



EXPLORATION OF OCCUPATIONAL ACCIDENT RISK FACTORS CAUSING WORKER DISABILITY IN THE COCONUT FLOUR INDUSTRY

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ABSTRACT

Occupational accidents in the coconut flour industry in Gorontalo Regency remain a serious threat to workers, with an increasing incidence rate and a high risk of causing permanent disability. This study aims to analyze the risk factors for work-related accidents leading to disability among workers in the coconut flour industry of Gorontalo Regency. This research is a qualitative study utilizing a case study approach. Data collection was conducted through in-depth interviews, field observations, and documentation. The informants consisted of workers with disabilities resulting from occupational accidents, the person in charge of the Occupational Health and Safety Management System (OHSMS), and OHS practitioners. Data analysis was performed using the Miles and Huberman model. The results indicate that accidents leading to disability are dominated by the sheller unit. These incidents are triggered by the interaction between unsafe actions and unsafe conditions. Behavioral factors include low OHS knowledge, rushed work attitudes to meet production targets, and non-compliance with the use of standardized Personal Protective Equipment (PPE). These conditions are exacerbated by substandard physical work environments, characterized by high room temperatures (32.3°C–33.7°C) and dim lighting (132–176 Lux), which significantly reduce worker concentration. Furthermore, the suboptimal implementation of OHSMS policies and management supervision increases the risk of fatalities.

Keywords: coconut flour industry; disability; occupational accident; OHS management system (SMK3)

How to cite (in APA style)

Nelwin, N., Ischak, N. I., & Kadir, L. (2026). Exploration of Occupational Accident Risk Factors Causing Worker Disability in the Coconut Flour Industry. *Indonesian Journal of Global Health Research*, 8(3), 463–470. <https://doi.org/10.37287/ijghr.v8i3.1237>.

INTRODUCTION

Occupational Health and Safety (OHS) remains a critical issue in industrial sectors. The occurrence of workplace accidents and occupational diseases poses a significant threat to organizational sustainability. An occupational accident is an unintended event that can result in various losses, ranging from material damage to fatalities. These accidents are generally classified into two categories: industrial workplace accidents and commuting accidents. Industrial accidents occur at the workplace due to existing hazards or resources, while commuting accidents occur outside the workplace but are related to the employment relationship.

According to the International Labour Organization (ILO, 2018), 2.78 million workers die annually due to work-related causes, with 2.4 million (86.3%) attributed to occupational diseases and over 380,000 (13.7%) to accidents. In Indonesia, the average number of occupational accidents reaches 99,000 cases per year, with approximately 70% resulting in fatal outcomes, including permanent disability and death. Data from the Social Security Administrator for Employment (BPJS Ketenagakerjaan) shows a significant upward trend; cases rose from 182,835 in 2019 to 370,747 in 2023. (BPJS Ketenagakerjaan, 2023).

In Gorontalo Province, BPJS Ketenagakerjaan recorded 803 occupational accidents between 2020 and 2024, seven of which resulted in permanent disability. In 2024 alone, there were 172 cases, dominated by the industrial sector (49%), with the coconut flour industry accounting for 38.3% of

these incidents. The coconut flour sector is particularly vulnerable; at a coconut flour industry in Gorontalo Regency, 131 accidents were reported over the last five years (2020–2024). Among these, 29 cases were fatal or led to disability, including one sudden death due to illness, two traffic accidents, and 26 factory-floor accidents resulting in functional impairment. These impairments primarily involved finger disabilities (24 cases) and visual impairment or blindness (2 cases).

Preliminary observations and interviews with workers revealed a gap between knowledge and practice. Although workers understand that Standard Operating Procedures (SOPs) are designed to minimize errors, non-compliance remains high. Some workers neglected to use safety glasses due to discomfort. Furthermore, the lack of strict sanctions, punishments, or reprimands from supervisors for PPE non-compliance or SOP violations exacerbates the issue. Workers often perceive SOPs as obstacles that hinder performance and time efficiency rather than essential safety measures.

