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OCCUPATIONAL RISKS IN SEAFOOD EXTRACTION IN THE MUNICIPALITY OF SÃO JOSÉ DE RIBAMAR - MARANHÃO

RISCOS OCUPACIONAIS INERENTES A EXTRAÇÃO DE MARISCOS NA CIDADE DE SÃO JOSÉ DE RIBAMAR – MARANHÃO

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ABSTRACT: O objetivo do estudo foi analisar os riscos ocupacionais inerentes a extração de mariscos na cidade de São José de Ribamar no estado do Maranhão. Realizaram-se levantamento bibliográfico, visitas e observações *in loco*, registros fotográficos e aplicação de questionário com 18 perguntas fechadas e abertas. Os dados obtidos foram submetidos aos parâmetros de estatística descritiva. A atividade de mariscagem ribamarense constitui-se em dois momentos: mariscagem e beneficiamento. Os trabalhadores ficaram expostos aos riscos ocupacionais de natureza biológica, ergonômica e acidentes de trabalhos. Estes riscos colaboraram para o desenvolvimento de dores nas regiões das costas, na região lombar, pescoço e nos membros inferiores e superiores, além de lesões por esforços repetitivos e de dermatites. O conhecimento dos riscos ocupacionais auxilia na sistematização de medidas mitigadoras e preventivas, amenizando os efeitos danosos e promovendo condições seguras para realização de atividades laborais e, consequentemente, da qualidade de vida dos trabalhadores.
KEYWORDS: Marisqueiras. Doenças ocupacionais. Segurança do trabalho.

RESUMO: The objective of the study was to analyze the occupational risks of shellfish extraction in the municipality of São José de Ribamar in Maranhão. A bibliographic survey, on-site visits and observations, photographic records and questionnaires were carried out, with 18 closed and open questions. The data obtained were submitted to descriptive statistics parameters. The seafood activity in Ribamar consists of two moments: seafood and processing. Workers were exposed to occupational hazards of biological and ergonomic nature and work accidents. These risks contributed to the development of pain in the back, lumbar region, neck and lower and upper limbs, in addition to Repetitive Strain Injuries and the presence of dermatitis. Knowledge of occupational risks helps in the systematization of mitigating and preventive measures, mitigating the harmful effects and promoting safe conditions for carrying out work activities and, consequently, the quality of life of workers.
PALAVRAS-CHAVE: Shellfish gatherers. Occupational diseases. Workplace safety.

INTRODUCTION

The Brazilian coastal zone extends over 8,500 km and includes a diversity of terrestrial and aquatic ecosystems. Among aquatic ecosystems, mangroves are the transitional environment between terrestrial and marine environments, whose biological richness and environmental conditions favor the supply of important goods and services used during the development of various economic activities, mainly in the primary sector, reflecting on the quality of life of the population[1,2,3].

In Brazil, the mangrove area covers 1,211,444 hectares (ha) of high biological productivity[4], corresponding to 87% of the country's entire ecosystem, distributed from Oiapoque, in the state of Amapá, to Laguna in Santa Catarina. The coast of Maranhão has the largest continuous line of mangroves in the country, as it presents characteristics favorable to this ecosystem: macro tidal regime, high rainfall, rich hydrography, and suitable sediments, among others[5].

The main practice of collecting shellfish in mangrove areas is part of the extractive fishing activity carried out by shellfish gatherers, in territories of traditional communities, characterized as shellfish extraction or shellfish gathering. This practice has great importance in the economic and financial support of family and social groups, in the supply of food with high nutritional value, and in the preservation of cultural knowledge and customs that are consolidated and developed by local communities[6].

However, during shellfish gathering work activities, workers are exposed to risk factors that threaten their health, which can lead to illnesses and accidents at work, known as occupational risks. These are characterized by all possibilities of any element or circumstance existing in a given procedure or work environment, expressed through accidents, illnesses, or suffering of workers, causing harm to the health or life of workers resulting from their occupational activities[7].

Identifying these risks is used to reduce occupational risks conditioned by the work environment and how work activities are carried out. It is a tool that helps in the diagnosis of related diseases, as well as in establishing a program of preventive and mitigating measures. This identification must be carried out from the perspective of multiple aspects: intensity, exposure time, temporal organization of the activity, duration of the work cycle, distribution of breaks, or schedule structure[8].

In the municipality of São José de Ribamar, state of Maranhão, shellfish gathering involves a group of shellfish gatherers due to the physio-geographic, climatological, and oceanographic characteristics that favor the development of fishing activity through the extraction of mollusks. This fishing activity is one of the main economic activities in Ribamar, given its great importance in the economic and financial support of the family and social nucleus, in the supply of food with high nutritional value, and in the preservation of cultural and traditional knowledge.

