

Co-occurrence of musculoskeletal pain among female kitchen workers

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Abstract *Objectives:* The co-occurrence of musculoskeletal pain symptoms in seven body sites and their combinations among women in kitchen work were studied. *Methods:* Data on musculoskeletal pain during the past 3 months in the neck, shoulders, forearms/hands, low back, hips, knees and ankles/feet were gathered by questionnaire from 495 female workers (mean age 45 years) in connection with an ergonomic intervention study in municipal kitchens of four cities in Finland. Altogether 122 kitchens (60% of those eligible) participated in the study. The response rate in the participating kitchens was 98%. *Results:* The 3-month prevalence of any musculoskeletal pain was 87%, the most common sites being the neck (71%), low back (50%) and forearms/hands (49%). About 73% of the subjects had pain in at least two, 36% in four or more, and 10% in 6–7 sites. In pair wise comparisons, e.g. neck pain was associated with pain in other sites with prevalence ratios (PR) varying from 1.3 to 1.6, and ankle or foot pain with ratios between 1.9 and 2.4. The seven pain symptoms occurred in more than 80 different combinations. When the co-occurrence of pain was studied in three larger anatomical areas, i.e. any pain in the axial (neck and low back),

upper limb and lower limb areas, subjects reporting concurrent pain in all three were the largest category (36% of the respondents). Altogether 53% of the workers reported pain in at least the axial and upper limb areas, and 48% in at least the axial and lower limb areas. *Conclusions:* Widespread co-occurrence of musculoskeletal pain symptoms was common among female kitchen workers with slight predominance in the upper body.

Keywords Neck · Upper limbs · Low back · Lower limbs · Co-morbidity

Introduction

Musculoskeletal pain continues to be a major cause of morbidity with considerable economic and societal consequences (Norlund and Waddel 2000; Mäntyselkä et al. 2002). According to a recent review, musculoskeletal disorders, particularly low back pain, neck pain and shoulder pain, are the main reasons for work-related consultations in general practice (Weevers et al. 2005). Pain disorders have a negative impact on work ability and work effectiveness (Frank et al. 1996; Blyth et al. 2003).

The majority of studies examining the occurrence of musculoskeletal pain have focused on a specific anatomic site such as the low back, neck, or upper extremities. There is some evidence, however, that subjects often report musculoskeletal pain in multiple body sites. Co-morbidity of low back and neck pain (Côté et al. 2000), and low back and upper-extremities pain (Ijzelenberg and Burdorf 2004) has been reported. In the Dutch population, pain during the past

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12 months in 2–3 sites of ten was reported by 29% and in four or more sites by 21% (Picavet and Schouten 2003).

Occupations with high physical work strain, non-neutral postures, prolonged static muscle contractions and repetitive movements are regarded as harbouring an increased risk of musculoskeletal pain (National Research Council and the Institute of Medicine 2001; Riihimäki 2005). Some reports exist on a high prevalence of musculoskeletal complaints in multiple body sites in occupations with manual work. Among industrial workers with low back pain, 37% had also neck pain, 40% shoulder pain and 27% pain in the elbow, hand or wrist (Ijzelenberg and Burdorf 2004). Among scaffolders with back pain during the past 12 months, 48% reported pain also in the knees, 39% in the shoulders and 37% in the neck (Molano et al. 2001). Of dentists, 35% had at least two and 15% at least three musculoskeletal complaints (Alexopoulos et al. 2004), whereas of men in manual lifting work 63% had pain in at least two and 48% in at least three body sites (Yeung et al. 2002).

Kitchen workers are mostly women with a high physical workload (Oze 1984a; Pekkarinen and Anttonen 1988). Very little systematic research has focused on this occupational group. In a nationally representative study in Finland, kitchen aids had an increased risk of low back disorders leading to hospitalisation (Leino-Arjas et al. 2002). It seems reasonable to assume that kitchen workers have a high occurrence of even other musculoskeletal pain problems, and further that these cluster by anatomic area.

The present study made use of the baseline data of an ergonomic intervention study carried out among kitchen workers in four cities in Finland. We examined the co-occurrence of pain in seven anatomical sites among women. This was done, first, by examining pairs of two symptoms at a time. Second, a sum score of the number of painful sites was calculated. Third, we assessed which patterns emerged based on the seven sites, and also when the symptoms were primarily clustered into three larger anatomical areas.

