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Field Study

Subjective Symptoms among Female Workers and Winter Working Conditions in a Consumer Cooperative

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Abstract: Subjective Symptoms among Female Workers and Winter Working Conditions in a Consumer Cooperative: Ryoichi INABA, *et al*. Deparatment of Occupational Health, Graduate School of Medicine, Gifu University—Subjective musculoskeletal symptoms are more frequently complained about in cold store work and in related conditions than in normal temperature work. This cross sectional study was undertaken (a) to explore the prevalence of subjective symptoms in winter among a group of female workers engaged in classification of cold storage goods, and in a group of female checkers in several supermarkets of a large consumer cooperative; and (b) to give recommendations for improving the winter working conditions of these workers. The subjects consisted of 46 workers engaged in classification of cold storage goods, 56 checkers operating a laser scanner in supermarkets and 59 office workers (control group). Work loads for the three groups were estimated according to the recommended criteria. A self-administered questionnaire covering age, occupational career, smoking, alcohol drinking and physical exercise, present or past history of diseases, individual protective measures against cold, and subjective symptoms (54 items) was used. The air temperature of the working site at the opening time for classification workers was 4.8°C which was significantly lower than those measured for the other two work places (12.1°C and 15.8°C). About 70 to 80% of classification workers complained of cold sensation in different body regions, as well as shoulder stiffness, and problems related to the back. The supermarket checkers and office workers had a high prevalence of cold sensation in their feet. The frequencies of using warm clothes and foot heaters, as an individual measure to work comfortably in winter among the classification workers and the checkers were significantly higher than that among the office workers. We concluded that work difficulty due to moderate cold exposure among workers in the consumer cooperative could be reduced by some physical activity as well as proper clothes.
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Key words: Cold exposure, Subjective symptoms, Female workers, Warm Clothes, Physical activity

Some studies have shown a relationship between indoor cold exposure and the development of subjective complaints particularly those related to the musculoskeletal system. In a recent study, Bang *et al*.[1)] investigated the relation between feeling cold at work and the risk of symptoms from muscles, skin, and airways among 1,767 seafood industry workers. They showed that moderate cooling, caused by a cold indoor working environment, may increase muscle, airway, and skin symptoms. The associations between indoor cold exposure and some musculoskeletal disorders such as low back pain, knee pain and shoulder pain[2)], carpal tunnel syndrome[3)], and neck and shoulders[4)] have been reported.

In Japan, consideration of comfortable thermal working conditions is advised as a duty having been adopted by the revision of the Health and Safety at Work Act in 1992[5)]. The first author has carried out activities as an industrial physician in a consumer cooperative for the past several years in a certain city located in the central part of Japan. The consumer cooperative has one work site for classification of cold storage goods and several supermarkets in the vicinity of the city. Environmental temperatures in the workshop for classification and the supermarkets are regulated 0–18°C and 22–23°C throughout the year, respectively. It has been shown that

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musculoskeletal symptoms are more frequent in cold store work and in related conditions than in neutral temperature work and symptoms seems to increase when the working time in the cold environment increases[6].

The high prevalence of subjective complaints related to cooling disorder in various body parts in the summer among the female classification workers and checkers in this consumer cooperative was reported elsewhere[7]. With respect to cold weather in the winter in the same city, it is reasonable to assume that the artificially cold environment at these work sites might not be so subjectively cold in winter, and consequently less stressful to the workers. However, little is known about the effects of daily exposure to a moderate cold environment (–5 to 15°C)[8]. In addition, a large number of workers in the work places are females who are more sensitive to the cold[8–10]. Thus, it can be anticipated that among these female workers, subjective symptoms related to the chilliness such as finger or foot cold sensation, Raynaud's phenomenon, gastrointestinal complaints, and cold[7] might be complained about in higher percentages.

The purposes of this cross-sectional study were: to determine the prevalence of subjective symptoms among female workers engaged in classification of cold storage goods and female checkers in the supermarkets in winter; and to give recommendations for improving these workers' working conditions in winter.

Materials and Methods

Subjects and questionnaire

This study was conducted among 160 female workers in a consumer cooperative located in G city in the central part of Japan. The subjects consisted of 46 workers engaged in classification of cold storage goods for door to door delivery, 56 checkers operating a laser scanner in 3 supermarkets, and 59 office workers in the head office (control group). Work loads of the classification workers, checkers and office workers were estimated to be at rates of RMR 1–3, 0.5–2 and 0–0.5, respectively[7]. Through the headquarters of the consumer cooperative, a self-administered questionnaire not requiring a signature covering age, body dimensions, occupational career, working days in a week as well as daily working hours, lifestyles (Morimoto's 8 items[11] such as smoking, alcohol drinking and physical exercise), present illness, past history of diseases, individual protective measures to the cold, and subjective symptoms (54 items) was distributed and collected. The questionnaire was the same as that used in our previous study[7]. The participants were questioned as to whether they had any of the investigated symptoms in winter. The subjective symptoms were classified into three categories of frequency: frequently, sometimes, or none. In order to be able to present and to discuss the results obtained, selection of "frequently" or "sometimes" was taken to indicate the presence of the symptom. The survey was carried out at the beginning of February 2001. All the subjects replied to the questionnaire.

The study was approved by the Ethical Committee of Gifu University School of Medicine.

Measurement of thermal condition in the workshops

Temperature and relative humidity were measured at 150 cm height from the ground at the picking line in the classification workshop, at the checkout counter in one of the supermarkets and at the central part in one of the offices. The measurement time was at the opening time, noon and at the closing time for 5 days (from January 28th (Monday) to February 1st (Friday), 2001). Opening times of the classification workshop, the supermarkets and the offices were 9:00, 8:30 and 10:00, respectively. Their closing times were 16:30, 17:30 and 20:00, respectively.

Statistics

The significance of differences among values was tested using χ^2 test, Student's paired t-test and one way analysis of variance (ANOVA) followed by Scheffe's multiple comparison. When the frequency was low (below 5), Fisher's exact test was used. The significance level was set at $p<0.05$.

