Issue Rehabil. Orthop. Neurophysiol. Sport Promot. 2019; 28: 21–27. ISSN 2300-0767
DOI: 10.19271/IRONS-000101-2019-29

RESEARCH REPORT

THE PREVALENCE OF NECK PAIN RELATED TO THE SEASONAL WORK OF FARMERS ON TRACTORS

WYSTĘPOWANIE DOLEGLIWOŚCI BÓLOWYCH W SZYJNYM ODCINKU KRĘGOSŁUPA ZWIĄZANYCH Z SEZONOWĄ PRACĄ ROLNIKÓW NA CIĄGNIKU

Jagoda Goślińska[1], Karolina Tułacz[2]
[1]Department of Rehabilitation, Poznań University of Medical Sciences, Poznań, Poland
[2]Department of Physiotherapy, Non-public Specialized and Nursing Healthcare Institution "Medyk", Kalisz, Poland

ABSTRACT

Introduction

Spinal pain is a major problem in the farming profession. The factors that determine the disorder are long-term uncomfortable posture for most of the day and whole body vibrations caused by the agricultural equipment.

Aim

The aim of the study was to assess the occurrence of cervical spine dysfunction clinical symptoms in farmers working mainly on agricultural tractors.

Material and methods

The group consisted of 24 participants (mean age 32 ± 8.02) of both sexes living in the countryside, whose main task was to work on a farm tractor. The assessment was performed in spring. A questionnaire, an algometer to measure pain threshold at selected points and a goniometer to assess the range of lateral cervical flexion of the spine were used to carry out the study.

Results

The research carried out shows that 95% of the respondents report pain of the cervical spine. Statistical analysis showed that the work performed by the farmers surveyed has a negative impact on their health. The neck mobility to the left side was limited and the trapezius muscle pain threshold to the right was lower.

Conclusions

Work in an agricultural tractor can lead to pain within the neck. In order to reduce the problem it is necessary to adapt the cabin to a seat that reduces the amount of vibrations and evenly distribute the control devices on the right and left side of the steering wheel.

Keywords: neck pain, tractor work, farmers

Author responsible for correspondence:
Jagoda Goślińska
Department of Rehabilitation
Poznań University of Medical Sciences
28 Czerwca 1956 No 135/147
61-545 Poznań, Poland
jagoda.goslinska@gmail.com

Authors reported no source of funding
Authors declared no conflict of interest

Date received: 4th November 2019
Date accepted: 3rd December 2019

STRESZCZENIE

Wstęp

Dolegliwości bólowe w obrębie kręgosłupa to główny problem w zawodzie rolnika. Czynniki, które determinują występujące zaburzenia to długotrwała, niewygodna pozycja przez większą część dnia oraz wibracje całego ciała powstające na skutek poruszania się sprzętem rolniczym.

Cel pracy

Celem pracy była ocena występowania klinicznych objawów świadczących o zaburzeniach w obrębie odcinka szyjnego kręgosłupa u rolników pracujących głównie na ciągniku rolniczym.

Materiał i metody

Grupę tworzyło 24 uczestników obu płci mieszkający na wsi (średni wiek: 32±8.02 lat), których główną pracą była obsługa ciągnika rolniczego. Oceny dokonano w okresie wiosny. Do przeprowadzenia badań wykorzystano ankietę, algometr do badania progu pobudliwości bólowej w wybranych punktach oraz goniometr do oceny zakresu skłonu bocznego odcinka szyjnego kręgosłupa.

Wyniki

Przeprowadzone badania dowodzą, iż 95% badanych zgłasza dolegliwości bólowe w obrębie kręgosłupa szyjnego. Analiza statystyczna wykazała, iż praca, którą wykonują badani rolnicy ma niekorzystnie na ich stan zdrowia. Na podstawie przeprowadzonych badań stwierdzono ograniczenie ruchomości głowy w lewą stronę, a także niższy próg pobudliwości bólu w obrębie mięśnia czworobocznego po prawej stronie.

Wnioski

Praca w ciągniku rolniczym sprzyja powstawaniu dolegliwości bólowych w obrębie szyi i głowy. Aby zmniejszyć powstały problem, należałoby przystosować kabinę w fotel zmniejszający ilość powstających wibracji oraz równomiernie rozłożyć urządzenia sterujące po prawej i lewej stronie kierownicy.

