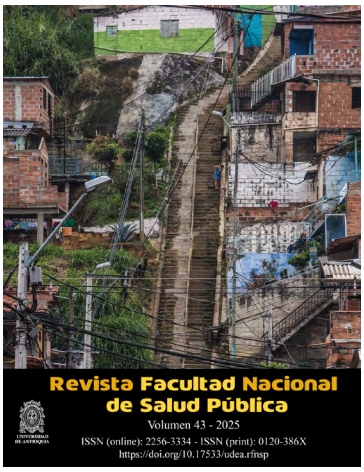

Title: Stairs
Author: Juan Fernando Ospina - Photographer
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Occupational risks perceived by rural workers in panela production in the municipality of Nariño, Antioquia*

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Abstract

Objective: To understand the occupational risks perceived by rural workers in panela production in the municipality of Nariño, Antioquia.
Methods: Descriptive study with a qualitative approach based on the theoretical concepts of Blumer's symbolic interactionism; the research method and design follow Corbin and Strauss' grounded theory; and the Colombian Technical Guide 45 of Icontec was used for hazard classification. Convenience and snowball sampling were used, until theoretical sampling was reached, with 13 participants. The information collected through interviews, observation and photovoice exercises was transcribed and analyzed by applying open, axial and selective coding; then, from the descriptive, analytical, and interpretative categories that were generated a substantive theory was developed. The duration of the study was nine months, between December 2021 and September 2022.
Results: The people who work in panela production do perceive and recognize the risks to which they are exposed in their work. However, panela producers face such risks because of the economic income received and the need for subsistence. Moreover, women work both directly in the mill and indirectly in household chores and food preparation for their family and mill operators, which increases their workload.
Conclusion: There is a relationship between panela production work, even with exposure to high occupational risks, and the economic income obtained for livelihood, as well as with a greater workload for women. From an occupational health and safety perspective, a reflection on the relationship between the execution of risky work activities and the monetary income received is required in order to propose the adoption of preventive measures.

----------*Keywords:* occupational hazards, risk perception, panela production, occupational health and safety

* This article was derived from the study entitled "Experienced working conditions, perception of occupational risk, and risk management practices implemented by sugar mill operators in Nariño, Antioquia, 2021-2022," which was registered in the Research Center of the National School of Public Health on November 12, 2021, with code INS 718-21. Research was conducted between December 2021 and September 2022

Riesgos laborales percibidos por los trabajadores rurales productores de panela en el municipio de Nariño, Antioquia

Resumen

Objetivo: Comprender los riesgos laborales percibidos por los trabajadores rurales productores de panela en el municipio de Nariño, Antioquia.
Métodos: Estudio descriptivo con enfoque cualitativo, fundamentación teórica en el interaccionismo simbólico de Blumer, método y diseño de investigación de la teoría fundamentada de Corbin y Strauss, y uso de la clasificación de peligros de la Guía Técnica Colombiana 45 del Icontec. Se hizo un muestreo por conveniencia y por bola de nieve, hasta alcanzar el muestreo teórico, con la participación de 13 personas. La información se recolectó mediante entrevistas, ejercicios de observación y fotovoz; fue transcrita y analizada, aplicando la codificación abierta, axial y selectiva, con lo cual se generaron categorías descriptivas, analíticas e interpretativas que dieron lugar a la teoría sustantiva. La duración del estudio fue de 9 meses, entre diciembre del 2021 y septiembre del 2022.
Resultados: Las personas que laboran en los establecimientos productores de panela sí perciben y reconocen los riesgos a los cuales se exponen en su trabajo. Sin embargo, los productores de panela se enfrentan a dichos riesgos por los ingresos económicos recibidos y por la necesidad de subsistencia. Las mujeres, además, trabajan de manera directa en el trapiche, e indirecta en las labores del hogar y en la preparación de los alimentos para la familia y los operarios del trapiche, lo cual incrementa su carga laboral.
Conclusión: Hay una relación entre las labores de producción de panela, aun con exposición a riesgos laborales altos, y los ingresos económicos obtenidos para subsistir, así como una mayor carga laboral para las mujeres. Desde la seguridad y la salud en el trabajo se debe reflexionar sobre la relación entre la ejecución de actividades laborales riesgosas y los ingresos económicos percibidos, para proponer la adopción de medidas preventivas.

---------*Palabras clave:* percepción del riesgo, producción de la panela, riesgos laborales, seguridad y salud en el trabajo

Riscos laborais percebidos pelos trabalhadores rurais produtores de rapadura no município de Nariño, Antioquia

