MILKING IS A HIGH-RISK JOB FOR YOUNG FEMALES

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ABSTRACT. The prevalence of and the impact of selected factors on self-reported musculoskeletal complaints in Swedish female milkers with special reference to symptoms in the upper extremities were investigated using data from mail-in surveys. An agricultural study group was formed of three subgroups: 161 active milkers, 108 non-milkers and 62 ex-milkers, women who had been milkers earlier but were no longer doing that kind of work. In the course of the analysis these subgroups were compared with each other and also, separately or in combination, with a non-agricultural population consisting of 166 nursing assistants. Problems in the upper extremities were significantly more common in the agricultural group than in the non-agricultural group. Milkers ran a higher risk of developing symptoms in the wrists and hands than non-milkers. Women. Symptoms such as numbness, coldness in the wrists and white fingers were more common in all agricultural subgroups than in the non-agricultural group. Numbness and white fingers were related to vibration exposure in the ex-milkers and the non-milkers but not in the milkers group. Psychosocial factors such as occupational well-being were not related to the occurrence of symptoms. Milking in a modernized barn gave fewer problems in elbows than milking in a traditional barn. Milkers who had received ergonomic instruction on how to work in order to reduce muscle stress had fewer problems in the elbow region than those who had received no such instruction.

Key words: female milkers, agriculture, musculoskeletal disorders, upper extremities, hands, wrists.

INTRODUCTION. During recent decades awareness has increased of the growing problem of musculoskeletal disorders in neck and upper extremities of employees in different occupational groups. In a study by Lissin (17) it was shown that 58% of the work-related injuries in agriculture affected the locomotor system as compared with 49% in all Swedish industries. Women in agriculture suffered from work-related injuries in the wrists and hands to a greater extent than men, 33% and 8%, respectively.

A total of 40,000 women work in agriculture in Sweden (1991) including 27,000 engaged in farming and animal husbandry, where milking is a large part of the work (20). Gustafsson et al. (8, 9) reported high frequencies of work-related disorders in a sample of 3,000 Swedish milkers including 1,000 women. Pain, ache and discomfort in the shoulders were reported by 35% of the men and by 34% of the female milkers. The corresponding figure for pain in the wrists and hands was 18% for men and 35% for women. This prevalence of pain in the wrists and hands in men and women working in separate milking parlours was also confirmed by Sölö & Pinta (27).

It is well known that the work in dairy barns is associated with the lifting of heavy objects, and moving and carrying equipment (18). The attachment of the machine to the udder of the cow is still a typical manual task in which the milkers holds the cluster in the hand (weight 2.0-3.5kg). The total weight of a milking machine is about 6kg. The milking machine is not adapted to handling by women. Thus the diameter of the base of the claw is 11 to 15cm, which hardly fits the hand of a woman which is smaller than that of a man (24). When connecting the milking cluster to the pipeline, the forearm is in a maximally pronated position, and when the cluster is being attached to the udder, the claw is held with the arm elevated to about 30° and the elbow flexed only to a few degrees. Furthermore, the fingers are extended and the wrist is in a maximal dorsal flexion position. Extreme positions of the wrists can cause increased stress on sensitive tissues such as nerves, muscles, tendons and ligaments (2, 23). Each fixation of the milking machine to the udder...
takes about 8 to 10 seconds. That means that milking also induces a heavy static load on the upper extremities. Furthermore, the work is repeated and must be done twice a day every day for the entire year.

The degree of mechanization of the milking equipment is of importance when discussing problems in the locomotor system. The normal system of milking in Sweden is milking tied cows, where the milkers must lift and carry the heavy milking units to the cows. Only about 5% of the 17,000 Swedish dairy farms have a loose housing system, where the milking equipment is stationed in the milking parlour.

It is strongly suspected that the musculoskeletal disorders in the upper extremities among female milkers are associated with the different environmental factors in milk production.

Until now, ergonomic analyses have focused on musculoskeletal disorders in the back and in the lower extremities (22, 28) and only to some extent on disorders in shoulder joints (1). To our knowledge, comparative studies with agricultural women and other groups of women performing heavy physical work have so far not been carried out. Among employed women in Sweden, nursing assistants have reported the highest prevalence of work-related disorders (7). These three more work-related loading injuries were reported in a survey among women in any comparable group.

Manual lifting produces a load (8) and as well as in hospital work (18). Agricultural non-milking women might be working with the sewing of pigs and beef-cattle, where lifting and carrying is also often observed. However, these women do not regularly have to handle equipment which does not fit the size of their hands, which is the case with milking women.