Results

Table 1 shows the characteristics of the subjects. The mean ages of the classification workers (48.0 ± 6.6 yr) and the office workers (47.4 ± 6.2 yr) were significantly higher than that of the checkers (35.9 ± 13.1 yr) ($p<0.01$). The occupational careers of the classification workers (6.4 ± 4.3 yr) and the office workers (8.6 ± 5.3 yr) were significantly longer that of the checkers (3.4 ± 3.6 yr) ($p<0.01$). Mean occupational career of the classification workers was significantly shorter than that of the office workers ($p<0.05$). Working days in a month of the classification workers (20.0 ± 1.0 d) and the office workers (19.8 ± 1.3 d) were significantly more than that of the checkers (18.7 ± 3.6 d) ($p<0.05$). There were no significant differences in the scores of lifestyle among the three groups. However, prevalence rates of skipping breakfast (17.9%), and food intake in which a balance of the nutrition was removed (39.3%) in the checkers were significantly higher than the obtained values (2.2% and 15.6%) in the classification workers ($p<0.01$ or 0.05).

From the questionnaire, hypertension was found in 2 (4.4%) classification workers, 3 (5.4%) checkers and 4 (6.8%) office workers. Two (4.4%) classification workers but no checkers or offices workers had menoxenia. Also, 1 (1.7%) office worker but no classification workers or checkers had cardiac disease (Data not shown in Table).

Table 2 shows the individual protective measures against coldness taken by subjects working in winter. The

Table 1. Characteristics of the subjects

Group	Classification workers (N=45)	Checkers (N=56)	Office workers (N=59)	Total (N=160)
Age (yr)	48.0 ± 6.6 (22 –58)$^{++}$	35.9 ± 13.1 (16– 58)**	47.4 ± 6.2 (31 – 57)	43.4 ± 10.9 (16 – 58)
Height (cm)	155.3 ± 4.7 (145 –167)	155.3 ± 5.3 (142– 168)	155.1 ± 4.5 (146 – 165)	155.3 ± 4.8 (142 – 168)
Body weight (kg)	50.3 ± 5.0 (38 –60)	51.8 ± 7.3 (43– 75)	50.1 ± 5.6 (38 – 65)	50.7 ± 6.1 (38 – 75)
BMI	20.9 ± 2.0 (17 –26)	21.5 ± 2.9 (17.0– 33)	20.9 ± 2.4 (16 – 27)	21.1 ± 2.5 (16 – 33)
Occupational career (yr)	6.4 ± 4.3 (0.3 –12)*$^{++}$	3.4 ± 3.6 (0.2– 21)**	8.6 ± 5.3 (0.2 – 19)	6.2 ± 5.0 (0.2 – 21)
Working frequency (d/month)	20.0 ± 1.0 (17 –23)$^{+}$	18.7 ± 3.6 (7– 23)*	19.8 ± 1.3 (16 – 22)	19.5 ± 2.4 (7 – 23)
Daily working time (h/d)	4.5 ± 0.3 (4 –5)	4.5 ± 1.5 (3– 9)	4.5 ± 0.6 (3.5 – 6.5)	4.5 ± 1.0 (3 – 9)
Sleeping period (h/d)	6.4 ± 0.9 (5 –8)	6.5 ± 1.0 (4.5– 10)	6.4 ± 0.9 (4.5 – 8)	6.4 ± 0.9 (4.5 – 10)
Years of cigarette smoking	0.8 ± 5.2 (0 –35)	0.7 ± 3.0 (0– 16)	0.9 ± 4.5 (0 – 30)	0.8 ± 4.3 (0 – 35)
Daily smoking (cigarettes/d)	0.2 ± 1.5 (0 –10)	1.0 ± 3.9 (0– 20)	0.6 ± 2.6 (0 – 15)	0.6 ± 2.9 (0 – 20)
Frequency of drinking (d/wk)	1.1 ± 2.0 (0 –7)	0.7 ± 1.3 (0– 7)	0.7 ± 1.6 (0 – 6)	0.8 ± 1.7 (0 – 7)
Drinking volume (Japanese Sake, gou/d)$	0.2 ± 0.3 (0 –1.5)	0.2 ± 0.4 (0– 2)	0.1 ± 0.3 (0 – 1.2)	0.2 ± 0.4 (0 – 2)
Score of life style (Morimoto's 8 items)	6.2 ± 0.8 (4 –8)	5.9 ± 1.1 (3– 8)	6.2 ± 1.1 (4 – 8)	6.1 ± 1.1 (3 – 8)

Each value represents the mean ± SD (Minimum–Maximum). *p<0.05, **p<0.01, compared with the office workers; $^{+}$ p<0.05, $^{++}$$p$<0.01, compared with the checkers (one way ANOVA followed by Sheffe's multiple comparison). $: one "gou" is about 180 m*l*.

Table 2. Individual protective measures against coldness taken by subjects working in winter

Group	Classification workers (N=45)	Checkers (N=56)	Office workers (N=59)	Total (N=160)
Robe	0 (0.0)	0 (0.0)*	14 (23.7)	14 (8.8)
Warm clothes	24 (53.3)**$^{++}$	12 (21.4)*	4 (6.8)	40 (25.0)
Warm trousers	37 (82.2)**$^{++}$	0 (0.0)	1 (1.7)	38 (23.8)
Gloves	26 (57.8)**$^{++}$	0 (0.0)	2 (3.4)	28 (17.5)
Warm socks	12 (26.7)	14 (25.0)*	26 (44.1)	52 (32.5)
Warm tights	23 (51.1)	23 (41.1)	27 (45.8)	73 (45.6)
Warm shoes	35 (77.8)**$^{++}$	3 (5.4)	5 (8.5)	43 (26.9)
Muffler	11 (24.4)*$^{++}$	2 (3.6)	3 (5.1)	16 (10.0)
Warm underwear	9 (20.0)$^{+}$	22 (39.3)	15 (25.4)	46 (28.8)
Body warmer	16 (35.6)	27 (48.2)**	12 (20.3)	55 (34.4)
Foot heater	45 (100.0)**	56 (100.0)**	0 (0.0)	101 (63.1)
Subjects who used at least one of the protective measures described.	45 (100.0)**$^{+}$	47 (83.9)	49 (83.1)	141 (88.1)