Despite its socioeconomic importance, workers perform their activities in a work environment with occupational risks that can compromise their health, causing occupational diseases and accidents. Therefore, studies aimed at understanding these risks are essential so that mitigating and preventive actions can be effectively established. In this context, this study aimed to analyze the occupational risks of shellfish extraction in the municipality of São José de Ribamar, state of Maranhão, contributing to minimizing damage and promoting well-being.

METHODOLOGY

STUDY AREA

This was a qualitative and quantitative study that focused on the production chain and occupational risks inherent in shellfish harvesting workers in the municipality of São José do Ribamar (02º33'S and 044º44' W) (Figure 1), a coastal area in the state of Maranhão, located about 37 km from the capital São Luís, with an area of 388.4 km² and 180,345 inhabitants[9]. The municipality's economy relies heavily on the exploitation of natural resources through agriculture, livestock farming, and fishing, as well as shellfish harvesting[9].

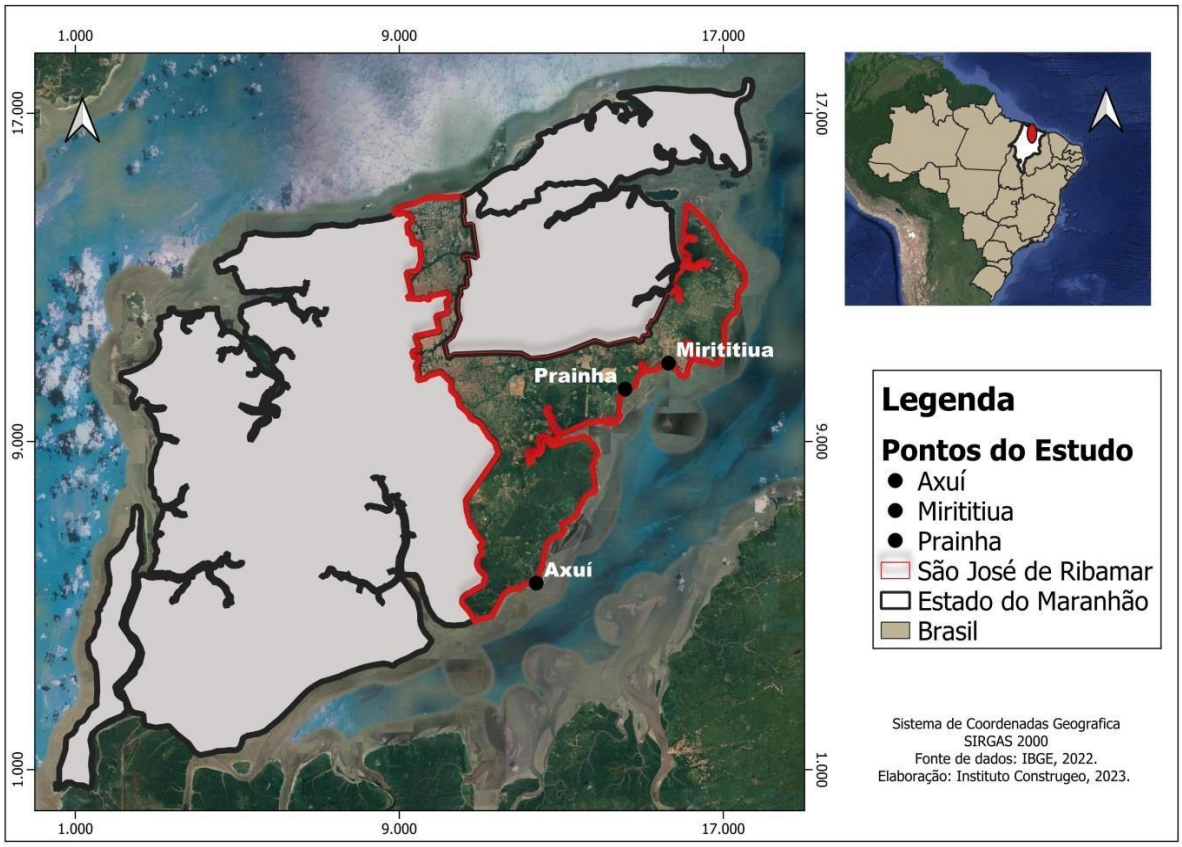

Figure 1. Location map of São José de Ribamar and study points generated in the q-gis program.