Material and methods

Data collection

This study is part of a randomised controlled intervention study by the Finnish Institute of Occupational Health (FIOH), investigating the effectiveness of improved workplace ergonomics in promoting musculo-

skeletal health and general well being (Pehkonen et al. 2004). The study population consisted of employees in municipal kitchens of schools, kindergartens and nursing homes of four large cities in Finland. A prerequisite for participation was that the kitchen had at least three full-time employees working for at least 6 h per day. A written informed consent was obtained from the subjects. If more than one-third of the employees in a kitchen refused to participate, the kitchen was excluded from the study. A total of 122 kitchens (60% of those eligible) and 523 employees participated in the study. The Ethics Committee of the FIOH approved the study proposal.

A baseline questionnaire was administered to the employees of eligible kitchens in clusters of eight kitchens that were subsequently randomised into intervention and control groups. The employees of the first series responded to the questionnaire in March 2002 and those of the last series in October 2003. The response rate varied between 93 and 100% by kitchen series, the total average being 98.5%. As the number of male respondents was low ($n = 19$) the analyses were carried out among women only ($n = 504$).

Musculoskeletal pain

Neck pain was assessed by the questions: “Have you had neck pain during the past 12 months? (yes/no)”. If the answer was yes, the next question was: “Have you had neck pain during the past 3 months? (yes/no)”. Similar questions were asked regarding the following anatomical sites: left and right shoulder, left and right forearm or hand, low back, hips, knees and ankles or feet. In the questionnaire pre-shaded illustrations of the neck, shoulders, forearms/hands and low back were provided to help define the area of interest (appendix).

To obtain an indicator of shoulder pain and of forearm or hand pain in general, the variables regarding pain on the left or the right were combined. If one of the answers was “no” and the other was missing, the response was defined as missing. If either one was “yes”, the combined variable was defined as “yes”.

To obtain an overall picture of concurrent musculoskeletal pain in the total body the original seven anatomical sites were combined to three larger areas: the axial (neck and low back), the upper limbs (shoulders, forearms or hands) and lower limbs (hips, knees, ankles or feet). If at least one of the pain responses on the items on neck or low back was affirmative, the combined variable on axial pain was defined as affirmative. If at least one of the pain re-

sponses on the items on shoulders or forearms or hands pain was affirmative, the combined variable on upper limb pain was defined as affirmative. If at least one of the pain responses on the items on hips, knees, or ankles/feet pain was affirmative, the combined variable on lower limb pain was defined as affirmative. Further, if at least one of the answers was missing and the rest of them were negative, the combined answer was defined as missing.

In the analyses, we used the subjects with information on all seven musculoskeletal pain symptoms ($n = 495$).

The questionnaire also included items on occupational title, employment history (e.g. years in kitchen work), and type of employment (full/part-time, permanent/temporary).

Statistical analysis

The prevalence rates are proportions of affirmative responses of all responses. The subjects were divided into three equal-sized age groups. Differences in pain prevalence between age groups were assessed by the Mann–Whitney U -test and the differences between occupational groups by the chi-square test.

To test whether pain is likely to affect multiple body sites in some individuals, the number of subjects expected to have 0, 1, 2, 3, 4, 5, 6, or 7 numbers of sites with pain was calculated by Poisson's distribution. The presence of the pain in different anatomical sites in a subject was assumed independent from the presence of pain in other sites. The distribution parameter used to generate the expected number of subjects was the average number of sites with pain per individual. The observed frequencies were compared with the expected frequencies using the chi-square test.

Prevalence ratios (PR) for pain in one anatomical site relative to another were calculated using Cox

proportional hazards regression (Lee and Chia 1993; Lee 1994; Thompson et al. 1998). To reduce the chance of false positive findings, the Bonferroni correction was applied. The adjustment for multiple tests was applied when the significance of deviation of PR from 1.0 was assessed. The significance level was set at 0.001, adjusted for 42 multiple tests. To obtain all combinations of the seven symptoms, or the three groups of symptoms, each of the dichotomous (0, 1) symptoms (or the symptom categories) was multiplied with a unique power of ten, after which the variables were summed. All analyses were performed using the SPSS Version 12.0.1.

Results

The mean age of the workers was 45 (SD 10, range 19–63) years. The majority (88%) were in permanent employment. The subjects had been in kitchen work for 19 years and in the current workplace on average for 8 years. The distribution of occupational titles was as follows: kitchen aids 57%, cooks 21%, chefs 19%, foodservice managers 2% and others 1%.