Resumo

Objetivo: Compreender os riscos laborais percebidos pelos trabalhadores rurais produtores de rapadura no município de Nariño, Antioquia.
Métodos: Estudo descritivo com enfoque qualitativo, fundamentação teórica no interacionismo simbólico de Blumer, método e desenho de pesquisa da teoria fundamentada de Corbin e Strauss, e uso da classificação de perigos da Guia Técnica Colombiana 45 do Icontec. Foi realizada uma amostragem por conveniência e por bola de neve, até atingir a amostragem teórica, com a participação de 13 pessoas. A informação foi coletada por meio de entrevistas, exercícios de observação e foto voz; foi transcrita e analisada, aplicando a codificação aberta, axial e seletiva, com o que foram geradas categorias descritivas, analíticas e interpretativas que deram lugar à teoria substantiva. A duração do estudo foi de 9 meses, entre dezembro de 2021 e setembro de 2022.
Resultados: As pessoas que trabalham nos estabelecimentos produtores de rapadura percebem e reconhecem os riscos aos que se expõem no seu trabalho. Contudo, os produtores de rapadura enfrentam esses risos pelos ingressos econômicos que recebem e pela necessidade de subsistência. As mulheres, além disso, trabalham de maneira direta no engenho e indireta nas tarefas do lar e na preparação dos alimentos para a família e para os operários do engenho, o que incrementa sua carga de trabalho.
Conclusão: Há uma relação entre o trabalhos de produção da rapadura – ainda com exposição a altos riscos laborais – e os ingressos econômicos obtidos para subsistir, assim como com uma maior carga de trabalho para as mulheres. É preciso reflexionar desde a segurança e a saúde no trabalho sobre a relação entre a execução de atividades de trabalho arriscadas e os ingressos econômicos percebidos, para propor a adoção de medidas preventivas

----------*Palavras-chave:* riscos laborais, percepção do risco, produção de rapadura, segurança e saúde no trabalho

Introduction

Research on risk perception has been ongoing since the 1960s in disciplines such as sociology, psychology, and health sciences, among others. Over time, the concept has expanded into various fields, where its application was considered relevant to decision-making processes [1].

According to Almeida *et al*., a *risk* is defined as the probability of occurrence of an event that may pose harm to human health or the environment [2, p. 325]. From the perspective of occupational safety and health (OSH), a risk is defined as the probability of a hazardous event combined with the severity of its potential consequences [3]. Identifying such risk is imperative for the prevention of such events, thereby avoiding or minimizing their harmful effects.

Morillejo and Pozo argue that risk can be evaluated objectively, often reflected in human or material losses. However, it is important to incorporate a subjective perspective focused on human behavior, emphasizing how individuals perceive and interpret situations they consider hazardous to their health [4]. This integration of perspectives is crucial for developing preventive strategies that encourage the adoption of safe behaviors among workers.

Similarly, the concept of *perception* entails a process through which individuals receive and process information, a process shaped by their beliefs, attitudes, and motivations. This means that perceptions of risk will vary among individuals. Therefore, a valuable approach to understanding how individuals behave in relation to risk involves examining their cognitive processes [4, pp. 419, 420]. Such an approach entails the design and implementation of control measures designed to modify unsafe behaviors.

Scholars in the field commonly define risk perception as the cognitive assessment of risk potential [5,6]. It is also understood as a social construct, shaped by the social and cultural context in which individuals reside and the relationships they establish [1,7].

According to Xia *et al.* [8], "risk perception influences safe behaviors; however, little is known about how such perceptions influence the adoption of safe behaviors, due to the paucity of research in this regard, as OSH research has generally been based on objective risk measurement." The authors emphasize the significance of incorporating emotional risk assessments into conventional objective evaluation frameworks. They argue that enhancing safety behaviors can be achieved by identifying the perception of risk [8]. Consequently, when addressing human exposure to risk, it is essential to comprehend how individuals formulate daily assessments of risk in their professional endeavors, taking into account their emotional perceptions.

An individual perception of risk is therefore fundamental. Beyond the control systems and preventive measures implemented in the workplace, it is a person's cognitive interpretation that shapes how they judge risks as more or less severe. Their sense of whether they possess adequate knowledge and control over these risks can ultimately determine whether an occupational incident occurs. In this sense, the motivations that drive workers to engage in unsafe practices and to adopt safe practices for their health can be understood.

The *perception of occupational risk* "is a malleable construct, in which the working conditions are related to the different perceptions and experiences of the actors" [9, p. 250]. As noted by Camarena *et al*., the perception of occupational hazards is an interwoven process within the workplace. This process is influenced by the performance of daily tasks, and through personal and collective experiences shared among co-workers [9, p. 254]. Consequently, the study of occupational risk perception is relevant for the implementation of preventive controls targeting human behavior. Without a sense of vulnerability, it becomes unlikely that a worker will adopt necessary safety measures [4].

In the Colombian context, panela production holds substantial importance in economic, labor, and nutritional dimensions. It ranks as the second most significant agricultural activity, after coffee [10], serving as a link between the country's agroindustrial and agricultural sectors.

Most panela production is informal and artisanal, with low technological adoption and extended working hours. It is important to recognize the pivotal role of working conditions in the well-being of laborers. This occupation often involves exposure to hazards that, if ignored, can result in long-term health issues for workers [11].

Numerous occupational hazards have been identified in sugarcane mills, colloquially known as "trapiches" [11]. These risks are exacerbated by the lack of healthcare services due to their rural location [12]. Furthermore, occupational exposure to sugarcane has been linked to bagassosis, a pulmonary disease characterized by the inhalation of moldy sugarcane contaminated with pathogenic microorganisms [13]. Concurrently, milling was identified as one of the most hazardous activities in the mills. Despite these known dangers, a review of the existing literature revealed that no control measures had been implemented in this regard [11].