The immediate causes of workplace accidents are generally categorized into two groups: unsafe actions (human factors) and unsafe conditions (environmental factors) (Ulva, 2019). Unsafe actions stem from physical imbalances, lack of education, excessive working hours, working outside one's expertise, or overloading. Conversely, unsafe conditions arise when the workplace fails to meet established OHS standards. Research indicates that 80–85% of accidents are caused by human error. This is supported by Teko and Bulan (2020), whose study at PT Eastern Pearl Flour Mills Makassar showed a significant correlation between OHS compliance and accident rates ($p = 0.000 < 0.05$). Similarly, Kirana (2020) found a significant relationship between PPE compliance and accident risks in the garment industry. Ultimately, accidents do not occur in isolation but result from a chain of events classified into three main categories: human, equipment, and environmental factors (Sulistyaningsih, 2021). Based on this background, this study aims to explore the risk factors of occupational accidents causing worker disability in the coconut flour industry of Gorontalo Regency.

METHOD

This study employed a descriptive qualitative research design with a case study approach. The objective was to analyze the risk factors of occupational accidents leading to disability among workers in the coconut flour industry in Gorontalo Regency. Data analysis was conducted using the Miles and Huberman model, whereby the information obtained from selected informants, categorized into three groups: key informants consisting of two workers who sustained disabilities from occupational accidents at a coconut flour company; a primary informant consisting of the person in charge of the Occupational Health and Safety Management System (OHSMS/SMK3) at the coconut flour company; and an additional informant consisting of one OHS practitioner or expert. The informants were selected using a purposive sampling technique to ensure relevant and rich data collection. In this qualitative framework, the researcher served as the primary instrument, supported by secondary instruments including semi-structured interview guides and observation checklists. Tools such as stationery, audio recorders, and cameras were utilized to document the process. Data collection was carried out through in-depth interviews, field observations, and documentation. The gathered data were analyzed using the Miles and Huberman model, which involves data reduction, data display, and conclusion drawing or verification. This research has passed the research ethics stage with the number: 021A/UN47.B7/KE/2025

RESULT

Risk Factors Contributing to Disability Resulting from Occupational Accidents

Based on the analysis of occupational accident reports for the 2020–2025 period and in-depth interviews, the sheller unit (coconut de-shelling) was identified as the area with the highest risk, accounting for 26 accident cases. These risk factors are classified into five main themes:

1. Equipment and Material Characteristics

The primary hazards originate from high-speed rotating and sharp machinery. The risk is further exacerbated by the use of non-standard Personal Protective Equipment (PPE), specifically cloth gloves. The threaded material of these gloves easily snags on coconut fibers or machine components, subsequently pulling the worker's hand into the machine.

"The most dangerous thing is the machine; the tool rotates and it's made of iron... If the gloves have holes, it's dangerous; there are threads from the gloves that stretch out, and that's what usually gets pulled into the machine. It could be the shell getting pulled in, or the machine itself pulling you in." (Informant K2)

This finding was corroborated by the management:

"Just a tiny thread getting caught will pull [the hand] into the machine... the glove gets carried away by the shell. However, we also lack references regarding the recommended types of gloves." (Informant P1)

2. Worker Behavior and Psychology (Unsafe Actions)

There is evidence of unauthorized PPE modification and low compliance in wearing safety glasses. Workers perceive that PPE hinders comfort and productivity, particularly due to heat and sweat that blur their vision.

"For example, I provide safety glasses, but they don't use them because they are used to working without them; they feel uncomfortable... it affects them psychologically and leads to accidents... They even cut off the fingertips of their gloves to minimize the chance of threads getting caught in the machine." (Informant P1)

3. Physical Work Environment (Unsafe Conditions)

Field measurements and observations indicate that the work environment fails to meet several occupational health standards:

Lighting: Measurements showed levels of 132–176 Lux, which is below the minimum standard of 200 Lux. Dim or flickering lights contribute directly to eye and hand injuries.

"At that time, the lights were dim or sometimes flickering... my vision was blurred because it wasn't clear, and honestly, that was also my own mistake for forcing myself to work at that time." (Informant K2)

Ambient Temperature: Results showed temperatures between 32.3°C and 33.7°C, exceeding comfort standards. High temperatures make workers reluctant to wear masks, head covers, and safety glasses.

