Section: Orthopaedics

Original Research Article

THE PROFILE OF AGRICULTURAL INJURY CASES IN A YEAR INCLUDING TWO MAJOR HARVESTING SEASONS PRESENTING TO A TERTIARY HEALTH CARE INSTITUTE IN RURAL NORTH INDIA

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ABSTRACT

Agriculture in India, while foundational to the national economy, remains a highly hazardous occupation, especially during peak seasonal periods such as harvesting. This study aimed to investigate the profile of agricultural injuries presenting to a tertiary healthcare institute in rural North India over the span of one year, covering both Kharif and Rabi harvesting seasons. A prospective, cross-sectional analysis was conducted involving 175 patients presenting with extremity injuries within 12 hours of occurrence. The study found that males constituted the majority of cases, and the most affected age group was between 30 and 45 years. Injuries were marginally more frequent during the Kharif season, with threshers and tractors being the most common sources of injury. The forearm and hand were the most frequently injured anatomical regions. Lack of safety devices and poor lighting were identified as the leading contributing factors. The study concludes that agricultural injuries follow a predictable seasonal pattern and are significantly influenced by machinery design, environmental conditions, and safety practices. Focused interventions including improved engineering of equipment, better training and awareness, and policy-level safety mandates are urgently needed to reduce the incidence and severity of these injuries in rural India.

Keywords: Agricultural Injury, Harvesting Seasons.

INTRODUCTION

Agriculture underpins the Indian economy yet remains one of its most hazardous occupations.[1] The mechanisation surge following the Green Revolution has intensified exposure to high energy equipment such as tractors, threshers, and pump sets.[2,3] Although these innovations have augmented yield, they introduce complex injury mechanisms that disproportionately affect rural populations with limited access to trauma care.[4,5] Previous Indian studies have highlighted seasonal spikes in farm accidents, but comprehensive profiles from tertiary centres in the northern wheat belt are scarce.[6,7] This investigation characterizes the demographic and mechanistic spectrum of agricultural extremity injuries during two consecutive harvesting seasons in rural Haryana, thereby identifying modifiable risk factors for targeted prevention.

MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted in the Department of Orthopaedics at Maharaja Agrasen Medical College, Agroha (Hisar), Haryana. The study period spanned from August 2023 to July 2024. A total of 175 patients presenting with extremity injuries sustained during agricultural activity and within 12 hours of occurrence were included. Eligibility criteria encompassed all age groups and both sexes. Exclusion criteria ruled out cases involving isolated skull, facial, thoracic, or abdominal trauma, as well as injuries due to animal attacks, chemical exposure, or heat and inhalational hazards. Data collection included detailed clinical history, physical examination, radiological imaging, and information on the causative agricultural equipment, environmental factors, and time of injury. Informed consent was obtained from all participants.

RESULTS

The mean age of injured patients was 32.81 years, with the majority belonging to the 30 to 45-year age group. Men accounted for 82.86 percent of the study population, reflecting the male-dominated nature of field labor in rural agriculture. Most patients had primary or middle school education, while a substantial proportion were illiterate. Farmers constituted the largest occupational group i.e.56.6%, followed by laborers i.e. 22.3%. Housewives and students accounted for 12.0% and 9.1% of cases, respectively.

In terms of seasonal distribution, 53.7% of injuries occurred during the Kharif cropping season, while 46.3% took place during the Rabi season. The monthly incidence of injuries was highest in April at 13.7%, followed by November at 10.9%, and December at 9.7%. The lowest incidence occurred in June at 5.1%.

Threshers were the most common agricultural implements involved, implicated in 22.3% of cases, followed closely by tractor and tractor-operated implements at 21.7%. Electric motors and pump sets were responsible for 18.3% of injuries, and chaff cutters accounted for 14.3%. Other tools included animal-drawn equipment (6.3%), manual spades (5.7%), cane crushers (5.1%), sprayers (5.1%), and power tillers (1.1%).

The most common etiological factor associated with injuries was the lack of safety devices, reported in 32.6% of cases. Poor lighting was the second leading contributor at 30.9%. Additional factors included overspeeding and ignorance (each at 5.1%), overloading (5.1%), alcohol use and slippery surfaces (each at 4.0%), machine defects (3.4%), tiredness (2.9%), and other isolated factors such as improper garments and unguarded machinery (each less than 1.0%).

Regarding the anatomical site of injury, the forearm and hand were most commonly affected, accounting for 45.7% of cases. Injuries to the knee, leg, and foot represented 23.4%, while injuries to the shoulder and upper arm, as well as the hip and thigh regions, each accounted for 13.7%. Spinal trauma was rare, occurring in just 1.1% of cases.