There are no studies on the impact of psychosocial factors on the development of musculoskeletal complaints in female milkers.

The aim of the investigation was to study the prevalence of musculoskeletal problems with special emphasis on symptoms in the upper extremities among female professional milkers compared with a non-milking female agricultural group and a group of nursing assistants with physically demanding jobs. Furthermore, the purpose was also to study to what extent reported problems affected the ability to perform daily work tasks.

An additional aim was to investigate the influence of physical, psychosocial and environmental factors on reported musculoskeletal symptoms in the upper extremities among female milkers in Sweden.

SUBJECTS AND METHODS

Subjects

The original study population comprised a female agricultural group made up of active milkers as well as non-milkers and a non-agricultural sample represented by a group of nurses in the same area in Sweden. The county was chosen because of its large number of family farms with intensity information about aches and occupations was taken from registers belonging to the Federation of Swedish Farmers, the Relief-worker service, the Swedish Animal Husbandry Organisation and a hospital in the south of Sweden, respectively.

To participate in the study the farmers had to milk daily and the non-milkers were not to have been milkers in the past 20% refused to participate. Thus 161 female dairy milkers and 90 non-milkers were invited to participate. Among the remaining 62 women who had been milkers before but were no longer, they formed the study group ex-milkers. Only 9% had stopped milking because of musculoskeletal problems. A reduced 1% refused since the study group. Examples switched their production from dairy cattle to beef cattle. Thus the final non-milk group consisted of 10 patients with postural and/or swine production or plant production. There had never milked cows or handled heavy equipment.

A total of 241 nursing assistants were selected, with all nurses as a main task. Forty-five (24%) women refused to participate in the investigation and thus the group of nurses consisted of 166 women.

The agricultural groups have all indoor jobs, especially during the cold season. All the investigations were conducted in the same temperature conditions.

The groups of musculoskeletal complaints as follows. The women in the agricultural group (n = 331) were compared with all the nursing assistants (n = 166). The agricultural groups (milkers, non-milkers, ex-milkers) were compared with the psychological factors. The aim of the investigation was to study the prevalence of musculoskeletal problems with special emphasis on symptoms in the upper extremities among female professional milkers compared with a non-milking female agricultural group and a group of nursing assistants with physically demanding jobs. Furthermore, the purpose was also to study to what extent reported problems affected the ability to perform daily work tasks.

An additional aim was to investigate the influence of physical, psychosocial and environmental factors on reported musculoskeletal symptoms in the upper extremities among female milkers in Sweden.

Milking in the high-risk job for young females

12 months were registered using a special questionnaire. This consisted of 15 questions, constructed and evaluated by Johannson & Hagberg (14). This questionnaire has earlier been used in a study of people exposed to low back pain. Four degrees of discomfort were registered from "none at all" to "very much discomfort." However, in this report the scale was transformed to a nominal yes or no scale, e.g. "no" on one side and "moderate or severe discomfort" on the other side.

Furthermore, four questions regarding the exposure to vibration during work were added. 3. Psycho-social factors such as occupational well-being and other environmental factors were studied among the female milkers, partly by using a modified questionnaire which has been tested earlier by Gelber (6). Some questions related to physical stress such as fatigue experienced during and after the milking work were added under the heading "Physical Demands." A series of hypotheses has been tested concerning the relationship between symptoms in each of the upper extremities considered in the questionnaire (16) and different independent variables characterising the female milkers and their working environment, i.e. the number of cows milked per day, the milking system and the total milking time for each milking event. The risk factors were introduced into the analysis as dichotomized variables above, versus below, the median value. Furthermore the milkers were divided into subgroups with respect to the occupation of the body (short- or long-term work) and weight (height, weight, height and weight, height and weight, height) and concerning milking time (short-term or long-term). These were used to see the relationship between the symptoms and some of these independent variables. Body Mass Index (BMI) was dichotomized above and below the median value with

Table 1. Background factors of the subjects

<table>
<thead>
<tr>
<th>Category</th>
<th>Milkers</th>
<th>Nurses</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
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<td>50 (15-65)</td>
<td>25 (18-32)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>160 (150-180)</td>
<td>160 (150-180)</td>
<td>160 (150-180)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>65 (50-80)</td>
<td>65 (50-80)</td>
<td>65 (50-80)</td>
</tr>
<tr>
<td>BMI</td>
<td>25 (18-30)</td>
<td>25 (18-30)</td>
<td>25 (18-30)</td>
</tr>
</tbody>
</table>

Statistical methods

To assess the degree of association between the potential risk factors of interest presently and an outcome of injury occurrence, relative risk (RR) was estimated. Student's t-test was used in the analysis of means as a complement to Duncan's multiple range test. The calculations were calculated for 2 by 2 tables with random variables. When using age as a covariate (controlling for confounding) in the model the quantities for the age distribution were weighted under study. With respect to the age group, the association between occurrence of musculoskeletal problems and different dichotomous and independent variables was characterized in the milkers was studied using univariate analysis and a multiple logistic regression testing.
takes about 8 to 10 seconds. That means that milking also induces a heavy static load on the upper extremities. Furthermore, the work is repeated and must be done twice a day every day for the entire year.

