

# Functional health and perceived exertion in artisanal fishermen working offshore

Saúde funcional e percepção de esforço no trabalho de pescadores artesanais embarcados

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**ABSTRACT** | **Introduction:** Fishing is a common means of obtaining raw materials for the food industry and drives a large economic market. **Objectives:** This field study aimed to evaluate functional health and work overload in artisanal fishermen. **Methods:** This cross-sectional study included 42 workers from Zone 18 fishing community in Passo de Torres, state of Santa Catarina, Brazil. The collected data included presence of pain and its location on a Corlett body diagram, pain severity measured with a visual analog scale, perceived exertion measured with a Borg scale, and grip and lumbar strength measured with dynamometers. **Results:** Forty percent of fishermen had low back pain and 26% had low back muscle weakness. Perceived exertion was greater in the activity of pulling out the fishing net. **Discussion:** This professional category requires greater attention with health policies that consider the actual context of their job.

**Keywords** | work; fishery; low back pain; workers' health.

**RESUMO** | **Introdução:** A pesca é um meio comum de aquisição de matéria-prima para indústrias alimentícias e gira uma grande engrenagem econômica. **Objetivos:** Esta pesquisa visou avaliar a saúde funcional e a sobrecarga de pescadores artesanais embarcados. **Método:** Foi um estudo transversal com 42 profissionais da Zona 18 de pesca de Passo de Torres, no estado de Santa Catarina. Os dados obtidos envolveram a presença de dor e localização com o diagrama corporal de Corlett, a escala visual análoga (EVA), a percepção do esforço com a escala de Borg e dinamometrias palmar e lombar. **Resultados:** Evidenciou-se 40% dos pescadores com dor lombar e 26% com fraqueza lombar. A percepção de maior esforço envolveu a atividade de recolher a rede. **Conclusões:** Há necessidade de mais atenção a essa categoria, com o desenvolvimento de políticas de saúde que considerem o contexto real de suas atividades laborativas.

**Palavras-chave** | trabalho; pesca; lombalgia; saúde do trabalhador.

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## INTRODUCTION

Fishing is a means of obtaining food for many people in different parts of the world, generating employment, contributing to the economy, and influencing the society and culture of traditional fishing regions.<sup>1</sup> Medium-scale artisanal fishery, such as that addressed in this article, may include both commercial and subsistence sectors.

There are 957,000 registered artisanal fishermen in Brazil. Fishing industry issues include child and adolescent labor, or even old-age labor, as well as sexual division of labor. Women are usually restricted to working as shellfish gatherers, added to the burden of domestic activities, while men often engage in offshore fishing activities. Additionally, fishers tend to work overtime, usually 12 to 16 hours a day, and there are ergonomic risks for their spine related to carrying heavy loads, poor posture, and excessive effort with repetitive movements. In this particular case, there is ergonomic evidence of risks for developing a repetitive strain injury (RSI) or a work-related musculoskeletal disorder (WMSD), especially because of the overload of repetitive tasks with excessive effort imposed by an accelerated pace during the workday.<sup>2</sup>

In 1988, Törner et al.<sup>3</sup> conducted a study on musculoskeletal symptoms, working conditions, and ergonomic status of professional fishermen in Sweden. Saldanha et al.<sup>4</sup> addressed a more ergonomic fishery method based on the use of rafts built for preserving the health of fishermen.

Little attention has been given to this topic, thereby concealing the reality of fishermen working offshore. Targeting these workers is crucial to perform an ergonomic redesign in the setting where they work and to identify the consequences of the intense and risky activities they carry out. As is the case with many other professional categories involved in heavy work, covering the fishing environment in scientific research will reveal the real problems faced by these workers. Because their job is risky and no specific ergonomic studies have been found, there is an urgent need to

conduct an in-depth study of these workers. The lack of relevant studies assessing functional physical status and main ergonomic risks for professional artisanal fishermen working offshore prevents attention to be given to these workers.

Pain is a symptom difficult to grade and diagnose, as it may be classified in a wide variety of forms and be present in different body sites. It may also have a substantial association with each person's job.<sup>5</sup> Perceived exertion refers to the degree of perception regarding the work of the muscular, respiratory, neurological, peripheral, and metabolic systems, and may be directly related to pain, activity, or strength in the muscles.<sup>6</sup>

One of the body segments most affected by painful symptoms among workers is the low back. Low back pain is that located below the costal margin and above the inferior gluteal line.<sup>7</sup>

This field study aimed to evaluate aspects of functional health and work overload in artisanal fishermen working offshore in the municipality of Passo de Torres, state of Santa Catarina (SC), Brazil.