Each value represents the number (%) of the subjects. *p<0.05, **p<0.01, compared with the office workers; $^{+}$ p<0.05, $^{++}$ p<0.01, compared with the checkers.

frequencies of using warm clothes and foot heaters to work comfortably in winter among the classification workers and the checkers were significantly higher than those in the office workers (p<0.05 or p<0.01). It should be noted that footing heater set up in the work place for classification site ran automatically only when the environmental temperature fell below 5°C. The frequencies of using warm clothes, warm trousers, warm gloves, warm shoes and muffler in the classification workers were significantly higher than those among the checkers and the office workers (p<0.05 or p<0.01). The checkers used body warmers significantly more than the office workers (p<0.01). The frequency of using warm underwear in the classification workers was significantly lower than that in the checkers (p<0.05). The frequency of using warm socks in the checkers was significantly

Table 3-1. Prevalence of subjective symptoms in winter among subjects

Subjective symptoms	Group	Symptom frequency		None	
		Frequently	Sometimes		Total
Finger cold sensation	Classification workers+	9 (20.0)	17 (37.8)	19 (42.2)	45 (100.0)
	Checkers**	22 (39.3)	23 (41.1)	11 (19.6)	56 (100.0)
	Office workers	15 (25.4)	15 (25.4)	29 (49.2)	59 (100.0)
Numbness in the fingers	Classification workers	0 (0.0)	11 (24.4)	34 (75.6)	45 (100.0)
	Checkers	3 (5.4)	11 (19.6)	42 (75.0)	56 (100.0)
	Office workers	1 (1.7)	12 (20.3)	46 (78.0)	59 (100.0)
Pain in the fingers	Classification workers	3 (6.7)	10 (22.2)	32 (71.1)	45 (100.0)
	Checkers	1 (1.8)	14 (25.0)	41 (73.2)	56 (100.0)
	Office workers	0 (0.0)	9 (15.3)	50 (84.7)	59 (100.0)
Stiffness in the fingers	Classification workers	5 (11.1)	8 (17.8)	32 (71.1)	45 (100.0)
	Checkers	7 (12.5)	18 (32.1)	31 (55.4)	56 (100.0)
	Office workers	3 (5.1)	13 (22.0)	43 (72.9)	59 (100.0)
Raynaud's Phenomena in the fingers	Classification workers	1 (2.2)	5 (11.1)	39 (86.7)	45 (100.0)
	Checkers**	5 (8.9)	13 (23.2)	38 (67.9)	56 (100.0)
	Officeworkers	2 (3.4)	3 (5.1)	54 (91.5)	59 (100.0)
Pain in the wrist	Classification workers**+	2 (4.4)	19 (42.2)	24 (53.3)	45 (100.0)
	Checkers	0 (0.0)	9 (16.1)	47 (83.9)	56 (100.0)
	Office workers	1 (1.7)	8 (13.6)	50 (84.7)	59 (100.0)
Pain in the arm	Classification workers**++	6 (13.3)	22 (48.9)	17 (37.8)	45 (100.0)
	Checkers	4 (7.1)	11 (19.6)	41 (73.2)	56 (100.0)
	Office workers	3 (5.1)	10 (16.9)	46 (78.0)	59 (100.0)
Dullness in the arm	Classification workers*	3 (6.7)	21 (46.7)	21 (46.7)	45 (100.0)
	Checkers	4 (7.1)	16 (28.6)	36 (64.3)	56 (100.0)
	Office workers	2 (3.4)	15 (25.4)	42 (71.2)	59 (100.0)
Shoulder stiffness	Classification workers	15 (33.3)	20 (44.4)	10 (22.2)	45 (100.0)
	Checkers*	25 (44.6)	16 (28.6)	15 (26.8)	56 (100.0)
	Office workers	21 (35.6)	30 (50.8)	8 (13.6)	59 (100.0)
Pain in the shoulders	Classification workers+	7 (15.6)	20 (44.4)	18 (40.0)	45 (100.0)
	Checkers**	14 (25.0)	11 (19.6)	31 (55.4)	56 (100.0)
	Office workers	4 (6.8)	24 (40.7)	31 (52.5)	59 (100.0)
Neck stiffness	Classification workers	15 (33.3)	19 (42.2)	11 (24.4)	45 (100.0)
	Checkers	17 (30.4)	16 (28.6)	23 (41.1)	56 (100.0)
	Office workers	16 (27.1)	23 (39.0)	20 (33.9)	59 (100.0)
Pain in the neck	Classification workers+	4 (8.9)	21 (46.7)	20 (44.4)	45 (100.0)
	Checkers	12 (21.4)	12 (21.4)	32 (57.1)	56 (100.0)
	Office workers	5 (8.5)	18 (30.5)	36 (61.0)	59 (100.0)
Back dullness	Classification workers++	3 (6.7)	19 (42.2)	23 (51.1)	45 (100.0)
	Checkers**	12 (21.4)	10 (17.9)	34 (60.7)	56 (100.0)
	Office workers	1 (1.7)	16 (27.1)	42 (71.2)	59 (100.0)
Back pain	Classification workers+	2 (4.4)	18 (40.0)	25 (55.6)	45 (100.0)
	Checkers	9 (16.1)	11 (19.6)	36 (64.3)	56 (100.0)
	Office workers	4 (6.8)	16 (27.1)	39 (66.1)	59 (100.0)
Low back dullness	Classification workers*	10 (22.2)	24 (53.3)	11 (24.4)	45 (100.0)
	Checkers*	15 (26.8)	21 (37.5)	20 (35.7)	56 (100.0)
	Office workers	5 (8.5)	24 (40.7)	30 (50.8)	59 (100.0)