Source: Geographic Coordinate System/SIRGAS, 2000

RESEARCH SUBJECTS AND SAMPLING PROCEDURES

The participants were sixty-seven shellfish workers who were members of the municipality's fishermen's union. To compose the sample universe, the union president was contacted in advance, who indicated the possible participants and became a key informant. From the dialogues with the first participants, others were indicated, constituting the non-probabilistic snowball technique[10].

The research was submitted to the Research Ethics Committee (CEP) of the Federal University of Maranhão (UFMA) and approved with opinion 37029420.0.0000.5086, in compliance with the ethical principles for research involving human beings, according to Resolution 466/2012 of the National Health Council (CNS).

DATA COLLECTION

The methodological procedures for data collection consisted of three stages:

1. Bibliographic survey: an in-depth analysis of the research subject in scientific journals, technical reports, theses, dissertations, monographs, and electronic documents in local libraries of public and private institutions, Scielo, Springer link, Science Direct, and Pubmed databases, websites of institutions directly and indirectly linked using the descriptors: population health, occupational diseases, and family extraction.
2. Recognition of the study area: observation, description, and evaluation of the location through visits, on-site observations, and photographic records.
3. Analysis of socioeconomic aspects, description of the production chain, and occupational risks: the field visits took place between December 2020 and April 2021, with six visits, three of which occurred in the morning and three in the afternoon. Due to the Covid-19 pandemic, all health safety protocols were respected. Semi-structured questionnaires with 18 open and closed questions were applied, addressing the characterization of the shellfish gathering activity (working time, species captured, gears used, working hours, daily activities, processing and marketing techniques); and general aspects of occupational risks (main risks, development of occupational diseases, use of personal protective equipment, medications, the area of the body where they feel the most pain, and quantification of pain intensity using the visual analog scale (VAS) ranging from zero to ten, with zero being no pain; one to three, mild pain; four to six, moderate pain; and seven to ten, severe pain.

The collected data were organized and analyzed in the Microsoft Excel software (version 2016), and submitted to descriptive statistics (maximum and minimum), central tendency or position (mean), and dispersion (standard deviation). These values were expressed in descriptive forms, percentages, tables, and graphs.

RESULTS

The study included 67 workers/shellfish gatherers from communities in the municipality of São José de Ribamar. Shellfish gathering was predominantly carried out by women (67.16%), aged between 26 and 33 years (29.8%), and with only elementary education (68.7%) (Table 1). Regarding monthly family income, the majority (50.74%) had a salary of up to ½ minimum wage, estimated at around BRL 500.00 per month (Table 1). Meanwhile, 25.37% of shellfish gatherers were engaged in complementary economic activities (bricklayer, carpenter, trader, and occasional activities without employment relationship), and received approximately two minimum wages. Social benefits from the federal government such as Bolsa Família are represented by 74.6% of shellfish gatherers.

Table 1 – Distribution of sociodemographic variables of workers/shellfish gatherers in the municipality of São José Ribamar, state of Maranhão, Brazil. (N=67), 2021.

Gender	**N**	**%**
Female	43	67.16
Male	24	32.84
Age group	**N**	**%**
18 to 25 years	13	19.4
26 to 33 years	20	29.8
34 to 41 years	11	16.5
42 to 49 years	9	13.4
50 years or older	14	20.9
Education	**N**	**%**
Literate	2	2.9
Elementary school	46	68.7
High school	19	28.4
Marital status	**N**	**%**
Single	43	64.18
Married	14	20.90
Divorced	04	5.97
Widowed	06	8.95
Number of Children	**N**	**%**
From 1 to 3 children	43	70.1
From 4 to 6 children	17	25.3
From 7 to 9 children	02	2.9
From 10 to 12 children	01	1.5
Monthly Income	**N**	**%**
Half the minimum wage (BRL 500)	34	50.7
up to 1 salary (BRL 2,012) + social benefit	32	47.7
up to 2 salaries (BRL 2,824)	1	1.4

Source: Research data, 2021.

PRODUCTION CHAIN

The extraction of bivalve mollusks in the municipality of São José de Ribamar is a small-scale fishing activity carried out by shellfish gatherers, generally practiced for 3 to 4 days a week. For this activity, the shellfish gatherers applied empirical knowledge, acquired and consolidated, and actively transmitted through generations through oral tradition, during the period of activity in the extraction activity, which corresponds to an interval between 10 and 30 years.

The shellfish gathering activity had two distinct moments: 1) Shellfish gathering: includes the steps related to the shellfish gathering process itself. 2) Processing: involves the steps from preparation to commercialization (Figure 2). During the activity, a functional division by gender was noted as follows: men exclusively perform the shellfish gathering steps, and women exclusively perform the processing phases.