The degree of mechanization of the milking equipment is of importance when discussing problems in the locomotor system. The normal system of milking in Sweden is milking tied cows, where the milking units are mounted on a mobile platform. To carry the heavy milking units to the cows, there is only an 5% of the 17,000 Swedish dairy farms have a loose housing system, where the milking equipment is situated in the milking parlour. It is strongly suspected that the musculoskeletal disorders in the upper extremities among female milkers are associated with the different environmental factors in milking production.

Until now, ergonomics analyses on joint work in milking production have been focused on musculoskeletal disorders in the back and in the lower extremities (22, 23) and only to some extent on disorders in shoulder joints (1). To our knowledge, comparative studies with agricultural women and other groups of women performing heavy work have so far not been carried out. Among employed women in Sweden nursing assistants have reported the highest prevalence of work-related disorders (7). Three times more work-related loading injuries were reported in this profession than in any other comparable group. Manual lifting predisposes the workers to work-related injuries in the hand (18) as well as in hospital work (4).

Agricultural non-milkers might be working with the nursing or pigs and beef-cattle, where lifting and carrying occurs also. However, these women do not regularly have to handle equipment which does not fit the size of their hands, which is the case with milking women.

There are no studies on the impact of psychosocial factors on the development of musculoskeletal symptoms in female milkers.

The aim of the investigation was to study the prevalence of musculoskeletal problems with special emphasis on symptoms in the upper extremities among female professional milkers compared with a non-milking female agricultural group and a group of nursing assistants with physically demanding jobs. Furthermore, the purpose was also to study to what extent reported problems affected the ability to perform daily work tasks. An additional aim was to investigate the influence of physical, psychosocial and environmental factors on reported musculoskeletal symptoms in the upper extremities among female milkers in Sweden.

SUBJECTS AND METHODS

Subjects

The original study population comprised a female agricultural group made up of active milkers as well as non-milkers and a non-agricultural sample represented by a group of female nursing assistants. All participants lived in the same area in Sweden. The investigation was based on data from the county health service of the province. A total of 532 people were invited to participate, 106 people were 21 to 65 years of age and were willing to participate. The distribution of the population was based on the number of milkers in the area with similar characteristics.

Table 1. Background factors of the subjects

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>106</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>106</td>
</tr>
<tr>
<td>Milkers</td>
<td>106</td>
</tr>
<tr>
<td>Non-milkers</td>
<td>106</td>
</tr>
</tbody>
</table>

Methods

Questionnaire: 1. The general standardized Nordic questionnaire for the analysis of musculoskeletal disorders was used in order to compare the prevalence regarding symptoms in nine different parts of the body during the preceding week, and an option whether a problem would be reported. The questionnaire was distributed in the paper. It was sent to the persons who participated in the investigation. All responses were based on a 5-point scale from 0 to 4 (none to severe). The questions were divided into three groups: 1) general questions, 2) questions regarding symptoms in the upper extremities, and 3) questions regarding symptoms in the lower extremities.

Statistical methods

To assess the degree of association between the potential risk factor of interest presently and an outcome, an incidence rate ratio (IR) was estimated. Student's t-test was used in the analyses of means as a complement to Duncan's multiple range test. The correlation coefficients were calculated for 2 by 2 tables with random marginals. When using age as a covariate (contrasting for confounding) in the model regression equation for the age distribution was fitted to the data (as a function of the age distribution). It was assumed that the distribution of the age distribution was the same for different age groups.

With respect to the milkers group, the association between occurrence of problems and and independent variables characterizing the milkers was studied using univariate analysis and a multiple logistic regression test. The significance level is given as critical values (CI) 95% and the level of significance was set at 5%.

RESULTS

An overall description of the study material is presented in Table 1. As the sub-populations are age-related.
dependent by definition there are significant differences between milkers/non-milkers and the two other groups. The non-milkers who have milked earlier, of course show a higher number of years in the present profession.

