

# MUSCULOSKELETAL DISORDERS AMONG HERDSMEN WORKING IN SWEDISH DAIRY AND PIG FARMING.

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*The most frequently reported musculoskeletal disorders among dairy and pig stockmen were in the “upper extremities” (52% and 62%, respectively) and in “the back” (60% and 57%, respectively). Furthermore, milking was the most time-consuming task (15 hours/week) among the dairy stockmen and also the task with the highest Physical Work Strain index (PWS 1.46). Among the stockmen on the pig farms the most time-consuming task was removal of manure occupying 10 hours/week and it was also the most physically demanding work task (PWS 0.86).*

*Key words: Musculoskeletal disorders, physical exertion, livestock farming*

## **1 Introduction**

Several national and international studies have shown that animal farming can cause musculoskeletal disorders (MSD) and the most common reasons for this are associated with a heavy workload, repetitive strenuous movements, and poor working postures (Lundqvist 1988; Pinzke 1999; Stål 1999; Hartman et al. 2000; Walker-Bone & Palmer 2002; Holmberg 2004; Stål & Englund 2005a). While the number of livestock farms in Sweden has decreased considerably, the herd sizes have increased noticeably during the last 10 years (Statistics Sweden 2005). Along with the structural changes there has been a substantial development especially in machine milking systems and this has helped to reduce the workload (Nevala-Puranen et al. 1996; Stål et al. 2003a). Only a few studies can be found regarding the impact of the workload on MSD among stockmen working with pigs (Hartman et al. 2000; Stål et al. 2005a). Despite these technical advances in large livestock farming, stockmen still report high frequencies of MSD.

## **2 Objectives**

The aim of the study was to explore the prevalence of perceived symptoms of MSD among Swedish stockmen and their experience of the physical exertion while performing different work tasks on large dairy and pig farms.

## **3 Methods**

The study was based on questionnaires which have been applied and tested as reliable and valid methods in several similar studies (Kourinka et al. 1987; Borg 1990). Forty two dairy stockmen and 37 pig stockmen on 20 large livestock farms in Sweden were randomly selected from a list received from the Local Livestock Association.

### 3.1 Subjects

The proportion of males and females on the dairy farms was 67% and 33%, respectively, and on the pig farms 51% and 49 %, respectively. The mean age among the dairy and the pig stockmen was almost the same, 32 and 34 years, respectively. The mean height and weight was 180.0 cm, 82.5 kg and 178.0 cm, 77.6 kg for the male dairy and pig stockmen, respectively, and 168.8 cm, 67.7 kg and 166.7 cm, 63.5 kg for the female dairy and pig stockmen, respectively. The dairy and the pig stockmen worked 39 and 36 hours per week, respectively. Doing sports such as aerobics, jogging or training in a health centre was more frequent among the dairy stockmen (48%) than among the pig stockmen (32%).

### 3.2 Questionnaires

The general standardized Nordic questionnaire by Kourinka et al. (1987) was used for analyses of perceived symptoms of MSD in nine different body parts 12 month prior to the study (presented in Table 1). Furthermore, the CR-10 scale by Borg (1990) was used for analyses of the perceived physical exertion while performing different work tasks in the barns (presented in Table 2). The participants' demographic data, working hours and work tasks were also assembled by a questionnaire. The response rate was 100%.

### 3.3 Data and statistical analysis

For the statistical analysis of the results the Mann Whitney's Test and Chi-Square analyses were used. Fisher's Exact Test was used instead of Chi-Square when the expected values in any of the cells were <5. The probability limits for evaluating statistical significance were: <sup>1)</sup> =  $p \leq 0.05$ , <sup>2)</sup> =  $p \leq 0.01$  and <sup>3)</sup> =  $p \leq 0.001$ .

In order to get a deeper understanding of how time related to different work tasks influence the physical work strain in dairy and pig farming an index was constructed, named the Physical Work Strain index (PWS). The PWS is based on the CR-10 scale (Borg 1990) and on the number of hours per week the participants spent on different work tasks. The indexes for the different work tasks were calculated according to the equation:

$$\text{PWS}_i = \frac{t_i \cdot p_i}{T}$$

where  $t$  and  $p$  is the number of work hours per week and the physical exertion (CR-10 scale), respectively, for work task  $i$  and  $T$  is the total number of work hours per week.

## 4 Results

### 4.1 The prevalence of MSD

The study showed that 86% of the dairy stockmen and 78% of the pig stockmen reported symptoms of MSD in at least one body part during a period of 12 months prior to the study (Table 1).

