

## **Musculoskeletal symptoms, and perceived fatigue and work characteristics in supermarket cashiers**

T. Sirge\*, J. Ereline, T. Kums, H. Gapeyeva and M. Pääsuke

Institute of Exercise Biology and Physiotherapy, University of Tartu, Jakobi 5, EE51014 Tartu, Estonia; \*Correspondence: triinu.sirge@ut.ee

**Abstract.** Working in the sitting position is often regarded as a cause for discomfort and pain in the musculoskeletal system. The aim of the present study was to evaluate musculoskeletal symptoms in different body regions in association with the perceived fatigue and work characteristics in supermarket cashiers, who are predominantly working in the sitting position. The subjects were 67 female supermarket cashiers with the mean ( $\pm$  *SD*) age of 33.5 years, body mass index (BMI) of  $23.8 \pm 0.4$  kg m<sup>-2</sup> and the working time of 9.7 hours a day. All subjects completed the standardized Nordic Questionnaire and self-administered questionnaire concerning cashier's work, bio-demographic variables and fatigue. The results of this study indicated that 86.6% of subjects reported experiencing discomfort at least in one body area. Musculoskeletal symptoms in the last 6 months were localized primarily in the lower back and neck regions (67.2% and 53.7%, respectively) and in the last 7 days also in the lower back (44.8%) and equally in the neck and wrist (40.3%). Correlation analysis showed that low back pain (LBP) perceived during the last 7 days was associated with knee pain ( $r = 0.44$ ,  $p < 0.001$ ). Last 6 months LBP was associated with shoulder ( $r = 0.35$ ,  $p < 0.01$ ) and neck pain ( $r = 0.43$ ,  $p < 0.001$ ) during last 6 months. On the other hand, no significant correlation emerged between LBP, fatigue and work characteristics (physical and mental fatigue after workday, rushing and monotony at work). From the cashiers, 80.9% had experienced rushing at work, while the majority of them (89.6%) felt physical fatigue after the workday, and 62.7% reported their work being monotonous. Approximately one-half of the subjects (49.3%) practiced recreational sport in their free time. It was concluded that in supermarket cashiers the highest prevalence rate of discomfort and pain was emerged in low back and neck, and they perceived rushing and monotony at work and physical and mental fatigue after the workday. Recreational sport can be recommended as a preventive activity for avoiding discomfort.

**Keywords:** discomfort, musculoskeletal symptoms, supermarket cashier, perceived fatigue, sitting position.

## **INTRODUCTION**

Working for a long time in the sitting position is called 'forced position'. It has been suggested that prolonged working in forced position causes musculoskeletal disorders (MSDs) (Pensri et al., 2010). The European Agency for Safety and Health at Work has reported that in the European Union the relative prevalence rate of MSDs is the highest among service workers, and shop and market sales employees (Schneider et al., 2010). In Estonia, forced position is the main cause of occupational diseases according to the Estonian Health Board (2012). The field of service and sales holds the

second place in the occurrence of occupational diseases in Estonia. In 2012 many cashiers claimed an occupational disease due to working in forced position. MSDs are also the main symptoms of work-related diseases (Estonian Health Board, 2012). The causes and occurrence frequency of MSDs among cashiers in Estonia has not been researched so far.

Working as a cashier in a supermarket does not usually require any specific skills – most cashiers are secondary school graduates –, and their income is low to moderate, depending on the sum of working hours. Cashiers' work conditions have received minimal attention and no specific measures have been taken for preventing work-related injuries. The work is monotonous and the employees are frequently exposed to manual handling tasks, such as lifting goods of different weight, and experience stress, especially at rush hours in the store. Cashiers' work is mentally fatiguing (Åhsberg, 2000; Vasseljen et al., 2001; DiDomenico & Nussbaum, 2008), while they manage cash and card payments, requiring extreme accuracy. Supermarket cashiers work for the whole day at the counter in the sitting position. They are affected by MSDs, because their body muscles are forced into one position at working time (Baron et al., 1992; Forcier et al., 2008). Previous studies have indicated that constant sitting affects mostly the neck and lower back region (Lehman et al., 2001; Beladev & Masharawi, 2011). Research results on musculoskeletal symptoms among supermarket cashiers have generally reported neck, shoulder, upper-limb and back pain (Baron et al., 1992; Lehman et al., 2001; Vasseljen et al., 2001; Violante et al., 2005), but also ankle-foot symptoms (Pensri et al., 2009). The most frequently affected body region is followed by low back (Violante et al., 2005), knees, hips, shoulders, head/neck, upper back, wrist/hands and elbows (Pensri et al., 2009).