Prevalence of pain, ache and discomfort during the last 12 months

Out of the 161 women who regularly milked cows, only 26 (16%) did not report problems from the musculoskeletal system. A total of 136 individuals (84%) had experienced pain in different parts of the locomotor system at some time during the preceding 12 months. The corresponding numbers for the three other groups non-milkers, ex-milkers and nursing assistants were 85%, 87% and 75%, respectively.

<table>
<thead>
<tr>
<th>Table II.</th>
<th>Age-standardized (q5 = 35, q3 = 43, q1 = 51) rate ratios (RR) with 95% confidence intervals (CI 95%) for the shoulder, elbow and wrist/hand symptoms during the preceding 12 months in nursing assistants (n = 166) and milkers (n = 161).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Nursing assistants n = 166</td>
</tr>
<tr>
<td>Shoulder</td>
<td>RR* CI 95%</td>
</tr>
<tr>
<td>&lt;35</td>
<td>1.00</td>
</tr>
<tr>
<td>35–51</td>
<td>0.96–2.40</td>
</tr>
<tr>
<td>&gt;51</td>
<td>0.91–1.36</td>
</tr>
<tr>
<td>All</td>
<td>0.95–1.35</td>
</tr>
<tr>
<td>Elbow</td>
<td>RR* CI 95%</td>
</tr>
<tr>
<td>&lt;35</td>
<td>1.00</td>
</tr>
<tr>
<td>35–51</td>
<td>0.48–3.98</td>
</tr>
<tr>
<td>&gt;51</td>
<td>0.86</td>
</tr>
<tr>
<td>All</td>
<td>0.84</td>
</tr>
<tr>
<td>Wrist/hand</td>
<td>RR* CI 95%</td>
</tr>
<tr>
<td>&lt;35</td>
<td>1.00</td>
</tr>
<tr>
<td>35–51</td>
<td>1.13–3.44</td>
</tr>
<tr>
<td>&gt;51</td>
<td>1.00</td>
</tr>
<tr>
<td>All</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Risk ratio (RR) of symptoms in the neck and upper extremities during the preceding 12 months

The risk ratio (RR) was significantly higher in the total agricultural group (milkers, non-milkers and ex-milkers) than in the nursing assistant group with respect to symptoms in the neck in the age group 35–51 years (RR = 1.76, CI 95% = 1.35–2.70), shoulders (RR = 1.53 CI 95% = 1.09–2.13), elbows, (RR = 2.67 CI 95% = 1.43–5.00), wrist, and hand symptoms were also more often seen in the younger agricultural group (RR = 1.78, CI 95% = 1.05–3.02).

A significantly increased risk of developing symptoms in wrists and hands was found only among active milkers as compared with nurses (Table II). This was the case not only in the age group 35–51 years but also among those who were younger. Ex-milkers reported almost the same number of upper limb problems as the milkers but with respect to symptoms in wrists and hands the differences were significantly higher only in the total group compared with the nursing assistants. Non-milkers had higher risk ratios as compared with nurses with regard to problems in the neck, shoulders and elbow but not in the wrists and hands (Table III). With respect to age, most complaints were reported in the 35–51-year-olds.

As compared with non-milkers, active milkers reported significantly more often pain and discomfort in wrists and hands, especially in the age group 35–51 years (Table IV). There was no significant difference within the agricultural groups with regard to symptoms in the neck, shoulder or elbow region.

Multilocal pain, ache and discomfort in the upper limbs experienced by the women in the study group

Among the different groups pain, ache and discomfort was reported in more than one localisation, e.g. in the neck, the shoulders and in the elbows/wrists/hands. The occurrence of neck and upper extremity problems is shown in Fig. 1. In the milkers group, 35 women (21%) reported problems in both neck, shoulders, and elbows/wrists/hands. The corresponding figures for the non-milkers were 20%, ex-milkers 19% and nursing assistants 12%. The difference between the milkers and the nursing assistant group was significant (OR = 1.92, CI 95% 1.06–3.47). When excluding the neck region, 54 (33%) of the 161 milkers reported pain in the shoulders as well as in the wrists/hands/ elbows. The corresponding figures for non-milkers were 33 (20%), ex-milkers, 22 (34%) and nursing assistants, 28 (16%). A significant difference was found when comparing milkers and nurses assistants (OR = 2.49, CI 95% 1.48–4.19).

Inability to work during the preceding 12 months

Of those in the milkers, non-milkers, ex-milkers and nursing assistants groups with problems in the upper part of the body, very few had been unable to work due to the reported pain. Problems in wrists and hands which had prevented the women from carrying out their daily work were reported by 5%, 6%, 7% and 6% in the milkers, non-milkers, ex-milkers and nursing assistants groups, respectively.

