

# Reducing Joint Loading and Preventing Osteoarthritis with Proper Footwear Choices in India

Sudip Bhattacharya<sup>1</sup>, Vishal Kumar<sup>2</sup>, Sachin Kale<sup>3</sup>, Abhishek Bhati<sup>3</sup>, Aditya Vyas<sup>3</sup>, Moin Darvesh<sup>3</sup>

## Abstract

The abstract outlines a comprehensive study on the increasing prevalence of osteoarthritis (OA) in India from 1990 to 2019. The number of affected individuals rose from 23.46 million to 62.35 million during this period. Standardized OA prevalence per 100,000 people also saw an increase, along with Disability-Adjusted Life Years (DALYs) attributed to OA, highlighting the growing burden of the condition. Knee OA emerged as the most widespread form, with higher prevalence, incidence, and DALYs observed in females compared to males. The present OA management primarily focuses on symptom alleviation rather than addressing the underlying biomechanical stress. Research indicates that abnormal dynamic loads during walking contribute to joint damage, and reducing these loads can provide relief from symptoms. This opinion emphasizes the significant impact of modern footwear on knee loads, particularly in individuals with symptomatic knee OA. Cheaper, budget-friendly footwear often lacks proper cushioning and ergonomics, potentially worsening knee joint issues over time. To address the issue, a multi-pronged approach is proposed. Government subsidies and incentives, Public-Private Partnerships, indigenous research and development, public awareness campaigns, and community clinics are suggested strategies to make ergonomically designed footwear more affordable and accessible. In addition, offering affordable orthotic inserts and encouraging local shoemakers and small-scale manufacturers can contribute to this effort. We concluded by emphasizing the importance of quality assurance in ensuring that low-cost ergonomic footwear meets essential ergonomic criteria. Overall, the proposed strategies aim to reduce the burden of knee osteoarthritis in India and improve public foot health.

**Keywords:** Osteoarthritis, gait, posture.

## Introduction

### Problem Statement

In 1990, about 23.46 million individuals in India were impacted by osteoarthritis (OA), but by 2019, this number had surged to 62.35 million. The standardized prevalence of OA per 100,000 people also saw an increase, going from 4,895 (with a 95% uncertainty interval (UI) of 4,420–5,447) in 1990 to 5,313 (with a 95% UI of 4,799–5,898) in 2019. Furthermore, the Disability-Adjusted Life Years (DALYs) attributed to OA escalated from 0.79 million (with a 95% UI of 0.40–1.55) in 1990 to 2.12 million (with a 95% UI of 1.07–4.23) in 2019. Over the same period, the age-standardized DALYs increased

from 164 (with a 95% UI of 83–325) to 180 (with a 95% UI of 91–361) per 100,000 individuals.

In 2019, OA ranked as the 20th most common contributor to Years Lived with Disability (YLDs) in India, making up 1.48% (with a 95% UI of 0.88–2.78) of all YLDs. This represented an increase from its 1990 position as the 23rd most prevalent cause, accounting for 1.25% (with a 95% UI of 0.74–2.34) of YLDs. Knee OA was identified as the most widespread form of OA, followed by hand OA. It is noteworthy that the prevalence, incidence, and DALYs associated with OA and knee OA consistently showed higher numbers among females when compared to males.

However, present approaches to managing OA predominantly focus on alleviating symptoms with oral pain medications, traction and ultimately knee replacement surgery, rather than addressing the abnormal biomechanical stress that contributes to its progression

<sup>1</sup>Department of Community and Family Medicine, All India Institute of Medical Sciences, Deoghar, Jharkhand, India,

<sup>2</sup>Department of Orthopaedics PGIMER, Chandigarh, India,

<sup>3</sup>Department of Orthopaedics, D Y Patil School of Medicine and Hospital Nerul Navi Mumbai, India

### Address of Correspondence

Dr. Sudip Bhattacharya,  
All India Institute of Medical Sciences, Deoghar, Jharkhand, India  
E-mail: drsudip81@gmail.com

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from the early days of wear and tear. In the case of OA affecting the lower extremities, some of the damage is linked to unusual dynamic loads (loads experienced during walking) that affect the joints. Analysing these loads during walking has revealed a direct correlation between elevated joint loads and the severity seen in X-ray images, the advancement of the disease, and the experience of pain in individuals with knee OA. Conversely, reducing these loads on the knee joint can lead to noticeable relief from symptoms.

Recent findings indicate that modern footwear has a significant impact on the amount of load experienced by the knee, especially in individuals with symptomatic knee OA. This is particularly important because shoes are worn for a substantial portion of the day, particularly when walking, which is when the joints in the lower extremities endure significantly greater stress compared to when at rest.

### **The adding insult to injury**

“Sanskritization” is a sociological concept that originated in India and was first introduced by M.N. Srinivas, a prominent Indian sociologist. It refers to a process through which lower-caste or lower-class groups emulate the customs, rituals, practices, and way of life of higher-caste or higher-class groups, often in an effort to improve their social status and gain acceptance within the dominant culture. This process is named after “Sanskrit,” the classical language and culture of ancient India that was traditionally associated with the upper castes.