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Subjective symptoms	Group	Symptom frequency		None	Total
		Frequently	Sometimes		
Lumbago	Classification workers*+	11 (24.4)	26 (57.8)	8 (17.8)	45 (100.0)
	Checkers	17 (30.4)	18 (32.1)	21 (37.5)	56 (100.0)
	Office workers	9 (15.3)	25 (42.4)	25 (42.4)	59 (100.0)
Low-back cold sensation	Classification workers+	8 (17.8)	17 (37.8)	20 (44.4)	45 (100.0)
	Checkers*	17 (30.4)	8 (14.3)	31 (55.4)	56 (100.0)
	Office workers	12 (20.3)	21 (35.6)	26 (44.1)	59 (100.0)
Knee joint pain	Classification workers	4 (8.9)	18 (40.0)	23 (51.1)	45 (100.0)
	Checkers	4 (7.1)	11 (19.6)	41 (73.2)	56 (100.0)
	Office workers	4 (6.8)	17 (28.8)	38 (64.4)	59 (100.0)
Foot cold sensation	Classification workers++	8 (17.8)	20 (44.4)	17 (37.8)	45 (100.0)
	Checkers	26 (46.4)	19 (33.9)	11 (19.6)	56 (100.0)
	Office workers	22 (37.3)	24 (40.7)	13 (22.0)	59 (100.0)
Foot stiffness	Classification workers	1 (2.2)	6 (13.3)	38 (84.4)	45 (100.0)
	Checkers	3 (5.4)	7 (12.5)	46 (82.1)	56 (100.0)
	Office workers	1 (1.7)	6 (10.2)	52 (88.1)	59 (100.0)
Foot numbness	Classification workers	0 (0.0)	7 (15.6)	38 (84.4)	45 (100.0)
	Checkers	2 (3.6)	5 (8.9)	49 (87.5)	56 (100.0)
	Office workers	1 (1.7)	6 (10.2)	52 (88.1)	59 (100.0)

Each value represents the number (%) of the subjects. *$p<0.05$, **$p<0.01$, compared with the office workers; +$p<0.05$, ++ $p<0.01$, compared with the checkers.

lower than that in the office workers ($p<0.05$). Among office workers 23.7% of them but no classification workers or checkers used lobe. No classification workers, checkers or office workers used a cap or warm earmuff. The proportion of the subjects who used at least one protective measure of the described items against the cold in the classification workers (100.0%) was significantly higher than those among the checkers (83.9%) and the office workers (83.1%) ($p<0.05$ or $p<0.01$).

Tables 3–1 to 3–4 show the prevalence of subjective symptoms in winter among the subjects. The five main subjective symptoms among classification workers were lumbago (82.2%), shoulder stiffness (77.7%), neck stiffness (75.5%), low-back dullness (75.5%) and easily fatigued (73.3%). The five main subjective symptoms among checkers were finger cold sensation (80.4%), foot cold sensation (80.4%), shoulder stiffness (73.2%), low-back dullness (64.3%) and lumbago (62.5%). The five main subjective symptoms among office workers were shoulder stiffness (86.4%), foot cold sensation (78.0%), easily fatigued (71.2%), neck stiffness (66.1%) and lumbago (57.6%). The prevalence rates of pain in the wrist, pain in the arm and lumbago in the classification workers were significantly higher than those among the checkers and the office workers ($p<0.05$ and $p<0.01$). The classification workers had significantly higher prevalence rates for dullness feeling in the arm, low-back dullness, irregularity of menstruation and subjectively strong condition of stomach and intestines, compared with those of the office workers ($p<0.05$ or $p<0.01$). The prevalence rate of constipation in the classification workers was significantly lower than those among checkers and office workers ($p<0.05$ or $p<0.01$). The prevalence rates of pollakisuria in the night, tinnitus and sweating in the classification workers were significantly higher than those in the checkers ($p<0.05$). The classification workers had a significantly higher prevalence for subjective resistance to the cold, compared to that of the checkers ($p<0.05$). The prevalence rate of finger cold sensation in the checkers was significantly higher than those among the classification workers and the office workers ($p<0.05$ or $p<0.01$). The checkers complained of pain in the shoulders, back dullness and low-back cold sensation more significantly than the classification workers and the office workers ($p<0.05$ or $p<0.01$). The prevalence of Raynaud's phenomenon in the fingers, low-back dullness, rough skin and dysmenorrhea in the checkers were significantly higher than those in the office workers ($p<0.05$ or $p<0.01$). Percentages in the checkers who complained of shoulder stiffness and body dullness were significantly higher than those in the office workers ($p<0.05$ or $p<0.01$). The checkers had significantly higher prevalence rates for foot cold sensation, compared with those of the classification