In the municipality of Nariño, located in the department of Antioquia, Colombia, most of the population is engaged in agriculture, particularly in the production of coffee and panela [14]. The town has a small hospital that offers a limited range of first-level services [15]. This means that in emergency situations, requiring medium to high complexity care, residents are forced to travel to health care facilities located four to six hours

away by road. This situation places significant demands on the health care infrastructure and poses a serious barrier to timely and adequate treatment in critical cases. Such challenges highlight the need for attention from prevention professionals and constitute a field of interest to be addressed by OSH, with the aim of preventing occupational accidents and diseases and promoting occupational health.

Research on occupational hazards in sugarcane production and other agricultural subsectors has predominantly focused on risk assessment employing objective measurements [11,16,17]. In addition, qualitative studies have been conducted on occupational risk behaviors in agriculture [18,19]. However, a noticeable gap persists in the literature regarding studies that explore occupational risks from the subjective perspectives of the workers who directly experience them. Therefore, further research is necessary to elucidate how individuals employed in panela production perceive and interpret the risks associated with their work in this crucial agricultural subsector for Colombia; this is an imperative, considering the country holds the distinction of being the foremost per capita consumer and the second largest producer of panela worldwide [10,20].

Thus, the objective of this study is to examine the occupational hazards as perceived by rural workers engaged in panela production in the municipality of Nariño, Antioquia. The research is guided by the following question: What are the occupational risks perceived by rural panela producers in Nariño, Antioquia, Colombia?

Methods

This study adhered to the guidelines of the Consolidated Criteria for Reporting Qualitative Research (COREQ) [21]. Accordingly, a qualitative study was designed, grounded in the theoretical framework of Blumer's symbolic interactionism [22]. This framework focuses on understanding human behavior and their ways of life within group contexts. This approach is based on three premises: first, that individuals behave towards things according to what they mean to them; second, that these meanings emerge from social interactions with others; and third, that meanings are modified to the extent that human beings reinterpret them [22].

This study adopted a qualitative research approach to understand the meanings of occupational hazards perceived by panela producers. These hazards were classified according to the Colombian Technical Guide (GTC 45), which classifies risk into biological, physical, chemical, psychosocial, biomechanical, safety conditions, and natural phenomena [3]. Developed by the Colombian Institute of Technical Standards and Certification, this guide serves as a tool for hazard identification and risk assessment, supporting decision-making processes regarding the implementation of preventive measures in Colombian workplaces [3].

The research design followed the grounded theory methodology as proposed by Corbin and Strauss [23]. This approach was employed to construct a substantive theory, aimed at elucidating the social phenomenon of occupational risks perceived by rural workers producing panela in the municipality of Nariño. This is due to the fact that, to elucidate how individuals perceive occupational risks, subjectivity should be regarded as a complement to the objective assessments predominantly employed in OSH [1,24].

The study was conducted over a nine-month period, from December 2021 to September 2022.

Population and sample

The study participants comprised women and men of legal age who were employed in panela-producing establishments.

The sampling process began with convenience sampling, initiating contact with a known panela producer. Subsequently, snowball sampling was implemented within the framework of theoretical sampling [23]. The initial participant helped identify other potential participants, who in turn referred additional individuals, creating a chain-referral mechanism to recruit participants

As the study progressed, the direction was more intentional towards the saturation of the categories of analysis of interest, through theoretical sampling [23].

Data saturation was achieved when no additional categories emerged, as determined from the analysis of the instruments.

Exclusion criteria included individuals under 18 years of age; those who voluntarily and consciously chose to withdraw after being informed of the purpose of the study, individuals with documented communication impairments or mental health conditions, terminal illnesses, as well as refugees, migrants, or individuals living in public spaces.

In total, 13 individuals participated in the study, 9 men and 4 women, who had been employed in panela production between 5 to 55 years of experience. The participants resided in different villages, including El Recreo, Campo Alegre, Guamal, El Llano, El Palmar, Uvital, and Río Arriba.

This study was conducted in the municipality of Nariño, Antioquia, where approximately 85% of the population lives in rural areas and the economy is based mainly on sugarcane crops and the production of panela, second only to coffee [14]. Despite the high-risk nature of this activity [10], the municipality has only one first-level hospital, located in the urban area [15]. Numerous challenges were observed in the sugarcane mills, inclu-

ding noncompliance with sanitary requirements, poor infrastructure, lack of occupational health and safety protocols (such as protective equipment, hygiene standards, and food handling training), inadequate technology, and poor road conditions. Underreporting of accidents and health issues is also prevalent in this sector, limiting the availability of accurate data on the number of workers and associated morbimortality conditions. This issue merits the attention of prevention professionals.

In Colombia, access to healthcare is determined by the regime under which an individual is enrolled. Individuals may be enrolled in a contributory regime, which involves economic contributions through a formal labor contract, or a subsidized regime, in which healthcare is provided by the state.

