

# Work-Related Hazards and Health Risks Among Sugarcane Harvesting Workers in: Maharashtra Insights from a Systematic Review

Anil D Khunte<sup>1</sup>, Dr Priyanka Kaskar<sup>2</sup>, Dr Anjali Upadhye<sup>3</sup>, Ashish Shejwal<sup>4</sup>  
Pratik Devkate<sup>5</sup>

<sup>1</sup>PhD Scholar JSPM University Pune Maharashtra

<sup>2,4,5</sup>Faculty Of Business Management Commerce, JSPM University Pune, Maharashtra

<sup>3</sup>Professor of Business Management Commerce, JSPM University Pune, Maharashtra

Author. E-mail: [anil.khunte02@gmail.com](mailto:anil.khunte02@gmail.com)

\*Corresponding author. E-mail: [psk.sobm@jspmuni.ac.in](mailto:psk.sobm@jspmuni.ac.in)

E-mail: [anu.sobm@jspmuni.ac.in](mailto:anu.sobm@jspmuni.ac.in)

E-mail: [ashish.shejwal@outlook.in](mailto:ashish.shejwal@outlook.in)

E-mail: [devkate.pratikraj@gmail.com](mailto:devkate.pratikraj@gmail.com)

---

## Abstract

In Indian agriculture sector sugarcane is one of the important commercial crops so large numbers of sugarcane cutters labour other farm labour are employed during the cane harvesting season. However, these labours experience a wide range of occupational health problems due to the high demanding nature of their work. Sugarcane harvesting is highly labor-intensive, and cutters are routinely exposed to ergonomic strain, occupational hazards, and frequent injuries. Repetitive cutting motions, prolonged bending, and the use of inadequately designed tools contribute to cuts, lacerations, and chronic musculoskeletal disorders among workers. In addition to physical strain, as well as exposure to agricultural chemicals such as toxic pesticides, which impact to respiratory symptoms such as breathing discomfort, coughing, and pain in chest . The current review examined the occupational health challenges faced by sugarcane cutting labours in Maharashtra, analyzing 88 relevant studies out of an initial pool of 58 articles, with 30 excluded based on defined criteria. The result show that how urgent need for ergonomic improvements to less the physical burden of harvesting tasks and reduce musculoskeletal injuries. Low-cost ergonomic equipment's, modifications to work practices, and training programs were identified as effective approaches to improving working conditions and protecting workers' health. The review emphasizes that systematic ergonomic assessments and targeted interventions are important to avoid work-related injuries among sugarcane cutters labours in Maharashtra. The existing studies focusing specifically on ergonomic and occupational health hazards in this group. Further future research is needed to design, implement, and evaluate interventions that can enhance long-term health outcomes and productivity. This review provides important insights to support the development of rule regulations, improved tools, and evidence-based strategies aimed at safeguarding the occupational health and overall well-being of sugarcane cutters in Maharashtra.

**Keywords:** Occupational health, Sugarcane cutters, Workplace injuries, Maharashtra, Occupational hazards, Ergonomic interventions, Work-related injuries Labor-intensive farming, Health risks, Workplace safety

**How to cite this article:** Khunte A D, Kaskar P, Upadhye A, Shejwal A, Devkate P. Work-Related Hazards and Health Risks Among Sugarcane Harvesting Workers in Maharashtra: Insights from a Systematic Review. *Int J Drug Deliv Technol.* 2026;16(37s): 586-592. DOI: 10.25258/ijddt.16.37s.77.

---

## Introduction

Sugarcane is one of the major commercial cash crops cultivated in Maharashtra, its contributing to state economy particularly in districts such as Kolhapur, Sangli, Satara, Pune, Ahmednagar, Solapur, and parts of Marathwada. The Maharashtra state is among the leading sugarcane-producing regions in India, contributing significantly to the country's sugar and ethanol output. With the increasing national focus on ethanol blending to reduce dependence on fossil fuels, sugarcane cultivation, Harvesting and processing in Maharashtra have expanded over the past decades. Traditionally, sugarcane harvesting in the state totally dependent on manual labor, with thousands of migrant workers, which is coming from drought prone regions of