"It's very hot in that room... Sometimes sweat gets into your eyes, which is why many of us don't wear glasses. Even if I did, they would just fog up because of the vapor." (Informant K2)

Working Floors: Floor surfaces are frequently wet and slippery due to oil residue from the raw coconuts.

"The floor conditions where they work are wet and slippery; this is unavoidable because the raw material is oily." (OHS Representative)

4. Ergonomics and Work Methods

Workers in the sheller section perform their tasks in a standing position, with the body slightly bent forward and the elbows positioned at approximately a 45-degree angle relative to the coconut peeling machine. In addition, the work involves repetitive movements carried out for a duration of 5–6 hours each day. This posture causes significant musculoskeletal fatigue, which indirectly reduces concentration and increases injury risk.

"The job requires standing; if we sit, there's no power to peel the coconut. Stooping like that makes my back and waist ache. Standing for 5 hours makes my waist hurt and my calves sore." (Informant K1) "The work method requires a pushing force, and technically, the coconut is braced by the body for leverage." (Informant P1)

5. Weaknesses in Management and OHS Supervision

Systemic risk factors include the absence of a certified OHS Expert (Ahli K3) at the company and weak law enforcement. Supervision is more focused on equipment feasibility and production targets rather than worker safety.

"Work procedures and regulations seem to be posted, but there is no OHS expert in the company. Without an OHS expert, there are no safety briefings or guidance..." (Informant P2) "Routine supervision checklists are not focused on OHS, but rather on the production process. We previously had OHS personnel, but they resigned and have not been replaced." (Informant P1)

Worker Experiences Regarding Disability Risks

This section describes the subjective experiences of informants who have sustained occupational accidents. Based on the analysis of in-depth interviews, their experiences are categorized into four main themes: the drive to meet targets under environmental pressure, perceptions of PPE as a hindrance, self-regulated work timing and fatigue, and OHS knowledge and awareness.

1. The Drive to Meet Targets Amidst Environmental Limitations

The workers' experiences indicate a tendency to force the completion of production targets even when work environment conditions are inadequate. The desire to fulfill daily quotas promptly leads workers to ignore sudden risk factors, such as lighting system failures.

"At that time, my box was already filled to the 23rd line, while the light above me had gone out. I chased the target because I was only two lines short; I thought since there were only 200 coconuts left, I could maximize the next 15 minutes to finish, even though it was dark, I kept pushing myself." (Informant K2)

These substandard environmental factors are recognized by informants as the primary trigger for visual perception failure when working with sharp machinery.

"The lights were dim or flickered frequently. When the accident happened, there was no light or insufficient lighting, so my vision was blurred... that was also my own fault for forcing myself at that time." (Informant K2)

2. The PPE Dilemma: Between Protection and Work Hindrance

Informants expressed negative experiences regarding non-ergonomic Personal Protective Equipment (PPE). Safety glasses and cloth gloves are often perceived as additional burdens that increase accident risks by obstructing vision and ease of movement.

"Glasses were not provided; I wasn't wearing them when the accident happened and shell fragments hit my eye. I once tried a friend's glasses, but after only 5 minutes of work, I couldn't see—it was blurry and white. So, I'd rather not wear them; I wouldn't be able to work otherwise." (Informant K1)

Furthermore, there are experiences of workers procuring their own PPE because the stock provided by the company did not meet their comfort needs in the field.

"Sometimes workers buy their own boots. They also buy their own gloves; they prefer the soft white ones. If given safety-standard gloves, they refuse to wear them. In one day, they can go through three pairs... so they provide them themselves." (Informant P1)

4. OHS Knowledge and Awareness

The experiences of the workers are also characterized by a lack of formal information regarding OHS standards. Most workers rely solely on previous work experience (self-taught) without ever receiving adequate OHS socialization from the company.

"I have never heard of Occupational Health and Safety (OHS) standards." (Informant K2) "I already had experience in the same job back in Isimu at Tri Jaya Tangguh." (Informant K1)

OHS Prevention Efforts and Management Policies

The research findings reveal that the prevention efforts currently undertaken by the coconut flour factory management are still in the planning and transition stages. The primary focus of these prevention strategies is divided into two areas: the standardization of the management system and technical engineering of production equipment.