Prevalence of musculoskeletal pain

The 3-month prevalence of pain in the seven sites varied between 71 and 19%. Neck pain was the most common, followed by pain in the low back, forearms or hands, shoulders, ankles or feet, knees and hips (Table 1). The 12-month prevalence estimates were only slightly higher, varying between 75% (neck pain) and 22% (hip pain) and with the same order of frequency. The 3-month pain prevalence was used in the subsequent analyses.

No consistent age trend was seen in neck pain or low back pain (Table 1). At all other sites the prevalence

Table 1 Prevalence (%) and 95% confidence intervals (CI) of musculoskeletal pain in different anatomical sites during the past 3 months among women in kitchen work, by age group

	≤40 years ($n = 148$)		41–50 years ($n = 185$)		≥51 years ($n = 162$)		Total ($n = 495$)	
	%	CI	%	CI	%	CI	%	CI
Neck pain	71	63.7–78.3	70	63.4–76.6	72	65.1–78.9	71	67.0–75.0
Shoulder pain*	22	15.3–28.7	34	27.2–40.8	44	36.4–51.6	34	29.8–38.2
Forearm or hand pain*	37	29.2–44.8	54	45.4–62.6	54	46.3–61.7	49	44.6–53.4
Low back pain	50	41.9–58.1	52	44.8–59.2	50	42.3–57.7	50	45.6–54.4
Hip pain*	5	1.5–8.5	23	16.9–29.1	27	20.2–33.8	19	15.6–22.4
Knee pain*	22	15.3–28.7	27	20.6–33.4	38	30.5–45.5	29	25.0–33.0
Ankle or foot pain*	18	11.8–24.2	27	20.6–33.4	43	35.4–50.6	30	26.0–34.0

*Comparison of pain prevalence between the age groups statistically significant ($P < 0.005$), Mann–Whitney U -test

Table 2 Observed and expected numbers of sites with pain in 495 female kitchen workers. The χ^2 test compares observed and expected frequencies

Number of sites	Observed		Expected	
	<i>n</i>	%	<i>n</i>	%
0	66	13.1	30	6.1
1	68	13.7	84	17.0
2	94	19.0	118	23.8
3	91	18.4	110	22.2
4	79	15.6	77	15.6
5	50	10.1	44	8.9
6	32	6.5	20	4.0
7	15	3.0	12	2.4
χ^2	23.2			
Degree of freedom (<i>df</i>)	7			
<i>P</i> value	0.002			

increased with age and with the number of years in kitchen work ($P < 0.005$). However, pain in the forearms or hands was equally common in the two older age groups. Between the occupational groups, there were no differences in pain at any site.

Co-occurrence of musculoskeletal pain

Table 2 shows the observed frequencies of the number of sites with pain per person and the corresponding expected frequencies assuming that the presence of pain in a site was independent of that in other sites within the individual. Clustering of pain sites was observed (Chi-square test, $P = 0.002$).

About 13% of the subjects reported no pain and about 14% pain in only one site. Thus, the great majority of the workers, i.e. 73% of all subjects and 85% of those with pain, reported musculoskeletal pain in more than one site. About 36% of the workers reported pain in four or more sites, and 10% in 6–7 sites. Pain in all seven sites was present among 3% of the women.

Conditionally on the occurrence of pain in an index site, Table 3 reports the proportions of subjects with pain in each of the other sites. For example, among workers with neck pain, only 9% did not have pain in other sites, while 61% reported concurrent pain in the forearms or hands, 58% in the low back, 44% in the shoulders, 36% in the ankles or feet, 34% in the knees and 24% in the hips.

The PR for pain in one anatomical site relative to another are presented in Table 4. Having pain in one site was associated with an increased occurrence of pain at another site. Adjustment for occupation, age or work years had little effect on the estimates (data not shown).

The clustering of the seven individual pain symptoms was relatively weak. The symptoms occurred in altogether 83 different combinations in the data, in addition to those with no pain and with pain in one site only. Neck pain only was present among 6.5% of the subjects, and the proportion of subjects in each other category was less than 5%.

When the symptoms were primarily classified into three larger anatomical areas, i.e. axial (neck and low back), upper limbs and lower limbs, axial pain was the most prevalent (80%) followed by the upper limbs (58%) and lower limbs (52%) (Table 5). Within one anatomical area, often more than one pain site was mentioned. For instance, among workers with axial pain ($n = 394$), 52% reported concurrent pain in the neck and in the low back and 44% of those with upper limb pain ($n = 285$) had concurrent pain in the shoulders and in the forearms or hands.