\*Author for Correspondence: [psk.sobm@jspmuni.ac.in](mailto:psk.sobm@jspmuni.ac.in)

latur, Beed, Osmanabad (Ahilyanagar), and Ahmednagar—engaged in seasonal cane cutting work. Manual cane cutting has often been preceded by the with burning or without burning of sugarcane fields to remove dry leaves and facilitate easier cutting, reduce moisture content, and deter venomous animals. However, burning cane leads to large-scale emissions of pollutants and exposure to smoke, posing risks to both workers and nearby communities. Although regulations and environmental guidelines discourage burning, it continues in several areas due to operational convenience and labour demands. Sugarcane cutters in Maharashtra face multiple occupational hazards during manual cutting. Physical risks include long working hours, extreme temperatures, inadequate hydration, and

# Work-Related Hazards and Health Risks Among Sugarcane Harvesting Workers in: Maharashtra Insights from a Systematic Review

exposure to intense sunlight. Chemical hazards arise from smoke, soil particles, dust, and residual pesticides. Biological risks stem from scorpions, snakes, and other harmful organisms commonly found in the fields. People who work with canes can also get hurt by accidents like falls, cuts, and injuries caused by fires. Cane labours are also vulnerable to accidents such as falls and cuts, fire-related injuries. Ergonomic and psychosocial risks are widespread due to same repetitive movements, constant bending, heavy physical exertion, high workloads, and less rest periods. Several reports and many nos of field studies have highlighted health issues among Maharashtra’s sugarcane cutters, including respiratory problems, musculoskeletal disorders, dehydration, kidney-related illnesses, heat stress. Despite multiple studies, there remains a need for systematic consolidation of evidence and the development of comprehensive preventive measures to safeguard the health and well-being of sugarcane workers in the state.

This review aims to describe the occupational health risks and ergonomic faced by sugarcane cutting labours from Maharashtra.

## Objective

- To Assess Occupational Health Risks and Hazards
- To Evaluate Ergonomic Strains and Psychosocial Impact
- To Investigate the Environmental and Health Impacts on-Harvesting Labor

## Methodology

A research review was conducted in the databases Dimension, PubMed, ResearchGate, Medline, and Shodhganga, Scopus. The inclusion criteria comprised articles published in between January 2021 and the most recent available period, as this timeframe reflects the growing scientific interest in the occupational and health conditions of sugarcane cutters in Maharashtra, especially in the context of climate change, migration patterns, and occupational health challenges. Articles were initially screened based on their titles, followed by an abstract review, keywords. Studies that address the working conditions, health risks, or health impacts associated with manual harvesting worker & burned sugarcane among sugarcane cutters in Maharashtra were included. The keywords used in the search included: “sugarcane workers,” “sugarcane cutters,” “sugarcane harvesting,” “Maharashtra sugarcane workers,” “migrant cane cutters,” and “manual sugarcane cutting.” The final selection of manuscripts was made by the lead author and reviewed by a co-author. Any disagreements regarding eligibility were resolved through consensus using the predefined inclusion and exclusion criteria; when necessary, a third reviewer was consulted for the final decision.

Of the total number of articles identified, studies were excluded at different stages—after title screening, abstract or full-text review, and due to lack of full-text accessibility—resulting in a final set of publications included for this review.

