



The importance of work organization on workload and musculoskeletal health – Grocery store work as a model



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ABSTRACT

We have evaluated the consequences of work organization on musculoskeletal health. Using a postal questionnaire, answered by 1600 female grocery store workers, their main work tasks were identified and four work groups were defined (cashier, picking, and delicatessen work, and a mixed group, who performed a mix of these tasks). The crude odds ratios (ORs) for neck/shoulder complaints were 1.5 (95% CI 1.0–2.2), 1.1 (0.7–1.5) and 1.6 (1.1–2.3), respectively, compared to mixed work. Adjusting for individual and psychosocial factors had no effect on these ORs. For elbows/hands, no significant differences were found. Technical measurements of the workload showed large differences between the work groups. Picking work was the most strenuous, while cashier work showed low loads. Quantitative measures of variation revealed for mixed work high between minutes variation and the highest between/within minutes variation. Combining work tasks with different physical exposure levels increases the variation and may reduce the risk of musculoskeletal complaints.

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1. Introduction

A large number of recent studies show that work-related musculoskeletal disorders (WMSD) are still highly prevalent, more so in certain occupational settings (Buckle and Devereux, 2002; Bongers et al., 2006; Nordander et al., 2009; Farioli et al., 2014). There is an obvious need for preventive action (Hagberg et al., 2012). Many work settings are characterised by constrained postures and repetitive movements during long-lasting continuous time periods (Nordander et al., 2009). It has been suggested that variation between work tasks during the working day may reduce the risk of developing WMSD (Luger et al., 2014). However, Leider et al. (2015a) concluded that the evidence for the health benefits of job rotation is inconsistent, and that it may not be useful for all activities (Leider et al., 2015b). Bao et al. (2015) found that job rotation involved higher biomechanical stresses, while Keir et al. (2011) showed that there were beneficial effects on muscular loads. Obviously, workers rotating between jobs with different loads implies an exposure pattern of great complexity (de Oliveira Sato and Cote Gil Coury, 2009). Hence, as stated by Mathiassen (2006) further studies are still needed. Such studies must use

quantitative measures of the variation which are derived from physical exposure data. It is also necessary to find occupations where musculoskeletal problems occur, and which involve a large number of work tasks with different exposure profiles. Such a work situation is found in grocery stores, which retain a large number of employees, particularly women (Johansson et al., 2015).

In a survey from Statistics Sweden (2003), 93% of the cashiers in grocery stores reported performing physically monotonous, repetitive work for at least half their work time. Cashiers in grocery stores therefore constitute a relevant group for studying the importance of how work is organised. A number of publications show a high prevalence of WMSD among supermarket cashiers (Niedhammer et al., 1998; Lundberg et al., 1999; Rissén et al., 2002; Bonfiglioli et al., 2007; Forcier et al., 2008). Many risk factors have been highlighted, such as the physical work conditions (Lehman et al., 2001; Kihlstedt and Hägg, 2011; Draicchio et al., 2012) and the psychosocial environment (Niedhammer et al., 1998; Lundberg et al., 1999).

Recent recommendations from The Swedish Work Environment Authority state that: “If the checkout work is repetitive and closely controlled, it must be organised so that it does not normally exceed 4 h/day and does not last for more than 2 h at a time”. Thus changes need to be made to how cashier work is organised, possibly by alternating with other types of work.

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However, to achieve a better work environment for the cashiers, it is important that these other forms of work truly comprise a different physical exposure. Thus, information about workloads in all the work tasks carried out in grocery stores is needed, along with information about how variation and musculoskeletal health are affected by the way in which the work is organised. To achieve this, a number of measures regarding postures and movements, as well as muscular loads in the relevant body regions, have to be applied. The aim of the present study is to collect such information and to test the hypothesis that variations in workload imply a decreased risk for WMSD.

2. Study design

All 110 grocery stores within a large store association in the southern part of Sweden were invited to participate. A majority, 98, agreed to do so, and provided us with a list of those of their employees who work at least 10 h per week. All employees received a questionnaire, and written information about the study, which emphasised that participation was optional. If no response was received, two reminders were sent. In 13 of the stores, the data was augmented by performing a physical examination. Direct technical measurements of the physical workload were carried out in eight of these stores, taking into account different working days, the size of the stores, their location (town, city) and the three main work tasks identified from the questionnaire. In connection to the physical examination, the subjects were asked to participate in the measurements, and 1–5 were randomly selected for measurement. Four work groups were formed from subjects working a minimum of 30 h per week, divided according to the proportion their time spent on the main work tasks (see 3.1.). All work was performed during opening hours, 7 a.m.–10 p.m.