This trend is not limited to any specific market; it's a global phenomenon. In the realm of consumer goods, including the footwear industry, there's a growing demand for more affordable alternatives to expensive products. In today's market, a decent pair of shoes typically falls in the price range of 2000–5000 INR on average. However, this cost can often be prohibitive for many people with limited purchasing power. As a result, a substantial portion of the population seeks out budget-friendly alternatives and ends up purchasing inexpensive footwear. Unfortunately, these cheaper options often lack proper cushioning and ergonomics, which can have detrimental effects on their knee joints over time.

In a study conducted in the US with the aim to compare the peak knee loads experienced during walking across these various footwear conditions revealed that a total of 31 participants, comprising 10 males and 21 females, who were diagnosed with knee osteoarthritis (OA) based on radiographic evidence and reported symptoms, underwent gait analyses. This analysis utilized an optoelectronic camera system in conjunction with a multi-component force plate. For each participant, their gait was assessed under four distinct footwear conditions: (1) Dansko® clogs, (2) Brooks Addiction® stability shoes, (3) Puma H Street® flat walking shoes, and (4) flip-flops.

The study found that, both the clogs and stability shoes produced a notably higher peak knee adduction moment (measuring at  $3.1 \pm 0.7$  and  $3.0 \pm 0.7\%BWht$ , respectively), which was approximately 15% greater compared to that observed when wearing flat walking shoes (measuring at  $2.8 \pm 0.7\%BWht$ ), flip-flops (measuring at  $2.7 \pm 0.8\%BWht$ ), or walking barefoot (measuring at  $2.7 \pm 0.7\%BWht$ ). It's worth noting that there were no statistically significant differences in knee loads when comparing flat walking shoes and flip-flops to the loads experienced during barefoot walking.

This information substantiates the idea that the choice of footwear can indeed exert notable influences on knee loads when individuals have knee osteoarthritis (OA). Factors, such as the flexibility and height of the heel appear to be crucial distinguishing features of shoes that can impact knee loads. Considering the significant correlation between knee loading and OA, it is imperative that we thoroughly assess the design and biomechanical impact of contemporary footwear in relation to its effects on the progression of this condition.

### **What additional measures can be taken for the benefit of the public?**

Providing the public with ergonomically suited footwear at a low cost can be challenging, but not impossible. With the below-mentioned strategies and suggestions, ergonomically designed footwear can be made more affordable and accessible to the general public. First, the government can promote affordable, ergonomic footwear by subsidizing or providing incentives to manufacturers and retailers to produce and sell such footwear at lower prices. This could include tax breaks, grants, or reduced import tariffs on materials used to make ergonomic shoes. Second, Public-Private Partnership is also seems to be a viable option. Collaboration between government agencies and private companies can lead to the development of cost-effective, ergonomic footwear lines. These partnerships can help lower production costs and make the footwear more affordable. Third, indigenous research and development in the foot clinic (in the orthopedic department) can play a significant role. Investing in research and development to create cost-effective materials and manufacturing processes that maintain ergonomic qualities are also important. This can lead to the production of affordable, yet supportive and comfortable footwear. Fourth, an increase in public awareness can play a pivotal role. Public education campaigns can inform consumers about the importance of ergonomic footwear for overall health and well-being. Increased awareness may encourage people to seek out and purchase such footwear. Establishing community programs or clinics where people can access affordable, customized orthopedic assessments and recommendations for suitable footwear can play a significant role. Non-profit

organizations and charitable foundations may support such initiatives. They also can provide subsidized vouchers to individuals with specific medical conditions or financial constraints, allowing them to purchase ergonomic footwear at reduced prices.

In addition, affordable orthotic inserting materials may be a good option. Instead of entirely redesigning footwear, offering affordable orthotic insoles that can be inserted into existing shoes to provide ergonomic support. These inserts can help to improve the comfort and support of any shoes. Retailers can periodically offer discounts and sales on ergonomic footwear to make them more accessible to a wider range of consumers. We also need to encourage local shoemakers and small-scale manufacturers to produce ergonomic footwear, which can often be more cost-effective than imported brands. Under the Digital India initiative, promoting online marketplaces is also an important step to prevent knee osteoarthritis that connects consumers with manufacturers or brands that offer affordable,

ergonomic footwear options. For the destitute, we may encourage the resale and reuse of ergonomic footwear through thrift stores, online marketplaces, or charitable organizations. This can make such footwear more affordable for those in need. However, the most important thing is quality assurance. We need to implement quality control standards, such as ISI standards and 5-star ratings, to ensure that low-cost ergonomic footwear still meets basic ergonomic criteria for comfort and support.

### Conclusion

By implementing a combination of these strategies, governments, businesses, and communities can work together to make ergonomically suited footwear more accessible to the public at lower costs, improving overall foot health and comfort.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

**Conflict of Interest:** NIL; **Source of Support:** NIL

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