Nighturnal numbness, white fingers and coldness during the preceding 12 months

The occurrence of numbness experienced in the hands and fingers was significantly more frequent in...
dependent by definition there are significant differences between milkers/non-milkers and the two other groups. The non-milkers who have milked earlier, of course show a higher number of years in the present profession.

Prevalence of pain, ache and discomfort during the last 12 months

Out of the 161 women who regularly milked cows, only 26 (16%) did not report problems from the musculoskeletal system. A total of 136 individuals (85%) had experienced pain in different parts of the locomotor system at some time during the preceding 12 months. The corresponding numbers for the three other groups non-milkers, ex-milkers and nursing assistants were 85%, 97% and 75%, respectively.

Risks of symptoms in the neck and upper extremities during the preceding 12 months

The risk ratio (RR) was significantly higher in the total agricultural group (milkers, non-milkers and ex-milkers) than in the nursing assistant group with respect to symptoms in the neck in the age group 35–51 years (RR = 1.76, CI 95% = 1.15–2.70), shoulders (RR = 1.53 CI 95% = 1.09–2.15), elbows, (RR = 2.67, CI 95% = 1.43–5.00), wrist and hand symptoms were also more often seen in the younger agricultural group (RR = 1.78, CI 95% = 1.05–3.02).

A significantly increased risk of developing symptoms in wrists and hands was found only among active milkers as compared with nurses (Table II). This was the case not only in the age group 35–51 years but also among those who were younger. Ex-milkers reported almost the same number of upper limb problems as the milkers but with respect to symptoms in wrists and hands the differences were

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<td>Nursing assistants n = 166</td>
</tr>
<tr>
<td>Shoulder</td>
<td></td>
</tr>
<tr>
<td>&lt;35</td>
<td>RR*</td>
</tr>
<tr>
<td>35–51</td>
<td>1.60</td>
</tr>
<tr>
<td>&gt;51</td>
<td>0.89</td>
</tr>
<tr>
<td>All</td>
<td>1.57</td>
</tr>
<tr>
<td>Elbow</td>
<td></td>
</tr>
<tr>
<td>&lt;35</td>
<td>RR*</td>
</tr>
<tr>
<td>35–51</td>
<td>0.94</td>
</tr>
<tr>
<td>&gt;51</td>
<td>1.32</td>
</tr>
<tr>
<td>All</td>
<td>1.16</td>
</tr>
<tr>
<td>Wrist/hand</td>
<td></td>
</tr>
<tr>
<td>&lt;35</td>
<td>RR*</td>
</tr>
<tr>
<td>35–51</td>
<td>1.03</td>
</tr>
<tr>
<td>&gt;51</td>
<td>1.04</td>
</tr>
<tr>
<td>All</td>
<td>1.07</td>
</tr>
</tbody>
</table>

Significantly higher only in the total group compared with the nursing assistants. Non-milkers had higher risk ratios as compared with nurses with regard to problems in the neck, shoulders and elbow but not in the wrists and hands (Table III). With respect to age, most complaints were reported in the 35–51 year-olds.

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Multilocal pain, ache and discomfort in the upper limbs experienced by the women in the study group

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Inability to work during the preceding 12 months

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Nocurnal numbness, white fingers and coldness during the preceding 12 months

The occurrence of numbness experienced in the hands and fingers was significantly more frequent in

Fig. 1. Multi-local pain, ache and discomfort in neck, shoulders, wrists/hands/elbows experienced during the preceding 12 months by 161 female milkers.
all agricultural groups, milkers, 42%, non-milkers, 32%, and ex-milkers, 41%, than in the group of nursing assistants, 16%. However, within the agricultural groups there were no differences. In order to study the effect of age, the groups were divided using age standardization to above or below the median age of 43 years. There was a significant difference in experience of numbness in younger milkers as compared with younger nursing assistants (OR = 4.17 CI 95% 2.09–8.31) as well as between those above 43 years in corresponding groups (OR = 3.04 CI 95% 1.37–6.75). Problems such as a feeling of coldness were reported significantly more often in milkers (20%) and ex-milkers (16%) than in nursing assistants (7%). The odds ratios for younger milkers was 3.21 (95% CI 1.23–8.37).

Numbness and white fingers were experienced significantly more often in those exposed to vibrations in non-milkers and ex-milkers (OR = 10.50, CI 95% 1.77–62.20, OR = 5.69, CI 95% 1.53–21.58) than not in the milkers group.