Table 1. Sociodemographic information of participants

Features		Frequency	Percentage (%)
Gender	Men	9	69
	Women	4	31
Education	Incomplete elementary school	3	23
	Completed elementary school	3	23
	Incomplete bachelor's degree	2	23
	Technical studies	3	15
	Technological studies	1	8
	Bachelor's degree	1	8
Marital status	Married or in common-law union	9	70
	Separated	2	15
	Single	2	15
Parenthood	With children	11	85
	Without children	2	15
Health insurance affiliation	Subsidized regime	11	85
	Contributory regime	2	15
Occupational accidents	Yes	11	85
	No	2	15

Data collection process

Four primary data collection instruments were designed and applied:

- *Semi-structured interview guide* is a tool designed to elicit information from participants regarding their beliefs about risk. Key questions included: Do you think there are risks in your job? Does your work cause you any kind of fear? Do you feel safe and confident in your work?
- This guide was revised during the three phases of data collection and analysis, resulting in the creation of semi-structured interview guides two and three.
- *Observation exercise guide*, which includes guidelines for recording risk exposures at the worksite.
- *Photovoice exercise guide:* A photovoice is defined as a photograph accompanied by a text. This method allowed participants to capture images of workplace risk. Participants then answered a series of questions explaining their choice, which helped understand which tasks represented the most significant risks for the participants.
- *Commented observation exercise guide*: During the research, the instrument was adapted to allow for the flexibility required in qualitative studies [25]. The instrument was developed based on the theory of the commented tour, which involves an interview with a walkthrough of the research territory [26, 27]. The instrument was implemented during the visit to inactive sugarcane mills, where owners guided researchers through the facilities. The tour

included observations of the workplace, facilitating exploration and risk identification through dialogue.

Given the study's approach and methodological design, these instruments were applied to different subsets of participants, as summarized in Table 2.

These instruments were applied selectively throughout the different stages of data collection and analysis, which were conducted simultaneously, until the theoretical sampling was achieved.

During the study, the participants' identities were assigned numerical codes, as indicated below: E: Entrevista (Interview). O: Observación (Observation). OC: Observación Comentada (Commented Observation). F: Fotovoz (Photovoice). Subsequently, the generated codes were numbered (C and N°). The following codes were identified during the interviews: E: Entrevistador (Interviewer). P: Participante (Participant).

The application of each data collection instrument ranged from 60 to 90 minutes, except for the photovoice exercise, which lasted approximately 20 minutes.

Table 2. Application of data collection instruments per participant

Participant	Data collection instruments applied				Total instruments applied
	Instrument 1 Semi-structured interview guide	Instrument 2 Observation exercise guide	Instrument 3 photovoice exercise guide	Instrument 4 Commented observation exercise guide	
1	✓				
2	✓	✓			
3	✓				
4	✓				
5	✓				
6	✓		✓		
7	✓				
8			✓	✓	
9			✓	✓	
10	✓		✓		
11	✓		✓		
12	✓				
13	✓				
	11	1	5	2	19

Analysis plan

This research was grounded in symbolic interactionism, a theoretical framework that emphasizes the role of social interaction in understanding human behavior. This approach was employed to examine the empirical social world of panela producers. Consequently, from the standpoint of grounded theory, our objective was to ascertain how participants perceive and navigate labor risks in sugarcane mills.

The interviews and conversations were meticulously recorded and transcribed, facilitating the subsequent microanalysis. From this process, 1,338 distinct codes were identified. The *codes* represent fragments of value to the study, which were then grouped into categories according to thematic axes. This process resulted in the theoretical saturation of the information collected, following the three phases of grounded theory: 1) coding, analyzing narratives, and assigning labels to response fragment; 2) categorization, clustering codes into thematic sets that responded descriptively, analytically, and interpretatively, to what was happening; and 3) theorization, addressing the research objective [23].

The study was carried out in three stages, during which the four data collection instruments were applied. Essentially, the process entailed concurrent data collection and analysis, allowing the findings to be validated

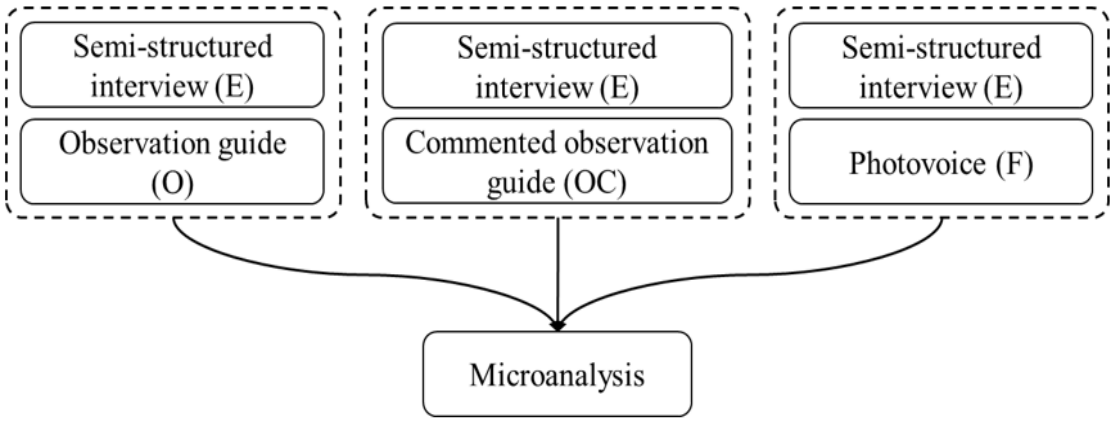
through triangulation. This methodological approach, supported by expert methodologists [28], has been shown to enhance the credibility of data collected from online sources.

