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Research Article

Work-related risk factors of knee osteoarthritis in Indian female farm field workers: a cross-sectional study

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ABSTRACT

Knee osteoarthritis (OA) is one of the leading causes of pain and disability worldwide. Female agricultural workers are particularly vulnerable because of prolonged exposure to repetitive knee-loading activities during farming and household work. To identify work-related risk factors associated with knee osteoarthritis among Indian female farm field workers. A cross-sectional study was conducted among 65 female farm field workers aged 30–60 years diagnosed with knee osteoarthritis. After obtaining institutional ethical approval and informed consent, demographic details and occupational characteristics were recorded. Participants completed a validated work-related risk factor questionnaire assessing occupational and domestic activities that impose stress on the knee joint. Descriptive statistics were used to summarize the findings. Most participants were aged 51–60 years (51%), and bilateral knee involvement was observed in 63%. Occupational activities such as walking on uneven surfaces (100%), deep squatting (92%), duck walking (88%), long-distance walking (85%), bending (85%), carrying heavy loads (78%), and prolonged standing (77%) were highly prevalent. Repetitive knee loading was also substantially contributed to by household activities such as cleaning utensils (91%), washing clothes (85%), cleaning floors (78%) and cooking in a sitting posture (68%). Repetitive occupational and domestic activities involving prolonged knee flexion and mechanical loading appear to be major contributors to knee osteoarthritis among Indian female farm field workers. Ergonomic interventions, physiotherapy, and preventive education may help reduce the burden of disease.

Keywords: Knee osteoarthritis, Female farm workers, Occupational risk factors, Agriculture, Musculoskeletal disorders, Physiotherapy pain.

INTRODUCTION

Osteoarthritis (OA) is a chronic progressive musculoskeletal disorder characterised by degeneration of articular cartilage, subchondral bone remodelling, osteophyte formation and varying degrees of synovial inflammation. It is a leading cause of chronic pain, physical disability and reduced quality of life worldwide, especially in older adults. The knee is the most affected of all synovial joints because it bears weight and is constantly exposed to mechanical loading during daily activities [1–3].

The global burden of knee osteoarthritis has risen considerably in recent decades. In 2020, the Global Burden of Disease Study 2021 estimated that around 595 million people were living with osteoarthritis, and this number is expected to increase considerably by 2050 due to population ageing, rising obesity and increased exposure to occupational risk factors [4]. Knee osteoarthritis is a major public health problem in India, affecting both urban and rural populations. It causes a lot of disability, impaired mobility, decreased work productivity, and increased health care costs [5].

There are several risk factors involved in the development and progression of knee osteoarthritis, including increasing age, female sex, obesity, previous joint injury, genetic predisposition, hormonal changes and occupational exposure [6–9]. Occupations with repetitive knee bending, prolonged squatting, kneeling, bending or lifting heavy loads, standing for long periods and walking on uneven surfaces can greatly increase compressive forces across the tibiofemoral and patellofemoral joints, accelerating cartilage degeneration and structural damage [6,10-12].

The highest risk occupational groups include agricultural workers, for whom farming activities often involve repetitive squatting, bending, lifting heavy loads, prolonged standing and walking long distances over uneven terrain. Long-term exposure to these biomechanical stresses is an important contributor to

cumulative joint loading and is a risk factor for knee osteoarthritis development [11–13].

In India, a large part of the agricultural workforce is women. They also do physically demanding domestic chores such as squatting while cooking, hand-washing clothes, cleaning floors, fetching water and carrying household items. The combination of occupational and household workload results in a long-term repetitive mechanical stress on the knee joints, which increases the probability of degenerative joint changes. Physiological changes related to age, loss of muscle strength, and hormonal changes occurring after menopause may put women at an even higher risk of developing knee osteoarthritis [3,9]. Though number of studies were conducted on occupational risk factors of knee osteoarthritis, relatively fewer studies were conducted on Indian female farm field workers, who are exposed to mechanical loading both from the agricultural and household activities. It is important to understand these combined risk factors for developing effective preventive strategies, ergonomic interventions, community-based rehabilitation programs and physiotherapy management in an effort to reduce disability and improve functional outcomes.

Thus the present study was conducted to identify and evaluate work related risk factors associated with knee osteoarthritis among Indian female farm field workers [1].