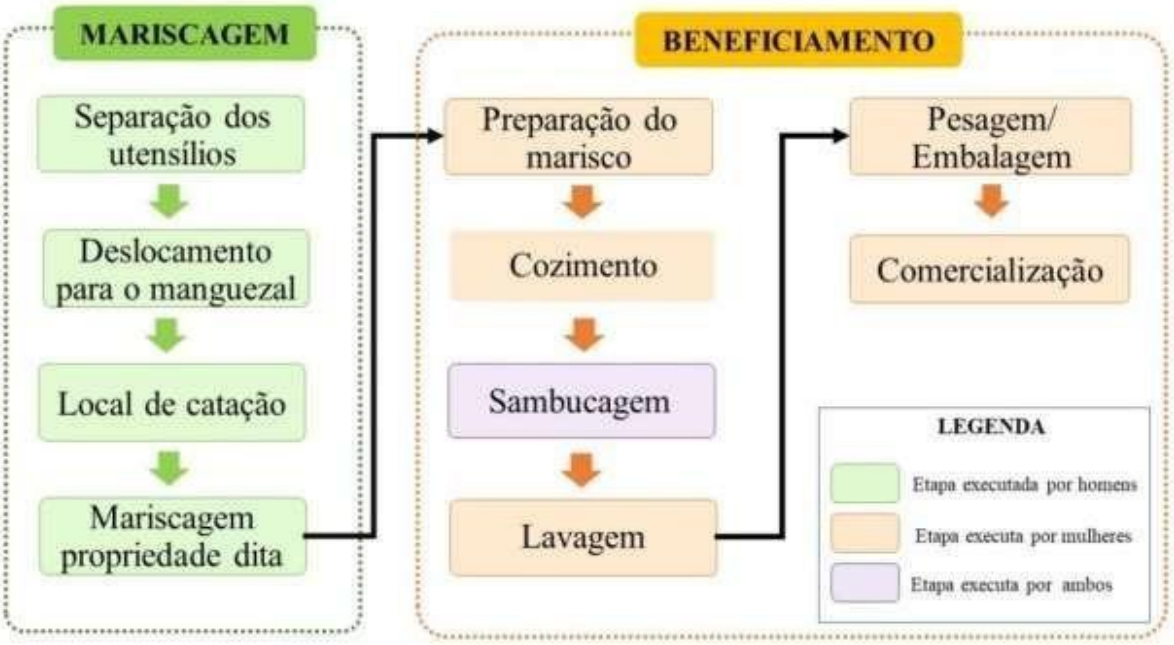

Figure 2. Production chain of the shellfish gathering activity in the municipality of São José de Ribamar, state of Maranhão. Source: Research author.

SHELLFISH GATHERING ACTIVITY

The process begins with the separation of the gears used in the collection, the selection criteria for which are based on the needs of each worker and the work method used, resulting in the selection of gears such as shovels, hoes, and baskets. Then, the shellfish gatherers travel on foot or by boat (such as canoes or motorized boats) for 30 minutes to 6 hours in the morning. This travel time varies according to the collection sites.

The collection sites are characterized by the presence of shellfish beds known as “wet or flooded areas”, which consist of unconsolidated and partially flooded substrate areas, whose main extraction areas were cited, according to the interviewees, in “Miritititua” and “Axuí” (Figure 1), but whenever possible they seek collection sites further away such as the municipality of Primeira Cruz, which is 77.74 km from Ribamar. The choice of collection areas may be related to factors such as tidal variation, substrates, water currents, temperature, and salinity, as well as the biological and ecological conditions of the shellfish, distances from the collection sites to the landing port, season of the year and the availability of shellfish.

Upon arrival at the collection site, the actual shellfish gathering begins. The shellfish gatherers spread out in an almost geometrical manner, looking for the best locations, and creating dynamic and lively configurations, modified in an almost natural way. The shellfish are extracted from the sediment with their hands or gears, taken in a sieve to wash out the mud, stored in baskets, and transported to the landing port in the Prainha Village (Figure 1) during the afternoon. After landing the shellfish, they are stored in the shellfish gatherers’ homes, where they are processed. It is worth noting that in 2012 the shellfish gatherers had a properly equipped shellfish processing unit created by the municipal government to perform this function, however, it is now deactivated.

During the collection, the predominant species were *Mytella falcata* and *Mytella guaniense*, known as sururu. Their production is seasonal, with a smaller number in the rainy season and larger quantities in the dry season. These seasonal changes have a negative impact on the quantity of

production and, more specifically, on the catch yield, which in turn affects the economic development of the activity.