## METHODS

### ETHICAL CONSIDERATIONS

This study was approved by the Ethics Committee at Universidade do Extremo Sul Catarinense, opinion number 1.147.459/2015. When first contacted, patients were explained the objectives of the study and then were invited to participate. Those who agreed to participate signed an informed consent form (ICF). Questions about ICF content were addressed by the researchers.

### SAMPLE

A quantitative cross-sectional study of professional artisanal fishermen working offshore in Passo de Torres (SC), Brazil, was conducted. According to Zone 18 fishing community (Colônia de Pescadores da Zona 18) data, they were between 18 and 60 years old. This working population was screened based on inclusion and exclusion criteria.

## INCLUSION CRITERIA

The following inclusion criteria were used: artisanal fishermen working offshore, registered with Zone 18 fishing community, aged 18 years or over, male, who had at least 5 years of work experience and worked in the fishing area effectively.

## EXCLUSION CRITERIA

The following exclusion criteria were used: artisanal fishermen not working offshore, those registered with a zone other than Zone 18 or not registered, those under 18 or over 60 years of age, fisherwomen, and those who had been working in the sector for less than 5 years or who do not fish or are retired.

## STUDY SITE

The study participants were approached at their workplace by the Passo de Torres (SC) wharves. The study questionnaire and muscle strength tests were administered at the same place, after consent was provided.

## DYNAMOMETRY

Muscle strength was assessed with both hand-held and lumbar dynamometers. A Takei lumbar dynamometer with a measuring range of 0 to 200 kgf and a Saehan hand-held dynamometer with a measuring range of 0 to 100 kgf were used. All dynamometers had calibration certificates.

Lumbar dynamometry consisted of the participant standing on the dynamometer with the feet resting on the base of the device, the knees slightly flexed, the trunk flexed, and both hands holding the handle. Then the participant pulled the handle upwards using the strength of low back muscle to stretch out the trunk. Hand-held dynamometry consisted of the participant sitting with the forearms resting and flexed at 90 degrees, the wrists in a slight ulnar deviation, using grip strength on the dynamometer handle.

The following verbal commands were used in each assessment: "Hold tight, ready, pull..." for lumbar dynamometry and "Hold tight, ready, press..." for hand-held dynamometry. Three measurements were taken with each dynamometer, and the highest value

obtained from each assessment was used for each participant.<sup>7</sup>

## VISUAL ANALOG SCALE

Because of its subjective nature, pain cannot be objectively determined by physical instruments such as dynamometers. One-dimensional instruments are designed to quantify only the severity or intensity of pain. Examples of these instruments are numerical/verbal category scales, such as a visual analog scale (VAS), which was used in the study to measure how workers perceived pain.<sup>8</sup>

## CORLETT BODY CHART

A Corlett body chart, which consists of a subjective scale for grading one's perception of body discomfort, was used by the participants to indicate the body parts where they had discomfort.

## BORG SCALE

A Borg<sup>6</sup> scale was also used. This scale measures overall perceived exertion, including shortness of breath or muscle fatigue, and is thus used by millions of researchers and health workers in many countries worldwide.

## DATA ANALYSIS

The collected data were analyzed with the aid of IBM Statistical Package for the Social Sciences (SPSS), version 22.0. Quantitative variables were reported as mean and standard deviation, and qualitative variables were described as frequency and percentage. Inferential analyses were performed at the 95% confidence level. Likelihood ratio and chi-square test with Yates correction were used to investigate the existence of associations between the qualitative variables.

## RESULTS

The sample consisted of 42 professional artisanal fishermen working offshore registered with Zone 18, Passo de Torres (SC). Workers' age ranged from 18 to 59 years (mean, 34.21 years). Height ranged from

160 to 191 centimeters (mean, 173.05 centimeters). Weight ranged from 55 to 120 kilograms (mean, 81.98 kilograms). The minimum length of time working as a fisherman was 5 years, and the maximum length of service was 45 years (mean length of service, 17.26). Sixteen respondents worked as deck sailors, 11 were masters, 9 were in charge of refrigeration, and 6 were drivers. Eleven respondents had had some other job before working as fishermen, and 9 had side jobs at the time. Only 10 respondents were involved in some relevant accident while working on board a fishing vessel (Table 1).

Regarding dynamometry data, all workers reached values within the normal range for hand-held

dynamometry, and 11 workers had lumbar strength below the normal range according to the age group (Table 2).

Figure 1 shows the major pain-related findings of the study. Pain is located on the Corlett body diagram and subjectively graded on the VAS.