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Analysis of injury timing revealed that the evening period (12:00 noon to 8:00 PM) saw the highest incidence at 36.0%, followed by the morning period (4:00 AM to 12:00 noon) at 32.6%, and nighttime (8:00 PM to 4:00 AM) at 31.4%.

Comparison between Kharif and Rabi seasons showed similar anatomical distribution, with forearm and hand injuries being predominant in both. However, in Kharif, injuries were more frequently caused by threshers and electric pumps, with lack of safety devices being the primary contributing factor. In Rabi, tractor-related injuries predominated, and poor lighting was the leading cause.

Table 1: Distribution of Amputation

Sr. No.	Level of amputation	Frequency	Percentage
1	Fingers amputation	51	75%
2	Mid palm amputation	4	5.88%
3	Wrist amputation	3	4.41%
4	Forearm amputation	6	8.82%
5	Toes amputation	3	4.42%
6	Mid tarsal	1	1.47%


THRESHER INJURY (INLET)


SUGERCANE MACHINE INJURY


FODDER CUTTER (GANDASA) INJURY


SEEDING MACHINE INJURY

DISCUSSION

The findings of this study affirm the well-documented observation that agricultural work remains among the most hazardous occupations globally, particularly during harvesting periods when mechanization is at its peak. The predominance of injuries among males in the productive age group mirrors trends observed both in India and internationally, underscoring the gendered nature of agricultural labor in rural economies.[6,7]

Seasonal variation in injury frequency was evident, with a higher incidence recorded during the Kharif season. This aligns with previous studies reporting increased injury rates during high-intensity agricultural operations such as sowing and harvesting.[7,8] In this study, threshers and tractors emerged as the primary culprits, a finding that echoes the results of Singh et al. and Aggarwal et al., who also highlighted threshers and tractor-related implements as major contributors to trauma in agricultural settings.[6,7]

Forearm and hand injuries constituted the largest proportion of cases, which is consistent with the mechanistic nature of these injuries. Similar anatomical patterns have been observed in studies from the United States, Canada, and Bangladesh, where upper limb trauma was associated with close interaction with moving mechanical parts such as power take-off units and fodder choppers.[9,10,11]

Lack of safety devices was identified as the most common etiological factor in this study, consistent with previous Indian research emphasizing the absence of protective covers, inadequate machine guarding, and outdated equipment design as critical contributors to injury risk.[7,12] Poor lighting was also a significant factor, particularly in Rabi season injuries, highlighting infrastructural deficits that are often overlooked in rural farm environments.[13]

The predominance of injuries during the evening and early morning hours is likely attributable to reduced visibility and fatigue-related operator errors. This temporal pattern was similarly reported by Swanton et al., who noted longer time-to-care and worse outcomes for injuries sustained during off-peak hours in farm environments.[14]

Globally, the patterns observed in this study parallel findings from developed nations such as the United States and Canada, where musculoskeletal injuries peak during planting and harvesting seasons, and tractors remain a leading cause of both fatal and non-fatal accidents.[9,15] In developing countries, the situation is further compounded by the widespread use of outdated tools and lack of formal training, as reported in studies from Nigeria, Nepal, and Bangladesh.[16,17,18]

Additionally, this study supports prior observations that poorly trained operators and unsafe design features—especially in chaff cutters and threshers—are key determinants of injury severity and frequency.[19] As demonstrated in earlier literature, even minor ergonomic or engineering improvements can significantly reduce the incidence and severity of injuries in agricultural workers.[18,20]

Given the high prevalence of limb injuries and the socioeconomic disruption they cause, there is a pressing need for multidisciplinary intervention. These should include engineering controls, public health education, legislation enforcement, and insurance coverage tailored to the agricultural

workforce, as recommended by the AICRP on Ergonomics and Safety in Agriculture .21

CONCLUSION

This study provides compelling evidence that agricultural injuries in rural North India are seasonal, machinery-driven, and predominantly affect the extremities. Most injuries occur among working-age males, and the primary causes are preventable, such as poor lighting, unsafe equipment, and lack of training. Both harvesting seasons present unique risks that necessitate targeted interventions. There is an urgent need for policy frameworks that enforce mandatory safety features in farm equipment, promote ergonomic tool design, and encourage the use of protective gear. Community education programs, coupled with regulatory support and accessible healthcare, can significantly reduce the burden of agricultural injuries.

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