Shellfish gathering activity has a typical working day divided into two distinct moments: the extraction, which lasts for a period of 5 to 8 hours, considering shellfish gathering, and the post-extraction working day, which lasts for 9 to 13 hours of work, considering the processing and storage of the shellfish. Shellfish gatherers have a daily working day of between 14 and 21 hours, highlighting that this working day varies according to the family and the community.

Artisanal processing of shellfish adds value to the final product and comprises seven main steps: 1) Preparation (Figure 3A): consists of storing the shellfish in a container with water, such as buckets, so that it does not deshell, indicating that the natural deterioration can make the product unsuitable for consumption; 2) Cooking (Figure 3B): consists of cooking the shellfish in wood-burning stoves for about 3 to 4 hours, to facilitate the deshelling process; for this process to be satisfactory, it is necessary to stir the shellfish constantly. 3) *Sambucagem* (Figure 3 A, B, and C): consists of removing the shellfish from the shells, which is carried out manually; this process lasts on average 3 to 5 hours, depending on the number of organisms; 5) washing the meat: involves removing the sand, ensuring excellent quality to the meat product, which in turn influences the higher value of the product; 6) weighing/packaging for sale; and 7) Marketing: seashell products are typically sold by shellfish gatherers to the local population or middlemen in bags with a capacity of 12 kg to 14 kg, priced at BRL 50.00. These intermediaries then resell the products to end consumers in cans that hold between 0.850 kg and 1 kg, also for BRL 50.00.

Figure 3. Shellfish processing stages in the municipality of São José de Ribamar, state of Maranhão. A. Shellfish preparation. B. Shellfish cooking. C, D and E. Shellfish *sambucagem*.
Source: Research author, 2021.

The working conditions of shellfish extraction expose workers to biological and ergonomic risks and work-related accidents (Box 1).

PHYSICAL RISKS	CHEMICAL RISKS	BIOLOGICAL RISKS
▪ Exposure to non-ionizing ultraviolet radiation; ▪ Excessive humidity ▪ Excessive heat	▪ Inhalation of smoke resulting from burning wood.	▪ Virus; ▪ Bacteria; ▪ Fungi; ▪ Protozoa; ▪ Worm eggs and larvae; ▪ Sea fish or other animals.
ERGONOMIC RISKS	**RISKS AND ACCIDENTS**	
✓ Muscle overload in the neck, shoulders, upper and lower limbs, and lower back. ✓ Inadequate postures (Figure 4 A, B and C) ✓ Trunk twist and lack of breaks. ✓ Repetitive motion and effort. ✓ Psychic and social constraints. ✓ Physical effort. ✓ Lifting and carrying weight. ✓ Excessive cognitive and physical demands.	▪ Cuts with sharp instruments on the upper and lower limbs. ▪ ▪ Burns. ▪ ▪ Drowning. ▪ ▪ Falls. ▪ Stung by aquatic animals (stingrays) (Figure 4D).	

Frame 1: Main occupational risks (biological, ergonomic and accidents) identified in shellfish workers in São Jose de Ribamar, state of Maranhão.
Source: Research author, 2021.

Figure 4. Exposure of workers to occupational risks inherent in shellfish gathering in the municipality of São José de Ribamar, state of Maranhão. A, B and C. Inadequate postures during *sambucagem*. D. Stung by aquatic animals.
Source: Research author, 2021.

Ergonomic risks were the most frequent (34.78%), followed by ergonomic (26.9%), accidents (21.74%), physical (13.4%), and chemical risks, which were the least frequent with 4.35%. Occupational risks inherent in shellfish extraction activities contribute to the development of health problems among shellfish gatherers in Ribamar, with complaints of pain mostly, with 7 to 10 in intensity (95.52%), especially in women, classified in the category of very intense pain to severe pain in the back, specifically in the lumbar region, as well as in the neck and lower limbs such as legs, resulting from long periods of inadequate posture, overloads and repetitive strain during the process of collecting and processing shellfish.

The presence of dermatitis such as chilblains, soft and brittle nails, red eyes, sore throat, varicose veins, calluses on the hands, allergic respiratory diseases (sinusitis and rhinitis), dehydration, cramps, vision disorders and swelling in the upper and lower limbs resulting from joint and muscle overload and repetitive strain were also observed (Figure 5).

Figure 5. Repetitive strain injuries caused by exposure to occupational risks inherent in shellfish gathering activities in São José de Ribamar, state of Maranhão.
Source: Research author, 2021.