Table 3-2. Prevalence of subjective symptoms in winter among subjects

Subjective symptoms	Group	Symptom frequency		None	Total
		Frequently	Sometimes		
Pain in the foot	Classification workers	2 (4.4)	15 (33.3)	28 (62.2)	45 (100.0)
	Checkers	5 (8.9)	10 (17.9)	41 (73.2)	56 (100.0)
	Office workers	1 (1.7)	10 (16.9)	48 (81.4)	59 (100.0)
Appetite loss	Classification workers	1 (2.2)	5 (11.1)	39 (86.7)	45 (100.0)
	Checkers	1 (1.8)	12 (21.4)	43 (76.8)	56 (100.0)
	Office workers	3 (5.1)	12 (20.3)	44 (74.6)	59 (100.0)
Stomach discomfort	Classification workers	1 (2.2)	9 (20.0)	35 (77.8)	45 (100.0)
	Checkers	2 (3.6)	12 (21.4)	42 (75.0)	56 (100.0)
	Office workers	1 (1.7)	14 (23.7)	44 (74.6)	59 (100.0)
Abdominal pain	Classification workers	0 (0.0)	6 (13.3)	39 (86.7)	45 (100.0)
	Checkers	1 (1.8)	9 (16.1)	46 (82.1)	56 (100.0)
	Office workers	2 (3.4)	11 (18.6)	46 (78.0)	59 (100.0)
Diarrhea	Classification workers	1 (2.2)	9 (20.0)	35 (77.8)	45 (100.0)
	Checkers	2 (3.6)	17 (30.4)	37 (66.1)	56 (100.0)
	Office workers	0 (0.0)	18 (30.5)	41 (69.5)	59 (100.0)
Bad abdominal condition due to the cold	Classification workers	1 (2.2)	12 (26.7)	32 (71.1)	45 (100.0)
	Checkers	5 (8.9)	19 (33.9)	32 (57.1)	56 (100.0)
	Office workers	5 (8.5)	17 (28.8)	37 (62.7)	59 (100.0)
Constipation	Classification workers*++	3 (6.7)	5 (11.1)	37 (82.2)	45 (100.0)
	Checkers	8 (14.3)	21 (37.5)	27 (48.2)	56 (100.0)
	Office workers	8 (13.6)	19 (32.2)	32 (54.2)	59 (100.0)
Pollakisuria in the night	Classification workers+	1 (2.2)	10 (22.2)	34 (75.6)	45 (100.0)
	Checkers	5 (8.9)	3 (5.4)	48 (85.7)	56 (100.0)
	Office workers	1 (1.7)	5 (8.5)	53 (89.8)	59 (100.0)
Dull head	Classification workers	5 (11.1)	10 (22.2)	30 (66.7)	45 (100.0)
	Checkers	6 (10.7)	17 (30.4)	33 (58.9)	56 (100.0)
	Office workers	3 (5.1)	24 (40.7)	32 (54.2)	59 (100.0)
Headache	Classification workers	6 (13.3)	13 (28.9)	26 (57.8)	45 (100.0)
	Checkers	3 (5.4)	24 (42.9)	29 (51.8)	56 (100.0)
	Office workers	4 (6.8)	26 (44.1)	29 (49.2)	59 (100.0)
Dizziness	Classification workers	2 (4.4)	11 (24.4)	32 (71.1)	45 (100.0)
	Checkers	3 (5.4)	7 (12.5)	46 (82.1)	56 (100.0)
	Office workers	2 (3.4)	9 (15.3)	48 (81.4)	59 (100.0)
Palpitation	Classification workers	1 (2.2)	8 (17.8)	36 (80.0)	45 (100.0)
	Checkers	1 (1.8)	12 (21.4)	43 (76.8)	56 (100.0)
	Office workers	2 (3.4)	13 (22.0)	44 (74.6)	59 (100.0)
Cough	Classification workers	2 (4.4)	13 (28.9)	30 (66.7)	45 (100.0)
	Checkers	3 (5.4)	13 (23.2)	40 (71.4)	56 (100.0)
	Office workers	1 (1.7)	9 (15.3)	49 (83.1)	59 (100.0)
Sputum	Classification workers	3 (6.7)	8 (17.8)	34 (75.6)	45 (100.0)
	Checkers	1 (1.8)	15 (26.8)	40 (71.4)	56 (100.0)
	Office workers	1 (1.7)	10 (16.9)	48 (81.4)	59 (100.0)
Tinnitus	Classification workers+	0 (0.0)	14 (31.1)	31 (68.9)	45 (100.0)
	Checkers	5 (8.9)	7 (12.5)	44 (78.6)	56 (100.0)
	Office workers	2 (3.4)	16 (27.1)	41 (69.5)	59 (100.0)

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(continued)

Subjective symptoms	Group	Symptom frequency		None	Total
		Frequently	Sometimes		
Vertigo	Classification workers	2 (4.4)	11 (24.4)	32 (71.1)	45 (100.0)
	Checkers	1 (1.8)	17 (30.4)	38 (67.9)	56 (100.0)
	Office workers	2 (3.4)	13 (22.0)	44 (74.6)	59 (100.0)
Nausea	Classification workers	0 (0.0)	7 (15.6)	38 (84.4)	45 (100.0)
	Checkers	1 (1.8)	5 (8.9)	50 (89.3)	56 (100.0)
	Office workers	0 (0.0)	4 (6.8)	55 (93.2)	59 (100.0)
Sweating	Classification workers+	3 (6.7)	10 (22.2)	32 (71.1)	45 (100.0)
	Checkers	5 (8.9)	3 (5.4)	48 (85.7)	56 (100.0)
	Office workers	3 (5.1)	11 (18.6)	45 (76.3)	59 (100.0)
Initial insomnia	Classification workers	2 (4.4)	10 (22.2)	33 (73.3)	45 (100.0)
	Checkers	8 (14.3)	11 (19.6)	37 (66.1)	56 (100.0)
	Office workers	5 (8.5)	16 (27.1)	38 (64.4)	59 (100.0)
Easily fatigued	Classification workers	7 (15.6)	26 (57.8)	12 (26.7)	45 (100.0)
	Checkers**	13 (23.2)	20 (35.7)	23 (41.1)	56 (100.0)
	Office workers	5 (8.5)	37 (62.7)	17 (28.8)	59 (100.0)
Urticaria	Classification workers	0 (0.0)	2 (4.4)	43 (95.6)	45 (100.0)
	Checkers	0 (0.0)	3 (5.4)	53 (94.6)	56 (100.0)
	Office workers	2 (3.4)	5 (8.5)	52 (88.1)	59 (100.0)

Each value represents the number (%) of the subjects. *p<0.05, **p<0.01, compared with the office workers; ^{+}p<0.05, ^{++}p<0.01, compared with the checkers.

workers (p<0.01). The percentages of the checkers who complained of pain in the neck and back pain were significantly higher than those of the classification workers (p<0.05). There were no significant differences in the percentages of subjects who complained of work difficulty due to the cold among the three groups.

Figure 1 shows the environmental temperature in the work places. At the opening time, environmental temperature in the classification work place (4.8 ± 1.2°C) was significantly lower than that at the checkout counter in the supermarket (12.1 ± 0.2°C) and that in the office (11.0 ± 3.7°C) (p<0.01). At noon, environmental temperatures in the classification work place (10.0 ± 1.2°C) and at the checkout counter in the supermarket (15.8 ± 1.2°C) were significantly lower than that in the office (21.6 ± 1.4°C) (p<0.01). At the closing time, environmental temperatures in the classification work place (10.2 ± 1.0°C) and at the checkout counter in the supermarket (16.6 ± 0.5°C) were significantly lower than that in the office (21.4 ± 0.8°C) (p<0.01). Both at noon and the closing time, environmental temperatures in the classification work place were significantly lower than that at the checkout counter in the supermarket p<0.01). Both in the classification work place and the office, environmental temperatures at the opening time were significantly lower than those at noon (p<0.01). There were no significant differences in the environmental temperatures recorded at noon and at the closing time in all work places.