The clustering of the three anatomical areas was further evaluated. The prevalence of the combination of pain in different areas was higher than expected on the basis of independence. Concurrent pain in all three areas was the most common combination and was present in 36% of the women (Table 5). Among workers with pain in two areas ($n = 154$) approxi-

Table 3 Co-occurrence of musculoskeletal pain during the past 3 months among women in kitchen work. Conditional proportions

Musculoskeletal pain during the past 3 months	(% , yes)	Proportion with concurrent musculoskeletal pain during the past 3 months (%)							
		No pain in other sites	Neck	Shoulders	Forearms or hands	Low back	Hips	Knees	Ankles or feet
Neck	71	9	–	44	61	58	24	34	36
Shoulders	34	2	93	–	75	59	29	40	44
Forearms or hands	49	4	89	52	–	61	29	36	40
Low back	50	5	83	41	61	–	28	38	40
Hips	19	1	88	52	75	73	–	43	48
Knees	29	3	84	47	60	64	28	–	48
Ankles or feet	30	2	86	51	66	67	31	47	–

Total $n = 495$

Table 4 Prevalence ratios (PR) for pain in a single anatomical site relative to another among women in kitchen work. Cox regression analysis

Site	Neck ^a	Shoulder ^a	Forearm or hand ^a	Low back ^a	Hip ^a	Knee ^a	Ankle or foot ^a
Neck pain ^b	–	5.8*	3.2*	1.9*	3.1*	2.1*	2.4*
Shoulder pain ^b	1.6*	–	2.1*	1.4	2.1*	1.7*	2.0*
Forearm or hand pain ^b	1.6*	3.1*	–	1.6*	3.0*	1.5	2.0*
Low back pain ^b	1.4	1.5	1.6*	–	2.8*	1.8*	2.1*
Hip pain ^b	1.3	1.8*	1.7*	1.6*	–	1.6	1.9*
Knee pain ^b	1.3	1.6	1.3	1.5	1.8	–	2.1*
Ankle or foot pain ^b	1.3	1.9*	1.6*	1.6*	2.2*	2.1*	–

*Prevalence ratios are statistically significant ($P < 0.001$), adjusted for 42 multiple tests

^aTreated as the dependent variable

^bTreated as the independent variable

mately 57% reported concurrent pain in the axial area and in the upper limbs, and only 3% had concurrent pain in the upper and lower limbs.

The occurrence of concurrent pain in the axial area and in the upper and lower limbs increased successively with age from 22% among the youngest group to 49% in the oldest group ($P < 0.005$) (Fig. 1). The longer the women had been in kitchen work the higher was the prevalence of pain in all three anatomical areas. There were no differences in the number of anatomical areas with pain between the three main occupational groups (kitchen aids, cooks and others).

Discussion

We found a high prevalence of musculoskeletal pain among female kitchen workers with only 13% of subjects reporting none of the seven studied symptoms during the past 3 months. Neck pain was by far the most common with seven of ten subjects reporting it, while every second respondent reported forearm or

hand pain and low back pain. These estimates are higher than usually reported in the normal female population of the comparable age range (Picavet and Schouten 2003; Binglefors and Isacson 2004; Riihimäki and Heliövaara 2004) and among the highest published in occupational samples (Blatter and Bongers 1999; National Research Council and the Institute of Medicine 2001; Riihimäki 2005). Comparisons are, however, hampered by the sensitivity of pain estimates to differences in question wording and reference periods.

Few epidemiological studies have examined the occurrence of musculoskeletal pain among kitchen workers. Oze (1984a, b) observed a high prevalence of symptoms in the neck, shoulders, arms and lower back among cooks, as well as an exposure-response relationship between the cumulative duration of cooking work and the symptoms. Almost 80% of workers in canteen kitchens reported problems in the neck-shoulder area (Pekkarinen and Anttonen 1988). Nursery school female cooks had a higher PR of low back pain (1.9, 95% CI 1.5–2.5) and of epicondylitis

Table 5 Occurrence of concurrent musculoskeletal pain in three anatomical areas during the past 3 months among women in kitchen work (axial: neck and low back combined)

Number of anatomical areas with pain	Areas	n	%
None		66	13.3
One area	Axial	69	14.0
	Upper limbs	16	3.2
	Lower limbs	14	2.8
Two areas	Axial + upper limbs	88	17.8
	Axial + lower limbs	61	12.3
	Upper limbs + lower limbs	5	1.0
Three areas	Axial + upper limbs + lower limbs	176	35.5
Total		495	100