1. Standardization Plan for the OHS Management System

The management, through the Human Resources Department (HRD), recognizes a void in OHS standardization following the resignation of the previous OHS expert. Current policy focus is directed toward establishing formal standards that can be integrated into the workers' culture without triggering significant resistance.

"I have recommended this to the management; at the very least, we should establish the standards first. Once the OHS standards are set, we can begin with equipment construction, but workers must apply safety practices first so that it does not abruptly disrupt their work culture..." (Informant P1)

2. Engineering Controls and Equipment Construction

Given the high accident rate in the de-shelling (sheller) unit, prevention efforts are prioritized toward machine modification. This plan involves the addition of machine guarding to protect workers from flying shell fragments, which pose a high risk of eye and head disabilities.

"Due to the many accident cases caused by tools, I recommended adding covers to the coconut de-shelling equipment because of the shell fragments flying from the main engine rotation every minute... In the sheller-parrier section, what we might need to push for first is equipment construction." (Informant P1)

3. Integration of Environmental Control and PPE

Prevention efforts also encompass the need to improve working environment conditions, which have previously been the reason for worker reluctance to use PPE. Management is considering the use of cooling systems or air circulation (fans) as an indirect effort to increase compliance with safety glass usage by preventing lens fogging.

"Glasses are important, but fans must be used there so the glasses don't get blurry from the heat and sweat. If gloves are provided, thank God, that would be even better." (Informant K2)

4. Challenges in Policy Implementation

Although prevention efforts are being designed, this study identified significant challenges in their implementation, particularly regarding worker behavior and the absence of dedicated personnel to supervise daily OHS compliance. Current policies tend to remain administrative and have not yet fully addressed comprehensive physical protection for field workers.

DISCUSSION

Risk Factors Contributing to Disability from Occupational Accidents

The study identifies that the primary risk factors contributing to worker disability in the coconut flour industry include work attitudes, lack of knowledge, non-compliance, and substandard physical environmental conditions such as ambient temperature, lighting, and ergonomics. It was found that

all 26 accident cases occurred in the sheller unit. Permanent disabilities, such as finger lacerations/amputations and eye injuries, were caused by the use of non-standard cloth gloves (prone to snagging), unguarded sharp machinery, and an environment that fails to meet safety benchmarks. Temperature measurements in the parer and sheller rooms (32.3°C – 33.7°C) and lighting levels (132–176 Lux) significantly deviate from occupational health standards.

These findings align with Nur Susanti (2023), who established a correlation between OHS attitudes and accident occurrence. Regarding the physical environment, Wirawati and Sutriyawan (2002) proved a significant relationship between high air temperatures and workplace accidents. Similarly, Supriyanto (2019) argued that poor lighting increases the probability of accidents compared to adequate illumination. From an ergonomic perspective, Singarimbun (2019) supports the finding that prolonged standing in a stooped position leads to musculoskeletal fatigue, a known trigger for accidents. In a study by Adeyemi et al. (2020), it was stated that to minimize injuries caused by cuts and punctures, ergonomic measures—including proper tool selection and the appropriate use of personal protective equipment (PPE), particularly cut- and puncture-resistant gloves—are essential.

The author contends that these disabilities are the direct result of accumulated unsafe conditions within the factory that have not been promptly mitigated by management. Temperatures above normal thresholds directly accelerate fatigue and subjective complaints. When coupled with heavy physical workloads, this diminishes worker endurance and concentration. Furthermore, low educational levels result in a lack of risk awareness, leading workers to disregard hazards and bypass procedures. This lack of safety consciousness causes workers to prioritize rapid task completion over personal safety to maximize personal break time.

To address this, management must conduct a comprehensive overhaul of the physical work environment. Lighting intensity must be increased to optimum standards to ensure clear visual perception of work objects. Additionally, room temperatures must be regulated through improved air circulation to minimize "negative energy" such as stress and heat exhaustion. The company should also redesign workstations and machine heights according to worker anthropometry to eliminate non-ergonomic postures that trigger chronic muscle fatigue.