Figure 2 shows the relative humidity in the working places. At the opening time, relative humidity in the classification work place (66.0 ± 4.0%) was significantly higher than that at the checkout counter in the supermarket (54.0 ± 4.2%) and that in the office (41.0 ± 2.2%) (p<0.01). In addition, at opening time, relative humidity at the checkout counter in the supermarket was significantly higher than that in the office (p<0.01). At noon, relative humidity in the classification work place (49.0 ± 9.7%) was significantly higher than that in the office (32.8 ± 4.6%) (p<0.01). There were no significant differences in the relative humidity among the opening time, noon and the closing time in all work places.

Discussion

Anatomically women are potentially at a disadvantage to cold stress because of their smaller total and lean body mass and larger body surface area/mass; however, they also have a potential advantage due to greater body fat[12]. Walsh and Graham[13] reported that comparing the response of men and women to cold stress (–10, –3.5, 3.5 and 10°C) during intermittent exercise (20 min. exercise (60W), 10 min. rest) for 3 h, women had a lower

Table 3-3. Prevalence of subjective symptoms in winter among subjects

Subjective symptoms	Group	Symptom frequency		None	Total
		Frequently	Sometimes		
Rough skin	Classification workers	5 (11.1)	14 (31.1)	26 (57.8)	45 (100.0)
	Checkers*	10 (17.9)	22 (39.3)	24 (42.9)	56 (100.0)
	Office workers	2 (3.4)	27 (45.8)	30 (50.8)	59 (100.0)
Sore throat	Classification workers	3 (6.7)	19 (42.2)	23 (51.1)	45 (100.0)
	Checkers	5 (8.9)	26 (46.4)	25 (44.6)	56 (100.0)
	Office workers	1 (1.7)	24 (40.7)	34 (57.6)	59 (100.0)
Head cold	Classification workers	2 (4.4)	20 (44.4)	23 (51.1)	45 (100.0)
	Checkers	8 (14.3)	19 (33.9)	29 (51.8)	56 (100.0)
	Office workers	3 (5.1)	19 (32.2)	37 (62.7)	59 (100.0)
Cold	Classification workers	1 (2.2)	20 (44.4)	24 (53.3)	45 (100.0)
	Checkers	3 (5.4)	26 (46.4)	27 (48.2)	56 (100.0)
	Office workers	0 (0.0)	22 (37.3)	37 (62.7)	59 (100.0)
Algomenorrehea	Classification workers	3 (6.7)	11 (24.4)	31 (68.9)	45 (100.0)
	Checkers*	8 (14.3)	17 (30.4)	31 (55.4)	56 (100.0)
	Office workers	1 (1.7)	12 (20.3)	46 (78.0)	59 (100.0)
Irregularity of menstruation	Classification workers*	6 (13.3)	9 (20.0)	30 (66.7)	45 (100.0)
	Checkers	6 (10.7)	10 (17.9)	40 (71.4)	56 (100.0)
	Office workers	1 (1.7)	10 (16.9)	48 (81.4)	59 (100.0)
Body dullness	Classification workers	3 (6.7)	20 (44.4)	22 (48.9)	45 (100.0)
	Checkers**	11 (19.6)	17 (30.4)	28 (50.0)	56 (100.0)
	Office workers	2 (3.4)	30 (50.8)	27 (45.8)	59 (100.0)
Neuralgia	Classification workers	1 (2.2)	8 (17.8)	36 (80.0)	45 (100.0)
	Checkers	0 (0.0)	6 (10.7)	50 (89.3)	56 (100.0)
	Office workers	0 (0.0)	10 (16.9)	49 (83.1)	59 (100.0)
Work difficulty due to the cold	Classification workers	1 (2.2)	15 (33.3)	29 (64.4)	45 (100.0)
	Checkers	7 (12.5)	17 (30.4)	32 (57.1)	56 (100.0)
	Office workers	2 (3.4)	17 (28.8)	40 (67.8)	59 (100.0)

Each value represents the number (%) of the subjects. *p<0.05, **p<0.01, compared with the office workers.

Table 3-4. Prevalence of subjective symptoms in winter among subjects

Subjective symptoms	Group	Strong	Medium	Weak	Total
Condition of stomach and intestines	Classification workers*	8 (17.8)	26 (57.8)	11 (24.4)	45 (100.0)
	Checkers	5 (8.9)	40 (71.4)	11 (19.6)	56 (100.0)
	Office workers	2 (3.4)	45 (76.3)	12 (20.3)	59 (100.0)
Subjects' resistance to cold	Classification workers+	7 (15.6)	25 (55.6)	13 (28.9)	45 (100.0)
	Checkers	2 (3.6)	26 (46.4)	28 (50.0)	56 (100.0)
	Office workers	5 (8.5)	29 (49.2)	25 (42.4)	59 (100.0)
Subjects' resistance to heat	Classification workers	6 (13.3)	20 (44.4)	19 (42.2)	45 (100.0)
	Checkers	7 (12.5)	33 (58.9)	16 (28.6)	56 (100.0)
	Office workers	12 (20.3)	27 (45.8)	20 (33.9)	59 (100.0)

Each value represents the number (%) of the subjects. *p<0.05, **p<0.01, compared with the office workers; ^{+}p<0.05, compared with the checkers.