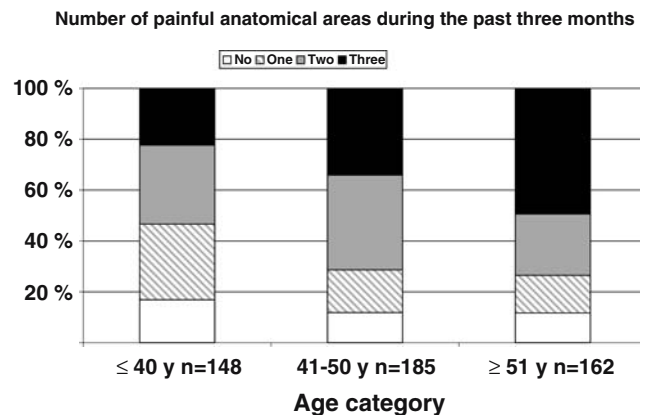


Fig. 1 Prevalences (%) of the number of painful anatomical areas (neck or low back, upper limbs, lower limbs), classified as no, one, two and three, among women in kitchen work, by age group

(5.4, 95% CI 2.4–11.9) as compared with the nursery school teachers (Ono et al. 1997; Ono et al. 1998).

Among the strengths of the study were the high response rate among the personnel of the participating kitchens and the uniformity of the sample as to gender and occupational setting. About 60% of all eligible kitchens took part in the study. Some kitchens collectively refused to participate, in some kitchens at least one-third of the workers individually refused, in some cases the decision of refusal was administrative (e.g. made by the manager of the kindergarten or the headmaster of the school), and in other cases participation was withdrawn due to major reconstruction of the kitchen. Of the participating kitchens 71% were located in schools, 17% in kindergartens, 5% in nursing homes and 7% elsewhere. In the non-participating kitchens the distribution was 75, 15, 5 and 5%, respectively. Thus, the non-participating kitchens did not differ from the participating ones by the type of institution or location. However, it is possible, that, e.g. physical or mental overstrain or poor social relationships at work could have influenced the willingness to participate in a time-consuming intervention study. It seems less likely that the workers in the non-participating kitchens would have had a different level of pain compared to those in the participating kitchens.

Musculoskeletal pain is somewhat more common in women than in men (Bergman et al. 2001; Bingefors and Isacson 2004; Treaster and Burr 2004). A limitation of our study was the lack of intensity and frequency measures of pain. Different reference periods (3 and 12 months) did not materially affect the prevalence of pain. This is in accordance with previous Nordic studies (Ørhede 1994). The 3-month reference period was considered more reliable due to the shorter required span of memory, and was used in further analyses, as also recommended by Ørhede (1994). The use of illustrations in the questionnaire showing the area of interest in the four cases where a verbal description seemed to leave too large a share for individual opinion (the neck, shoulder, forearm/hand and low back areas) probably enhanced the reliability of reporting. It may be argued that a similar approach might have been preferable in hip pain as well.

Among the main findings of the present study was the tendency of pain attributed to the musculoskeletal system to co-occur with similar symptoms in other anatomical sites. We described this phenomenon using several approaches. Significant PR between pain at one anatomical site and pain at another site were found. The lowest conditional proportions of pain in a particular site were 24% (hip pain among those with neck

pain) and 28% (hip pain among those with low back pain or knee pain) and the highest between 83 and 93% (neck pain among those with any other pain). These figures are, of course, dependent on the overall frequency of pain at each site.

The prevalence of neck and low back pain were not related to age although the five other symptoms were. The co-occurrence of pain was age related. It is conceivable that underlying factors such as degenerative changes in the musculoskeletal system could contribute to this.

The seven studied pain symptoms co-occurred more often than expected based on the assumption of independence. The clustering of these seven pain sites was not very strong, however, as two-thirds ($n = 85$) of the theoretically possible ($2^7 = 128$) combinations of pain were observed. When pain in three larger anatomical areas (the axial, and upper and lower limbs) was studied, every third woman in our sample reported pain in all three anatomical areas concurrently (every second among those aged 51–63 years).

A substantial overlap of pain in different locations has been reported previously in the normal population (Mäkelä and Heliövaara 1991; Urwin et al. 1998; Côté et al. 2000; Picavet and Schouten 2003; Ijzelenberg and Burdorf 2004). The present findings add to the rather sparse literature on the co-occurrence of pain symptoms among occupational samples (Molano et al. 2001; Yeung et al. 2002; Alexopoulos et al. 2004; Ijzelenberg and Burdorf 2004).