As illustrated in Figure 1, each instrument was implemented throughout all phases of the data collection and analysis process.

The first stage involved open coding and descriptive categorization. Here, codes were grouped by thematic axes, resulting in nine descriptive categories [23]: panelera production by family tradition; entry into sugarcane mill work at an early age; perceived risks in the sugarcane mills; risk management practices; marketing panela strategies; panelera production as a means for family subsistence; working conditions in sugarcane mills; cultural roots of panela consumption; and consequences of working in sugarcane mills.

The second stage focused on axial coding and analytical categorization. A comprehensive analysis of the nine descriptive categories revealed relationships among them, which, in conjunction with the grouped axial codes, resulted in the identification of three content-oriented analytical categories [23]: labor risks perceived by rural panela producers in Nariño, Antioquia; panela production: a risky job and its relationship with subsistence; and panela production: labor risks and rural women workers.

Figure 1. Overview of the stages of data collection and analysis.



In the third and final stage, selective coding and interpretative categorization were carried out. Specifically, the analytical categories and selective coding were utilized to create the interpretative category [23], capturing how rural sugarcane mill workers perceive occupational risks. This interpretative category represents the main result of this study. The analytical categories and the interpretative category are described and analyzed in the results section.

The consolidation of the interpretative category uncovered how workers perceive threats in their labor environment and the motivations that drive them to face such dangers. This understanding could inform better safety control measures in an informal yet economically vital sector. Some selected narratives are presented in the results section.

The organization and analysis of the information were facilitated using Word® and Excel® software tools.

Ethical considerations.

Ethical considerations included informed consent (signed or via recorded verbal consent), free and voluntary participation, mental and physical integrity, and the custody and confidentiality of the information of the study participants. Names were replaced with nomenclature.

This study adhered to national and institutional ethical regulations for research involving human subjects [29] and was approved by the Research Ethics Committee of the National School of Public Health, Universidad de Antioquia, in session 278, held on November 26, 2021, under file number 21030002-00227-2021.

Results

The articulation of the final categories enabled the emergence of substantive theory as a grounded theory. This process began by formulating three analytical categories, detailed below, which culminated in the interpretative category presented in this article.

Occupational risks as perceived by rural panela producers in Nariño, Antioquia

This category was developed based on the meanings that workers in sugarcane mills attribute to occupational risks, as defined in GTC 45 [3], and how these perceptions influence their approach to OSH.

The study revealed that panela workers do perceive the risks inherent to their profession. Participants identified the operational processes of the mills as the primary source of mechanical hazards [3]. In the observed cases, these mills are driven by electrical systems consisting of masses, gears, and belts that rotate at high speeds without the essential safety guards. This significantly heightens the risk of entrapment, leading to serious injuries such as amputations or even fatalities.

Mill operation is assigned to individuals with practical knowledge and expertise. However, not all mills are equipped with safety guards, primarily due to outdated equipment and a lack of motivation to upgrade, despite the occurrence of accidents at the mill's entrance, where the sugarcane is introduced. Risks escalate when operators attempt to remove stuck pieces of sugarcane manually or with a *machete* while the mill is active. Participants shared the following insights:

> You know you can't stick your hand in it, or you'll lose it. That, man, you also know you can't wear loose clothes. because when you raise your hand… (E1C12).

> In the trapiche, every area is dangerous, but the most dangerous part is the press; if someone gets careless, the machine will swallow them (E3C87).

> E: When you see the machine, how do you feel, or what perception do you get?

> P: Fear (FV2C1).

According to some participants, the process of heating the sugarcane juice in containers poses a significant risk, constituting a physical hazard [3], due to the high temperatures generated. Sudden temperature changes can result in severe burns, numbness, muscle paralysis, joint damage, and even death. Participants voiced their concerns regarding these risks:

> Everyone knows that you can't touch the guarapo with your bare hands, because that's too hotyou have to be well protected (E5C19).

> If a person falls into one of those holes filled with honey, Holy Mother of God! (OC2C64).

> Well, there are two very, very risky parts: the mill and the oven; there's no need to say, "This one is safer than that one," both are high risk (E7C44).

Another significant risk mentioned by participants, related to psychosocial hazards [3], is the long working hours. Many individuals work across multiple sugarcane mills for consecutive days, starting very early in the morning and finishing late in the afternoon. They often rest briefly before beginning another day exceeding eight hours. The employment arrangement is marked by the absence of a predetermined work schedule and the absence of restrictions on the number of workdays per week.

Furthermore, the physical and mental demands of such routine can result in a decline in concentration and an increase in drowsiness, elevating the risk of accidents and a variety of health concerns, including cardiovascular, respiratory, immune, gastrointestinal, dermatological, endocrinological, musculoskeletal, and mental illnesses. According to the statements made by two interviewees:

> I: How many hours a day does this job usually take?

