



ANALYSIS OF MUSCLE FATIGUE IN TRACTOR OPERATORS IN WESTERN SANTA CATARINA

Tahiana C. Lorenzet Zorzi ^{1*}

Kauana Inês Petzen ²

Jeanquiele Pendon Grando ³

Josiane S.de Almeida Altemar ⁴

Abstract

The daily work of the agricultural tractor operator causes him/her to remain seated and isolated for a long time, often compromising his/her health, characterizing a stressful profession.

Objective: to evaluate the subjective perception of muscle fatigue when performing activities by agricultural tractor operators in a small municipality in the State of Santa Catarina. Methodology: an observational quantitative cross-sectional study, carried out in the off-season of the corn between April and June 2018, with 15 tractor operators. The instruments used were the Bipolar Questionnaire and the simple identification questionnaire. Results: the Bipolar Questionnaire showed that muscle fatigue was high at the end of the work activity of the agricultural tractor operator. Conclusion: there is a subjective perception of muscle fatigue during the execution of the agricultural tractor operation, which is more pronounced at the end of the working day.

Keywords: Muscle fatigue; Operator; Physical therapy

1. INTRODUCTION

The need to replace human labor with agricultural machinery due to the rural exodus and the need for a constant increase in the volume of food for consumption, have caused the tractor and agricultural equipment industry to experience an extraordinary evolution (ALCÂNTARA et al., 2017).

On the other hand, this activity has been bringing physical and mental overload and occupational risks such as muscle fatigue, related to equipment vibrations, poor posture and the work process itself (BARDIERI, 2017).

¹ Docente do Curso de Fisioterapia, Universidade Comunitária da Região de Chapecó.

*tahiana@unochapeco.edu.br.

² Unochapecó, discente do curso de Fisioterapia da Unochapecó, Chapecó.

³ Unochapecó, discente do curso de Fisioterapia da Unochapecó, Chapecó.

⁴ Docente do curso de Fisioterapia, Doutora Área de Ciências da Saúde Universidade Comunitária da Região de Chapecó.



Operator fatigue is one of the main factors that affects the activity of a tractor driver, which has repercussions on their motor and intellectual skills, such as looking less at the control instruments, reducing the frequency of travel and becoming less sensitive to environmental information (BAESSO et al., 2018)

Work-related activities have a physical, cognitive and psychic load and indicate that overload can influence or cause suffering and physical fatigue, changes in the rhythm of work execution and cognitive work overload, with the physical load being related to muscular effort, cognitive load resulting from mental effort and psychic load is associated with the affective of the task performed (CARDOSO AND GOTIMJO , 2012).

Thus, the concern with the comfort and safety of the operator has drawn the attention of the physiotherapy area, as it is its role to contribute to the maintenance, well-being and quality of life of these workers; In addition, this population is more studied in the areas of agronomy and engineering, but few studies in the area of health.

In this context, knowing the fatigue index can be important for the survey of intervention strategies in the field of disease prevention, especially in the territory where the research was carried out, which is predominantly agrarian.

Thus, this study aimed to evaluate the subjective perception of muscle fatigue in the execution of activities of agricultural tractor operators in a small municipality in western Santa Catarina.

2. MATERIALS AND METHODS

The present study is of the cross-sectional, quantitative, observational type. The selected scenario was a small municipality in the west of Santa Catarina, with an area of 234.40 km², divided into 14 neighborhoods and 25 rural communities. The economy of the municipality is developed by the partnership between agriculture and agribusiness, but with great emphasis on poultry, pig farming, grain and milk production.

In the municipality, there are five mechanized agricultural patrols, with the participation of 168 members. Patrols are groups of farmers from various communities created from the federal and municipal governments in 16 communities in the municipality. The patrol group is



composed of four tractor operators, one of whom will harvest with the forage harvester and the others support the loading and transportation of the harvested product.

For the research, operators who worked with agricultural tractors over 18 years of age, literate, with experience with tractors for at least one year as an integral part of their work routine, and who accepted to participate in the research of their own free will, totaling 20 people, were selected.

We excluded 5 participants who had a confirmed diagnosis of repetitive strain injuries (RSI) or work-related musculoskeletal disorders (WMSD), or pain and workers who returned from vacation in the last three weeks

Initially, authorization was requested from the municipality's Department of Agriculture for the research. After approval by the Human Research Ethics Committee by opinion 2,582,698, data collection began between April and July 2018.

To select the sample, an identification questionnaire was applied by the authors themselves to characterize the subject, including age, weight (kg) and Body Index Mass (BMI), height (cm), presence of pain, installed disease, practice of physical activity, time working with a tractor, number of hours a day used by the tractor, type of activity performed, breaks, tractor model and brand of the tractor set.

