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## Prevalence of Musculoskeletal Disorders among Slaughter House Workers

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### Abstract

**Background:** Employees in meat processing industry experience many health risks. It is clear that meat processing workers have a high prevalence of musculoskeletal disorder (MSD) including sprain/strain, dislocation, contusion, laceration, and amputation, with the most common injuries located in the upper extremities.

**Aim:** The purpose of this study was to determine the prevalence and incidence of MSD symptoms; and to identify the prevalence of MSD in relation to gender, age, and work experience amongst New Zealand meat processing employees.

**Materials and Method:** A discomfort survey (Nordic questionnaire) was conducted in 2016 in six meats processing slaughterhouses factories and included 1467 employees to determine the point prevalence.

**Results:** Most musculoskeletal symptoms in workers were from the hands/wrists (54.8%), followed by the elbow (45.2%), and then lower back (43.5%). Gender and work experience were strongly significantly associated with musculoskeletal symptoms and pain in the shoulder, elbow, hands/wrists, lower back and ankles.

**Conclusion:** Prevalence of musculoskeletal disorders is very common among meat processing workers (64.9%). We recommended additional studies to identify possible factors that make these populations more susceptible to MSD in order to propose appropriate preventative strategies to control and reduce the occurrence of these disorders in meat processing workers.

**Keywords:** Musculoskeletal disorders; Prevalence; Meat processing; Slaughter house; Disorders

### Introduction

Musculoskeletal disorders are one of the most common work-related health disorders in both the general population and among workers causing injuries and illnesses that result in serious social and economic impact on the health and quality of life as well as long term disability on individuals and communities [1-3]. Musculoskeletal conditions involve nerves, bones, tendons, muscles, and other related soft tissues of the body, affecting the hands, wrists, elbows, neck, and upper extremities, caused by a variety of factors; frequently occur from overuse or repetitive motion [2,4-6]. This is most notable in the meat processing industry, affecting a large number of workers, employers, compensation organizations as well as various healthcare systems [7-9]. Work tasks performed in the meat processing industry are considered static and repetitive, with rapid movements of the upper and lower limbs involving knives, slippery floors, live animals, cold exposure, and dangerous machines [10,11].

Internationally MSD in the meat processing industry have one of the highest incidence rate for any industry sector, based on the estimated annual incidence of occupational injury by compensating organizations [7]. For example in the USA the department of labor have reported that the prevalence of WMSD in meatpackers over a 12-month period was two times higher than US-national average, with days off work, and job transfer three times higher than the national average [12]. In Australia, also meat processing were the highest risk industries claims incidence rate was four times higher than the manufacturing industry and that manual handling claims in meat processing cost almost 50% more than other injuries [13]. In New Zealand MSD incidence rate for meat processing was estimated to be 59 per 1000 full-time equivalent workers (FTE), compared to 20 per 1000 FTE for forestry and logging, and 16 per 1000 FTE for construction; with high risk for MSD in the neck and upper extremity due to repetitive tasks, awkward postures, and heavy physical work [14].

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It is clear that meat processing workers have a high prevalence of MSD including sprain/strain, dislocation, contusion, laceration, and amputation, with the most common injuries located in the upper extremities [15-18]. Low back, shoulder, and neck pains also constitute a high proportion of the total injuries [18-25]. For example, poultry workers reported a greater prevalence of symptoms than other workers. The prevalence of shoulders was 62.6%, neck 46.2%, spine 36.4% during the past 12 months [26]. In another study, the most frequent symptoms were wrist/hand 40.4%, low back 36.8%, shoulders 30.8% and neck 17.4% [23].

Definitive information and data on MSD prevalence around the world is still limited, as the majority of countries still do not collect adequate data and relevant statistics for MSD. Therefore, the purpose of this research was to estimate the prevalence of MSD symptoms; and to identify the prevalence of MSD in relation to gender, age, and work experience amongst New Zealand meat processing employees.