Musculoskeletal symptoms, as work-related musculoskeletal discomfort and pain in different body regions are common complaints in individuals whose occupations are characterized by repetitiveness and monotonous work (Bernard, 1997). A screening examination performed by the occupational health care service on Swedish workers established that monotonous work was positively associated with neck and shoulder pain (Bernard, 1997), and repetitive tasks can be responsible for the high prevalence of lower back, neck and shoulder symptoms among cashiers (Lundberg et al., 1999). This is in accordance with a study that was also conducted in Sweden, showing the high prevalence (70%) of neck and shoulder pain during last 6 months (Rissen et al., 2002). Neuromuscular fatigue and discomfort are commonly perceived by cashiers in shoulder, low back and neck muscles (Nõu et al., 2011), cumulative local muscle fatigue may lead to potential risks for MSDs (Ma et al., 2013). Supermarket cashiers are generally known to be an at-risk population for MSDs (Forcier et al., 2008). However, the association of musculoskeletal symptoms with work-related characteristics in cashiers has not been well studied.

The aim of the present study was to evaluate the musculoskeletal symptoms in different body regions in comparison with perceived fatigue and work characteristics in supermarket cashiers who are working in sitting position.

## MATERIALS AND METHODS

### Subjects

Sixty-seven females, working as checkout cashiers in supermarkets, aged from 18 to 63 years (with mean  $\pm$  *SD* age:  $33.5 \pm 12.8$  years) participated in this study. The anthropometric and work experience characteristics of participants are presented in Table 1. The majority of the subjects (64) were right-handed.

**Table 1.** The anthropometric and work experience characteristics of participants ( $n = 67$ )

	Mean $\pm$ <i>SD</i>
Age (years)	$33.5 \pm 12.8$
Height (cm)	$165.4 \pm 6.0$
Body mass (kg)	$65.1 \pm 11.3$
Body mass index ( $\text{kg m}^{-2}$ )	$23.8 \pm 0.4$
Years of work experience as a cashier (years)	$5.3 \pm 5.3$
Working hours per day (hours per day)	$9.7 \pm 2.5$
Working hours per week (hours per week)	$37.2 \pm 8.5$

The subjects participated in the research voluntarily and the selection of cashiers was random. Approval for the study was obtained from the managers of the supermarkets, and from the Ethics Review Committee on Human Research, University of Tartu. Written informed consent for participation in the study was obtained from all participations.

### Questionnaire

Cashiers received a self-administrated comprehensive questionnaire. In this study we used questions about demography (age, gender, height/weight), employment information (working experience as a cashier, number of daily and weekly working hours), psychosocial and work characteristics (fatigue, rushing at work, job dissatisfaction, monotony of work), and frequency of any exercise.

To assess MSDs were used the questions similar to the ones in The Nordic Questionnaire (NQ) (Kuorinka et al., 1987). NQ evaluates the frequency of musculoskeletal symptoms such as pain, tingling and/or numbness in six body regions (low back, neck, shoulder, elbow, wrist/hand, and knee) in two time periods: the previous seven days and the previous six months. A simple figure with six particular body parts in the questionnaire helped answerers to evaluate their MSDs.

The questionnaires were filled in at the workplace or at home. The subjects wrote the values of height and body mass themselves and the body mass index ( $\text{kg}\cdot\text{m}^{-2}$ ) was calculated.

### Statistical analysis

Means and standard derivations ( $\pm$  *SD*) of mean were calculated. Mann–Whitney *U*-test was used to determine differences in musculoskeletal symptoms. Linear correlations were calculated to observe the relationship between the received characteristics. A level of  $p < 0.05$  was selected to indicate statistical significance.

## RESULTS

The questionnaire was completed by 67 (55%) of the cashiers invited to take part in the research. All cashiers worked at the counter most of their work time. The mean number of hours worked per day was  $9.7 \pm 2.5$  hours and per week  $37.2 \pm 8.5$  hours, and 16.4% cashiers worked for more than 40 hours per week. All were female, with the mean age of  $33.5 \pm 12.8$  years. The majority of them (38.8%) had worked as a cashier for 1–5 years, 32.8% for more than 5 years, and 25.4% for less than one year.