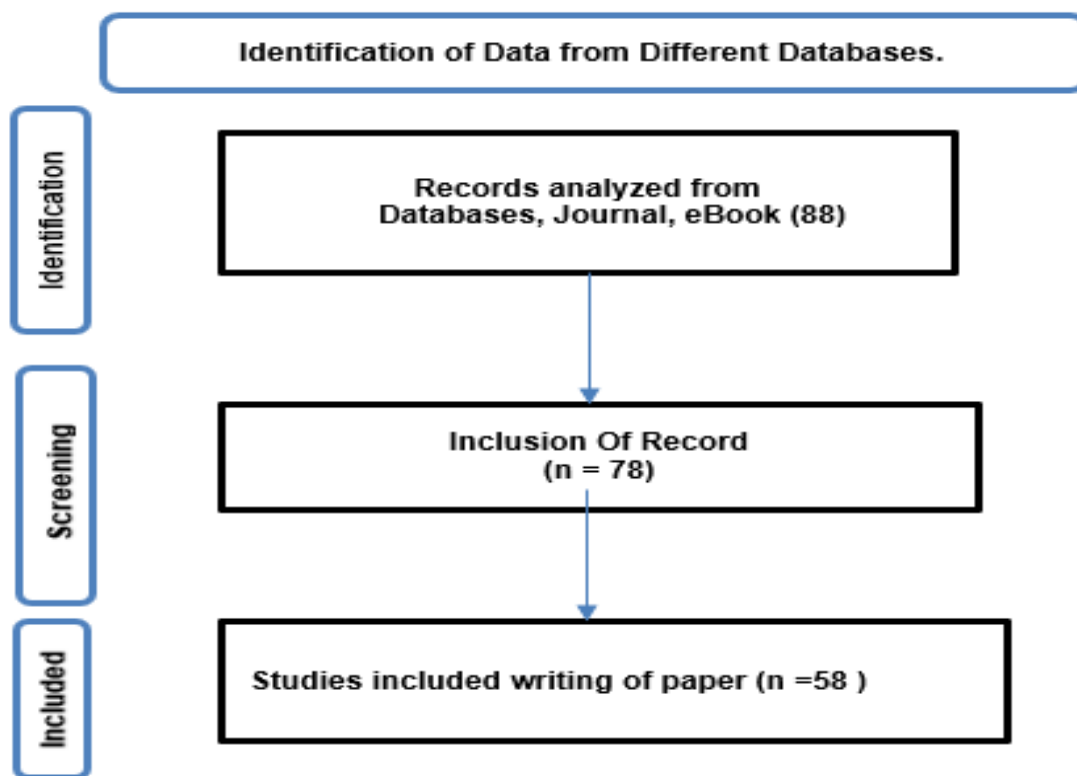


Diagram 1.1 Prisma Flow Diagram of Inclusion & Exclusion Criteria

### Sugarcane Cutting Work Environment and Organization

The working process of manual sugarcane cutting in Maharashtra places a substantial physical burden on workers, especially migrant labourers who constitute a major part of the workforce. The task involves continuous, forceful, and repetitive movements using a sickle or machete, often performed for long hours in high-temperature conditions. Workers are required to cut the cane stalks close to the ground, clean the leaves, and gather them into bundles typically weighing between 30 kg and 45 kg. These bundles are then carried over short distances—usually three to five meters—and arranged in rows for collection by tractors or trucks that transport the harvest to sugar mills for crushing.

A major organizational factor contributing to work strain is the widespread practice of **payment based on output (piece-rate system)**. Under this system, workers' earnings depend directly on the quantity of cane cut per day. This leads cutters to maintain an intense and accelerated pace of work, with limited breaks, in order to secure a better daily wage and improve their chances of being rehired in the following harvest season. This production-driven payment model increases physical overload, fatigue, and the risk of injuries, while also contributing to mental stress and pressure within work teams, particularly among migrant couples who work jointly as cutting units in many districts of Maharashtra.