To minimize the effects of health problems resulting from occupational risks inherent in shellfish gathering, workers use over-the-counter painkillers and antibiotics for seven consecutive days with a seven-day break, and then take them again for the same period, triggering a medication cycle that workers call the "seven-day regimen." This practice is carried out throughout the workers' time in the activity, demonstrating the indiscriminate use of medication for a long period that can compromise the integrity of their health, such as the emergence of liver and neuropathy problems in 67.19% of women shellfish gatherers.

A more appropriate way to minimize the health problems of these workers would be the use of personal protective equipment (PPE). However, these actors, in their entirety (100%), do not use PPE for the activity, the sanitary conditions of the place are inadequate and unhealthy, without any safety conditions, especially in the stages of displacement to the mangrove, the collection site, shellfish gathering itself, cooking, and *sambucagem*. When gloves are used by the worker, this protective equipment is inadequate for the activity.

DISCUSSION

The significant women's participation in shellfish gathering may be related to their exclusion from fishing activities, which are mainly practiced by men, and the fact that the activity is carried out in a work environment that does not require much physical strength, but rather the development of psychomotor skills used during shellfish extraction. This high female participation reflects a quite common aspect in shellfish gathering communities in the Northeast region[11,12].

As for education, the levels are attributed to the cultural aspect of the family unit, difficulty in accessing and remaining in school; and the lack of interest of individuals in education, in ensuring that the family's economic and subsistence needs are met through work. A somewhat similar situation was observed in Raposa, state of Maranhão, where the majority (43%) of shellfish gatherers had only completed elementary school[13].

Shellfish gathering communities are in a situation of socioeconomic vulnerability, particularly in the financial aspect, in which this situation may be associated with work activity, dependence on a limited natural resource to obtain family income, an unstable work environment, low sales power, and low product value.

The frequency of shellfish harvesting in the municipality of São José de Ribamar was similar to that of shellfish gatherers in the municipality of Raposa, in the same state[14], who collected shellfish at least 3 to 4 days a week. This frequency was slightly similar to that of shellfish gatherers in Tinharé, state of Sergipe[15], who harvested shellfish periodically for at least 2 to 7 days a week. Regarding the period of activity of the shellfish gatherers in Ribamar, they reported a longer period than those in the community of Raposa, Maranhão,[16] and the communities of Mem de Sá and Tinharé in Sergipe[17], who had spent more than 5 years collecting shellfish. This period of activity was similar to the time of experience of the shellfish gatherers in the community of Chaval, state of Ceará, who had spent 24 to 40 years collecting shellfish[18].

The women shellfish gatherers in the municipality of São Jose de Ribamar used few gears when carrying out their activities when compared to other communities in the Northeast region, which used spoons, buckets, knives, coconut shells, pots, scythes, shovels, plastic boxes, fan covers, and their own hands, as did the shellfish gatherers in the communities of Baía do Iguape[19,20]. The travel time of the shellfish gatherers is shorter than that of the shellfish gatherers in the communities of Ilha de Maré and Chaval, state of Ceará, who traveled on foot or by boat (such as a canoe) for between six and eight hours to the shellfish collection area[20,21].

It is worth noting that the collection site in Ribamar has a peculiar characteristic compared to most shellfish collection sites in the Northeast region, which harvest shellfish from *croas* (sandbanks) exposed year-round during low tide. There was also a near-absence of species diversity collected by shellfish gatherers from São José de Ribamar when compared to the shellfish species caught by the community of Raposa, Maranhão, which consisted of sarnambi (*Anomalocardia brasiliana*), tarioba (*Iphigenia brasiliensis*), sururu (*Mytella falcata* and *Mytella guaniense*), mangrove cupped oyster (*Crassostrea rhiphorozae*), southern white shrimp (*Penaeus schmitti*), crab (*Callinectes* sp.), unha-de-velho (*Tagelus plebeius*), and swamp crab (*Ucides cordatus*)[15,16].

The shellfish processing carried out in the municipality of São José de Ribamar is similar to the processing carried out by shellfish gatherers in Raposa, Maranhão[19], which consisted of the steps of washing the organisms, cooking in a wood-fired oven, removing the shells, selecting the meat, weighing, packaging and marketing the product. All steps are carried out in the homes of the shellfish gatherers. Most of these locations presented precarious basic sanitation conditions, in particular the water supply, solid waste treatment, and sewage system, indicating inadequate infrastructure associated with unsatisfactory hygienic and sanitary conditions for processing a food product. It is worth noting the lack of an appropriate location such as a mollusk processing unit with adequate facilities and equipment for processing, as regulated by the legislation related to hygienic and sanitary conditions such as Resolution 216 of September 15, 2004, of the Brazilian Ministry of Health.