The majority of subjects (86.6%) reported experiencing discomfort and pain at least in one body area in the last 6 months, and 71.7% in the last 7 days (Table 2). Approximately 68.7% of participants had experienced musculoskeletal discomfort and pain at  $\geq 2$  anatomical sites in the last 6 months, and 56.8% in the last 7 days. Of those who reported pain in the last 6 months, 17.9% reported symptoms at  $\geq 4$  anatomical sites. Three body sites of pain per participant occurred most frequently both in the last 6 months and 7 days (23.9% and 20.9%, respectively).

**Table 2.** The number of body sites with musculoskeletal pain in the last 6 months and last 7 days ( $n = 67$ )

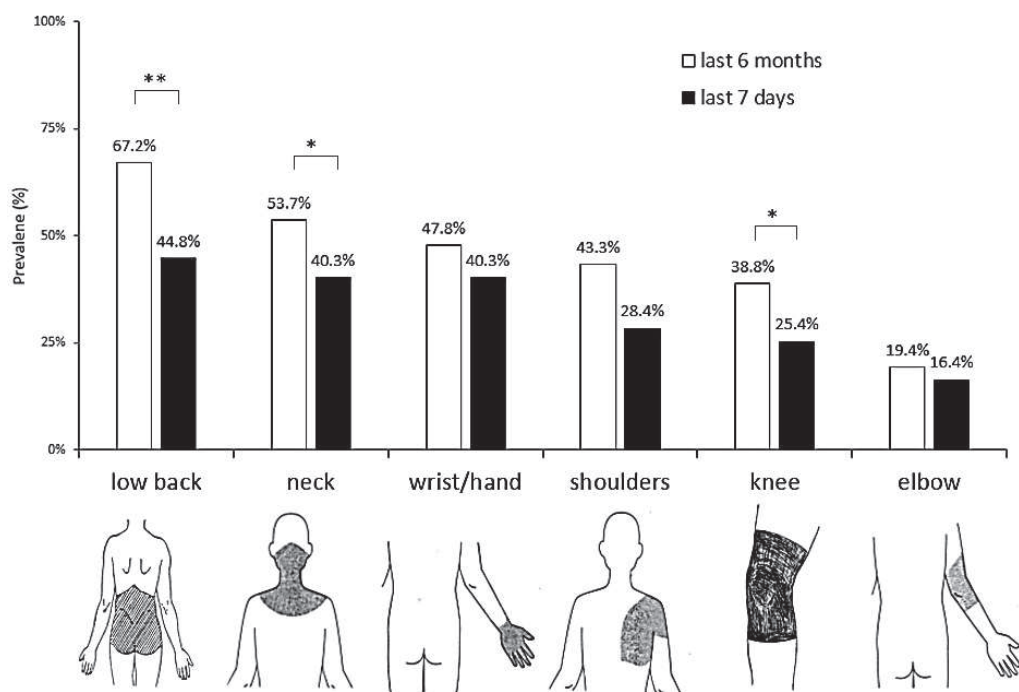
Number of body sites with pain	Last 6 months (%)	Last 7 days (%)
<b>0</b>	13.4	28.3
<b>1</b>	17.9	14.9
<b>2</b>	11.9	20.9
<b>3</b>	23.9	20.9
<b>4</b>	17.9	7.5
<b>5</b>	9.0	1.5
<b>6</b>	6.0	6.0

Musculoskeletal symptoms in the last 6 months were localized primarily in the lower back and neck regions (67.2% and 53.7%, respectively) and in the last 7 days also in the lower back 44.8% and equally in the neck and wrist 40.3% (Fig. 1).

The share of complaints about discomfort and pain in shoulders during the last 6 months was 43.3%, in the last 7 days 28.4%. In the 6-month period there was a high prevalence of discomfort and pain in the knee (38.8%), throughout the last 7 days it was 25.4%. Fewer complaints occurred in the elbow region. Subjects perceived significantly more discomfort and pain during the last 6 months compared to the last 7 days in low back (67.2% vs 44.8%, respectively;  $p < 0.01$ ), in the neck (53.7% vs 40.3%, respectively;  $p < 0.05$ ), and in the knee (38.8% vs 25.4%, respectively;  $p < 0.05$ ).

