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Orthostatic symptoms, blood pressure and working postures of factory and service workers over an observed workday

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Abstract

North American workers usually stand while working, and prolonged standing is associated with discomfort and cardiovascular problems. Moving may alleviate the problems, but optimum mobility is unknown. The effects of variations in mobility were explored among (1) 34 health care workers whose symptoms of orthostatic intolerance (OI) were recorded after work; (2) 45 factory and laundry workers. Postures were observed over a workday and blood pressure (BP) and heart rate (HR) of both groups were recorded before and after work. Among health care workers, 65% manifested OI symptoms. In a multiple logistic regression, presence of $\geqslant 1$ symptom of OI was associated with static postures and being female ($p = 0.001$). More static standing was associated with a larger drop in BP ($p = 0.04$) in both populations. The results suggest that more static standing postures are associated with OI and musculoskeletal symptoms and with a subclinical drop in BP.

Keywords: Standing; Orthostatic intolerance; Blood pressure

1. Introduction

Prolonged standing at work has been associated with a variety of adverse effects (McCulloch, 2002), such as lower extremity discomfort (Messing et al., 2006), varicose veins (Tuchsen et al., 2005), chronic venous insufficiency (Krijnen et al., 1997a, b) and progression of carotid artery disease (Krause et al., 2000). However, the precise mechanisms linking different standing postures to health effects are not known. In particular, the role of mobility in promoting or preventing cardiovascular effects has not been studied in the workplace.

Hemodynamic changes observed during prolonged static standing may affect arterial blood pressure (BP) resulting in altered properties in lower limb tissue (Freeman et al., 2002; Jacob et al., 2000; Novak et al., 1998; Stewart, 2002; Stewart et al., 2003). Symptoms (headache, nausea, vomiting, palpitations, excessive fatigue, breathlessness, dizziness, blurred vision, abnormal perspiration, flushing, cramps, paresthesia and oedema in the lower limbs) may result if the organism is not able to restore hemodynamic equilibrium; these symptoms are collectively termed orthostatic intolerance (OI) or postural tachycardia syndrome (Novak et al., 1998; van Lieshout et al., 2001). These phenomena may contribute to the symptoms reported by workers who stand for long periods of time (Novak et al., 1998; Stewart and Weldon, 2000). However, OI has not been studied in real work situations.

Previously, a study of 45 factory and laundry workers who stood almost all of the day showed a subclinical decrease in arterial blood pressure over the workday (Laperrière et al., 2006). The present article extends this study to another population and also considers OI symptoms. Thus, we examine OI symptoms, heart rate

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and blood pressure among 34 health care workers exposed to prolonged standing. We also revisit the earlier study data and combine it with those from the current study in an attempt to identify workplace exposures associated with changes in regulation of the cardiovascular system.

2. Materials and methods

2.1. Study populations

2.1.1. Study 1

Study participants were 11 men and 26 women who worked in a long-term health care facility (Table 1a). Those who reported lifting 10 kg or more regularly were excluded in order to minimize variation of cardiovascular parameters due to non-postural factors. Participants included a variety of jobs: nurses' aides, orderlies, housekeeping personnel, kitchen staff, maintenance, mechanics, security guards, laundry workers, occupational therapists and nurses. Criteria for inclusion in the study were: age over 18; not lift regularly weights of 10 kg or more; work standing for at least some part of the day; not suffer any illness associated with the cardiovascular system; anticipate working a full shift; volunteer to be included. Three women were eventually eliminated from the study because they accepted observation for less than an hour and a half.

2.1.2. Study 2

Two populations totaling 45 standing workers were recruited: 36 factory workers and nine laundry workers; (Table 1b). Criteria for inclusion in the study were: age over 18; not lift regularly weights of 10 kg or more; work standing for at least some part of the day; not suffer any illness associated with the cardiovascular system; anticipate working a full shift; volunteer to be included.

Both Studies 1 and 2 were part of a larger research program involving tests of pain-pressure threshold. Workers were only available half an hour before and after work, so the numbers of questions they could be asked and the number of tests they could undergo was necessarily quite limited.

Table 1
Characteristics of study participants

	N	Age ± S.D. (year)	Body mass index ± S.D.
(a) Study 1: health care workers[a]			
Men	11	40.1 ± 9.0	28.7 ± 5.0
Women	23	45.7 ± 9.7	26.4 ± 5.6
Total	34	44.1 ± 9.7	27.1 ± 5.5
(b) Study 2: factory and service workers[a]			
Men	21	33.3 ± 11.5	25.9 ± 4.7
Women	24	34.2 ± 8.0	23.8 ± 4.7
Total	45	33.7 ± 9.9	24.9 ± 4.8

[a]No significant difference between the sexes in age or BMI.

2.2. Working postures

We characterized working posture in two ways:

(1) Walking/static standing/sitting were scored during a full workday (except during breaks and lunchtime) for each subject in the factory and laundry using a Palm handheld event register. Data on the duration of each episode of each posture were transferred to a desktop computer using ActoPalm for PC (Kerguelen, 2002). Initiation of walking was defined after each foot had left the floor once. Walking was finished when both feet were firmly on the floor. Static standing was scored irrespective of whether the workers shifted their weight from one foot to the other.
(2) Every half hour, we counted the steps and sequences of steps of workers for a 10-min period. A step was defined as the situation where one foot lost all contact with the floor and then was put down fully on the floor (after Selin et al., 1994). A sequence was defined as the steps taken from the initiation of the first step to the time when toe and heel of both feet were firmly on the floor (Messing and Kilbom, 2001). Time sitting was not considered during the step and sequence counts. Since two observers recorded these sequences, they underwent a training period of an hour where they counted sequences independently until they were able to come to agreement for three times in a row.

2.3. Questionnaire

To assess symptoms, a questionnaire was administered to all participants, based on that used in the Québec Health and Social Survey of 1998 (Tissot et al., 2005). Before work, workers answered questions on sociodemographic variables (age, weight, health and seniority), anticipated working postures (Laperrière et al., 2005) and filled out a body map containing questions on pain experienced before work. After work, another part of the questionnaire was administered, containing questions on smoking, on pain felt after work (body map and questions) and on perception of working postures (Laperrière et al., 2005). These questions on pain and symptoms were phrased (our translation): Does it happen that you feel pain during your work (Yes/No)? If so, where do you feel pain? During what movements? During what tasks? At what time during work?

For Study 1 participants only, there was a question about symptoms of OI: Does it happen that you feel other symptoms that you think are related to your work? (Participants could choose from a list of symptoms that included headache, nausea, excessive fatigue, dizziness, palpitations, ringing in the ears, vertigo and breathlessness.)

2.4. Arterial blood pressure and heart rate measurements

Blood pressure and heart rate were recorded in the supine position at the beginning and end of the workday,