The observed occupational risks presented conditions similar to those of the shellfish communities in the Northeast region, which expressed a higher frequency of ergonomic risk (30.78%), followed by biological risk (19.23%) and accident risk (15.38%) for these workers[9].

The physical risks observed, such as excessive humidity and heat, when associated with the exposure to diverse microorganisms from the work environment during the shellfish gathering stage or deficiencies in basic sanitation, can compromise the normal microbiota of the genitourinary region, causing urinary infections, specifically in women, and manifestations of diseases transmitted via water and arboviruses, such as yellow fever, malaria, dengue, Chikungunya, and Zika[20]. The municipality of São

José de Ribamar during the study period presented temperatures between 21.4°C and 33.4°C, and the average temperature remained approximately 26.73°C, as well as an average air humidity of 83.23%, an average solar radiation of 1,754 kJ/m² and an average ultraviolet (UV) index of 13; this UV index is classified as extreme[17].

According to the National Institute for Space Research (INPE), the Ultraviolet Index (UVI) is a measure of the intensity of UV radiation and, according to the WHO, is grouped into four categories: Low ≤ 2; Moderate - 3 to 5; High - 6 to 7; Very High - 8 to 10; and Extreme ≥ 11[17]. Therefore, the thermal variation associated with air humidity provides high thermal sensitivity and excessive heat, and when these are added to solar radiation and high ultraviolet intensity, they can cause a risk of burns to the skin of workers even within a minimum exposure time of 10 minutes. Thus, it demonstrates that the work environment of shellfish gatherers in Ribamar presented physical risk agents.

Regarding chemical risks, inhalation of smoke from burning wood during shellfish cooking was observed. During wood burning, incomplete combustion occurs, resulting in the release of carbon monoxide, polycyclic aromatic hydrocarbons, nitrated and oxygenated hydrocarbons, and their derivatives when inhaled as smoke through the respiratory tract, which can cause acute respiratory tract infection, chronic bronchitis, tuberculosis, ischemic heart disease, laryngeal cancer, chronic obstructive pulmonary disease, among others[18].

Ergonomic risks such as poor posture, physical effort, repetitive strain, lifting and carrying weight were also observed in shellfish gatherers on Ilha de Maré, state of Bahia[12], and Ilha de Mem de Sá, Itaporanga D'ajuda, state of Sergipe[22]. These risks can cause several problems to the physical and mental health of workers, with the development of Repetitive Strain Injuries and Work-Related Musculoskeletal Disorders (RSI/WMSDs), trigger finger, elbow epicondylitis, cubital tunnel syndrome, thoracic outlet syndrome, anterior interosseous syndrome, pronator teres syndrome, long biceps tendonitis, and supraspinatus tendonitis[12].

Regarding biological risks related to shellfish extraction, participants work in an environment susceptible to contamination caused by pathogenic microorganisms such as viruses, bacteria, fungi, and parasites (eggs and larvae), due to injuries, itching, perforations, and contact with contaminated water. So-called lesions in the epithelial tissue can cause superficial infections that affect mucous membranes and previously damaged areas of the skin such as mycoses, dermatitis, systemic infections, infectious diseases, and lung diseases, which in turn can weaken the immune system.

The workers expressed little similarity with the risks of accidents in the communities of the Ponta do Tubarão Sustainable Development Reserve, in Macau, state of Rio Grande do Norte[16]. These participants reported that the main risks of accidents during shellfish collection were cuts, falls and punctures (stings from aquatic organisms), and the main risks related to work in artisanal fishing were falls, cuts, fractures, drowning, and accidents with marine animals[16].

These signs and symptoms are related to muscle overload in the neck, shoulders, back, upper limbs, and lower back associated with the intense and self-imposed work rhythm, which aims to speed up the work of collecting shellfish, to gather more products for sale and more income, increasing the workload, demonstrating an exhaustive, repetitive and constant work rhythm[16].

The manifestations of signs and symptoms in shellfish gatherers can lead to the emergence of RSI/WMSDs and musculoskeletal disorders, which can trigger inflammatory and degenerative conditions affecting mainly the structures of the upper limbs (fingers, hands, wrists, forearms, arms, shoulders, neck, and spine) and lower limbs (mainly knees and ankles) such as muscles, nerves, ligaments, and joints[16]. These manifestations contribute significantly to the hindrance of activities related to work and domestic and leisure activities[16].