After the initial interview, a day was scheduled to apply the Bipolar Questionnaire, which assesses the subjective sensation of muscle fatigue of workers referring to the individual's sensation at that moment of work. The questionnaire consists of 14 questions with two extremes in each question from 1 to 7 to quantify the situation, and the closer to 1, the lower the fatigue, and the closer to 7, the greater the fatigue. He must choose a number according to his perception at that moment, in three stages: at the beginning, middle and end of the journey.

All stages of the research were carried out in the participants' workplaces.

Finally, a non-participant observational analysis of the operational environment was carried out, for a better understanding of the work routine and environment.

For the research, the guidelines and criteria established in Resolution 466/12 of the National Health Council (CNS) were respected, with regard to ensuring the legitimacy of the information, privacy and confidentiality of the information, and all subjects signed the Free and Informed Consent Form and the authorization for the use of images.



For a preliminary exploration of the data, they were characterized from a descriptive frequency analysis. For this, the data were tabulated in a Microsoft Excel Office 2010 spreadsheet.

To analyze possible differences between the samples, they were submitted to normality tests (Shapiro-Wilk).

To evaluate the relationship between the daily number of hours worked and the chronicity of fatigue (Borg Scale at the beginning of activities), Spermann correlation analysis was used. The same analysis was used to compare the homogeneity of the outcome of tiredness at the three moments, beginning, middle and end of the workday.

To compare the results of the Borg Scale, before, during and after, the Kruskal-Wallis test was used. To test pairwise differences, Tukey's post-test was used.

For the bipolar questionnaire, a descriptive analysis of attendance was used in a Microsoft Excel Office 2010 spreadsheet.

3. FINDINGS

Regarding gender, all were men and had an average age of 40 years \pm 14.5 years, ranging from 18 to 60 years, a result close to that found in the study by SANTOS (2014), this is mainly due to the productive age range in Brazil, in which people are more active in their work activity.

In addition, as the region surveyed is small, a large part of the population that works in the field also lives in it, and the children end up continuing to work on their parents' property, having the characteristics of a family farm.

Family farming has as a peculiarity the labor in the family group, so it is distinguished by the production for self-consumption and daily consumption of the city's population.

Regarding body mass index (BMI), 7 operators (47%) were within normal ranges, presenting low risk for cardiovascular diseases, 6 (40%) were overweight, indicating a risk factor for cardiovascular diseases, and 2 (13.3%) were obese, indicating a high risk for cardiovascular diseases. These data corroborate the study by ZIANET (2016), in which 46.09% of the workers in the study were overweight due to the development of cardiovascular diseases.



About the hours worked in the harvest period, it was 9.45 ± 1.18 , more than eight hours per day. CAFFAROA et al (2017) brings the relationship that when an operator works many hours a day, fatigue increases and reduces his alertness, which can trigger a work accident.

Table 1 shows the index of perceived tiredness in three moments, verifying that at the beginning of the working day, 7 (46.67%) operators presented moderate fatigue, which remained in the middle and end of the workday.

Table 1 - Classification of the index of subjective perception of fatigue in the three moments of the work activity.

| PERCEPTION TIREDNESS | n(%) |
|------------------------|-----------|
| START JOURNEY | |
| No fatigue | 7(46,67%) |
| Very weak tiredness | 1(6,67%) |
| Moderate tiredness | 7(46,67%) |
| HALFWAY JOURNEY | |
| No fatigue | 1(6,67%) |
| Very weak | 1(6,67%) |
| Weak | 2(13,33%) |
| Moderate | 6(40,00%) |
| Strong intense | 5(33%) |
| MATCHDAY END | |
| Moderate | 7(47%) |
| Strong intense | 2(13%) |
| Very strong intense | 4(27%) |
| Almost maximum | 2(13%) |

Table 2 shows the subjective fatigue index of muscle fatigue in the three moments of the workday, and it is already possible to perceive critical points of moderate fatigue in the lumbar, back, arm, wrist or left hand. Fatigue in the middle of the workday was also evaluated, and it was possible to perceive the critical points of intense fatigue in the arm, hand or left wrist. In the final questionnaire of the day, it was possible to perceive that the most critical points of



intense fatigue were head, lumbar, back, thighs, legs, arm, wrist or left hand, neck and shoulders, calm, tired and compromised productivity.