**TABLE 1.** Prevalence of musculoskeletal disorders (MSD) during the preceding 12 months in nine different body parts and 4 clustered body regions. The descriptive values (number (n), per cent (%)) and possible significant differences between sexes) are listed according to branch and sex.

Body parts	Dairy stockmen			Pig stockmen		
	♂ and ♀	♂	♀	♂ and ♀	♂	♀
	n = 42	n = 28	n = 14	n = 37	n = 19	n = 18
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Shoulders	20 (48)	10 (36)	10 (71) <sup>1)</sup>	16 (43)	6 (32)	10 (56)
Elbows	4 (10)	1 (4)	3 (21)	6 (16)	0 (0)	6 (33) <sup>2)</sup>
Wrists/hands	11 (26)	3 (11)	8 (57) <sup>2)</sup>	14 (38)	8 (42)	6 (33)
“The upper extremities” *)	22 (52)	11 (39)	11 (79) <sup>1)</sup>	23 (62)	10 (53)	13 (72)
Neck	14 (33)	7 (25)	7 (50)	12 (32)	3 (16)	9 (50) <sup>1)</sup>
Upper back	11 (26)	5 (18)	6 (43)	8 (22)	3 (16)	5 (28)
Lower back	17 (41)	10 (36)	7 (50)	18 (49)	8 (42)	10 (56)
“The lower extremities” *)	16 (38)	11 (39)	5 (36)	14 (38)	6 (32)	8 (44)
Hips	6 (14)	3 (11)	3 (21)	4 (11)	2 (11)	2 (11)
Knees	10 (24)	6 (21)	4 (29)	11 (30)	5 (26)	6 (33)
Feet	6 (14)	4 (14)	2 (14)	5 (14)	2 (11)	3 (17)
“The back” *)	25 (60)	15 (54)	10 (71)	21 (57)	9 (47)	12 (67)
“In any body part” *)	36 (86)	23 (82)	13 (93)	29 (78)	14 (74)	15 (83)

\*) Clustered body regions: Consisting of at least one of the following body parts:  
 “The upper extremities” Shoulders, elbows, wrists/hands  
 “The lower extremities” Hips, knees, feet  
 “The back” Neck, upper back, lower back  
 “In any body part” Neck, shoulders, elbows, wrists/hands, upper back, lower back, hips, knees, feet

<sup>1)</sup> Denotes significant level  $p \leq 0.05$ ; <sup>2)</sup> denotes significant level  $p \leq 0.01$

The most frequently reported MSD among both the dairy and the pig stockmen were in the “upper extremities” (52% and 62%, respectively) especially in the shoulders (48% and 43%, respectively) and in “the back” (60% and 57%, respectively) particularly in the lower back (41% and 49%, respectively). Furthermore, the female stockmen reported MSD more frequently in all the body parts in comparison with the male stockmen.

#### 4.2 The physical exertion and the Physical Work Strain index

As shown in Table 2 the dairy and the pig stockmen estimated the physical exertion according to the Borg scale of all the work tasks at approximately the same level (2.52 and 2.41, respectively).

**TABLE 2.** Perceived physical exertion during different work tasks, number of work hours and Physical Work Strain index (PWS). Number (n), mean and standard deviation (sd)

Work tasks for dairy stockmen	Number	Physical exertion <sup>*)</sup>	No. of hours per week	PWS <sup>**)</sup>
	of stockmen			
	n	mean (sd)	mean (sd)	mean (sd)
Machine milking	26	3.46 (1.70)	15.33 (5.38)	1.46 (0.97)
Handling of feed	10	4.40 (2.17)	6.33 (4.33)	0.64 (0.47)
Removal of manure	24	3.16 (2.22)	3.80 (2.12)	0.38 (0.52)
Feeding (roughage & concentrate)	27	1.89 (1.40)	6.81 (4.52)	0.34 (0.31)
Strewing of litter (sawdust/straw)	24	2.88 (1.73)	4.18 (4.66)	0.28 (0.31)
Cleaning parlour & equipment	24	2.83 (2.16)	3.03 (1.46)	0.24 (0.23)
<b>ALL WORK TASKS<sup>1) a)</sup></b>	<b>27</b>	<b>2.52 (1.29)</b>	<b>38.62 (10.03)</b>	<b>2.97 (1.45)</b>

  