The use of PPE for shellfish gatherers may include appropriate clothing (long-sleeve UV-protection shirt and pants), gloves, goggles, sunscreen, hats or caps, and shoes, among others, to reduce or eliminate the effects of occupational risks and harmful conditions; indicated to maintain the physical integrity of the worker during the shellfish gathering until processing against the impact of flying particles, abrasive agents, cutting and piercing agents, and biological agents. The use of PPE is classified as a measure to prevent accidents and occupational diseases, and should be guaranteed as a right of workers; similar data were found in the study de [24]. Most informal workers did not use PPE during their work practices. This attitude reinforces the need for health education, promotion of conscious habits regarding the appropriate use, and critical awareness of workers regarding occupational exposures. Given that the need for guidance on ways to protect workers is present in the face of daily work challenges, in our research, the informality of shellfish gathering activities was found in the group studied.

Nevertheless, the existing mechanisms for the safety of shellfish gathering activities and their applicability are still insufficient and neglected by the Brazilian government, placing these workers in a situation of constant vulnerability related to their safety and health, given the incidence of diseases such as RSI/WMSDs and work-related accidents. Considering that the State is committed to promoting the improvement of environmental conditions, the main purpose of which is to value human beings, increase self-esteem and quality of life, reducing the costs of work-related accidents[22].

Shellfish gathering in the municipality of São José de Ribamar is carried out in an environment that exposes workers to harmful and/or dangerous physical, chemical, and biological agents such as exposure to non-ionizing radiation, and humidity for a prolonged period, humidity, smoke inhalation, contact with microorganisms, among others, thus triggering occupational diseases, which in turn compromise the health integrity of workers.

Given these reasons, shellfish gathering in Ribamar is classified as an unhealthy activity, recommending the establishment of an additional amount ranging from 10% to 40% of the worker's salary associated with corrective measures to eliminate or neutralize the unhealthiness, such as the use of PPE aimed at preserving occupational health within the work environment. It is important to note that, to receive the additional amount, the rural worker needs to establish an employment relationship. The employment relationship comprises the provision of work by an individual, personal nature, subordination, non-eventuality, onerousness, and otherness[16].

However, the shellfish gatherers of Ribamar in their entirety do not receive the additional amount due to the lack of a formal salary for carrying out an activity without a formal employment relationship, confirming the non-existence of an employment relationship, failing to comply with a requirement for receiving the allowance. These rural workers have an employment relationship for autonomous activities, which is characterized by the essential provision of activity on a habitual basis, on their own account, and without subordination of schedule, free from supervision by the recipient, which differs from the employment relationship[23].

A different situation was found among women shellfish gatherers formally employed by the microenterprise JAPESCA in the Lagoa dos Patos estuary, state of Rio Grande do Sul, who received a fixed monthly salary consisting of a minimum wage plus an additional unhealthy work allowance, with the possibility of an increase in salary for overtime and childcare assistance twice a year[16]. These women shellfish gatherers had an employment relationship associated with unhealthy working conditions and the use of PPE to eliminate or neutralize occupational risks.

Importantly, the women shellfish gatherers in the municipality of São José de Ribamar are organized as a union, which consists of an association of individuals or legal entities that carry out economic activities to defend the collective or individual rights and interests of the category, including

in judicial or administrative matters such as situations of receiving social security benefits such as unemployment insurance, maternity insurance, retirement benefits, among others. In this case, union membership may represent the only legality that shellfish gatherers may have, considering all the irregularities identified during the research.

Among the practical implications of the study on the occupational risks of women shellfish gatherers in the region of São José de Ribamar, state of Maranhão, is the promotion of the health of communities that often become invisible to society and governments in general. Studies addressing this topic allow for the survey and diagnosis of the real situation of these populations, in addition to showing how the study tools can contribute to improving public policies, aiming to enhance the working conditions and performance of these people in the job market.

CONCLUSION

Shellfish gathering activities carried out under working conditions (work environment and method) pose occupational risks that contribute to the development of occupational diseases such as repetitive strain injuries, causing harm to the health of workers in this activity and compromising their social and professional quality of life.

Knowledge of these risks serves as a basis for systematizing simple mitigation and prevention actions to be applied according to the type of harmful agent, mitigating the effects and thus promoting an environment with safe conditions for carrying out work activities, improving the quality of life of workers, as well as recognizing unhealthiness so that labor laws provided for this category of workers can be applied by competent institutions.

It is also important to emphasize that research into the risk factors and health problems of these workers must be further developed, that technical and ergonomic alternatives must be created to avoid excessive workloads and that breaks and rest periods must be introduced. It is also important to focus more on the health problems of the group of shellfish workers who participate in the local economy but whose labor rights are not guaranteed.

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