Correlation analysis demonstrated that the last 6 months LBP is associated with 6 months neck pain ( $r = 0.43$ ,  $p < 0.001$ ) and with last 7 days neck pain ( $r = 0.32$ ,  $p < 0.01$ ) (Table 3). Last 7 days LBP is associated with last 6 months knee pain ( $r = 0.39$ ,  $p < 0.001$ ) and 7 days knee pain ( $r = 0.44$ ,  $p < 0.001$ ). Last 6 months LBP is associated with 6 months shoulder pain ( $r = 0.35$ ,  $p < 0.01$ ).

Last 7 days shoulder pain is associated with last 7 days elbow pain ( $r = 0.44$ ,  $p < 0.001$ ) and last 6 months elbow pain ( $r = 0.36$ ,  $p < 0.01$ ). Last 6 months elbow pain is associated with 6 months wrist/hand pain ( $r = 0.36$ ,  $p < 0.01$ ) and 6 months knee pain ( $r = 0.31$ ,  $p < 0.05$ ). Last 7 days elbow pain is associated with last 7 days knee pain ( $r = 0.48$ ,  $p < 0.001$ ), and last 7 days wrist/hand pain ( $r = 0.54$ ,  $p < 0.001$ ), and last 6 months wrist/hand pain ( $r = 0.38$ ,  $p < 0.01$ ). Significant correlation was noted between discomfort and pains in six different body regions occurring during the last 6 months and 7 days.

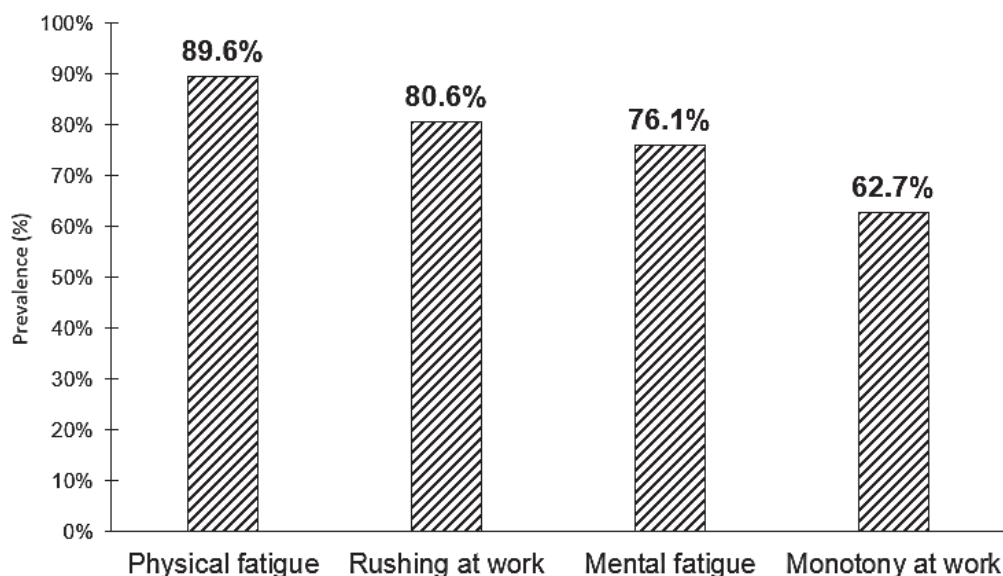


**Figure 1.** Prevalence (%) of musculoskeletal discomfort and pain in different body regions in the last 6 months and 7 days ( $n = 67$ ); \* $p < 0.05$ ; \*\* $p < 0.001$ .

During the workday, 80.6% of volunteers perceived rushing, while most of them (89.6%) felt physically fatigued after the workday and 76.1% felt mentally fatigued (Fig. 2). Despite being fatigued, 74.6% of cashiers are satisfied with their work, whereas 62.7% reported that their work is monotonous.