An established classification of widespread pain includes pain in the upper and lower extremities (both sides of the body) and axial pain (Wolfe et al. 1990) that must have been present for at least 3 months. Such a definition could not be applied here, as we did not have information on pain persistence or on pain in the left and right lower limb separately. The observed amount of overlap in pain areas in our study is clearly higher than the prevalence of chronic widespread pain found in previous surveys (Gran 2003).

There is evidence that exposure to repetitive motion patterns, forceful exertion and non-neutral body postures (both dynamic and static) may cause musculoskeletal disorders in one or more anatomical site (Punnett and Wegman 2004). The high concurrence of pain in different anatomical areas found in this study could be connected with the pattern of workload in kitchen work: loading may be rather uniformly distributed on the musculoskeletal system. Kitchen workers face a number of occupational hazards. Several risk factors for the development of musculoskeletal disorders can be identified in their daily work

tasks, and many tasks include exposure to a combination of two or more of these risk factors. For example, in dishwashing frequent bending and twisting of the trunk, lifting, repetitive movements of the hand, non-neutral wrist and shoulder postures, and use of hand force often occur.

Kitchen work is done almost exclusively when standing or walking. Messing and Kilbom (2001) conducted a small workplace field study to evaluate the consequences of prolonged standing and walking among kitchen personnel. They found that prolonged standing and short-distance slow walking induced a decrease in plantar pain-pressure threshold over the workday. The majority of the workers had experienced foot pain during the past 3 months. We may speculate in the light of these results that standing or walking could be associated with lower limb pain.

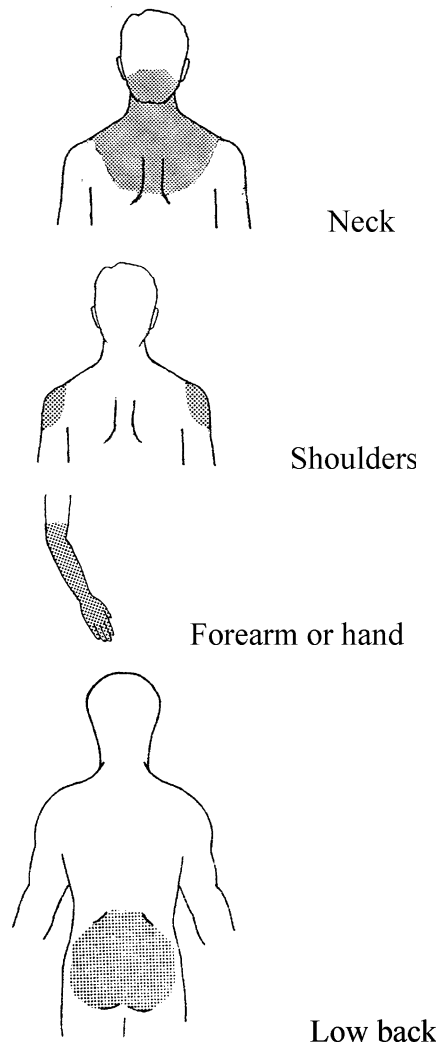
The data comprised three major occupational categories, kitchen aids, cooks and chefs (97% of all subjects). Although chefs' duties include some office work, their main tasks are identical with those of cooks and kitchen aids. Given that, it is understandable that no differences in pain prevalence were found between the occupational groups.

Multiple-site pain seems to be to some extent predicted by mechanical loading at work (McBeth et al. 2003). The possible association of loading in kitchen work with the distribution of combinations of pain observed in this study is clearly an object for further study.

Multiple-site pain seems to be a persistent phenomenon (Papageorgiou et al. 2002). Genetic and psychosocial factors may also have an influence on symptom occurrence and be associated with reporting pain at multiple sites (Zubieta et al. 2003; Feuerstein et al. 2004).

In conclusion, when examining musculoskeletal pain among female kitchen workers, we found widespread co-occurrence of pain in different body areas. Age and years in kitchen work were associated with the amount of co-occurrence, while occupational category was not. The results suggest that pain location should generally not be seen in isolation but that assessment of pain in several sites should be considered. To what extent such clusters of pain as observed here are persistent vs. modified with time would be an additional object for study.

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Appendix

Pre-shaded illustrations of the neck, shoulders, forearms/hands and low back.

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