Physical and environmental factors related to symptoms among 161 female milkers

Those women who experienced milking cows as a physically tiring job, had a higher prevalence of problems, especially in the wrists and hands, than milkers who did not, the odds ratio being 2.36 (CI 95% 0.99–5.61). The pattern was similar for pain in the shoulder region (OR = 2.28, CI 95% 0.86–5.45). With respect to elbow symptoms there was a significant difference between those female milkers who had received ergonomic instructions on how to work in order to reduce the muscle stress, and those women who had not had any ergonomic information at all.

Furthermore there was a significant difference with respect to problems experienced in the elbows between women working in a traditional dairy barn and women working in a modernized barn where certain work environment improvements had been carried out. However, there were only 13 milkers who had the opportunity to work under those conditions.

The occurrence of symptoms in the upper extremities was not related to the number of cows. There was no significant difference with respect to reported symptoms like numbness, coldness or white fingers in wrists and hands between the milkers who sometimes had worked with vibration tools compared with those who had not been using this kind of equipment.

Perceived physical stress estimated by two groups of milkers

The results of the female milkers′ estimate of perceived muscle stress during ten different milking tasks are shown in Figs. 2 and 3. The difference between the estimate of the mean value of the two groups of milkers, with and without problems in wrists and hands, was significant in many of the milking tasks. Milkers with problems made a higher assessment than milkers with no symptoms.

The tasks which were rated highest were carrying and lifting one or two milking machines, pre-milking, disconnecting and removing the milking unit, and attaching the cluster to the udder (Figs. 2, 3).

Psycho-social environmental factors

There was no relationship between the factors dealing with social demands, well-being and civil status and symptoms in the upper extremities among the 161 female milkers; nor was there any relationship between symptoms and smoking. Only 9% of the milkers smoked every day.

Background factors

Shorter milkers (145–158 cm) experienced significantly more symptoms in the shoulders than did the taller milkers (174–182 cm).

With respect to the Body Mass Index (kg/m²) it was found that short and stout milkers reported a significantly higher frequency of problems in the shoulders than tall and thin milkers.

Concerning working hours per week, milkers with a shorter working week (4–20 hours) reported significantly more problems in the shoulders than did the milkers who were working 60–90 hours.

DISCUSSION

This study is based on a postal survey, using different questionnaires (4, 6, 14, 16) which have been tested and evaluated by others (12, 14, 15). About 20% of the women in the different groups did not answer the questionnaire. The drop-out frequency in the study was 15%.
all agricultural groups, milkers, 42%, non-milkers, 32%, and ex-milkers, 41%, than in the group of nursing assistants, 16%. However, within the agricultural groups there were no differences. In order to study the effect of age, the groups were divided using age standardization to above or below the median age of 43 years. There was a significant difference in experience of numbness in younger milkers as compared with younger nursing assistants (OR = 4.17 CI 95% 2.09-8.31) as well as between those above 43 years in corresponding groups (OR = 3.04 CI 95% 1.37-6.75).

Problems such as a feeling of coldness were reported significantly more often in milkers (20%) and ex-milkers (16%) than in nursing assistants (7%). The odds ratio for younger milkers was 3.21 (95% CI 1.25-8.37).

Numbness and white fingers were experienced significantly more often in those exposed to vibrations in non-milkers and ex-milkers (OR = 10.50, CI 95% 1.77-62.20, OR = 5.69, CI 95% 1.53-21.15) but not in the milker group.

**Physical and environmental factors related to symptoms among 161 female milkers**

Those women who experienced milking cows as a physically tiring job, had a higher prevalence of problems, especially in the wrists and hands, than milkers who did not, the odds ratio being 2.36 (CI 95% 0.99-5.61). The pattern was similar for pain in the shoulder region (OR = 2.29, CI 95% 0.96-5.45).

With respect to elbow symptoms there was a significant difference between those female milkers who had received ergonomic instructions on how to work in order to reduce the muscle stress, and those women who had not had any ergonomic information at all.

Furthermore there was a significant difference with respect to problems experienced in the elbows between women working in a traditional dairy barn and women working in a modernized barn where certain work environment improvements had been carried out. However, there were only 13 milkers who had the opportunity to work under those conditions.

The occurrence of symptoms in the upper extremities was not related to the number of cows.

There was no significant difference with respect to reported symptoms like numbness, coldness or white fingers in wrists and hands between the milkers who sometimes had worked with vibration tools compared with those who had not been using this kind of equipment.

**Perceived physical stress estimated by two groups of milkers**

The results of the female milkers’ estimate of perceived muscle stress during ten different milking tasks are shown in Figs. 2 and 3.