> P: Between 12 and 14 hours; the working days in the mill are always between 12 and 14 hours. That is the typical shift, depending on the infrastructure and the installed production capacity; it is the volume of production, but the workdays are planned like that […] Starting from 3 AM until 6 or 7 PM at the latest(E1C119).

> I grinded here, before I would grind for up to two days, and I would get up just as early. But that's a waste of life: you wake up early, go to bed late, and the next day you get up early again. You sleep two or three hours, and you go to bed, and sometimes you don't even sleep, you just half-rest. So, what I have been doing lately, for about a year now, I just go out for the day, not too far, not too bad, and so I do about eight or ten small loads, no more (that's around fourteen or eighteen hours, more or less) (O1C23 - O1C104).

Mechanical hazards, as defined by GTC 45 [3], include sharp injuries caused by hand tools such as machetes, axes, and knives, which have the potential to inflict lacerations and wounds. The following hazards were also identified:

- Biological hazards [3]: The presence of scorpions, snakes, cockroaches, mice, and fungi in the environment poses serious health risks through bites, which can lead to infectious and bacterial diseases.
- Physical hazards [3]: The intense heat from furnace operations can cause several adverse effects, including heat stress, fatigue, drowsiness, disorientation, burns, and even death.
- Chemical hazards [3]: Dust from sugarcane fibers and bagasse can cause bagassosis disease. Additionally, particulate matter released during the combustion of bagasse, wood, and guadua impair pul-

monary function, raise blood pressure, and increase the risk of cardiovascular and respiratory diseases.

- Biomechanical hazards [3]: Manual labor such as cutting cane, loading guadua and handling pans (*pailas*) during panela preparation can cause lumbar injueries injuries, muscle strains or ruptures, contusions, and wounds.
- Locative hazards [3]: Uneven or slippery working surfaces, combined with variations in level during activities such as planting, harvesting, and transportation of sugarcane, as well as within the confines of the sugarcane mill, increase the risk of falls, blows, and fractures.

This conclusion is based on the interaction with two interviewees:

> Here, everything is dangerous; everything that is said is dangerous. Of course, the most dangerous and deadliest thing is the machine (E2C26).

> Q: Well, as I said, about twenty days ago, I went over there to help a man. You know, just helping out, but my hands aren't strong enough anymore. I've lost a lot of strength in my hands, and they hurt a lot, like I'm broken right here. It has been three weeks; with this hand, I can't do anything. A lady over there put some ointments on me and prayed; those people who know how to rub and heal with prayer bring some relief. I had an X-ray, or maybe it was an ultrasound, or I don't know what they did at the hospital eight days ago, but they told me my tendons were very inflamed, completely messed up.

> I: And you're saying that this is from the work in the trapiche?

> P: Yes, I've been doing it all my life (E3C16 - E3C23).

- Technological hazards [3]: The storage of combustible materials, such as bagasse, wood, and guadua, which are used to ignite the kiln, presents a serious fire risk. Sparks carried by the wind can ignite fires. Under high temperatures, this could cause burns, smoke inhalation, and fatalities.

According to one participant:

> The second risk, the one that comes with those long shifts, is when the trapiche breaks down, or when someone falls asleep by the oven, because it is so hot, the person falls asleep, then... the trapiche catches fire, or the candle goes out and the bagasse starts burning; then, as it keeps the bagasse dry, it can cause a fire. Trapiches have burned due to negligence of the stoker who is not paying attention (E1C125).

- Work at heights [3]: Tasks such as uncovering the chimney, and installing or removing light bulbs from the roof, while avoiding damage from lightning. These tasks are performed using bamboo and sweet wire ladders, climbing heights of meters or more, with a risk of falling, which can lead to fractures and death.
- Natural phenomena [3], such as thunderstorms, can cause structures to fall and cause injuries.

Sugarcane production: a risky job and its relation to subsistence

The formation of this category was developed by analyzing the factors that motivate farmers to engage in panela production. This process entails significant physical and mental effort, as well as handling hazardous tools and machinery. Officially classified as a class III medium-risk task [30], panela production involves several high-risk activities, like hot work [31] and the use of mechanized and electrical equipment [32, 33]. In some cases, work at heights is also considered a critical task, where accidents can result in severe injuries or even fatalities [34]. This perspective is shared by the workers of the panela-producing establishments, participating in this study.

It is acknowledged that this trade poses potential risks to their safety and well-being. Nevertheless, these risks are accepted, and there is a predilection for panela production. This is primarily because panela production does not require substantial investment in inputs. Sugarcane grows year-round, and panela can be produced quickly; it is easy to prepare, can be consumed immediately, and its marketing is straightforward.

Similarly, the municipality of Nariño has a significant panela production yield within the department of Antioquia, which makes its production attractive, as it supports the economic income and subsistence of farmers and their families. One participant noted:

With sugarcane, I can make money in just one or two days; that is not possible with other crops (E6C30).

Sales are primarily made directly to visitors at the mills. To a lesser extent, it is sold through the Paneleros Association (PASONAR) and directly to local traders. In this regard, some interviewees noted:

> Panela puts food on our table, thanks to God (E8C27).

> Panela means a very important food (O1C110).