When asked about which activity required most physical exertion, the fishermen reported one of the following 12 activities: pulling out the net, refrigerating the fish, finding the fish, unloading the fish, untangling the fish, boarding the nets, carrying the boxes, sailing, pulling out the anchor, breaking the ice, removing the fish from the boat, and harvesting the fish with a hoop net. Thirteen respondents reported that pulling the net out of the sea into the vessel is the activity that requires most exertion. Fifty percent of the respondents rated exertion as “very strong” (between 6 and 9) on the Borg scale (Figure 2).

**Table 1.** Data collected from professional fishermen during field research interviews. The results are reported as mean and standard deviation or as number of workers and percentage

Variable	Mean ± standard deviation
Age (years)	34.21 ± 11.19
Height (cm)	173.05 ± 7.09
Weight (kg)	81.98 ± 15.69
Time working as a fisherman (years)	17.26 ± 11.63
	n (%)
Role on board the vessel	
Sailor	16 (38.1)
Master	11 (26.2)
Refrigeration	9 (21.4)
Driver	6 (14.3)
Type of vessel	
Mesh size 13 cm	34 (81.0)
Mesh size 10 cm	5 (11.9)
Trawler	3 (7.1)
Previous jobs	
Yes	11 (26.2)
No	31 (73.8)
Side jobs	
Yes	9 (21.2)
No	33 (78.6)
Relevant accidents	
Yes	10 (23.8)
No	32 (76.2)

## DISCUSSION

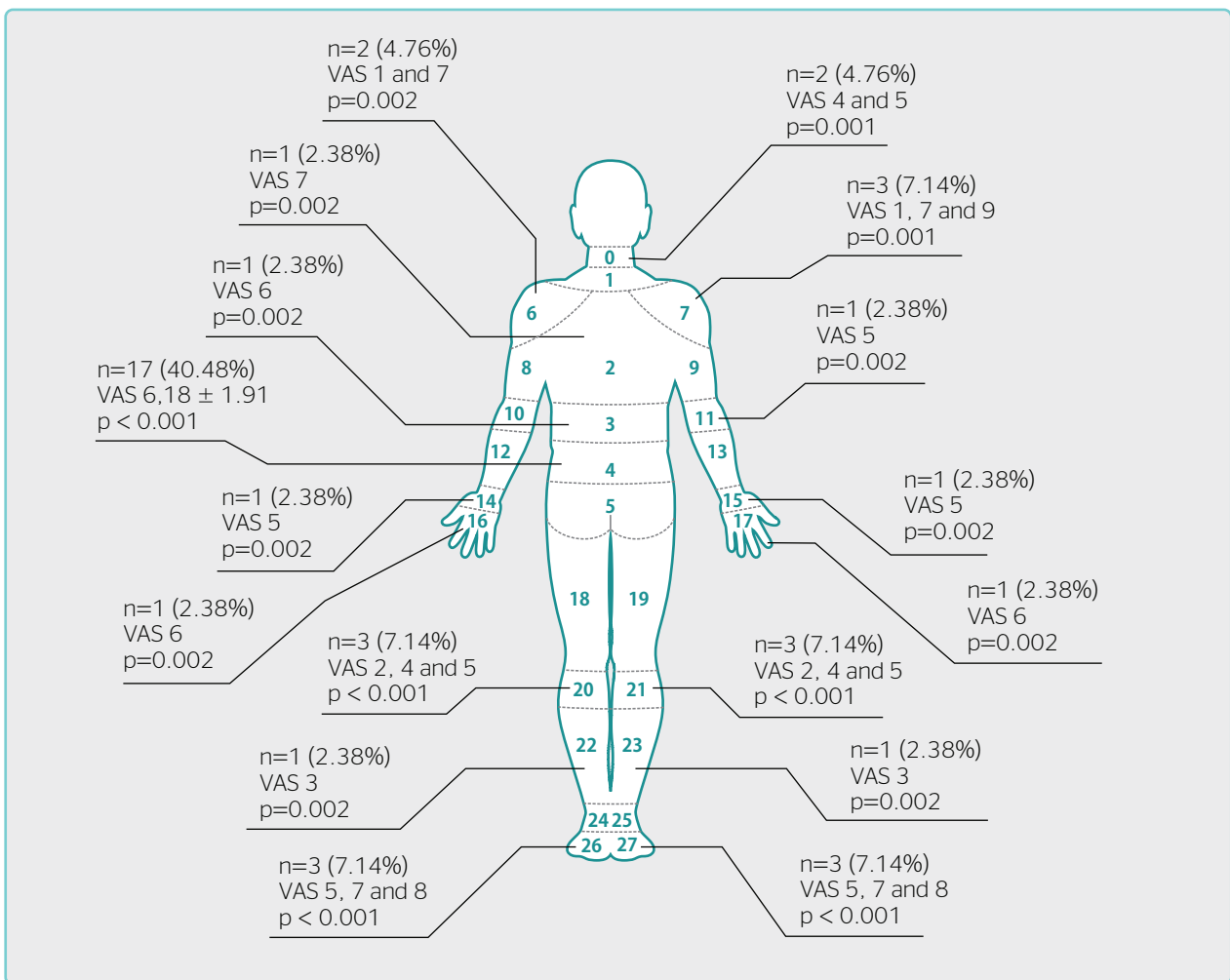
In the present study, a significant number of fishermen were affected by low back pain, as 40% of these workers reported symptoms of such condition. The rate is clearly substantial when compared to those of studies that investigated low back pain as a symptom