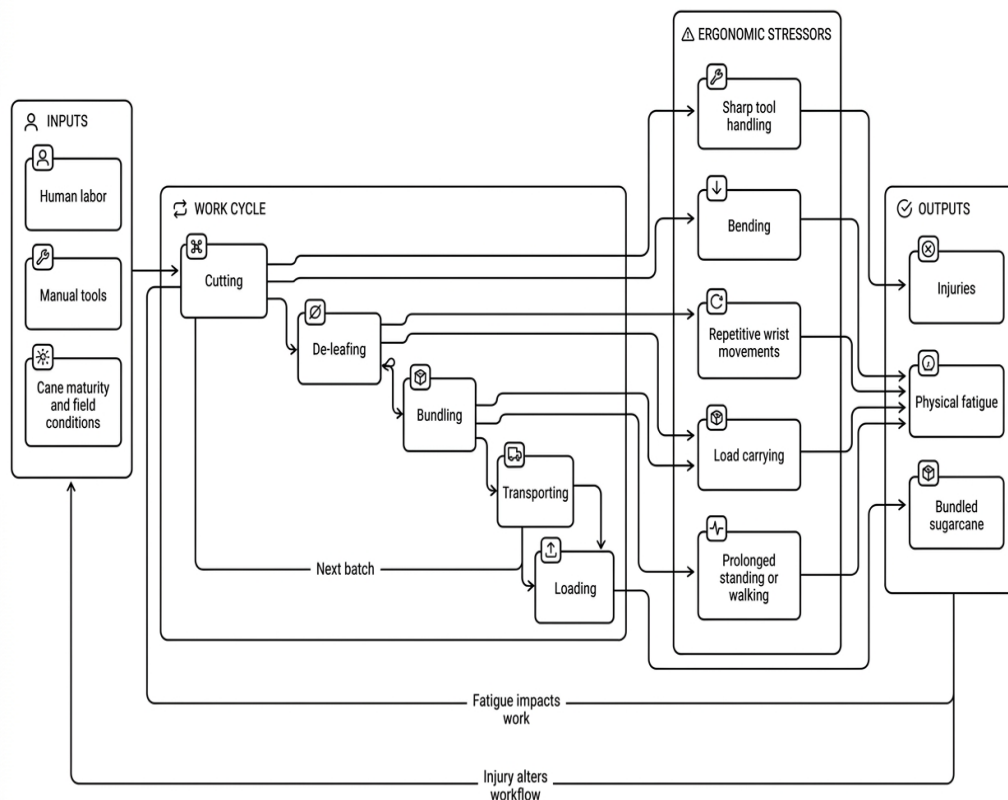


Diagram 1.2 Process Flow of Sugarcane Harvesting with Ergonomic Risk Factors

#### Key Components of the Conceptual Model1.

##### 1. Input

- Human labor
- Manual tools (sickle, billhook)
- Cane maturity and field conditions

##### 2. Processes (Work Cycle)

- Cutting
- De-leaving
- Bundling
- Transporting
- Loading
- 

##### 3. Ergonomic Stressors

- Bending
- Repetitive wrist movements
- Load carrying
- Sharp tool handling
- Prolonged standing/walking

##### 4. Outputs

- Bundled sugarcane
- Physical fatigue
- Injuries (cuts, musculoskeletal disorders)

**Work-Related Hazards and Health Risks Among Sugarcane Harvesting Workers in: Maharashtra  
Insights from a Systematic Review**

**Results And Discussion**

Title & Objectives of Research Study in Table 1.

<b>Sr No</b>	<b>Title</b>	<b>Focus and objectives</b>	<b>Methodology used</b>	<b>Outcomes</b>
1	"An assessment of mechanical vs manual harvesting of the sugarcane in Sudan– The case of Sennar Sugar Factory" Adam E. Ahmed a,b,*, Amna O.M. Alam-Eldin c	To evaluate the current sugarcane manual and mechanical harvesting systems with regard to production efficiency, cost effectiveness, cane loading efficiency, infield losses, and the effect of trash (extraneous matter) in factory process.	Primary data are obtained through personal communication, direct observation and discussion conducted formally and informally with the different departments in Sennar Sugar Factory	Sennar Sugar Factory as increasing sugarcane mechanical harvesting and reduce the manual harvesting to less than 10%of the total area. The specialized cane cutter labor should be employed in other agricultural operations during the off season to ensure their availability at the start of the season.
2	"Manual Sugarcane Cutter Performances in the Southern African Region" E. Meyer & L.J. Fenwick	identify productivity of manual sugarcane cutters across different harvesting systems (green & burnt cane), and investigate factors influencing cutter performance.	Cane cutter survey (Excel-based) , Time & motion studies , Statistical analysis (SPSS)	Cutter output varies widely by system, region & conditions. Cut & windrow system had highest productivity. Productivity linked more to harvesting system than burnt/green cane. Water supply, terrain & supervision affect output.
3	"Documenting Migrant Lives of Sugarcane Harvesting Labourers in Maharashtra – Autoethnographic Reflections" Mithunchandra Chaudhari & Ruchi Jaggi	Explore and document the lived experiences, hardships, exploitation, migration patterns, and gendered realities of sugarcane harvesting labourers in Maharashtra through an autoethnographic lens.	Autoethnography + Documentary Research + Field observations + Interaction with migrant labourers over 2 harvesting seasons	Women forced into hysterectomies; unsafe work, sexual abuse. Children drop out of school, face malnutrition. - No water, electricity, toilets, health services. - Labourers remain unrecognized & unprotected despite contributing to sugar economy.
4	"Characterization of Drudgery in Sugarcane Production System" Sushma Gangwar & Seema Kwatra	To analyze and characterize the drudgery experienced by farm workers in sugarcane production across activities using 6 drudgery factors.	Survey via interview schedule, recall method; Drudgery Index based on 6 parameters: physical load, posture, repetitive strain, physiological load, time load & MSD load; ANOVA; qualitative & quantitative scoring	Drudgery varies significantly across sugarcane farm tasks. Highest drudgery: Weeding (74%), Load transport (75%), Traditional planting (88%), Harvesting (83%). Manual methods and poor tools increase strain.

