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Abstract

**Risk Factors of Work-related Musculoskeletal Symptoms
Among Motor Engine Assembly Plant Workers**

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Objectives: To determine the synthetic risk factors of musculoskeletal disorders, and to examine effect on musculoskeletal symptoms of physical work intensity and change of work intensity.

Methods: Self-administered questionnaire survey was conducted on 588 motor engine assembly workers, in Chanwon, Kyungnam provance, Korea, from April 1 to May 31, 2003. The contents of the questionnaire investigation included general characteristic items, work-related characteristic items, presence of musculoskeletal symptoms, ergonomic risk factors items, job stress items, current physical work intensity and changes of work intensity items. The results underwent statistical analysis with frequency test, t-test, and logistic regression. The statistical significance level was 0.05, and SAS(v8.1) was used.

Results: Multiple logistic regression analysis was used to examine the relationship between risk factors and musculoskeletal symptoms. From the results, significant variables were high Quick Exposure Check (QEC) score, high job demand control, physical work intensity, change of work intensity.

Conclusion: Among the known risk factors of musculoskeletal disorders, the outbreak of musculoskeletal symptoms was confirmed to be correlated with age, tenure, ergonomic risk factors, and job stress. Physical work intensity and the changes of work intensity were also related to musculoskeletal symptoms.

Key Words: Musculoskeletal symptoms, Risk factors, Work intensity

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가 Li Buckle Quick Exposure Check(QEC) (1998) (p<0.05), (stepwise)

Karasek(1979, 1998) Job Content Questionnaire(JCQ)

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NIOSH 61.8%, / 가 58.4%, 50.0% 2 20.5%, / 20.0%, 11.8% (Table 1).

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Table 1. Prevalence of work-related musculoskeletal symptoms (N=474) (): %

| Regions | At least one symptom | NIOSH Criteria | Criteria* |
|---------------------|----------------------|----------------|------------|
| Neck | 264 (55.7) | 237 (50.0) | 56 (11.8) |
| Shoulders | 312 (65.8) | 293 (61.8) | 97 (20.5) |
| Arms/elbows | 100 (21.1) | 86 (18.1) | 15 (3.2) |
| Fingers/hands | 184 (38.8) | 160 (33.8) | 33 (7.0) |
| Back | 299 (63.1) | 277 (58.4) | 95 (20.0) |
| Knees/legs | 217 (45.8) | 193 (40.7) | 63 (13.3) |
| At least one region | 453 (95.6) | 430 (90.7) | 200 (42.2) |

* NIOSH Criteria (lasted more than one week or occurred at least once a month within the past year) and symptom severity more than 'moderate'

Table 2. Relations between musculoskeletal symptoms and general characteristics

| General characteristics | Categories | Mean ± SD | No. | % | OR | 95% CI |
|---------------------------|------------------|------------|-------------|-------------------|-------------------|------------|
| Age (years) | <30 | | 147 | 31.1 | 1.0 | |
| | 30 Age<35 | 31.4 ± 4.4 | 235 | 49.7 | 2.25 [†] | 1.46-3.47 |
| | 35 Age<40 | | 70 | 14.8 | 1.60 | 0.89-2.89 |
| | 40 | | 21 | 4.4 | 1.70 | 0.67-4.32 |
| BMI* (kg/m ²) | <20 | | 38 | 8.0 | 1.0 | |
| BMI* (kg/m ²) | 20 BMI<25 | 23.0 ± 2.4 | 334 | 70.5 | 1.04 | 0.52-2.06 |
| | 25 | | 102 | 21.5 | 0.97 | 0.62-1.52 |
| | Marriage | | Non-married | 169 | 35.7 | 1.0 |
| Marriage | Married | 303 | 63.9 | 1.88 [†] | 1.19-2.97 | |
| | Smoking | Non-smoker | 125 | 26.4 | 1.0 | |
| | | Ex-smoker | 46 | 9.7 | 0.95 | 0.47-1.91 |
| Present smoker | | 303 | 63.9 | 1.26 | 0.82-1.95 | |
| Drinking | None | 177 | 37.3 | 1.0 | | |
| | 1-2 times/week | 262 | 55.3 | 0.92 | 0.62-1.35 | |
| | 3-5 times/a week | 35 | 7.4 | 1.32 | 0.63-2.74 | |
| Exercise | Regular | 105 | 22.2 | 1.0 | | |
| | Occasional | 261 | 55.1 | 0.89 | 0.56-1.41 | |
| | None | 108 | 22.8 | 0.64 | 0.37-1.11 | |
| Tenure (years) | <5 | | 137 | 37.6 | 1.0 | |
| | 5 tenure<10 | 6.0 ± 3.5 | 261 | 58.3 | 4.13 [†] | 2.28-7.46 |
| | 10 | | 50 | 11.2 | 7.23 [†] | 2.79-14.74 |