Table 2 shows the level of subjective tiredness of muscle fatigue at the beginning, middle and end of the workday in relation to anatomical points.

| | MODERATE | | SEVERE | | ABSENCE | |
|------------------------|----------|---------|--------|---------|---------|---------|
| | N | Average | N | Average | N | Average |
| INITIAL BIPOLAR | | | | | | |
| Lumbar | 14 | 1,50 | 1 | 5 | - | - |
| Back | 14 | 1,50 | 1 | 5 | - | - |
| Arm, wrist or hand E | 14 | 1,50 | 1 | 5 | - | - |
| Neck and shoulders | 13 | 1,15 | 2 | 4 | - | - |
| Calm | 14 | 1,5 | 1 | 5 | - | - |
| BIPOLAR MEDIUM | | | | | | |
| Lumbar | 12 | 1,17 | 3 | 4,33 | - | - |
| Back | 13 | 1,15 | 2 | 4 | - | - |
| Thighs | 14 | 1,50 | 1 | 5 | - | - |
| Legs | 14 | 1,50 | 1 | 5 | - | - |
| Arm, wrist or hand E | 14 | 1,50 | 1 | 5 | - | - |
| Neck and shoulders | 11 | 1,55 | 4 | 4,25 | - | - |
| Tired | 13 | 1,25 | 1 | 4 | 1 | 6 |
| Desc. visually | 14 | 1,50 | 1 | 4 | - | - |
| BIPOLAR FINAL | | | | | | |
| Head | 14 | 1,50 | - | - | 1 | 5 |
| Lumbar | 10 | 1,63 | 2 | 4 | 3 | 6,33 |
| Back | 12 | 1,42 | - | - | 3 | 4,33 |
| Thighs | 14 | 1,50 | - | - | 1 | 5 |
| Legs | 13 | 1,15 | 1 | 4 | 1 | 6 |
| Arm, wrist and hand D | 10 | 1,50 | 5 | 4,80 | - | - |
| Arm, wrist and hand D | 9 | 1,44 | 5 | 4,80 | 1 | 6,50 |



| | | | | | | |
|--------------------|----|------|------|------|---|------|
| Feet | 15 | 1,07 | - | - | - | - |
| Neck and shoulders | 10 | 1,90 | 3 | 4,33 | 2 | 6,50 |
| Concentration | 12 | 1,46 | 3 | 4,33 | - | - |
| Calm | 13 | 1,38 | - | - | 2 | 6,50 |
| Tired | 4 | 2,25 | 2,25 | 6 | 5 | 6,40 |
| Desc. visually | 14 | 1,50 | 1,50 | 1 | - | - |
| Committed product | 13 | 1,31 | 1,31 | 1 | 1 | 6 |

Source: Authors

Another important factor was that all tractors used did not have closed cabs. Studies show that the lack of a protective cab can trigger an accident at work, in which the operator is susceptible to extreme weather conditions and unfavorable sound effects.

It was possible to observe the stress among the operators, thus reflecting on subjective fatigue, because during the harvesting process there are episodes in which the harvesting machine silage broke or clogged with the corn that was being ground; Therefore, the operators had to stop the harvest and go down to fix the machine to continue the process, if they could not, they needed to call the mechanic for help to finish the process.

Through the operators' reports at the time of the machine breakdown, it was seen that the fact that they have to leave their workstation and often take on a job that is not theirs – such as repairing the machine – makes them waste time harvesting and also generates a high level of stress, since the time that the tractor was stopped for repair is reflected in an even later harvest.

During the collection period, the climate of the region was a limiting factor, because on rainy days the operators did not carry out their work activity. Due to the collection being in the off-season (April to July), the sample was small. It is suggested that the research be carried out during the corn harvest period (November to January), as the working day is longer because it is daylight saving time and there are other climatic conditions, which probably predispose to greater fatigue and tiredness in the operators.

OLIVEIRA et al (2013), made use of the Bipolar Questionnaire for the subjective assessment of work fatigue in the rural population and highlights that work fatigue is present in the population mainly at the end of the working day, with complaints of pain in the legs, back and lower back. handling of machines, electric saws, sickles, machetes and manual work in general.



The author also mentions in his study that special attention should be paid to preventive measures regarding the health of these workers, as they are constantly exposed to unfavorable weather conditions, physical and nervous exhaustion, causing a decrease in work performance and an increase in the possibility of the risk of accidents during the execution of their activities.

4. CONCLUSION

Through this research, it was possible to verify that there is muscle fatigue during the execution of agricultural tractor operations, it is mainly at the end of the working day.

It is suggested that greater attention be paid to the prevention and health promotion of these workers and the rural population in general, as well as new research in times of larger harvests, since agricultural activities are still little studied.

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