**Table 2.** Muscle strength in the fishermen. The results are reported as mean and standard deviation or as number of workers and percentage

Variable	Mean ± standard deviation, n (%)
Lumbar strength	141.83 ± 36.35
Normal	31 (73.81)
Weak	11 (26.19)
Right-hand grip strength	47.29 ± 8.12
Normal	42 (100.0)
Weak	0 (0.0)
Left-hand grip strength	48.86 ± 9.20
Normal	42 (100.0)
Weak	0 (0.0)

in other professional categories. There is a report of low back pain in coal miners affecting 25% of the evaluated sample.<sup>7</sup> In a study of construction workers, a rate of 57% was found among hod carriers, while bricklayers had a low back pain rate above that of this study.<sup>9</sup> A study of commercial fishermen in North Carolina, USA, found a prevalence of 51.6% of cases of low back pain.<sup>10</sup> A more recent investigation conducted in Spain found a frequency of 65.5%.<sup>11</sup> A Brazilian study conducted in Saubara, Bahia, involving artisanal fisherwomen/shellfish gatherers — therefore, not working offshore —, found a surprising prevalence of 75% for low back pain.<sup>12</sup>

For these workers, low back pain may be a harmful factor for their health because it has a great tendency to become gradually stronger as well as chronic. This is one of the main causes of absence from work and, therefore, imposes a heavy burden on the economy involving these workers; it affects not only their personal lives but also their families, the economic sector, and society. The explanation is that fishery is important to maintain a circular economy, and the fish harvested by these fishermen feed the restaurant market, the local markets, and the homes of fishing communities and surroundings.<sup>13</sup>



**Figure 1.** Corlett body diagram and grading of pain on the VAS. VAS = visual analog scale.

The mean age of this working population (34 years), when compared to the mean length of service in the fishing industry (17 years), shows the importance of the activity in the history and daily life and work of these people, especially because fishery seems to be the only work perspective for most of the respondents. This makes actions aimed at facing the risks of low back pain in this professional category even more relevant.