Worker Experiences Regarding Disability Risks

Worker experiences reveal a tendency to engage in unsafe behaviors for the sake of time efficiency. On average, workers compress an 8-hour workday into 5 hours by rushing and skipping breaks to reach a target of 2,400 coconuts. Workers perceive PPE, such as safety glasses, as a hindrance due to fogging caused by heat, choosing to work unprotected despite the risk of flying shell fragments. Moreover, a culture of modifying tools and PPE for "comfort" exists, which ironically increases the risk of fatalities.

This is consistent with Suma'mur's theory (2020), stating that 80% of accidents are caused by unsafe actions. Ahmad and Mirwan (2022) also reinforce that higher levels of unsafe actions directly correlate with increased accident rates. Regarding PPE compliance, Rudyarti (2020) notes that the frequency of PPE use directly impacts safety; low usage rates significantly expand the window for accidents.

The author observes that recurring accidents stem from a worker perception that OHS procedures and PPE are obstacles to productivity. The false sense of security derived from modifying tools is driven by a desire for instant convenience without considering long-term risks. Relying on habit rather than formal OHS knowledge leads workers to push themselves in dangerous conditions—such as working in the dark or with unguarded machines—simply to meet production line targets.

To overcome this, the company must shift its procurement strategy to provide puncture-resistant or

cut-resistant gloves that comply with ANSI or EN 388 standards, featuring polymer coatings to enhance mechanical resistance without sacrificing comfort. Behavioral change must be pursued through effective, continuous OHS socialization to instill the understanding that standard PPE is not a burden, but a crucial barrier against fatal disabilities.

OHS Prevention Efforts and Management Policy

Prevention efforts at the coconut flour company Coconut are deemed ineffective due to the absence of standardized OHSMS (SMK3) policies and certified OHS experts. Supervision is currently performed by reassigned personnel, leading to poor regulatory compliance. Management has yet to implement law enforcement for non-compliance, and OHS supervision has not become a core routine.

According to Belmoro (2023), the implementation of OHS programs has a direct positive impact on worker safety. This is supported by Fauzi (2024), who found that supervision has a greater correlation with unsafe actions than knowledge alone. Emylia (2024) emphasizes that workers under suboptimal supervision are 3.5 times more likely to perform unsafe actions.

The author argues that the failure of prevention functions is due to a total reliance on top-level management policies that do not yet prioritize an integrated OHSMS. The absence of an OHS expert results in a loss of daily controls, such as safety briefings and periodic hazard threshold monitoring. Without a management system that defines clear responsibilities, accidents will continue to recur as the company remains focused on production output rather than worker protection.

Management must immediately establish a robust OHSMS policy in accordance with Government Regulation No. 50 of 2012, which includes appointing dedicated OHS experts for continuous monitoring and evaluation. Supervision must be implemented through routine inspections of equipment and behavior, alongside strict sanctions for safety violations. Furthermore, documenting every work procedure is mandatory to ensure that activities in the sheller and parer units operate within a structured safety framework, minimizing the risk of permanent disability.

CONCLUSION

Based on the research results and discussion presented, it can be concluded that the incidence of occupational accidents in the coconut flour industry, particularly within the studied company, is at an alarming level, with the majority of incidents occurring in the sheller or coconut de-shelling unit. Accidents resulting in permanent disabilities primarily involving finger injuries and visual impairment are triggered by a complex interaction between human factors (unsafe actions) and hazardous work environments (unsafe conditions). Behavioral factors, such as rushed work attitudes to meet production targets, low OHS knowledge due to limited education, and non-compliance with standardized Personal Protective Equipment (PPE), are the primary drivers of these fatal accidents. Workers tend to independently modify PPE and equipment for comfort, unaware of the severe risk of being caught in sharp, rotating machinery that lacks safety guards.

This situation is further exacerbated by a physical work environment that fails to meet occupational health standards. Ambient temperatures exceeding 32°C and dim lighting below 200 Lux cause significant physical fatigue, stress, and a sharp decline in concentration. Although administrative workloads and working hours remain within normal limits, a prevalent work culture that compresses working time without adequate rest to leave early creates muscle and eye strain, leading to accidents. Furthermore, management's role in prevention remains minimal, as evidenced by the lack of a functional OHS Management System (SMK3), the absence of certified OHS experts, and weak field supervision and safety socialization.

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