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Abstract

Multilevel Analysis of Risk Factors Related to Musculoskeletal Symptoms among Caterers for Elementary School Lunch Services

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Objectives: To examine the complaint proportion and characteristics of musculoskeletal symptoms and to find risk factors of musculoskeletal symptoms among caterers for school lunch services.

Methods: The study subjects were 385 caterers who were working for school lunch services in 71 elementary schools and 114 housewives who had visited a hospital for routine health check-up. A self-recording questionnaire was used to investigate the general characteristics, labor conditions, job stress and nature of musculoskeletal symptom. Caterers were surveyed from September to October in 2003 and the housewives during September by post. The ergonomic risk factors were examined for the caterers of an elementary school in Kyonggi Province in November, 2003.

Results: The complaint proportion of self-reported positive musculoskeletal symptoms was

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52.0% and that of severe musculoskeletal symptoms was 24.9%. Ergonomic assessment revealed that washing the dishes, carrying the soup containers and cleaning the sewage drain were highly risky activities in terms of repetitive and heavy weight-bearing motions. As for personal factors, the caterers having severe musculoskeletal symptoms had high psychological job demand. As for the workplace factors, the proportion of schools having severe musculoskeletal symptoms was significant higher where each caterer prepared more than 150 lunches. Among schools without school lunchroom, more schools had caterers having severe musculoskeletal symptoms. Using multilevel analysis, we found that the number of lunches to be prepared per caterer was a significant risk factor of severe musculoskeletal symptoms (O.R. 4.67).

Conclusions: This study showed that the number of lunches prepared per caterer has a significant influence on the development of musculoskeletal disorder and that caterers work in an ergonomically highly risky job environment. The study results suggest that the number of caterers be increased to decrease the number of lunches prepared per caterer and the ergonomic environment be improved.

Key Words: Caterers, Musculoskeletal disease

1997; Gawkrödger et al, 1986; Hjorth, 1981).

가 15.2%

가 1990 가

가 2002 9 가

94.6%

(, , ,) 83.1% 650 (, 2003).

(, 2002).

가

(, 1997), (, 1997) VDT (, 2003; , 1998) (, 2003; , 2003), (, 2001; , 2000; , 1999), (, 2000) 가 (, 2004), (, 2004), (, 2002), (, 2002), (, 2000), (, 2000)

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(Gleeson, 2001; Louis et al, 2000; Ono et al, 1997; Wood & Greig,

(5), (6)
) 114 가

2.

1.

NIOSH(1993)

(snowball sampling)

가

NIOSH

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(, ,)

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84 407 가

81.4%

. 407

30~60

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385 가

1

71

83.5%

84

Karasek et al

82 (97.6%)

(1998)

가

(, 2001).

(Skill Discretion) 6

(Decision Authority) 3

(Psychological Job De-

mands) 8

(Supervisor

Social Spport) 4

(Coworker Social Support) 4

(Job Insecurity) 6

31

Koh (2001)

30~60 244

. 9 16, 23

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9 22 10 22

125 가

51.2% . 125

30~60

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4. 가

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3. 가

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Students t-test

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3

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Mantel-SAS

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(hierarchical structure)

(, ,)

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(, 2002).

()

(NIOSH Lifting Guide) 가

RULA (Rapid Upper Limb Assessment), REBA (Rapid Entire Body Assessment), 가 JSI (Job Strain Index) 가

가

가 (=23x x)

null model

가 1

2 x x x x)

가 1

3 , 3 , 3

가

가

full model

가 63 cm

가

Variance partition coefficient(VPC, /(+))

RULA 가

1~2

MIwin1.1 , 5% , 3~4 , 5~6 , 7

가 REBA 가 15.1% 47.3%,
 3 , 4~7 36.6%
 , 8~10 . 11
 가 . 가 . 1 가 4
 JSI 가 , 3 37.5 28.2% ,
 , 7 1.2%
 가 가 가
 가 (Table 1).
 (97.6%)
 1. 3.9 가
 98 (41.5%) (Table 1).
 50
 30.7% 9.9% 3.1 가 47.6% 가 , , ,
 59.6%가 , 가 .