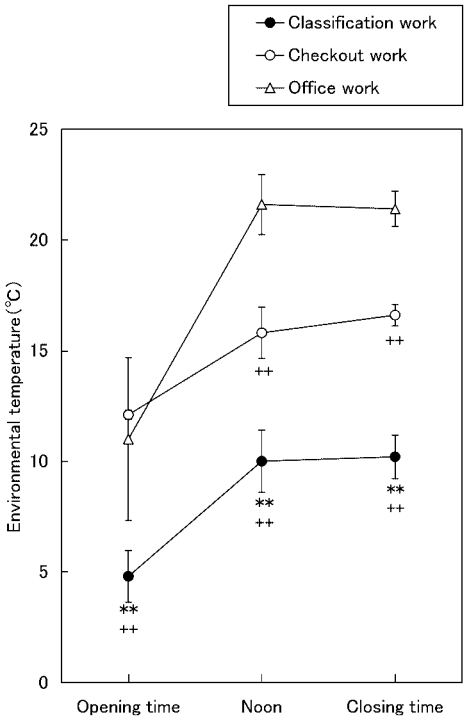

Fig. 1. Environmental temperature in the work places. $^{**}p<0.01$, compared with the temperature at the checkout counter in the supermarket. $^{++}p<0.01$, compared with the temperature in the office (ANOVA followed by Scheffe's multiple comparison).

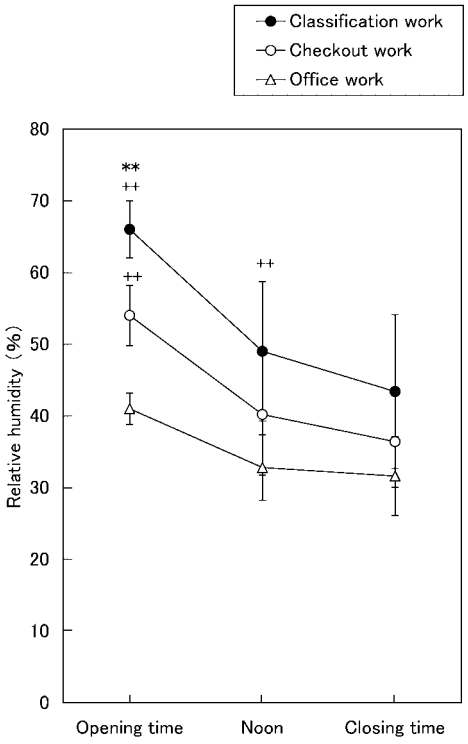

Fig. 2. Relative humidity in the working places. $^{**}p<0.01$, compared with the relative humidity at the checkout counter in the supermarket. $^{++}p<0.01$, compared with the relative humidity in the office (ANOVA followed by Scheffe's multiple comparison).

mean skin temperature. Meese *et al.*[14] reported by a laboratory study simulating factory work for 1 day that by fixing clothing levels, skin temperature during work in the cold (6 and 12°C) was decreased more in women than in men. Thus, the present investigation was undertaken by means of a cross-sectional inquiry in which female workers working in a moderately indoor cold environment (0–15°C, rest time for workers whose working time were under 4 h, 4–6 h and over 6 h were 10 min, 20 min and 60 min, respectively)[8] in winter reported their individual subjective complaints as well as protective measures against the cold in the work places.

In the present study, we observed that the environmental temperature in the classification work place was the lowest, followed by the temperature at the checkout counter in the supermarket in winter. Below we discuss the results and compare them with results obtained in the summer[7].

The main subjective symptoms in winter among classification workers, checkers and office workers were fairly different. The five main subjective symptoms among classification workers were the same as those reported in summer[6]. The prevalence rate for complaints of cold sensation in the feet in winter among checkers and office workers were significantly higher than those in summer (63.3% and 45.2%, respectively)[7]. These results suggest that main symptoms are related to musculoskeletal fatigue in classification workers, to peripheral circulatory disturbance in checkers, and both to musculoskeletal fatigue and peripheral circulatory disturbance in office workers[12].

Concerning the prevalence of lumbago, the results reported here (57.6%–83.2%) are somewhat higher than those reported by Chen *et al.*[2] who found lumbago in 42.3% of workers in a low temperature store (–10 to 25°C) and in 9.2% of workers in a normal temperature store (20 to 30°C). They concluded that cold exposure might be a co-factor in development of chronic problems of the muscles and joints. Lundqvist *et al.*[4], also indicated the same conclusion for those exposed to moderate cold exposure (5–19°C). The exposed subjects of the present study also worked in a moderately cold environment and regarding their musculoskeletal complaints, we also assume that besides the nature of the job and individual susceptibility, cold could be considered as an important co-factor in the development of the investigated musculoskeletal symptoms.

The prevalence rates for cold sensation in the fingers

and feet of the checkers were significantly higher than those among the classification workers although the room temperature at the checkout counter in the supermarket was significantly higher than that in the classification work place. It is possible that the results were due to healthy workers effects in that the classification workers had significantly higher prevalence rates for subjectively strong condition of stomach and intestines, compared with those of the office workers, and had a significantly higher prevalence for subjective resistance to the cold, compared to the checkers. We[7, 15] suggested that wearing warm shoes by female workers in moderate cold might be effective at preventing cold sensation in the fingers and feet, because during work in moderate cold, the percentages of the appearance of cold sensation in the fingers and feet among female workers with warm shoes were lower than those without warm shoes. Thus, it can be considered that the results were due to the significantly higher frequencies of use of warm shoes as well as gloves, warm clothes, warm trousers, and mufflers in the classification workers compared with the checkers, although the effects of age differences between the two groups cannot be neglected completely[16].

The frequency of use of foot heaters to work comfortably in winter of the checkers was significantly higher than that of the office workers. In addition, there were no significant differences in the prevalence rate for complaint of cold sensation in the feet in winter between checkers and office workers. These two factors might explain why the frequency of using warm socks of the checkers was significantly lower than that of the office workers.