**Table 3.** Correlations between self-reported pain and discomfort in different body regions during last 6 months and 7 days in supermarket cashiers (*n* = 67). \**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001

Variable	Low back, 6 months	Low back, 7 days	Neck, 6 months	Neck, 7 days	Shoulders, 6 months	Shoulders, 7 days	Elbow, 6 months	Elbow, 7 days	Wrist/hand, 6 months	Wrist/hand, 7 days	Knee, 6 months	Knee, 7 days
Low back, 6 months	1											
Low back, 7 days	0.44***	1										
Neck, 6 months	0.43***	0.23*	1									
Neck, 7 days	0.32**	0.18*	0.76***	1								
Shoulder, 6 months	0.35***	0.24*	0.27*	0.33*	1							
Shoulder, 7 days	0.09	0.30**	0.12	0.23*	0.59***	1						
Elbow, 6 months	0.10	0.01	0.08	0.14	0.26*	0.36**	1					
Elbow, 7 days	0.05	0.17	0.01	0.05	0.18	0.44***	0.70***	1				
Wrist/hand, 6 months	0.16	0.10	0.23*	0.31*	0.19	0.13	0.36**	0.38**	1			
Wrist/hand, 7 days	0.19	0.12	0.21	0.26*	0.20	0.23*	0.44***	0.54***	0.80***	1		
Knee, 6 months	0.30**	0.39***	0.19	0.16	0.17	0.25*	0.31**	0.23*	0.22	0.10	1	
Knee, 7 days	0.19	0.44***	0.13	0.15	0.18	0.24*	0.41***	0.48***	0.34**	0.22	0.66***	1



**Figure 2.** Prevalence (%) of subjectively perceived fatigue and work characteristics ( $n = 67$ ).

No significant correlation was noted between discomfort, and fatigue and work characteristics (physical and mental fatigue after the workday, rushing and monotony at work), and between discomfort and work experience characteristics.

Approximately one-half of the subjects (49.3%) practised recreational sport in their free time, mainly running and aerobics. 34.3% of participants practised sport for 1–2 hours per week, 10.4% for 3–4 hours per week and for more than 4 hours per week only 4.5% of cashiers.

## DISCUSSION

This study revealed, similarly to several other studies (Baron et al., 1992; Bernard, 1997; Lehman et al., 2001; Violante et al., 2005; Forcier et al., 2008; Pensri et al., 2009; Pensri et al., 2010; Beladev & Mashaeawi, 2011) that musculoskeletal symptoms are common among supermarket cashiers.

Participants in this study appeared to work the same or shorter hours during the week compared to their colleagues in other countries. Cashiers in Estonia work on an average for 37 hours per week, while sales workers in the United Kingdom work an average 38–40 hours per week (Wardle et al., 2000). Cashiers in Thailand work on an average even 60 hours per week (Pensri et al., 2010). Despite the working hours per week are shorter in Estonia compared to Thailand, the working hours per day are similar – in our study cashiers worked on an average 9.7 hours per day, in Thailand 10.2 hours per day. Our study revealed that 16.4% of cashiers worked for more than 40 hours per week. The cashiers' income also depends on the number of working hours, so in order to earn more, the employees agree to do longer hours. However, prolonged



work duration may place supermarket cashiers at high risk of musculoskeletal symptoms that was evidenced by their high prevalence rate.

Based on the self-reported musculoskeletal symptoms, the results of our study demonstrated that the majority of the subjects (86.6%) reported experiencing discomfort and pain at least in one body area in the last 6 months, and 71.7% in the last 7 days. Musculoskeletal discomfort and pain in the last 6 months in low back (67.2%) region indicated the highest prevalence of cashiers. The employees reported the high prevalence of neck (53.7%) and wrist/hand (47.8%) pain, the lowest prevalence was perceived in the elbow (19.4%). The prevalence of musculoskeletal discomfort and pain was higher in the last 6 months compared to the last 7 days in all body regions, whereas significant differences emerged in low back, neck and knee region. Consequently, chronic musculoskeletal symptoms prevail in cashiers over episodic symptoms. Our results are similar to the earlier data published by different authors. The United Kingdom Health and Safety Executive reported that out of cashiers who experienced work loss in one year due to musculoskeletal health problems, the occurrence percentages of affected body regions were low back (32%), wrist (28%), neck (21%) and shoulders (21%) (Lehman et al., 2001). Another study revealed that 57% of supermarket cashiers experience lower back pain, during a year (Spiers, 2003). Yet another study demonstrated that employees working in the sitting position are high prevalence in neck (56.7%) (Tsauo et al., 2007). In Thailand, a survey revealed that elbow pain (3%) is lowest in saleswomen who are standing for prolonged stretches of time (Pensri, et al., 2009). The occurrence of musculoskeletal symptoms in the elbow region seems to be lower compared to other often measured body regions in different worker categories, including cashiers.