**Work-Related Hazards and Health Risks Among Sugarcane Harvesting Workers in: Maharashtra  
Insights from a Systematic Review**

5	"Evaluation of Sugar Cane Harvester and Cutter" Gizachew Tefera	To develop and evaluate the performance of a sugarcane harvester and cutter under field conditions in Ethiopia, examining cutting efficiency, fuel use, capacity, and uniformity.	Measured cutting efficiency, fuel consumption, cutting uniformity, field efficiency - ANOVA F6(split-plot design) using GenStat software	Fuel consumption increased with motor speed. Best cutting uniformity, Avg field efficiency: 52.67% Machine reduces drudgery & feasible for smallholder use.
6	"Our Poverty has No Shame; the Stomach has No Shame, so We Migrate Seasonally": Women Sugarcane Cutters from Maharashtra, India ".Saroj Shinde	Analyzes the reasons behind <b>seasonal migration</b> towards the sugar belt and highlights women's negotiation at many levels, the nature of work, and benefits of migration. Explores the concerns of women sugarcane cutters, and their involvement in sugarcane cutting.	Data collected was primarily analyzed using thematic analysis. The framing factors were the nature of work, work conditions, and reasons for migration.	The seasonal migration of poor, unskilled, illiterate, lower caste, landless, resourceless, specific groups of women is a form of social exclusion. Drought, water scarcity, debt, and work unavailability, Marriage is a primary entry point for women, other entry points include extreme poverty
7	"A Study of Problems and prospects of sugarcane harvesting laborers of cooperative sugar factories in Solapur district". Vaibhav NilkantGaikwad, Dr. D.D. Pujari	To highlight the problems faced by sugarcane harvesting laborers of cooperative sugar factories in Solapur district. To assess the prospects of sugarcane harvesting laborers. To shed light on the problems and prospects of sugarcane harvesting labor or those who work in the fields	The study is based on secondary data source. Data was collected from sources related to the research topic, articles in different websites, and published and unpublished data sources	This paper stated that Major Problems include Women's specific problems include lack of water/sanitation, need to wake up early for open defecation/bathing , carrying the burden of field work and household work, domestic/gender-based violence, advance money, and regular payment
8	"Process Of Sugarcane Harvesting By Migrant Labourers". Dr. H. B. Mahantesh	1. To evaluate the situation of the seasonally migrated sugarcane harvesters. 2. To study the process of recruitment of seasonally migrating sugarcane harvesters. 3. To examine the problems and difficulties faced by seasonally migrated sugarcane harvesters.	Qualitative study conducted using primary data collected from various respondents through field work in Gokak taluk of Belagavi, Karnataka. 125 migrant sugarcane harvesters were interviewed by 25 Sociology students.	Migration can solve financial problems. The majority were recruited by brokers (Mukadam), often after taking advance money. Working Conditions & Pay: work 8-12 hours per day. The wage is fixed on the basis of tons. Workers are not covered by existing labor laws, leading to problems with job security and social protection.
9	"The crucial highlights on sugarcane cutters in Maharashtra: Unorganized seasonal migrant laborers" Dr Saroj Shinde	To highlight the crucial issues and problems faced by unorganized seasonal migrant sugarcane cutters in Maharashtra.	An exploratory study using qualitative methods, including: in-depth interviews of 20 women sugarcane cutters; informal talks with Mukadam's (team leaders) wives; and observations made during the sugarcane harvesting season 2019.	The paper highlights that the - Drought conditions and their consequences at native places are the push factors, while work availability at the sugar belt is the pull factor. Core Issues: Migrant laborers, typically poor, lower caste, and illiterate/low-educated, face an entire work burden beyond their physical limits and live in difficult conditions

**Work-Related Hazards and Health Risks Among Sugarcane Harvesting Workers in: Maharashtra  
Insights from a Systematic Review**