MATERIALS AND METHODS

Study design and setting

A cross-sectional observational study was performed for a duration of six months in a tertiary care hospital and surrounding community settings of Ahilyanagar, Maharashtra, India. The study was approved by the Institutional Ethics Committee of DVVPF's College of Physiotherapy before its commencement. Written informed consent was obtained from all participants prior to enrolment.

Study population

A purposive sampling method was used to select 65 female farm field workers diagnosed with knee osteoarthritis.

Inclusion criteria

Women farm field workers aged 30-60 years.

Knee osteoarthritis diagnosed by clinician.

Active farm work.

Willing to participate and sign an informed consent.

Exclusion criteria

History of major trauma or surgery to the lower limbs.

Other musculoskeletal or neurologic disorders affecting the lower extremity.

Cognitive impairment which would prevent completion of the questionnaire.

Declining to participate in the study.

Data collection

Screening of eligible participants was done according to inclusion and exclusion criteria. Baseline demographic characteristics including age, height, weight, body mass index (BMI), duration of farming work and average daily working hours were recorded.

Pain intensity was measured at rest and during activity using the Numeric Pain Rating Scale (NPRS).

The main outcome measure was a self-developed Osteoarthritis Knee–Work Related Risk Factor Questionnaire, which was designed to identify occupational and domestic activities that contribute to increased mechanical loading of the knee joint.

The questionnaire included 22 questions on:

Occupations (deep squatting, duck walking, bending, kneeling, prolonged standing, long-distance walking, carrying heavy loads, walking on uneven surfaces).

Housekeeping activities (cooking posture, doing laundry, floor cleaning, cleaning utensils and other routine household work).

Life style factors.

Eating habits.

Travel Activities

Responses were recorded using a three-point format (Yes, No, Sometimes).

Expert review was used to establish content validity of the questionnaire. A pilot study was conducted with 15 participants before the main study to test clarity, feasibility and comprehensibility.

Table 1: Demographic and clinical characteristics (n=65)

Variable	Category	n (%)
Age	30–40	13 (20%)
	41–50	19 (29%)
	51–60	33 (51%)
Side	Right	14 (22%)
	Left	10 (15%)
	Bilateral	41 (63%)
BMI	Underweight	2 (3%)
	Normal	38 (58%)
	Overweight	16 (25%)
	Obese	9 (14%)

Statistical analysis

The data were entered into Microsoft Excel and analysed using descriptive statistical methods. Continuous variables are presented as mean ± standard deviation, where appropriate, and categorical variables as frequencies and percentages. Descriptive statistics were used to summarise the prevalence of occupational and household risk factors associated with knee osteoarthritis [2].

RESULTS

Interestingly, the majority of the participants had normal BMI (58%), and only 39% were overweight or obese, suggesting that mechanical occupational exposure may be more important than obesity in this population. In addition, more than half (54%) were post-menopausal, providing further support for the role of hormonal changes in OA progression.

The predominance of moderate pain during activity (55%) points to the functional impact of OA on daily and occupational tasks.

Table 2: Occupational and Lifestyle Risk Factors

Risk Factor	n (%)
Duck walking	57 (88%)
Long-distance walking	55 (85%)
Bending	55 (85%)
Carrying weight	51 (78%)

Prolonged standing	50 (77%)
Cleaning utensils	59 (91%)
Washing clothes	55 (85%)
Cleaning floor	51 (78%)
Cooking in sitting	44 (68%)
Uneven surface walking	65 (100%)

High prevalence of activities involving repetitive knee flexion and mechanical loading, especially duck walking (88%), bending (85%) and long-distance walking (85%), was observed. Particularly, all participants (100%) reported walking on uneven surfaces, an environmental risk factor common to all.

Household activities also contributed significantly. Sustained squatting postures were adopted while cleaning utensils (91%) and washing clothes (85%).

Activities involving repetitive knee flexion and mechanical loading included duck walking (88%), bending (85%) and long-distance walking (85%). Notably, 100% of the participants reported walking on uneven surfaces, which was a universal environmental risk factor.

Household chores were also important, with cleaning utensils (91%) and washing clothes (85%) involving prolonged squatting postures. These findings suggest that the occupational and domestic exposures add up to an increased accumulated knee joint stress, and hence to the accelerated degenerative changes [10-12].