In the present study, we found a very strong relationship between the last 6 months LBP and neck pain. Our data indicated that the last 7 days LBP is strongly associated with knee pain and 6 months shoulder pain. This means that LBP prevalence is associated with discomfort and pain in other body regions. Our study revealed that 86.6% of participants experienced discomfort and pain in 1–6 body areas, and most frequently three body sites of pain occurred per participant. Working in the sitting position caused more discomfort in low back and neck region, working in the standing position resulted in discomfort in lower limbs, and discomfort emerged also in knees.

This study demonstrated that approximately 90% of cashiers felt fatigued after the workday. The indicators of rushing at work (81%) and mental fatigue (76%) were also remarkably high. We found no significant relationship between discomfort and subjectively evaluated fatigue and work characteristics (physical and mental fatigue after the workday, rushing and monotony at work). The study of Lundberg et al. (1999) revealed that physical workload was not correlated with discomfort and mental fatigue of cashiers in Sweden. However, Skov et al. (1996) reported significant associations between neck, shoulder and low back symptoms and a range of psychosocial risk factors in salespeople in Denmark. Fatigue after the workday occurs due to reduced blood flow to muscles, therefore employees working in the sitting position and not doing physical hard work, feel highly fatigued at the end of the workday. Cashiers are socially active, their work is intensive, requiring verbal communication with many customers. This explains the high rate of cashiers' mental fatigue. The work of supermarket cashier includes the handling of a large number of items during the work shift, implying repetitive movements of the shoulders, arms and hands/wrists, and a



high work rate. The work is associated with a high prevalence of disorders in the low back, neck and upper extremity (Kjellberg et al., 2012), as proved the results of this study. This study also revealed that cashiers are exposed to monotony at work (63%). Monotonous work, working in forced position and repetitiveness can cause MSDs (Bonfiglioli et al., 2007).

According to the results of this study, discomfort is not correlated with work experience characteristics. This finding contrasts the results of a previous study by Pensri et al. (2010), who reported significant association between the average working hours per day, working hours per week and prevalence of lower extremity symptoms. In our study all cashiers worked in the sitting position. This work posture puts high pressure on low back muscles and the correlation between working experience and discomfort could be possible. Cashiers in the Thailand study were exposed to prolonged standing, which requires the continuous contraction of number of muscles in the legs (Pensri et al., 2010).

Our study indicated that approximately one-half (49.3%) of subjects practiced recreational sport in their free time, mainly for 1–2 hours per week. Recreational sport is a good preventive activity to avoid discomfort (Hildebrandt et al., 2000).

In conclusion, the highest prevalence of musculoskeletal symptoms was noted in low back and neck regions, whereas the lowest prevalence was noted in elbow region. Cashiers perceived obvious physical and mental fatigue after the workday, rushing and monotony at work. The musculoskeletal symptoms in lower back region are significantly related with symptoms in other body regions (neck, knee, shoulder). This study indicated significantly higher prevalence of chronic musculoskeletal symptoms (reported during the last 6 months) in low back, neck and knee region compared to episodic musculoskeletal symptoms (reported during the last 7 days). However, no significant relationships emerged between musculoskeletal symptoms and perceived fatigue and work characteristics in this study.

## REFERENCES

- Åhsberg, E. 2000. Dimensions of fatigue in different working populations. *Scand J Psychol.* **41**, 231–241.
- Beladev, N. & Masharawi, Y. 2011. The effect of group-exercising on females with non-specific chronic low back pain in a sitting position: a pilot study. *J Back Musculoskelet Rehabil.* **24**, 181–188.
- Bernard, B.P. 1997. *Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back*. National Institute for Occupational Safety and Health (NIOSH). United States Department of Health and Human Services, Cincinnati, 590 pp.
- Bonfiglioli, R., Mattioli, S., Fiorentini, C., Graziosi, F., Curti, S. & Violante, F.S. 2007. Relationship between repetitive work and the prevalence of carpal tunnel syndrome in part-time and full-time female supermarket cashiers: a quasi-experimental study. *Int Arch Occup Environ Health.* **80**, 248–253.
- Di Domenico, A. & Nussbaum, A. 2008. Interactive effects of physical and mental workload on subjective workload assessment. *Int J Ind Ergon.* **38**, 977–983.
- Hildebrandt, V.H., Bongers, P.M., Dul, J., van Dijk, F.J., Kemper, H. C. 2000. The relationship between leisure time, physical activities and musculoskeletal symptoms and disability in worker population. *Int Arch Occup Environ Health.* **73**, 507–518.