10	<p>“The Economic Importance of Sugarcane: An Imperative Grass of Indian Sub-Continent”.S. K. Singh and Arti Katiyar</p>	<p>To highlight the economic importance of sugarcane as a cash crop in India, focusing on its role as a source of sugar, biofuel, fibre, fertilizer, and myriad byproducts/co-products with ecological sustainability.</p>	<p>Research Based on compilation of existing literature and data regarding sugarcane's uses and byproducts (evidenced by the extensive references to prior works and surveys).</p>	<p>This paper focuses on the macro-economic and industrial importance of sugarcane: Economic Value- It is a major crop for earning foreign exchange. Byproducts and Co-products: Bagasse and Molasses (used in distilleries for ethyl alcohol, butyl alcohol, citric acid, etc.) are the main byproducts. Press mud has good potential as organic fertilizer. Green tops of cane are used as fodder.</p>
11	<p>"The Role of Sugar Industries in Economic Development in India" Shivanand Rathod.</p>	<p>The importance of the sugar industry in India's economy. The role of the sugar industry in the development of the country. The problems faced by the sugar industry. Future suggestions for the sugar industry.</p>	<p>The paper presents an analysis based on existing data and literature regarding the sugar industry's economic impact, scale, and issues.</p>	<p>The sugar industry is one of the most important in India, impacting the livelihood of approximately 5 crore farmers and directly employing about 5 lakh workers. The industry has an annual turnover of about Rs 80,000 crore. Scale: &amp;700 installed sugar factories. The industry's size is a clear indicator of its role in economic development. Demand: The increasing population drives a greater demand for sugar, further cementing the industry's importance.</p>

**Research Gaps Summary**

1. Several studies identify high drudgery, musculoskeletal disorders, and physical strain, very few have designed, tested, and validated low-cost ergonomic tools or interventions under real field conditions.
2. Existing research mainly provides cross-sectional or short-term observations. There is a gap in long-term studies assessing chronic health outcomes (e.g., musculoskeletal disorders, respiratory illness, reproductive health issues) among sugarcane cutters.
3. Studies discuss mechanization efficiency and recommend reducing manual labor, but there is little research on how mechanization affects livelihoods, employment security, and skill transition of displaced workers.
4. Gender-specific occupational health issues are underexplored quantitatively. Exploitation, and dual workload, there is a lack of quantitative, large-scale data on women's occupational health and ergonomic burden.
5. Many studies point out poor working conditions and lack of legal protection, but there is insufficient evaluation of existing labour laws, welfare schemes, and policy interventions in improving workers' conditions.

6. Inadequate study of environmental and workplace factors affecting productivity and health. Factors such as water availability, sanitation, housing, climate exposure, and pesticide exposure are mentioned, but there is a gap in comprehensive models linking these factors to both productivity and health outcomes. The reviewed literature collectively provides an extensive understanding of sugarcane harvesting, particularly highlighting the occupational, economic, and social realities faced by sugarcane cutters, with several studies offering insights directly relevant to Maharashtra. Research comparing manual and mechanical harvesting, such as the study by Ahmed and Alam-Eldin (2013), emphasizes differences in production efficiency, cost-effectiveness, and field losses, illustrating why manual harvesting remains dominant in many regions. Meyer and Fenwick (2003) further explore manual cutter productivity across green and burnt cane systems, identifying physical strain, work environment, and cutting conditions as major determinants of output. Within Maharashtra, a strong sociocultural and occupational dimension emerges. Chaudhari and Jaggi (2020) use an autoethnographic approach to document the lives of migrant sugarcane

laborers, revealing systemic hardships, exploitative work arrangements, gendered inequalities, and the cycles of migration that shape workers' identities and vulnerabilities. Shinde's works (2020; 2023) also underscore the precarious lives of seasonal migrant sugarcane cutters, especially women, highlighting their negotiation of adversity, economic compulsions, and the multilayered challenges embedded in the migration-work nexus. Studies focusing on occupational challenges, such as Gangwar and Kwatra (2022), identify severe drudgery across sugarcane production stages, driven by repetitive physical tasks, long working hours, and inadequate tools, while Mahantesh's research examines the recruitment processes and the difficulties experienced by migrant harvesters throughout the harvesting cycle.