A correlation has been demonstrated between the perception of occupational risks and the occurrence of accidents. However, it was determined that the mere recognition of risk is insufficient for its prevention. In certain cases, the experience of an accident can led to a shift in perspective, prompting individuals to adopt a preventative approach. Still, this should not be regarded as a primary safety strategy, given the financial repercussions it entails.

One interviewee stated:

> Once, I went to play near the place where they take out the bagasse; back then, I had long hair down to my waist, and suddenly, my hair got tangled there. I felt that I was being pulled from behind, as a little girl; when I least expected it, the guy who was pulling out the cane whipped out his machete and chopped off my hair. I was left with my hair cut short, and I was all scared. He scolded me and said, "Do me a favor and go home and tell your mother not to send you here again". I got home soaking wet, and on top of that, my mother beat me up. I learned my lesson that day; I would never let my children near that place when they were grinding. I would hold their hands tight and wouldn't let them get close (E5C74 - E5C75).

Sugarcane production: occupational hazards and rural women workers

This category emerges from testimonies expressed by the participants, related to the work of producing panela, which presents a marked differentiation between men and women.

For women, their roles entail both direct and indirect participation in sugarcane work and household chores. Their days start before dawn and end late at night, leading to longer, harder days compared to their male counterparts.

Drawing from these narratives, it is also suggested that women exhibit greater financial awareness and demonstrate more efficient resource management. This is attributed to their prudence, long-term thinking, and understanding of economic stability. Despite the intricate nature of production conditions in the field, which are often influenced by market prices, there persists a sentiment among women that saving must be a priority, when feasible.

Similarly, women tend to be more cautious and apprehensive about risk, leading them to recommend preventive measures. However, some women in the study admitted to being afraid yet still working in sugarcane mills. This suggests that recognizing the risk is not enough to avoid it, but it does imply the need for safety measures. One participant reflected:

> I am afraid of the machine, but if, maybe, there is no one else, then there is no one else to put the cane in, and that is why we cannot use the mill, so we do it very carefully, but we do it (E8C77 - E8C92).

Although women are less likely than men to work directly in the mills, when they do, the workload for women increases substantially. This issue needs to be addressed by occupational safety professionals. One participant stated:

> Well, in the mills that I've seen, in general, that the women also work, because if the woman is not there in the mill, she is feeding the workers who are in the mill, so it is fifty/fifty. In all the mills, I see that the woman works twice as hard. Why? Because they get up around two or three o'clock in the morning to prepare the food for the day, takes the food ready to the mill, which is far from the house, and then they stay on, weighing, bagging, making multiple trips, and finally the woman ends up working more than the men themselves; making the broth that when they finish very late, at twelve o'clock at night, they give them broth to feed the people who are working, bringing fresh food (E5C40 - E5C41).

Baking panela is one of the most dangerous tasks, but it is also one of the most important, as it directly affects the quality of the final product. When skilled workers are unavailable, producers must learn the process themselves. Such was the case for a peasant woman who participated in the program after being displaced by violence during the Colombian armed conflict in this municipality located in the central mountain range. Unable to find a sense of belonging in the distant city, she returned to the territory and decided to manage a community mill, learning this trade. She diversified her production, manufacturing not only bulk panela but also individual portions. Today, she earns her living amidst the sweet aroma and taste of panela as an act of resilience and resistance because she fights to move forward despite the difficulties. She shared:

> Let's see. That mill has been there for about five years. Five years ago, we started making panela there. Now it's my turn to learn, haha. I taught myself to bake and manage the mill. I started baking in the trapiche because we were displaced and went to the city. When I arrived here, I saw that many people lost their sugarcane because they had to wait three months for the nearby trapiches to grind it. So, you would say: "Well, I'll go and say it, but I know that in three or four months, I can hardly wait; it takes too long." We started planting sugarcane and negotiating with the mayor to set up a community mill where people could grind their sugarcane faster. That way, they could consume it and sell it. Then, I started working on that, and we got it (E10C4).

Finally, the following interpretive category was established: Sugar mill workers recognize the risks associated with exposure hazards and acknowledge that these risks compromise occupational health and safety. Nevertheless, they prefer sugarcane production because it is produced year-round, consumed immediately, and easily marketed.

Therefore, it is important for public health—and specifically, occupational safety and health (OSH)—to investigate the motivations that drive people to perform risky work. This understanding will allow us to design

and implement effective injury and illness prevention and occupational health promotion strategies. In this regard, some interviewees stated that:

> When I get sick, I feel discouraged. Sometimes I start to think, what a hard life this is, but how can you walk away from it (O3C44).

> Food is never wasted, and it feeds many people, because the workers also eat from the same farm (O1C105).

Discussion

While no studies were found that directly address risk perception in panela production, there is extensive global research on occupational hazards in agriculture. For example, a study from the United Kingdom and Ireland [17] revealed that cowboys were aware of the hazards involved with cattle. Nevertheless, they engaged in unsafe practices, often prioritizing economic factors, such as the type of work, time efficiency, and profits. Tono and Irwin [17] argue that risk perception influences the response to hazards because people interpret information according to their experiences and worldview. If a worker has never experienced a work-related accident, they may develop a false sense of security. However, few studies have explored risk perception among farmers. Social psychological theories and social perspectives on this topic could be applied to agriculture [17]. Another study in the United Kingdom identified tractor-related hazards, but drivers also focused on economic losses from machine damage [35]. In Iran, rice farmers were aware of the dangers of sun exposure, but reported limitations in self-care due to limited time and financial resources [18].