Work tasks for pig stockmen	Number	Physical exertion <sup>*)</sup>	No. of hours per week	PWS <sup>**)</sup>
	of stockmen			
	n	mean (sd)	mean (sd)	mean (sd)
Removal of manure	28	2.62 (1.00)	10.64 (4.48)	0.86 (0.48)
Artificial insemination	18	2.97 (1.29)	5.75 (6.99)	0.45 (0.52)
Periodic cleaning	16	3.63 (1.36)	2.72 (1.68)	0.35 (0.29)
Daily inspection and treatment	26	2.25 (1.06)	4.61 (3.41)	0.30 (0.24)
Gelding of piglets	18	3.50 (1.20)	2.46 (1.62)	0.25 (0.18)
Strewing of litter (sawdust/straw)	30	1.52 (0.96)	4.89 (2.93)	0.21 (0.16)
<b>ALL WORK TASKS<sup>1) b)</sup></b>	<b>30</b>	<b>2.41 (0.82)</b>	<b>33.83 (8.44)</b>	<b>2.34 (0.87)</b>

<sup>\*)</sup> CR-10 scale of perceived physical muscle stress (Borg 1990): 0 = None at all; 0.5 = Extremely weak; 1 = Very weak; 2 = Weak; 3 = Moderate; 5 = Strong; 7 = Very strong; 10 = Extremely strong

<sup>\*\*)</sup> PWS (Physical Work Strain index) = Perceived physical exertion according to the CR-10 scale · Number of hours per week working with a specific task/Total working hours per week

All work tasks:

<sup>1)</sup> Are calculated on the basis of the individual means. Note that not necessarily all the participants have been engaged in every work task

<sup>a)</sup> Regarding dairy stockmen also included sweeping and cleaning in the barn, artificial insemination, daily inspection and office work. The results of these work tasks are not shown in Table 2.

<sup>b)</sup> Regarding pig stockmen also included ear marking, weaning, relocation of pigs, weighing of pigs, feeding and office work. The results of these work tasks are not shown in Table 2.

The stockmen on the dairy farms estimated handling of feed and machine milking as the most physically demanding work tasks (3.46 and 4.40 respectively). Among the stockmen on the pig farms, periodic cleaning and gelding of piglets were the highest rated work tasks (3.63 and 3.50, respectively). Furthermore, the results showed that milking was the most time-consuming task (15 hours/week) among the dairy stockmen and also the task with the highest Physical Work Strain index (PWS 1.46). Among the stockmen on the pig farms the most time-consuming task was removal of manure occupying 10 hours/week and it was also the most physically demanding work task (PWS 0.86)

## 5 Discussion

### 5.1 *The prevalence of MSD*

This study shows that the problems with MSD were concentrated to the “*upper extremities*” and the “*back*”. On large dairy farms with loose-housing and milking parlours, symptoms of MSD have significantly increased in the upper extremities and decreased in the lower extremities (Pinzke et al. 2001; Holmberg et al. 2002; Pinzke 2003; Stål et al. 2003b). In a later study carried out on large pig farms high frequencies of symptoms were reported in the shoulders, arms and hands and wrists as well (Stål & Englund 2005a). The increased number of animals per herd on Swedish livestock farms implies that the daily work tasks for the stockmen have become more specialized and monotonous compared to working with fewer animals. This might be a contributory reason for our findings of high frequencies of MSD among the stockmen on these large livestock farms. Furthermore, the study showed that more female than male stockmen reported problems in their musculoskeletal system. Previous studies have shown that female farm workers doing repetitive work and lifting heavy burdens are more disposed to sustained problems in the musculoskeletal system especially in the upper extremities than their male colleagues (Stål 1999; Pinzke et al. 2001).

### 5.2 *The Physical Work Strain index*

Machine milking and handling of feed in dairy farming was estimated as the most physically exerting work task, a finding also reported by Gustafsson et al. (1994) (Gustafsson et al. 1994). The pig stockmen estimated periodic cleaning of pig pens with high pressure washers and gelding of piglets as the most physically demanding work tasks and this is confirmed by an unpublished study by Stål (2005b). However, it is not just the level of physical exertion that determines the physical exposure. The duration and repetitiveness of the tasks also need to be taken into consideration (Winkel & Mathiassen 1994; Pinzke 1999). When the physical exertion was related to the actual time taken to perform the different work tasks, an index illustrating a combined measure of the physical exposure was designed, the Physical Work Strain index. As an example, *machine milking* was estimated as 3.46 on Borg’s CR-10 scale and *handling of feed* as 4.40. If the time spent on working with these two tasks was taken into consideration, 15.33 and 6.33 hours per week, respectively, the physical exposure could be considered as greater regarding *machine milking* (PWS 1.46) than *handling of feed* (PWS 0.64). In addition, the result indicated that manual removal of manure from the pig pens with a hand-rake should be given some attention.

Despite the presumed technical advancement on large livestock farms, there is still high prevalence of MSD especially in the “*upper extremities*” and among the female stockmen.

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