## Materials and Methods

### Study design and study population

A cross-sectional study was conducted on 257 meat workers in six meat processing industries, randomly selected from 16 factories in the South Island between January and March 2016. The inclusion criteria were only full-time working with at least one-year job experience; involved in manual handling activities. Subjects with pregnancy, chronic systemic illness, recent fractures, or surgeries were excluded from the study.

Participants were recruited through advertisements (posters) in different work-sites including the on-site health clinic, plant administration, cafeterias, and all department notice-boards. Workers had chance for participation in the study allowing them to fill in the survey at their own convenience. The researcher explained the questionnaire to each participant and provided a contact number in case further explanation would be required. Ethics approval for the study was obtained from the Canterbury District Health Board, and all the participants signed an informed consent form.

### Questionnaire

A Nordic Musculoskeletal Questionnaire (NMQ) was distributed among study population and collected thereafter. The questionnaire includes two parts: the first part sought data on demographic information and job characteristics. The second part was designed for musculoskeletal complaints in each of the following body parts: neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees and ankles/feet. The workers were asked to report experiences of pain or discomfort in the soft tissue of the different body regions in the last 12 months and last 7 days. The NMQ has been widely used to evaluating musculoskeletal problems in general and specific populations. It has been shown to have good reliability and validity in different studies with good utility that can be completed in five minutes [27].

### Statistical analysis

Data were analyzed using Microsoft Excel® and Statistical Package for Social Sciences (SPSS®) version 21.0, and two tailed p values of <0.05 were considered statistically significant. The results were summarized in descriptive statistics to describe the participant demographics. Descriptive statistics such as means with standard deviation or frequency counts with percentage counts were calculated to describe the participant demographics and MSD prevalence of

**Table 1:** Characteristics of the Sample Population (N=176).

Characteristic	Mean and %	SD
Age	41.8	12.4
Height	172.6	9.4
Weight	83.3	17.6
Experience	11.7	7.7
Weekly working	41.5	4.5
Job position		
Slaughter board	63.8 % (113/176)	
Beef house	18.1% (32/176)	
Lamb-cuts	18.1 (32/176)	

**Table 2:** Distribution of musculoskeletal injuries by body part among meat processing workers (n = 176).

Body part	Number	%
Neck	69	39.5%
Shoulder	65	37.3%
Wrist/hands	96	54.8%
Elbow	79	45.2%
Upper back	46	26.6%
Lower back	76	43.5%
Hips/thighs	45	26.0%
Knees	42	24.3%
Ankles/feet	43	24.9%

the study population. The prevalence of MSD for each body region was estimated with 95% confidence intervals. Loglinear analysis was used to find the association between musculoskeletal symptoms and demographic factors.

## Results

### Descriptive data for the sample

A total of 176 meat processing workers responded in the study, with a response rate to the questionnaire was 68.4% (176/257). Table 1 presents the demographic factors related to the study population. The mean (SD) age of workers was 41.8 (12.4) years, with more male 58.8% than female who participated in this study. Hours worked per week were 41.5 (4.5) hours and the mean period of employment were 11.7 (7.7) years and 63.8 % (113/176) were employed in the slaughter board department.

Musculoskeletal symptoms were reported by 115 (64.9%) participants that troubled them in one or more of the nine defined body regions during the past 12 months. Table 2 shows the estimated prevalence of musculoskeletal complaints in different anatomical regions during the past 12 months. The anatomical region with the highest prevalence of pain complaints was the wrist/hands (n = 96; 54.8%), followed by the elbow (n = 79; 45.2%), lower back (n = 76; 43.5%), and neck region (n = 69; 39.5%). Those who reported musculoskeletal symptoms in one region usually reported symptoms in other regions as well. However, in the occupational groups, slaughter board workers reported a higher prevalence of musculoskeletal symptoms (62.3%) than boning room (19.4%) and lamb-cuts workers (18.3%).