In the context of Solapur, Gaikwad and Pujari (2022) discuss the problems and prospects of laborers associated with cooperative sugar factories, exposing issues such as low wages, health risks, and unstable employment. Technological perspectives, including Tefera's (2023) evaluation of a sugarcane harvester and cutter, highlight efforts to improve cutting efficiency and reduce the physical burden on workers, though such mechanized solutions remain limited in many Indian states. Broader economic analyses by Singh and Katiyar (2016) and Rathod (2023) position sugarcane as a critical agricultural commodity, indispensable to India's economy due to its contributions to sugar production, biofuel, rural employment, and industrial development, while also addressing structural challenges facing the sugar industry. Together, these studies reveal a complex picture of sugarcane harvesting—one shaped by labour-intensive practices, economic imperatives, migration-driven labour supply, and persistent occupational hazards—underscoring the urgent need for ergonomic improvements, policy interventions, labor protections, and sustainable technological solutions to safeguard the well-being and socio-economic stability of sugarcane Cutters, especially in Maharashtra.

### Conclusion

The literature shows that sugarcane harvesting is very hard physical work and workers face many health and social problems. In Maharashtra, many workers are migrants and live in poor conditions with low wages and job insecurity. Women workers face extra challenges due to both work and household responsibilities.

Most studies describe these problems but do not provide practical solutions. There is very little research on affordable tools that can reduce physical strain. Also, long-term health effects like body pain, breathing problems, and reproductive issues are not well studied.

Mechanization is suggested as a solution, but its impact on workers' jobs and income is not clearly understood. There is also limited data on women's health and workload.

Finally, government policies and welfare schemes are not properly evaluated. More research is needed to improve working conditions, protect workers, and

develop practical solutions for their health and livelihood.

### REFERENCES

1. Ahmed, Adam E., and Amna O. M. Alam-Eldin.
2. "An Assessment of Mechanical vs Manual Harvesting of the Sugarcane in Sudan – The Case of Sennar Sugar Factory." *Journal of the Saudi Society of Agricultural Sciences*, 7 Nov. 2013.
3. Meyer, E., and L. J. Fenwick.
4. "Manual Sugarcane Cutter Performances in the Southern African Region." *Proceedings of the South African Sugar Technologists' Association*, 2003.
5. Chaudhari, Mithunchandra, and Ruchi Jaggi.
6. "Documenting Migrant Lives of Sugarcane Harvesting Labourers in Maharashtra – Autoethnographic Reflections." *Rupkatha Journal on Interdisciplinary Studies in Humanities*, vol. 12, no. 5, 2020.
7. Gangwar, Sushma, and Seema Kwatra.
8. "Characterization of Drudgery in Sugarcane Production System." *International Journal of Scientific Engineering and Research (IJSER)*, vol. 10, no. 4, 2022.
9. Tefera, Gizachew.
10. "Evaluation of Sugar Cane Harvester and Cutter." *Engineering and Applied Sciences*, vol. 8, no. 2, 2023, pp. 31–35.
11. Shinde, Saroj.
12. "'Our Poverty Has No Shame; the Stomach Has No Shame, so We Migrate Seasonally': Women Sugarcane Cutters from Maharashtra, India." *CASTE: A Global Journal on Social Exclusion*, vol. 4, no. —, Oct. 2023.
13. Gaikwad, Vaibhav Nilkant, and D. D. Pujari.
14. "A Study of Problems and Prospects of Sugarcane Harvesting Laborers of Cooperative Sugar Factories in Solapur District." *NeuroQuantology*, vol. 20, no. 15, Nov. 2022.
15. Mahantesh, H. B.
16. "Process of Sugarcane Harvesting by Migrant Labourers." (Publication information not provided—cannot fully complete MLA citation.)
17. Shinde, Saroj.
18. "The Crucial Highlights on Sugarcane Cutters in Maharashtra: Unorganized Seasonal Migrant Laborers." *International Journal of Humanities and Social Science Research*, vol. 6, no. 1, 2020.
19. Singh, S. K., and Arti Katiyar.
20. "The Economic Importance of Sugarcane: An Imperative Grass of Indian Sub-Continent." *Journal of Experimental Zoology, India*, vol. 19, no. 1, 2016.
21. Rathod, Shivanand.
22. "The Role of Sugar Industries in Economic Development in India." *International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)*, vol. 3, no. 1, Mar. 2023.