Some assumptions about risk and how it is perceived are based on the cultural theory of risk. According to this theory, people prioritize risks based on the values and beliefs of their social groups [7]. Similarly, an individual's perception of risk depends on their lived experiences, which aligns with the postulates of symbolic interactionism. According to this theory, people behave in situations based on what those situations mean to them [20, 36]. This dynamic is evident in our study, as participants constructed the meaning of their work environment based on social interactions within their families and communities engaged in sugarcane production. These representations are modified when participants encounter new life experiences involving work-related incidents and accidents, and interact with others. These sociocultural factors may contribute to the adoption of safety practices, which underscores the importance of addressing the occupational risks perceived by panel producers.

Another relevant concept is *subjective immunity,* which describes how familiar risks are often perceived as non-hazardous. While this perception allows individuals to adapt and survive, it can also make individuals overconfident in the face of threats [37]. In other words, although risks may be recognized, daily exposure causes their significance to be minimized, resulting in perceiving a smaller effect than the actual potential consequences of their materialization [38]. In parallel, individuals may adopt an optimistic stance toward exposure risks under an illusion of invulnerability or illusory optimism, which is influenced by sociocultural factors [4]. Therefore, social and demographic factors can influence risk perception [6,39] and strategies designed to mitigate it. For example, higher levels of education, training, and experience are associated with the development of risk management strategies [40].

According to the literature, agriculture is considered a dangerous occupation due to exposure to physical, biological, chemical, and mechanical risk factors that can cause a range of diseases. Additionally, limited access to social security jeopardizes timely healthcare [41]. Similarly, farm workers recognize the risks they face at work. However, without other livelihood options, they must accept risks and their potential consequences [34, 42].

It is important to note that the primary risk in panel production is associated with the operation of the mill. This finding aligns with prior studies on panela mills in Colombia [11, 43].

On the other hand, although no research of this type had been conducted in the municipality of Nariño, a quantitative study of panelero establishments in another Colombian municipality was found. This study identified and valued the most significant occupational hazards according to GTC 45 [3]. The highest risks, which are not acceptable according to GTC 45 [3], are mill operation (mechanical hazard), exposure to extreme temperatures, poor lighting, and noise (physical hazards), and repetitive movements and manual handling of loads (biomechanical hazards) [11]. These findings are consistent with those of the present study.

Even though panela producers are fully aware of these hazards, financial considerations remain important to them. In other words, they recognize a relationship between carrying out productive activities, despite exposure to risks, and the economic income generated, which facilitates their own and their families' subsistence. Individuals can consciously take on risks for various reasons, such as saving time and money [44]. Therefore, to avoid occupational risks or adopt safe behaviors and preventive measures, it is not enough to perceive the risks [17] or receive training [16]; it is also necessary to understand the reasons that drive people to face such risks. Understanding these drivers is essential to desig-

ning strategies that effectively prevent occupational injuries and promote workplace health.

For rural women, the situation is even more complex. In addition to farming, they carry out traditional roles of caring for their families and livestock. This significantly increases their workload, yet this situation is not sufficiently recognized [45]. The women in this study are cautious about exposure to risks, which may be justified by the controls exerted by patriarchy that reduce women's willingness to take risks and make them less vulnerable than men [46]. However, some women who admitted to being afraid said that they are not prevented from acting in risky situations because of other motivations.

The fact that women are more cautious in the face of occupational risks may also lead them to be more cautious when it comes to managing financial risks, such as managing their finances effectively. This is a noteworthy position, given that financial education among rural women in Colombia and Latin America is incipient. However, it is recognized that they are the administrators of household finances and budgets [47].

Limitations of the study: This research did not consider objective measurements. Additionally, the geographical location of the territory and the distances between the sugarcane mills and the urban center made accessing all the mills difficult.

In conclusion, rural workers involved in panela production are aware of the occupational hazards inherent to their work. According to GTC 45, these hazards are classified as mechanical, physical, psychosocial, biological, chemical, biomechanical, technological, working at heights, and natural phenomena, in order of priority. Despite acknowledging the threat these hazards pose to their occupational health and safety (OSH), workers continue to engage in panela production due to its economic viability, year-round availability, and ease of commercialization. They also acknowledge the disproportionate workload that women have, because they must perform household chores, prepare food, and work in the sugar mill. Therefore, it is important to consider the relationship between risky work activities and the income they generate, which supports individuals and their families.

In addition to understanding the occupational risks perceived by rural sugarcane workers, it is important to consider the reasons that motivate people to face these risks, even after recognizing them. This comprehensive understanding is key to designing and implementing effective injury and disease prevention and health promotion strategies, which should be a priority for prevention and public health professionals.

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The authors are responsible for the information provided in the research and its accuracy.

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The authors meet the criteria for authorship established by the International Committee of Medical Journal Editors and participated in the concept and design, data acquisition, data analysis and interpretation, manuscript writing, and final approval.

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