Table 3 outlines associations between prevalent musculoskeletal symptoms and demographic variables. The prevalence of shoulders were significantly associated with work experience ( $P = 0.03$ ) and

**Table 3:** Association between demographic characteristic and prevalence of MSD.

Characteristics	Neck		Shoulders		Elbow		Wrist/Hands		Upper back		Lower back		Hips		Knees		Ankles	
	N(%)	P	N(%)	P	N(%)	P	N(%)	P	N(%)	P	N(%)	P	N(%)	P	N(%)	P	N(%)	P
Male	40(23)	0.75	43(24)	0.13	36(21)	0.02	61(35)	0.04	26(15)	0.37	33(19)	0.03	19(11)	0.03	19(11)	0.09	18(10)	0.04
Female	29(17)		22(13)		43(25)		35(20)		20(12)		43(25)		26(15)		23(13)		25(15)	
Exper Years																		
5-6	5(6)	0.58	31(18)	0.03	33(19)	0.02	43(25)	0.01	16(9)	0.39	36(20)	0.01	17(10)	0.25	17(10)	0.08	20(11)	0.03
6-11	7(8)		15(9)		20(12)		31(18)		11(6)		21(12)		11(6)		12(7)		8(5)	
11-12	5(6)		11(7)		11(6)		15(9)		8(4)		12(7)		10(5)		5(3)		7(4)	
18-23	7(8)		6(4)		13(8)		4(2)		7(4)		18(6)		6(4)		3(2)		6(4)	
24-30	7(8)		2(1)		2(1)		3(2)		4(2)		2(1)		1(1)		5(3)		2(1)	
Age																		
20-29	14(8)	0.27	17(10)	0.15	17(10)	0.3	31(18)	0.07	8(5)	0.11	19(11)	0.08	8(5)	0.12	9(5)	0.11	7(4)	0.32
30-39	13(7)		14(8)		16(9)		18(11)		6(4)		20(11)		7(4)		9(5)		10(6)	
40-49	17(10)		15(9)		22(13)		27(15)		13(8)		19(11)		11(7)		7(4)		11(6)	
50-65	25(14)		19(11)		24(14)		20(12)		19(11)		18(10)		19(11)		19(10)		15(9)	

occurred more often in participants with 1–5 year experience. MSD of elbow was significantly associated with gender and work experience ( $P=0.02$ , and  $0.01$ ), with more female than male reporting elbow complaints and occurred by participants with 1–5 year experience respectively. The lower-back was significantly associated with gender and work experience ( $P = 0.03$ ,  $P = 0.01$ ) respectively. A similar significant association were seen in prevalence of wrists/hands with gender and work experience ( $P = 0.04$ ,  $P = 0.01$ ) respectively, occurred more often in participants with 1–5 year experience.

## Discussion

Musculoskeletal disorders are a highly prevalent health problem widespread around the world. It is well known that meat processing workers have a high prevalence of MSD suffering pain in different parts of the body, with the most common injuries located in the upper extremities. Wrist/hands, elbow, and lower back were the regions being most affected within meat processing workers, followed by neck and shoulders. Awkward posture, overuse and repetitive motion for prolonged period of time may lead to musculoskeletal disorder among meat processing workers.

This study investigated the prevalence of musculoskeletal disorders among meat processing workers. The results showed that 64.9% of workers had reported pain or discomfort in one or more musculoskeletal complaints during the previous 12 months for their symptoms, whereas the prevalence of MSD in this population is similar to a systematic review that reported the prevalence rate of MSD ranged between 64% and 78% among dental professionals [28]. This is consistent with the findings of previous study in Iran whereas around 61% of steel workers had reported one claim of MSD over 12 month [29]. In contrast, a study combining face-to-face interviews, EMG, and questionnaire for 180 workers in two companies in Taiwan, the prevalence of MSD was 90% across all body regions [30]. In another study conducted in a sample of 3003 workers in NZ, identified an overall prevalence rate of 92%, and also other occupations in New Zealand such as nurses (91%) postal workers (88%), and office workers (84%) [31]. A possible explanation for the decreased rate reported in our study may be due to variation in outcome assessments such as questionnaires, methodological shortcomings such as inadequate sample size, and lack of reporting of confidence interval findings, and

difference in the work setting. Determining the prevalence rate of MSD using self-report questionnaires could result in overestimation of the true prevalence rate, compared to other approaches such as medical examination and EMG: assessing MSD prevalence rate in the same group, a prevalence rate of 13% was determined by questionnaire and 3% determined by physical examination [32].