The difference between the estimate of the mean value of the two groups of milkers, with and without problems in wrists and hands, was significant in many of the milking tasks. Milkers with problems made a higher assessment than milkers without problems.

The tasks which were rated highest were carrying and lifting one or two milking machines, pre-milking, disconnecting and removing the milking unit, and attaching the cluster to the udder (Figs. 2, 3).

**Psycho-social environmental factors**

There was no relationship between the factors dealing with social demands, well-being and civil status and symptoms in the upper extremities among the 161 female milkers; nor was there any relationship between symptoms and smoking. Only 9% of the milkers smoked every day.

**Background factors**

Shorter milkers (145-158 cm) experienced significantly more symptoms in the shoulders than did the taller milkers (174-182 cm).

With respect to the Body Mass Index (kg/m²) it was found that short and stout milkers reported a significantly higher frequency of problems in the shoulders than tall and thin milkers.

Concerning working hours per week, milkers with a shorter working week (4-20 hours) reported significantly more problems in the shoulders than did the milkers who were working 60-90 hours.

**DISCUSSION**

This study is based on a postal survey, using different questionnaires (4, 6, 14, 16) which have been tested and evaluated by others (12, 14, 15). About 20% of the women in the different groups did not answer the questionnaire. The drop-out frequency in the study...
was the same in all the groups. It has not been possible to investigate the drop-outs. Thus we do not know either age, prevalence of pain and discomfort or the reason why they did not answer. However, studies of other occupational groups indicate the prevalence of musculoskeletal problems does not differ significantly between those who answer and those who do not (13).

The study of agricultural women who did not work with milk processing mostly worked with swine- and poultry breeding and plant cultivation. In this group, there were 61 women who had previously been milkers but no longer were so.

Musculoskeletal problems in professional Swedish milkers, both men and women, have been described earlier by Gustafsson et al. (8, 9). In Gustafsson's study, the prevalence of problems in wrists and hands, for example, was much lower, 15% as compared with 51% in this investigation. However, in both studies younger milkers had more complaints than older milkers. The standardized Nordic questionnaire was used in both studies but the two studies were presented to the participants in different ways. In the study by Gustafsson, mapping of working environment was the most important. However, in the present study, the emphasis was on pain and discomfort with special reference to the neck and upper extremities. The prevalence of reported problems increased also in the men during the last three years in occupational groups in general (10, 20), which could partly explain the differences in the result. After the age of 52, the problems decreased, which could be explained by a healthy worker effect (29).

Milkers and ex-milkers had begun milking at almost the same age, 25 and 24 years. The highest prevalence of problems in wrists and hands appeared nine years in more milking, in comparison to 10 to 19 years of work for non-milkers and nursing assistants.

In a study on milkers Arborelius et al. (1) showed that the work load on the upper extremities is heavy, specially on the side on which the claw is held when the four teat cups are attached to the udder. The different loads on the body were measured by means of electromyography in combination with biomechanical calculations of the torque in the shoulder, but unfortunately not in the wrists and hands. The study was not carried out in farm surroundings, but in a laboratory. The result of the measuring could have been different if the study had been carried out on live cows. A laboratory study can never be fully compared with a real situation where an additional accident risk when handling animals exists (19).

Several studies have been carried out with respect to occupational injuries in hospitals and the work load in different kinds of work have been measured (4, 7). When giving lifting assistance to patients, the weight load has been exceeded the recommendations for permissible loads for single and repeated (4) several times (4). In a French study (5) it was shown that the main cause of sick leave was musculoskeletal disorders among female hospital workers. Many working postures such as stooping, twisting and lifting heavy objects are similar for hospital nurses and agricultural women. However, the prevalence of pain, ache and discomfort in the upper extremities was much higher in general in the agricultural group than in the nursing group, and particularly in wrists and hands in the young and middle age milk group compared with the nursing assistants group.

In this study it was shown that it is not only the daily milking that constitutes a risk of developing pain and discomfort in wrists and hands but mostly also milking earlier in life. Young active milkers reported great problems in wrists and hands. Many young people are interested in agricultural jobs in general and the milking of cows in particular. Therefore it is important to create a work situation which can be conducted safely and comfortably. Women among milkers and ex-milkers reported pain in both hands. Work in dairy barns also involves, for example, moving heavy feed sacks (11), which are not easy to hold while milking their hands even more difficult. In addition, in some milking operations the milkers do change hands and most of the work in agriculture involves the use of two hands. However, in certain milking motions one hand is much more loaded than the other, especially the hand which is holding the claw during the attaching of the claw to the udder. The prevalence of symptoms in numbness and coldness was increased in the agricultural group. Pain could be due to the use of vibrating tools. However, there was no significant difference in experience of numbness, coldness and white fingers among milkers who were using or had used vibrating tools as compared with the group of milkers who had never done so. The experience of numbness indicates that peripheral nerves might be affected (25).