Table 1. General characteristics of the subjects N(%)

Characteristics		Caterers (N=385)	Housewives (N=114)	p-value
Age	39	100 (26.0)	3 (2.6)	
	40~49	247 (64.2)	76 (66.7)	
Education	50	38 (9.9)	35 (30.7)	<0.0001
	Elementary	15 (4.0)	6 (5.4)	
	Middle	79 (21.3)	12 (10.7)	
	High	221 (59.6)	53 (47.3)	
Marital status	College	56 (15.1)	41 (36.6)	<0.0001
	Married	362 (96.0)	104 (92.0)	
Family income per one (10,000won)	Single or separated	15 (4.0)	9 (8.0)	0.09
	37.4	78 (28.2)	1 (1.2)	
Hosework hours per day	37.5~49.9	53 (19.1)	12 (14.8)	
	50~74.9	105 (37.9)	25 (30.9)	
	75	41 (14.8)	43 (53.1)	<0.0001
	3.9	186 (51.7)	51 (49.5)	
Employment type	4~7.9	166 (46.1)	46 (44.7)	
	8	8 (2.2)	6 (5.8)	0.17
Tenure(years)	Regular	8 (2.4)	-	
	Contingent	327 (97.6)	-	-
Member of labor union	Average	3.9 ± 2.9	-	
	2.9	172 (47.4)	-	
	3~6.9	114 (31.4)	-	
	7	77 (21.2)	-	-
Member of labor union	Yes	98 (41.5)	-	
	No	138 (58.5)	-	-

가 57.5% , 701 ~ 1100 가 32.5% 가 , 1501 ~ 2000 가 22.5% , 5 ~ 9 가 61.0% 가 (Table 2).

80.6% , (Table 2).

2. 701-1100 5.5 , 1101 ~ 1500 6.5 , 1501 ~ 2000 9.7 , (1995) (Fig. 1). 1 200 가 37.5% 가 , 150 가 26.3% 가 (Table 2). 7.6 .

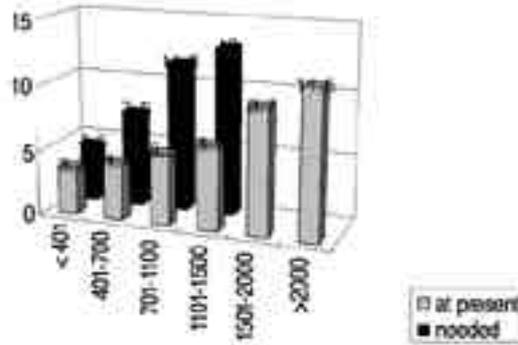


Fig. 1. Caterers by total number of lunches

Table 2. Characteristics of the schools and labor condition

Characteristics	N	%	
Area	Seoul	40	47.6
	Kwangju, Jeonbuk	19	22.6
	Daegu, Gyeongnam	13	15.5
	Incheon, Gyeonggi	12	14.3
Type of lunch service	Direct management	61	100
	Contract	0	0.0
Lunchroom	Yes	34	42.5
	No	46	57.5
Number of lunches	400	6	7.5
	401~700	7	8.8
	701~1100	26	32.5
	1101~1500	15	18.8
	1501~2000	18	22.5
	2001	8	10.0
Caterers per school	3~4	16	19.5
	5~9	50	61.0
	10~14	16	19.5
The number of lunches per caterer	149	21	26.3
	150~199	29	36.3
Working hours per day	200	30	37.5
	7.6 ± 0.6		
Rest	Yes	50	80.6
	No	12	19.4

49.7 , 3.
38.3 , 20.4 ,
8.2 .
67.0 , 69.0 , , , (Table 4).
가 (Table 3). 6 3

Table 3. Scores of job stress domains and stress response

		Mean \pm S.D	
		Caterers	Housewives
Job stress	Decision latitude	49.7 \pm 10.6	-
	Psychological job demands	38.3 \pm 5.9	-
	Social support	20.4 \pm 4.5	-
	Job insecurity	8.2 \pm 2.0	-
Stress response	67.0 \pm 25.5	69.0 \pm 25.4	

Table 4. Ergonomic assessment

Part	Working process	Score					Risk (The highest)
		RULA*	REBA [†]	JSI [‡]	LIo	NLG [§] LI [¶]	
Soup part	Processing vegetables	5	-	7	-	-	middle
	Carring a soup container	7	-	-	0.91	1.12	high
	Cleaning the tableware	6	-	6.75	-	-	middle
	Cleaning the spoon bag	6	-	6.75	-	-	middle
	Put the dishes in	-	-	18	-	-	high
	Take the dishes out	-	12	-	HD** >63 cm	-	high
Rice part	Carring a rice container	-	-	-	2.24	2.24	middle
	Preparing the dishes	6	-	-	-	-	middle
	Preparing a box of kimchi	-	-	5.06	-	-	middle
	Cleaning the vehicle for service	7	-	-	-	-	high
	Cleaning the sewage drain	-	13	13.5	-	-	high
Side dish part	Mixing a salad	6	-	-	-	-	middle
	Dishing up	-	-	6	-	-	middle
	Carring the food	6	-	-	-	-	middle
	Cleaning the dishes	5	-	18	-	-	high
	Cleaning the jerking bowl	6	-	-	-	-	middle