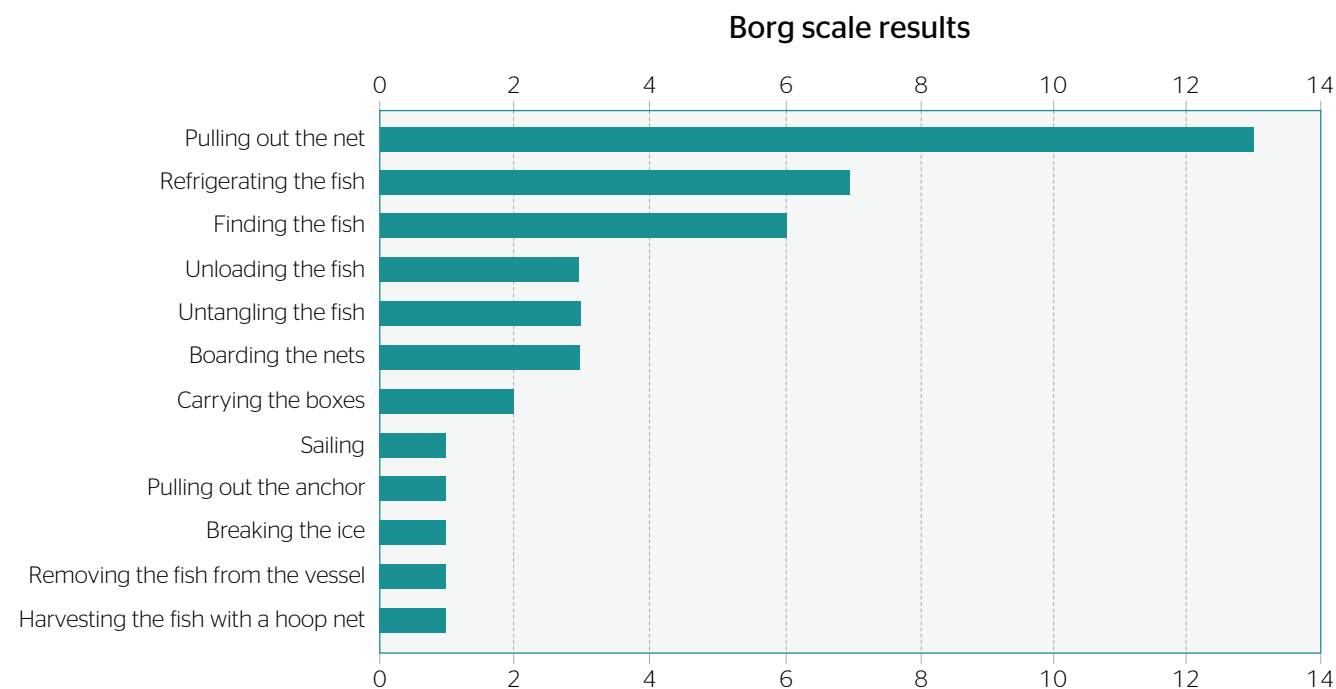
Several recent studies also refer to the psychological and emotional burden that low back pain and its consequences can place on workers. Fishermen usually have an exhausting workday and a brutal physical demand because of working offshore and performing the previously mentioned activities, such as pulling out nets loaded with fish, unloading tons of fish in boxes, and keeping all that load frozen with large amounts of ice.<sup>13</sup> In the fishermen with low back pain, the mean VAS pain intensity score was 6 points, which represents moderate pain.

Low back pain intensity has no full and direct relationship with disability. Many workers manage to

remain active despite a painful condition, certainly at the expense of some compensation. For some authors, the cutoff point for pain intensity is equal to or greater than 5, and there is proportional disability from that score upwards.<sup>14</sup> This has been contested by studies of different professional categories with chronic low back pain that have shown that, even under painful conditions, including moderate pain, disability for many is absent or minimal when specific functional assessment instruments are administered.<sup>15,16,6</sup>

The fishermen's functional status was characterized by a low impairment in lumbar strength, as only 26.9% of the sample showed strength values below the reference ranges for men and age group. Hand-held dynamometric strength was shown to be at a better level, as all fishermen had strength values equal to or greater than the reference ranges.

Manipulation of objects inherent to the activity and the product resulting from fishery, which is the fish itself, among other factors related to preparation and completion of the job, is a key action for fishermen.<sup>12</sup>



**Figure 2.** Column chart showing a comparison of responses provided by the workers about which activities they considered most exhausting.



In this study, the reported activities, such as loading the boxes, boarding the net, pulling out the anchor, pulling out the net, unloading the fish, refrigerating the fish, untangling the fish, sacrificing the fish, breaking the ice, and removing the fish from the boat, denote intense manual work. The characteristics of such manual work may explain the good grip strength results found in 100% of this working population.

Regarding the subjective perception of exertion, most fishermen reported that pulling out the net was the heaviest activity they performed. Handling the net, a large fishing artifact wetted by sea water, often full of the fruit of labor — the fish —, which is usually a live load, is part of the fishermen's job and an additional factor of exertion, requiring the workers to flex their trunks, sometimes associated with bending and rotating. These factors, associated with working on an unstable structure while predominantly standing and with ergonomically inadequate conditions for sitting, certainly contribute to a better understanding of the reasons that make musculoskeletal disorder prevalent in the fishermen evaluated in this study, while in other studies chronic low back pain was found to be the most common musculoskeletal disorder.

According to Guérin et al.,<sup>17</sup> understanding a job is required to transform it. This study clarifies, in part, the dimension of physical functionality and the

musculoskeletal status of fishermen, showing the need for providing health care and safety to this occupational category.

## CONCLUSIONS

Giving attention to artisanal fishermen, especially in aspects related to living, health, and safety conditions, is a very clear need. This working population has a local fishing community for support. However, public policies are needed with effective actions aimed at identifying, recognizing, and addressing occupational risks, with the purpose of contributing to maintaining work capacity in the fishing industry considering the identified profile of these fishermen, who tend to stay long in the job. This paper highlights the need for guidance and actions related to health care and health education, in order to ensure the dignity and preservation of fishermen's functional health.

## ACKNOWLEDGMENT

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