Słowa kluczowe: odcinek szyjny, praca na ciągniku rolniczym, rolnicy

Introduction

The farmer's work is associated with a high risk of any kind of injury or musculoskeletal overload (Solecki 2011, Walker-Bone and Palmer 2002). What is more, according to the European Agency for Safety and Health at Work, physical workers are not aware of ergonomics and that is why they often work in bad and constrained postures (Wdowiak *et al.* 2008).

About 93% of farmers report complaints of the locomotor system (Solecki 2011). Most often they complain of pain in the lumbar and cervical spine and the upper limbs (Gomez *et al.* 2003). These conditions are caused by overload and aggregate micro-injuries within the musculoskeletal tissues (Jaworski 2009).

Risk factors leading to musculoskeletal problems are remaining in one and the same position most of the day, frequent repetition of the same movements of arms and the upper limbs, carrying heavy loads, as well as vibrations from mechanical devices (Gomez *et al.* 2003).

Farmers using machines are forced to stay in a practically unchanged position, engaging the same muscle groups at all times. This leads to serious pathologies within the musculoskeletal system (Solecki 2011). Tractor

drivers spend in the driver seat most of the day, their torso and head are twisted to one side, which affects the cervical spine strongly. Pain in this spine section has been reported by a large number of research subjects (Jankowski and Piotrowski 1987, Kim *et al.* 2017).

Aim

So far many researchers have focused on the analysis of lumbar spine pain associated with agricultural work. By contrast, the objective of our study was to assess the occurrence of cervical spine disorders in farmers working on a tractor.

Material

The research group consisted of 24 people, including 8 women and 16 men aged 18–45 (mean age 32 ± 8.02) living in the countryside. The largest group of respondents to the survey were young farmers aged between 18 and 25 years (33.3%). They were active farmers, whose main task while working on the farm is to drive an agricultural tractor. These people have farms that do not cover less than 5 hectares of land. Working time per day ranges from 1 to 12 hours per day and depends on the season, number of hectares, type of crops and agricultural equipment. The characteristics of the research group performed are presented in Table 1.

Individuals who have been included in the study have been informed that the results will be used anonymously. Furthermore, each person knew that they could resign from participating at any time. Each person has given their written consent for voluntary participation in the project.

The following inclusion and exclusion criteria were applied in the recruitment of persons to the study. The inclusion criteria were: written consent to the study, age ≥ 18 years and ≤ 45 years, active male or female farmer, dominant type of work was driving an agricultural tractor, working time longer than 6 hours per day, working time per week ≥ 36 hours. The exclusion criteria included: no consent to participate in the study, genetic diseases that have a negative impact on the cervical spine, tumors in the cervical spine, advanced and symptomatic form of intervertebral disc disease, past injuries in the neck and/or head, cancer, rheumatic diseases, pretest operations that may be related to current cervical spine pain.

Methods

Questionnaire

Each participant received a questionnaire consisting of one-choice questions. It included questions about the specific features of their job and the symptoms occurring in the spine, with particular emphasis on the cervical segment.

Algometer

A digital pressure algometer (Digital Force Algometer) was used to measure the pressure pain threshold on the selected cervical muscles. Compression pressure at the round tip of 1 cm^2 was gradually increased perpendicularly at the rate of 500g/s on the tissue. When the participant reported their first pain, the specialist pressed the hold button and read the recorded value.

The locations where examined myofascial trigger points can be found were:

- Trapezius muscle: an algometer was applied to the centre of the most vertical muscle fibres (Simons *et al.* 1998, Davies *et al.* 2004).
- Sternocleidomastoideus muscle: the algometer was applied to the place where the attachment of this muscle to the mastoid proces is (Simons *et al.* 1998, Davies *et al.* 2018).
- Rectus capitis posterior major muscle: the algorithm was applied in the middle of the muscle (Davies *et al.* 2018, Simons *et al.* 1998).