The study was approved by The Regional Ethical Review Board in Lund.

3. Subjects and methods

3.1. Subjects

A questionnaire (see 3.2.1.) was answered by 1600 female (response rate 74%) and 445 male employees, respectively. Since only 6 male employees fulfilled the criteria for inclusion in the study (see below), all the males were excluded. Of the female employees, 989 fulfilled the inclusion criteria of working at least 30 h per week. Based on information from the questionnaire, three main work tasks were identified, namely cashier work, picking work and delicatessen work, and therefore three work groups were formed. Cashier work involves registrations of provisions, handling payments (money or credit cards) and providing customers with tobacco. The work is performed either sitting or standing. Picking work involves fetching provisions from the storeroom, either by carrying or pulling/pushing a roll cage trolley and subsequently filling the shelves and the freezers. The provisions are handled one by one or in larger packages. Delicatessen work involves filling up the refrigerated display counters, as well as attending to customers buying food at the delicatessen counter.

The subjects were included in one of these groups if they performed the task during at least 80% of their working time. In addition, a fourth group, mixed work, was formed, comprised of those who perform a combination of these three work tasks during at least 80% of their working time. For this group, the proportion of the main work tasks was 45%, 42% and 13% for cashier, picking and delicatessen work respectively (mean values for the group). There were 828 participants who fulfilled the inclusion criteria. The cashier, picking, delicatessen, and mixed groups consisted of 185,

199, 164 and 280 subjects respectively. The mean age of the 828 included subjects was 42 (with a span of 18–66) years, and their employment time 11 (0.3–46) years, there were no major differences in age or employment time between the four work groups. For all the individual factors, see Table 1.

3.2. Methods

3.2.1. Questionnaire

The questionnaire included questions about individual factors, musculoskeletal complaints (pain, aches or discomfort) occurring in the neck and upper extremities during the previous seven days (Standardized Nordic Questionnaire; Kuorinka et al., 1987). In addition, information was requested regarding the main work tasks, and the proportion of time per week spent upon each task. The psychosocial work environment was estimated using responses to a Job Content Questionnaire (JCQ) (Karasek and Theorell, 1990; Karasek et al., 1998).

3.2.2. Physical examination

In 13 of the stores, a physical examination of the neck and upper limbs (Ohlsson et al., 1994) was performed on all subjects, resulting in data from 212 female employees. As to the individual factors, these subjects did not differ from the study group as a whole. Diagnoses were decided on according to a set of predefined criteria (Ohlsson et al., 1994; Nordander, 2004; Nordander et al., 2009).

3.2.3. Measurement of physical workload

Measurements were obtained for 22 female grocery store workers. Their mean age was 37 years (range 22–60 years), height 168 cm (range 156–178 cm) and weight 75 kg (range 55–95 kg). Seventeen of the workers performed both cashier work and picking work. The remaining five workers performed delicatessen work. These participants did not differ from the total group, neither as to individual factors nor to the muscular skeletal complaints. During the recordings the subjects were observed and the time of the beginning and end of the tasks was noted. This information was used to split the analysis into work tasks.

3.2.3.1. Muscular load. Bipolar surface electromyography (EMG) was recorded bilaterally for the descending part of the upper trapezius muscle, and for the forearm extensor muscles (m. carpi radialis longus and brevis) (Åkesson et al., 1997). Muscular activity was normalised to the EMG activity (MVE) recorded during maximal voluntary contractions. For the trapezius muscles, these were performed as attempted arm elevation against a resistance, with the arm elevated to 90° in the scapula plane, and for the forearm extensor muscles as a maximal hand grip test (for details see Nordander et al., 2004). Data were sampled at 1024 Hz using data loggers (Logger Teknologi HB, Åkarp, Sweden; Hansson et al., 2003). The signal was band pass (30–400 Hz) and notch (50, 100, 150, 400 Hz) filtered, and the root mean square value (RMS) was calculated for epochs of 0.125 s (Hansson et al., 1997). The subtraction of noise was performed in a power sense (Hansson, 2011). Muscular rest, i.e. the fraction of time with an EMG activity below 0.5% MVE (Veiersted et al., 1990; Hansson et al., 2000), and the 10th, 50th and 90th percentiles of the amplitude distribution (Jonsson, 1982) were used to describe the muscle load.

3.2.3.2. Postures and movements and variation of the head and upper arms. Inclinometers, based on triaxial accelerometers were used for recording flexion/extension of the head and elevation of the upper arms (Hansson et al., 2001, 2006). The inclinometers were fixed on the forehead, and on the lateral part of the upper arms just distal to the insertion of the middle part of the deltoid muscle. The

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