarieau B, Fautrel B. Primary osteoarthritis and occupations: a national cross sectional survey of 10 412 symptomatic patients. Occupational and environmental medicine. 2003 Nov 1;60[11]:882-6.
  20. Zhang Y, Hunter DJ, Nevitt MC, Xu L, Niu J, Lui LY, Yu W, Aliabadi P, Felson DT. Association of squatting with increased prevalence of radiographic tibiofemoral knee osteoarthritis: the Beijing Osteoarthritis Study. Arthritis & Rheumatology. 2004 Apr 1;50[4]:1187-92.
  21. Escamilla RF, Fleisig GS, Zheng N, Barrentine SW, Wilk KE, Andrews JR. Biomechanics of the knee during closed kinetic chain and open kinetic chain exercises. Medicine and science in sports and exercise. 1998 Apr;30[4]:556-69.