Goniometer

To assess the cervical lateral flexion range of motion a goniometer was used. The ranges were examined on the basis of photographs taken with a digital camera. One arm of the goniometer was applied vertically and the other one was drawn in the photo as a line

Table 1. Characteristics of the research group

Feature		**Answers**	**No. and % of respondents**	
Residence		small village	No.	4
			%	17%
		big village	No.	20
			%	83%
No. of possessed hectares		5–15 ha	No.	6
			%	25%
		16–25 ha	No.	9
			%	38%
		> 25 ha	No.	9
			%	38%
No. of hours worked during the day	spring	< 8 h	No.	0
			%	0%
		8–12 h	No.	6
			%	25%
		> 12 h	No.	18
			%	75%
	summer	< 8 h	No.	0
			%	0%
		8–12 h	No.	6
			%	25%
		> 12 h	No.	18
			%	75%
	spring	< 8 h	No.	10
			%	42%
		8–12 h	No.	8
			%	33%
		> 12 h	No.	5
			%	21%
	winter	< 8 h	No.	18
			%	75%
		8–12 h	No.	5
			%	21%
		> 12 h	No.	0
			%	0%
No. of years worked as a farmer		5–10 years	No.	5
			%	21%
		11–20 years	No.	12
			%	50%
		> 20 years	No.	7
			%	29%

passing through the center of the chin and forehead during the maximum lateral flexion (Figure 1).

Statistics

The statistical analysis was carried out with the assistance of the MS Excel 2010 (Microsoft) and Statistica v.12.5 (StatSoft).

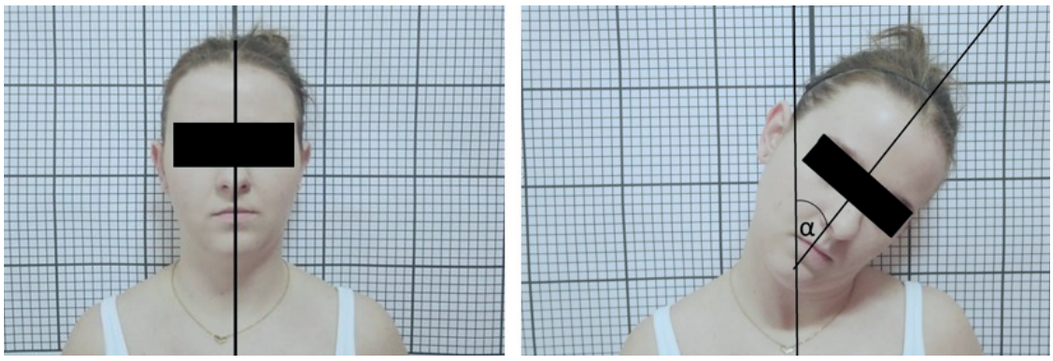

Figure 1. Photographs showing the measurement of the range of lateral flexion of the cervical spine

Results

Characteristics of pain reported by the research group (*Table 2*).

Back pain was reported by as high as 95% of respondents, only less than 5% indicated that there is no pain in any part of the spine. More than half of the farmers reported pain levels of 4–6, but 71% of them reported that their symptoms were rather rare. The prevalence of pain in the cervical spine is influenced by many factors. Most of the respondents indicated that pain is related to the lifting of heavy loads, as well as the seat and driving of an agricultural tractor. Only one person indicated that the pain increases during standing position.

Table 2. Characteristics of pain reported by the research group

Question	Answers	No. and % of respondents	
pain occurence	cervical spine	No.	18
		%	75%
	lumbar spine	No.	5
		%	21%
	no pain	No.	1
		%	4%
how often	every day	No.	6
		%	25%
	rarely	No.	17
		%	71%
	no pain	No.	1
		%	4%
character of pain	cutting	No.	16
		%	67%
	splitting	No.	4
		%	17%
	radiated	No.	3
		%	13%
	no pain	No.	1
		%	4%
VAS	no pain	No.	1
		%	4%
	1–3	No.	3
		%	13%
	4–6	No.	14
		%	58%
	7–9	No.	5
		%	21%
	10	No.	1
		%	4%
what intensifies the symptoms	tractor driving	No.	11
		%	48%
	lifting	No.	11
		%	48%
	standing	No.	1
		%	4%

Pressure Pain Threshold measured with algometer

Analysis of the results obtained from the pain threshold test showed a lower pain threshold on the right side in relation to all three tested muscles, but stastistically significant differences were observed only in the quadrilateral muscle (Table 3).