- Kjellberg, K., Palm, P. & Josephson, M. 2012. Development of an instrument for assessing workstyle in checkout cashier work (BASIK). *Work* **41**, 663–668.
- Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G. & Jørgensen, K. 1987. Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon*. **18**, 233–237.
- Lehman, K.R., Psihogiost, J.P. & Meulenbroek, R.G.J. 2001. Effects of sitting versus standing and scanner type on cashiers. *Ergonomics* **44**, 719–738.
- Lundberg, U., Melin, B., Ekström, M., Dohns, I.E., Sandsjö, L., Palmerund, G. & Parr, D. 1999. Psychophysiological Stress Responses, Muscle Tension, and Neck and Shoulder Pain Among Supermarket Cashiers. *J Occup Health Psychol*. **4**, 245–255.
- Ma, L., Zhang, W., Hu, B., Chablat, D., Bennis, F. & Guillaume, F. 2013. Determination of subject-specific muscle fatigue rates under static fatiguing operations. *Ergonomics* **56**, 1889–1900.
- Nõu, T., Ereline, J., Gapeyeva, H., Meister, E. & Pääsuke, M. 2011. Evaluation of work-related neuromuscular fatigue and discomfort in female sales workers. *Acta kinesiologiae Universitatis Tartuensis* **17**, 139–148.
- Pensri, P., Janwantanakul, P. & Chaikumarn, M. 2009. Prevalence of self-reported musculoskeletal symptoms among saleswomen. *J Psychosom Res*. **59**, 499–501.
- Pensri, P., Janwantanakul, P. & Chaikumarn, M. 2010. Biopsychosocial risk factors for musculoskeletal symptoms of the spine in salespeople. *Int J Occup Environ Health*. **16**, 303–311.
- Rissen, D., Melin, B., Sandsjö, L., Dohns, I. & Lundberg, U. 2002. Psychophysiological stress reactions, trapezius muscle activity, and neck and shoulder pain among female cashiers before and after introduction of job rotation. *Work & Stress* **16**, 127–137.
- Schneider, E., Irastorza, X. & Copsey, S. 2010. *OSH in figures: Work-related musculoskeletal disorders in the EU — Facts and figures*. European Agency for Safety and Health at Work, Luxembourg, 184 pp.
- Skov, T., Vilhelm, B. & Øerde, E. 1996. Psychosocial and physical risk factors for musculoskeletal disorders of the neck, shoulders, and lower back in salespeople. *Occup Environ Med*. **53**, 351–356.
- Spiers, C. 2003. *Tolley's Managing Stress in the Workplace*. Reed Elsevier (UK), Chippenham, 424 pp.
- Statistics of Estonian Health Board, [http://terviseamet.ee/fileadmin/dok/Tervishoid/tootervis/toost\\_pohjustatud\\_haigused\\_2012.pdf](http://terviseamet.ee/fileadmin/dok/Tervishoid/tootervis/toost_pohjustatud_haigused_2012.pdf) Ref. 12.01.2014. (In Estonian)
- Tsauo, J., Jang, Y., Du, C. & Liang, H. 2007. Incidence and Risk Factors of Neck Discomfort: A 6-month Sedentary-worker Cohort Study. *J Occup Rehabil*. **17**, 171–179.
- Vasseljen, O., Holte, K.A., Westgaard, R.H. 2001. Shoulder and neck complaints in customer relations: individual risk factors and perceived exposures at work. *Ergonomics* **44**, 355–372.
- Violante, F.S., Graziosi, F., Bonfiglioli, R., Curti, S. & Mattioli, S. 2005. Relations between occupational, psychosocial and individual factors and three different categories of back disorder among supermarket workers. *Int Arch Occup Environ Health*. **78**, 613–624.
- Wardle, J., Steptoe, A., Oliver, G. & Lipsey, Z. 2000. Stress, dietary restraint and food intake. *J Psychosom Res*. **48**, 195–202.