Looking upon the occupational factors of importance for developing injuries in female milkers, it appears that the kind of milking system might have an effect on the development of symptoms of the upper limbs. In this study it was also shown that milkers who are working in a modernized dairy barn have fewer problems in the upper extremities than women working in the traditional men's barn. There was a significant difference with regard to the level of rating of the most strenuous milking tasks among milkers with and without complaints from the upper extremities. The rating varied from about moderate to rather strong muscle stress when carrying milking machines to the cows, pre-milking, disconnecting and removing the machine from the milking pipe line and finally when attaching the cluster to the udder. The problems with poor working movements of the arm make it imperative to develop milking equipment to make it more comfortable for the milkers who are suffering from pain, but also to prevent work-related disorders. Equipment should be more adjustable to all kinds of people regardless of sex, physical strength and body dimensions. To adjust the work environment in dairy barns in general to the physical characteristics of the individual is the ultimate goal in order to reduce musculoskeletal disorders in female professional milkers.

The present study on the occurrence of pain, ache and discomfort was based on questionnaires. The results permit no conclusions with regard to the type of tissue injury causing the symptoms. Therefore, a clinical study will be carried out with special regard to symptoms in wrists and hands.

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MULTIMODAL TREATMENT TO PREVENT THE LATE WHIPLASH SYNDROME

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ABSTRACT. In order to assess the long-term efficacy of a multi-modal rehabilitation approach on whiplash injury, 60 patients were recruited within two months after neck injury. They were randomly allocated either to an experimental multimodal treatment (A) consisting of postural training, manual technique and psychological support or to a control treatment (B), using physical agents only, such as electrical and sonic modalities. Pain level, range of movement, self-rating scale of treatment efficacy and return-to-work delay were evaluated before and at the end of treatment, and later, 30 and 198 days after randomisation. The benefit obtained with treatment “A” was greater and longer lasting than that experienced with “B”, despite the fact that the same benefit was obtained in joint mobility in the two groups. Patients undergoing the experimental treatment returned to their usual occupations sooner than the controls. The results seem to confirm the hypothesis of a multifactorial involvement as a possible mechanism for the late whiplash syndrome.

Key words: whiplash injury; physical therapy; rehabilitation; neck sprain.

INTRODUCTION

For many years now there has been a lively debate about the symptoms following whiplash injury. Even in the terms regarding causal mechanisms and clinical pattern are not widely accepted (7, 8, 10, 17, 21, 28, 32, 38). Whiplash may be defined, according to the original description of Crow in 1928 (6), as the effects of sudden acceleration-decelerating forces on the neck and upper trunk due to external forces exerting a "lokshke effect". The acute consequences of dynamic injury on the cervical spine are often called "neck sprain" pointing to a collection of painful symptoms following injury to the neck, usually of a hyperextension-flexion type, without symptoms or signs of traumatic nerve root or cord dysfunction (33). The occurrence of long-lasting extra-articular symptoms focused attention on the so-called "late whiplash syndrome" whose nature and pathogenesis is still far from being defined (5, 7, 12, 15, 16, 30), owing to its peculiar epidemiological and clinical features, i.e. an unexplained higher incidence in women (2, 19), the frequent involvement of patients in compensation claims (30), the occurrence of "neurotic" symptoms such as anxiety, fatigue, insomnia (29) and the poor efficacy of analgesic drugs.

The clinical picture was justified on the basis of spine, neurovascular and neurological involvement. An antecedent cervical spondylolysis highlighted by radiological investigation and including disk space narrowing and posterior osteophyte formation was stressed by some authors while others emphasised the role of cervical zygapophysial joint or disk lesions (10, 18, 29). The role of root, cervical cord and myofascial lesions is widely discussed, but the occurrence of persistent neurological signs excludes a real neck sprain (32), whereas an injury to the neck muscles (from minor tears to partial avulsion of sternocleidomastoid or longus colli muscles), followed by vertebral artery spasm, might explain both the physical and behavioural symptoms (23).

Recent data provide evidence of the involvement of the central nervous system (CNS) after a whiplash injury (11). While Ettlin et al (12) try to correlate the abnormal behavioural response to pain with subtle structural damage of the basa frontal and upper brainstem structures, Pearse (31) rejects the hypothesis of any anatomical disruptive lesion on the basis of the normal BAEP and MRI results described by