Cervical lateral flexion range of motion

During the examination of lateral flexion range of motion, a statistically significant greater range was found in the right than in the left side (Table 4.).

Discussion

Based on the research and review of other authors, it should be stated that by virtue of their profession farmers are susceptible to pain in the musculoskeletal system, which amounts to approximately 93% of all occupational diseases in agriculture (Wdowiak *et al.* 2008).

A review of the data provided by Solecki (2014) and Jaworski (2009) between 1990 and 2012 shows that most publications referring to farmers dealt with pain in the lumbar spine. Relatively few studies focused on cervical spine pain in this professional group (Johanning

Table 3. Results of pain pressure pain induced in examined muscles (Wilcoxon signed-rank test)

Muscle	Side	mean ± SD [kPa]	Median [kPa]	min–max [kPa]	p
Trapezius	right	127.7 ± 41.6	123.453	61.4–200.5	< 0.05
	left	136.4 ± 42.3	127.569	58.6–225.1	
Sternocleidomastoideus	right	107.1 ± 37.9	92.7493	46.4–199.2	> 0.05
	left	110.2 ± 39.6	115.262	34.1–204.6	
Rectus capitis posterior major	right	106.2 ± 40.1	89.3425	47.8–201.9	> 0.05
	left	108.4 ± 29.3	98.9094	76.9–177.3	

Table 4. Results of the cervical lateral flexion range of motion (Wilcoxon signed-rank test)

Range of motion	Side	mean ± SD [°]	Median [°]	min–max [°]	p
Lateral flexion	right	41.6 ± 3.6	41.5	33–49	< 0.001
	left	35.2 ± 4	35	30–45	

2015, Kim *et al.* 2017, Milosavljevic *et al.* 2012, Sjaastad and Bakketeig 2002).

According to research conducted by Solecki (2014), farmers usually complain of pain in the lower spine. Also research by Gomez *et al.* (2003) revealed that the most frequent complaint reported by farmers, including tractor drivers, is pain in the lumbar spine. However, both authors mention that this kind of work favours pain in the cervical spine as well. This is confirmed by our research, in which the subjects (farmers) indicate cervical spine as the place of most frequent pain.

According to Gomez *et al.* (2003), the factors promoting the occurrence and intensity of pain in the musculoskeletal system include: remaining in a sitting position on agricultural machinery, a large number of hectares and a large number of hours during the day spent at work. That data was confirmed by our study. On the other hand, Hartman *et al.* (2006) enumerates the following as conditions increasing the number of sick leaves due to pain in the spine and shoulders: age, smoking, and previous pain episodes. Apart from that they also draw attention to the number of hours spent on the tractor and the high pace of work and loads handled during work.

The results of studies by other authors show that vibrations affect the lower spine (Solecki 2011, Walker-Bone and Palmer 2002, Kim *et al.* 2017). Our research shows that driving a tractor and the associated vibrations can also favour pain in the cervical spine. Milosavljevic *et al.* (2012) also noted in their study that the occurrence of cervical pain in farmers is related to exposure to vibration during quad biking. In turn, Rehn *et al.* (2002) observed more frequent occurrence of cervical and thoracic spine dysfunctions when riding all-terrain vehicles. Kim *et al.* (2017) determined that muscles affected by vibrations need to work harder to compensate the inertia forces caused by the weight of the head, which can lead to overloading. What is more, Johanning (2015) states that exposure to whole-body vibrations can also cause neck-shoulder pain in addition to lower back disorders.

Farmers were examined with an algometer to assess the pain threshold of three muscles (sternocleidomastoid, trapezius, suboccipital muscle) on both sides. This study showed that the subjects tested had a lower pain threshold in the right neck muscles, and in the trapezius muscle the difference was statistically significant. In addition, the trapezius muscle elasticity was assessed based on the range of lateral bend to the right and left. It turned out that the lateral bend to the left is statistically significantly smaller than to the right, which would mean trapezius contracture. This may be due to the asymmetry of the head position when driving the tractor, caused by the fact that most of the devices in the tractor's cab are on the right side, forcing the farmer to turn his head more often in their direction. Manninen *et al.* (1995) and

Kim *et al.* (2017) came to similar conclusions in their works. Moreover, Sjaastad and Bakketeig (2002) noticed, that the continuous turning of the head to the right beyond the neck pain may lead to the development of the headache. Kim *et al.* (2017) were simulating the conditions of driving a tractor and they observed differences in the activity recorded in the EMG study on the right and left side of the trapezius, sternocleidomastoid and erector spinae muscles when. They reached the conclusion that it might be a good idea to build tractors with a more symmetrical presentation of controllers.