Nishiyama *et al.*[17] and Itani[18] reported that supermarket checkers had more complaints of neck-shoulder-arm and general fatigue than other workers of the same supermarket, but in these reports no information about working environmental conditions and subjective complaints among checkers in winter were offered. In this study, we observed that percentages of the checkers who complained frequently of neck, shoulder and back pain, shoulder stiffness, back, low-back and body dullness and low-back cold sensation were significantly higher than those of the classification workers and/or those of the office workers in winter. These results might be in part due to the fact that individual protective measures against coldness such as warm clothes, warm trousers and warm shoes in the checkers were less often used than by classification workers. Niedhammer *et al.*[19] applied multiple logistic regression analysis to their data and observed a relation (Odds ratio 1.92, p=0.06) between exposure to cold and left shoulder pain among checkers. A causal relation is nevertheless questionable. Griefahn *et al.*[8] stated that pains in the shoulders and in the extremities complained of by workers were caused by repetitive physical activities rather than by cold. Their conclusions were on the basis of the evidence gained from a questionnaire survey performed among workers in the food industry, mainly from distributors, meat productions and from breweries, whose main occupational activities were manual material handling and heavy lifting, in moderately cold environments (–5 to 15°C).

We[7] reported that prevalence rates of pain in the wrist among the classification workers were significantly higher than those among the checkers and the office workers in summer. In the present study, we obtained the same result in winter. In addition, in winter a high prevalence of symptoms in the arm and lumbago in the classification workers was observed compared with the checkers and the office workers. Complaints of lumbago are usually more frequent with advancing age and is often provoked by more or less vehement motions[8]. Griefahn *et al.*[8] reported that lumbago was associated with changes in temperature or frequently interrupted exposures to cold by moving frequently between different rooms. However, frequent changes in temperature in the classification work place were not observed. In addition, as classification workers did not move to other rooms except at rest times, they were exposed to cold uninterruptedly. Thus, it is supposed that these results might be caused not only by aging but also by frequent movements of upper limbs and vehement motions in the classification work.

The classification workers had significantly higher prevalence rates of irregularity of menstruation, compared with the office workers. In addition, 2 (4.4%) classification workers but no checkers or office workers had menoxenia. The prevalence rates of dysmenorrhea in the checkers were significantly higher than those in the office workers. There have been some reports[20, 21] that dysmenorrhea and irregularity of menstruation in female workers are significantly related to work conditions such as cold exposure as well as ageing. Working schedule (starting time of work) variability was not observed either in the classification workers or in the checkers. Thus, it might be supposed that cold exposure during work as well as ageing was one of the factors causing the high frequencies of irregularity of menstruation in the classification workers and dysmenorrhea in the checkers.

In general, the prevalence of constipation in females increases with age[22]. However, in the present study, the prevalence of constipation in the classification workers, whose mean age was higher than the checkers, was significantly lower than those among the checkers and office workers. Kunimoto *et al.*[23] reported that in lifestyle the prevention of stress and skipping breakfast had a big effect in preventing constipation of working women. Recently, we[7] reported that in those workers working under air-conditioning (15–25°C) in summer, the prevalence of constipation in the classification workers with warm clothes against cold stress was significantly

lower than that in the classification workers without warm clothes. In this study, concerning the relationship between the prevalence of constipation and lifestyle, the prevalence of taking breakfast and taking food in which the nutrition was balanced in the classification workers were significantly higher than those in the checkers. Thus, it might be supposed that the low frequency of using warm clothes and the high frequency of skipping breakfast were the two main factors causing the high frequency of constipation in the checkers.

The prevalence of pollakisuria in the night and tinnitus in the classification workers were significantly higher than those in the checkers. It was reported that the prevalence of pollakisuria in the night and tinnitus in women increase with age[24, 25], and cold stress causes an osmolal diuretis and tinnitis[26, 27]. Thus, it might be supposed that these results were mainly caused by the age difference as well as the working conditions between the classification workers and checkers.

The prevalence of Raynaud's phenomenon in the fingers among classification workers, checkers and office workers were 13.3%, 32.1% and 8.5%, respectively. These prevalence rates were higher than in the female general population in Japan (1–4%)[28]. In addition, the prevalence of Raynaud's phenomenon in the fingers among the checkers was significantly higher than those among the office workers. Griefahn *et al*.[8] reported that exerted grip force may be one of the important factors in the pathogenesis of secondary Raynaud's phenomenon in workers who are at least temporarily exposed to low temperature. If so, the very high prevalence of Raynaud's phenomenon, especially in the checkers, could be due to the inadequate clothing against cold and repetition of exerted grip force (e.g. while lifting and carrying heavy weights or while handling manually cold material) as well as direct exposure to cold air from the show cases with cold storage.

The classification workers were clothed against cold more adequately than the checkers. However, the prevalence rates of sweating in the classification workers were significantly higher than those in the checkers. Insufficient protective clothing and too long a time inside the cold store have been cited[2] as key factors causing musculoskeletal symptoms and health problems among cold store workers. Sweating causes decrease of the body temperature afterward[29]. Thus, it is recommended, especially to the classification workers, to change wet clothes to dry ones in an appropriate resting room when heavy sweating occurs during working activities.

Interestingly, there were no significant differences in the percentages of subjects who complained of work difficulty due to the cold among the three groups. The result suggests that work difficulty due to the moderate cold among workers in the consumer cooperative was reduced by physical activity as well as by clothes; however the need for further research is apparent.

In Japan, legislation regulates relative humidity (40% to 70%) in order to prevent diseases related to a poor indoor air environment and to ensure the comfort of workers[30]. However, in the present study, we observed that at the checkout counter in the supermarket, relative humidity was under 40% at the closing time, and in the office, relative humidity was under 40% from noon to the closing time.

The prevalence of rough skin in the checkers was significantly higher than those in the office workers. Sato *et al*.[31] reported that the ultra-low relative humidity indoor air- exposed workers complained of skin symptoms more often than un-exposed workers, and the prevalence of atopic dermatitis was significantly higher in the exposed workers. The length of time, when relative humidity was under 40%, was shorter at the checkout counter in the supermarket than in the office. In addition, relative humidity at the checkout counter was higher than that in the office. Therefore, it is supposed that other factors including bare manual work, exposure to skin irritants relating to contact dermatitis[32], as well as low relative humidity, might participate in the causes of the high prevalence of rough skin among the checkers; further researches are required.

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