In our study the highest reported problem in MSD was wrist/hands pain with the prevalence of 54.8% that is slightly similar to slaughterhouse workers study in USA with (57.8%) during the past 12 months [33]. Consistent with a rice farmers in West Bengal, India 53.6% [34]. But this prevalence shows different results in other studies such as cleaning workers in Taiwan with (41.7%) [30], poultry slaughterhouse workers with 25.6% [26], and poultry workers in Western North Carolina with wrist/hands 40.4% [23]. Wrist/hands are common and highly prevalent complaints afflicting workers with hand-intensive tasks, strenuous manual jobs, prolonged exertions of the hands, and repetitive movements alone or in combination with other physical demands in the meat and fish processing industries, often contribute to the development of wrist/hands MSD [35]. The differences in the estimated prevalence of these studies may be explained by the methodologies applied, the musculoskeletal conditions definitions, the measurement instruments used and the population sample.

The elbow (45%) and lower back (44%) were found to be the next most prevalent problems reported body region of MSD among the workers studied. These findings are higher to the results of other studies involving New Zealand office workers (21%), New Zealand postal workers (30%), New Zealand nurses (13%) [31], or New Zealand working population (14%) [36] or among Iranian steel workers (13%) [29] for the elbow and by Quandt et al (2006) for Latino poultry workers in western North Carolina (36%), Schulz et al (2012) Latino poultry processing workers (37%), Tirloni et al (2012) poultry slaughterhouse workers (36%) and Das, B. (2015) rice farmers (25%) for the lower back.

The current study found several Socio-demographic factors associated with MSD, including gender, age, and work experience over the past 12 months. The present study found gender differences in MSD prevalence for males and females in varying body regions.

Pain in elbow, lower back, hips, knees, and ankles was shown in this study that was significantly more complaints among female workers than counterpart's male workers. This finding was consistent with similar findings in a study among dental profession in Brunei Darussalam [37], who reported that female dental profession showed higher prevalence of lower back, upper back, neck, shoulders, and hands/wrists compared to male. In addition, this finding is similar to other reports, which reported that females had higher prevalence of MSD than males in other occupational groups, such as construction workers [38], cashew factory workers [39], general population in a semi-urban Nigerian [40], and New Zealand working population [36]. However, the reason for this gender difference may be due to a variety of factors, including differences in biological and psychosocial factors, work experience, job tasks, and varying risk factors encountered outside of work which may lead to differences in pain tolerance levels [41,42] that make women being more likely to suffer from MSD.

There were no statistically significant differences in prevalence between age groups for all body regions for males, females. This supports previous literature, in which studies have demonstrated that age group is not significantly associated with MSD prevalence [36,39,43]. In contrast, an evidence from a large critical review of the epidemiologic literature of MSD factors, which identified that older workers are more susceptible to report MSD than young workers [44], while Moom, Sing (2015) reported that age, and work related factors were contributed to increase MSD among computer user's bank office employees [45].

In the current study, years worked were significantly associated with musculoskeletal symptoms and pain in the shoulders, elbow, wrist/hands, lower back, and ankles. This is consistent with previous findings from a systematic review evaluated the results of 29 studies on occupational risk factors for MSD confirming duration of employment as risk factors for the development of MSD [46]. Similar findings from another systematic review of 63 studies evaluated risk factors for the development of work-related MSD. Reported that duration of employment was associated with increased development of work-related MSD [47].

## Conclusion

In conclusion, the prevalence of musculoskeletal disorders among meat processing workers was 64.9%, which is a not ignorable and has to be addressed. The most common MSD site in workers was the hands/wrists, followed by the elbow and then lower back. We recommended additional studies to identify possible factors that make these populations more susceptible to MSD in order to propose appropriate preventative strategies to control and reduce the occurrence of these disorders in meat processing workers.

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