Based on the comparative analyses presented above one might conclude that active farmers can suffer from lumbar, sacral and cervical spine pain, which is supported by the results of our research.

Conclusions

The results of our study indicate that the work carried out by farmers driving a tractor has a significant impact on the occurrence of musculoskeletal disorders, especially in the cervical spine. Headache and limited head mobility may result from prolonged and frequent right-hand movements due to the right-hand location of on-board computers and joysticks, as well as from the vibrations generated in the tractor.

REFERENCES

Davies C., Davies A., Simons D.G. (2004) *'The Trigger Point Therapy Workbook: Your Self-Treatment Guide for Pain Relief'*, 2nd Edition, New Harbinger Publications, pp. 49–59.

Gomez M.I., Hwang S., Stark A.D., May J.J., Hallman E.M., Pantea C.I. (2003) *'An analysis of self-reported joint pain among New York farmers.'* J Agric Saf Health., May; 9(2): pp. 143–57.

Hartman E., Oude Vrielink H., Huirne R.B., Metz J.H. (2006) '*Risk factors for sick leave due to musculoskeletal disorders among self-employed Dutch farmers: a case-control study.*' Am J Ind Med., Mar;49(3): pp. 204–14.

Jankowski J., Piotrowski W. (1987) *'Zespół chorobowy traktorzystów'* Med Wiejska, 22: pp. 55–67.

Jaworski H. (2009) *'Działania prewencyjne i rehabilitacyjne prowadzone przez KRUS w celu ograniczenia uszkodzeń układu mięśniowo-szkieletowego'* Instytut Medycyny Wsi, pp. 69–79.

Johanning E. (2015) *'Whole-body vibration-related health disorders in occupational medicine-an international comparison.'* Ergonomics., 58(7): pp. 1239–52.

Kim J.H., Dennerlein J.T, Johnson P.W. (2018) *'The effect of a multi-axis suspension on whole body vibration exposures and physical stress in the neck and low back in agricultural tractor applications.'* Appl Ergon., Apr;68: pp. 80–89.

Manninen P., Riihimäk H., Heliövaara M. (1995) *'Incidence and risk factors of low-back pain in middle-aged farmers.'*, Occup Med (Lond), Jun;45(3): pp. 141–6.

Milosavljevic S., Bagheri N., Vasiljev R.M., McBride D.I., Rehn B. (2012) *'Does daily exposure to whole-body vibration and mechanical shock relate to the prevalence of low back and neck pain in a rural workforce?'* Ann Occup Hyg. Jan;56(1): pp. 10–7.

Rehn B., Bergdahl I.A., Ahlgren C., From C., Järvholm B. (2002) *'Musculoskeletal symptoms among drivers of all-terrain vehicles.'* J Sound Vib; 253: pp. 21–9.

Simons D.G., Simons L.S., Travell J.G. (1998) *'Travell & Simons' Myofascial Paint and Dysfunction: The Trigger Point Manual'*, 2nd Edition, Williams & Wilkins; pp. 279, 309–310, 472–473.

Sjaastad O., Bakketeig L.S. (2002) *'Tractor drivers' head- and neck-ache: Vågå study of headache epidemiology.'* Cephalalgia. Jul;22(6): pp. 462–7.

Solecki L. (2011) *'Bóle pleców w dolnej części kręgosłupa wśród rolników eksponowanych na wibrację ogólną – przegląd piśmiennictwa.'* Med Pr., 62(2): s. 187–202.

Solecki L. (2014) *'Przyczyny występowania dolegliwości bólowych ze strony układu mięśniowo-szkieletowego wśród rolników, w związku z wykonywaną pracą.'* Med Og. Nauk Zdr., 20(49) 4: s. 426–429.

Walker-Bone K., Palmer K.T. (2002), '*Musculoskeletal disorders in farmers and farm workers.*' Occup Med (Lond), Dec;52(8): pp. 441–50.