* Body mass index

[†] Statistical significance at 95% confidence interval

Table 3. Comparisons of quick exposure check (QEC) scores on the presence of musculoskeletal symptoms (N=474)
Mean (\pm SD)

| QEC scores | Symptoms | | p-value |
|-------------------------|-------------------|----------------------------------|---------|
| | No | Yes | |
| Total score of neck | 9.9 (\pm 4.4) | 10.9 (\pm 4.5) [†] | <0.01 |
| Total score of shoulder | 23.0 (\pm 7.8) | 26.5 (\pm 8.8) [†] | <0.01 |
| Total score of wrist | 27.7 (\pm 9.2) | 30.4 (\pm 9.2) [†] | <0.01 |
| Total score of back | 24.9 (\pm 9.6) | 28.86 (\pm 10.4) [†] | <0.01 |

[†] Statistical significance at 95% confidence interval

Table 4. Odds ratios between job stress and musculoskeletal symptoms (N=474)

| Job stress | Categories | OR | 95% CI |
|--------------------|------------|-------------------|-----------|
| Job demand | Low | 1.0 | |
| | High | 2.51 [†] | 1.70-3.71 |
| Decision latitude | Low | 1.0 | |
| | High | 1.01 | 0.69-1.38 |
| Supervisor support | Low | 1.0 | |
| | High | 0.63 [†] | 0.40-0.69 |
| Coworker support | Low | 1.0 | |
| | High | 1.05 | 0.72-1.01 |
| Social support | Low | 1.0 | |
| | High | 0.89 | 0.60-1.33 |

[†] Statistical significance at 95% confidence interval

Table 5. Comparisons of physical work intensity on the presence of musculoskeletal symptoms (N=474)Mean (\pm SD)

| Physical work intensities | Symptoms | | p-value |
|-------------------------------------|-------------------|--------------------------------|---------|
| | No | Yes | |
| Hands above shoulder level | 2.3 (\pm 1.1) | 2.8 (\pm 1.5) [†] | <.01 |
| Trunk bent | 3.0 (\pm 1.3) | 3.4 (\pm 1.3) [†] | <.01 |
| Awkward posture | 2.5 (\pm 1.2) | 3.1 (\pm 1.4) [†] | <.01 |
| Crouch down | 1.6 (\pm 1.2) | 1.7 (\pm 1.2) | 0.50 |
| Repetitive motion | 3.7 (\pm 1.6) | 3.9 (\pm 1.5) | 0.11 |
| Static motion | 2.6 (\pm 1.5) | 2.9 (\pm 1.6) | 0.06 |
| Work speed | 3.3 (\pm 1.0) | 3.6 (\pm 1.0) [†] | <.01 |
| Fatigue after finishing work | 3.3 (\pm 0.9) | 3.7 (\pm 1.0) [†] | <.01 |
| Sweating after working | 2.7 (\pm 1.0) | 3.1 (\pm 1.0) [†] | <.01 |
| Borg scale | 11.5 (\pm 1.9) | 12.5 (\pm 2.5) [†] | <.01 |
| Total physical work intensity score | 25.2 (\pm 6.0) | 28.2 (\pm 6.0) [†] | <.01 |

[†] Statistical significance at 95% confidence interval

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Table 7. Relationships between risk factors and musculoskeletal symptoms (N=474)

| Risk factors | Adjusted OR* | 95% CI |
|---------------------------------------|-------------------|-----------|
| Total score of neck | 1.05 [†] | 1.01-1.10 |
| Total score of shoulder | 1.03 [†] | 1.01-1.06 |
| Total score of wrist | 1.04 [†] | 1.02-1.07 |
| Total score of back | 1.04 [†] | 1.02-1.06 |
| Job demand | 1.06 [†] | 1.03-1.09 |
| Total physical work intensity | 1.11 [†] | 1.07-1.15 |
| Borg scale | 1.25 [†] | 1.13-1.38 |
| Absolute work intensity | 1.08 [†] | 1.02-1.14 |
| Relative work intensity | 1.05 [†] | 1.01-1.09 |
| Flexibility | 1.10 [†] | 1.02-1.18 |
| Total change amount of work intensity | 1.07 [†] | 1.04-1.11 |

*Adjust variable: age, marriage, education, smoking, BMI, job duty, tenure

[†]: Statistical significance at 95% confidence interval

Table 8. Risk factors of musculoskeletal symptoms (N=474)

| Variables | Adjusted OR | 95% CI |
|--------------------------------|-------------------|------------|
| Total physical work intensity | 1.10 [†] | 1.05 -1.16 |
| Total change of work intensity | 1.04 [†] | 1.004-1.08 |
| Borg scale | 1.15 [†] | 1.003-1.32 |

[†]: Statistical significance at 95% confidence interval

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