*RULA; Rapid upper limb assessment

†REBA; Rapid entire body assessment

‡JSI; Job strain index

§NLG; NIOSH lifting guide

LIo; Lifting index of origin

¶LI[¶]; Lifting index of destination

**HD; Horizontal distance

JSI 가 18 가 ,), , (,
RULA REBA 가
4.
20 (8.2 kg) 1)
(1200), 가 70 cm 52.0%,
24.9% ,
5 ,
2 , 가 1 , 가
가
가 5.01 (95%
가 1.44 ~ 17.45)
가 (Table 5).
/ 가 가 (17 kg) (23.6%), (21.4%), / (14.5%),
가 (13.6%) 가
, 가 ?
52.9%가
가 , 36%가 가
80% , , . 8.9%
가 (Table
가 JSI).
가 18 가
가 17 6
가 , 가

Table 5. Musculoskeletal symptoms of the subjects N (%)

	Caterers (N=385)	Housewives (N=114)
Positive musculoskeletal symptoms**	192 (52.0)	30 (27.3)
Severe musculoskeletal symptoms**	92 (24.9)	5 (4.6)
Odds ratio [†]	5.01*	1
(95% Confidence interval)	(1.44-17.45)	

*p<0.05 ** p<0.01

[†] Model adjusted for age, education, family income per one, housework hours and stress

(Table 6). 가 (Table 7). 가
 가 1 157.6 1, 2, 3
 가 190.5 (Table 8). VPC
 1 가 150 1 54.3 , 2, 3 54.0,
 가 26.3% , 150 52.5 . 1 null model
 62.5% 가 ,

Table 6. Musculoskeletal symptoms and individual factors in the caterers N (%)

		Musculoskeletal symptoms		p-value
		Yes (N=92)	No (N=277)	
Demographic factor				
Age	39	20 (20.4)	78 (79.6)	0.184
	40~49	60 (25.2)	178 (74.8)	
Education	50	12 (36.4)	21 (63.6)	0.230
	High	70 (26.3)	196 (73.7)	
	middle	18 (20.0)	72 (80.0)	
Hosework hours per day		3.57 ± 1.6	3.63 ± 1.5	0.744
Factors related to the job				
Tenure (years)	2.9	33 (19.8)	134 (80.2)	0.169
	3-6.9	29 (26.6)	80 (73.4)	
	7	22 (30.1)	51 (69.9)	
Member of labor union	Yes	24 (25.0)	72 (75.0)	0.503
	No	38 (29.0)	93 (71.0)	
Job stress	Decision Latitude	49.9 ± 10.4	49.4 ± 10.8	0.727
	Psychological Job Demands	40.0 ± 5.7	37.9 ± 5.9	0.009
	Social Support	20.4 ± 4.3	20.5 ± 4.7	0.848
	Job Insecurity	8.5 ± 2.1	8.0 ± 2.0	0.143

Table 7. Musculoskeletal symptoms and school factors in the caterers N (%)

		Complaint proportion		p-value
		0%(N=36)	>0%(N=43)	
The number of lunches per caterer	<150	14 (73.7)	5 (26.3)	0.006
	150	21 (37.5)	35 (62.5)	
Lunchroom	Yes	20 (64.5)	11 (35.5)	0.009
	No	15 (34.1)	29 (65.9)	
Rest	Yes	20 (42.6)	27 (57.5)	1.000
	No	4 (36.4)	7 (63.6)	

, full model 1.9(95% 1.5 ~ 2.5)
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Table 8. Multilevel analysis about risk factors related to musculoskeletal symptoms

Parameters	Model 1 [†]	Model 2 [‡]	Model 3 [§]
Fixed effect			
Odds ratio (95% Confidence interval)			
Age			1.06 (0.98~1.15)
Decision latitude			0.99 (0.96~1.03)
Psychiatric demand			1.06 (0.98~1.13)
Social support			1.01 (0.92~1.11)
Insecurity			1
Lunchroom	Yes		1.67 (0.25~1.79)
	No		0.67 (0.25~1.79)
Random effect			
Odds ratio (95% Confidence interval)			
The number of lunches per caterer	<150 150	1 2.18 (0.87-5.44)	4.67 (1.04~21.0)*
Variance (standard error)			
School level	1.189 (0.375)**	1.175 (0.391)**	1.105 (0.555)*
Individual level	1.000 (0.000)	1.000 (0.000)	1.000 (0.000)
Variance partition coefficient	54.3	54.0	52.5

*p<0.05 **p<0.01

[†]Model 1 included only constant

[‡]Model 2 included the number of lunches to be prepared per caterer for random effect

[§]Model 3 added age, job stress and lunchroom for fixed effect to model 2

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8~11 kg

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(1995)

400

20

4.1~4.8 , 401~700

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2003 9 15 2003 10 15 385

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effect) 가 가 , 114 2003

- VDT
1998;10(4):463-75.
- 가. 2003;15(4):422-35.
2003. pp 15-48.
- / . 2000.
- 2004;16
(1):92-102.
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