DISCUSSION

The present cross-sectional study was carried out to identify work related risk factors of knee osteoarthritis (OA) among Indian female farm field workers. The results suggest a strong association between repetitive work activities and household activities and the prevalence and severity of knee OA.

A key finding of this study was that most participants belonged to the 51–60 years age group, with a statistically significant association between age and pain severity ($p < 0.05$). This shows that the increase in age with long-term exposure to physically demanding activities contributes to disease progression. Felson et al. (2000) reported similar findings, identifying age as a major risk factor due to cumulative cartilage degeneration [1], while Zhang and Jordan (2010) emphasised age-related structural joint changes contributing to OA [2].

The fact that 63% of the participants had bilateral knee involvement suggests chronic and symmetrical joint involvement. This is in agreement with the findings of Sharma et al. (2010) who reported that prolonged mechanical stress leads to bilateral joint degeneration in weight-bearing joints [3].

Occupational activities like duck walking, deep squatting, bending, prolonged standing and carrying weight were very common. These activities put a lot of pressure on the joints and contribute to the breakdown of the cartilage. Cooper et al. (1994) showed that occupational activities like kneeling and squatting are strongly correlated with knee OA [4]. Similarly, Palmer (2012) reported that repetitive knee flexion and heavy physical workload are key occupational risk factors [5]. In addition, Tüchsen et al. identified a higher prevalence of OA in workers exposed to prolonged standing and lifting [6].

One of the major findings of this study was the high prevalence of household activities involving prolonged knee flexion. These results are in line with D'Souza and colleagues (2014) who emphasised the role of domestic workload in raising the risk of OA in Indian women [7]. The combination of occupational and household exposure in rural environments results in cumulative biomechanical load on the knee joint.

Environmental factors were also very important, with all participants reporting walking on uneven surfaces. Hunter and Bierma-Zeinstra (2019) highlighted that abnormal joint loading and instability due to environmental factors can accelerate OA progression [10]. Long-distance walking adds to repetitive stress and microtrauma to the knee joint.

This study concluded that the aetiology of knee OA in female farm workers is multifactorial. These findings are in agreement with Cross et al., 2014 who highlighted the global burden of OA and the role of combined risk factors in the progression of the disease [11]. This study highlights the need for specific interventions such as ergonomic changes, physiotherapy rehabilitation and awareness programs to decrease joint strain at work and at home.

Limitations of this study

The study had a relatively small sample size (n = 65), limiting generalizability. It is cross-sectional in nature and hence causality between risk factors and knee OA cannot be established. Data were self-reported, which may introduce recall bias, and the use of a self-developed questionnaire could affect standardisation. Without radiological confirmation, the severity of disease cannot be objectively assessed. Also, the study was conducted in one geographic area and did not control for potential confounding factors.

CONCLUSION

The cross-sectional study found various occupational and household activities associated with knee osteoarthritis among Indian female farm field workers. They were more prevalent and likely to be contributing to increased mechanical stress on the knee joint, such as prolonged deep squatting, duck walking, bending and long-distance walking, walking on uneven surfaces and prolonged standing and carrying heavy loads. Cumulative knee loading was greater for activities like washing utensils, washing clothes, cleaning floors and sitting postures for cooking. The results indicate the need for ergonomic modifications, physiotherapy interventions, muscle strengthening program, and community-based awareness programs to reduce the burden of knee osteoarthritis and improve functional outcomes among female agricultural workers.

Clinical relevance

The findings of this study highlight the need for early identification and prevention of knee osteoarthritis among female farm workers. Physiotherapists should focus on strengthening

exercises (quadriceps and hip muscles), flexibility training and joint protection techniques in an attempt to reduce stress on the knee joint.

Ergonomic changes in occupational and household tasks are in dire need like avoidance of prolonged squatting, use of raised platforms for cooking and washing and minimising heavy load carrying. Education and awareness programs should be used to encourage proper posture and activity modification.

Community-based interventions such as screening programs and physiotherapy camps can be useful in early detection and management. In general, a multidisciplinary approach including physiotherapy, ergonomics and lifestyle modification is essential to reduce disease burden and improve functional outcome.

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Conflict of interest

There was no conflict of interest for this study.

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