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Abstract

Daytime Sleepiness and Fatigue in Male Adults in Relation to Shift Work

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Objectives: The purpose of this study was to examine daytime sleepiness-related factors, including sleeping patterns and daytime activities, in shift and non-shift workers.

Methods: One hundred and twenty two shift workers, and two hundred and fifty four non-shift workers, were selected and identified in terms of their general characteristics, such as age, tenure, educational level, marital status and religion. Screening questionnaires were composed of the Epworth Sleepiness Scale (ESS) for evaluation of daytime sleepiness, the Multidimensional Fatigue Scale (MFS) for fatigue, and the Korean version of the National Institute for Occupational Safety and Health (NIOSH) for sleeping patterns.

Results: The shift worker group reported significantly higher rates of sleep disturbance and higher fatigue scores compared with the non-shift workers (all $p < 0.01$). The prevalence of daytime sleepiness was higher in the shift workers (19.7%) than the non-shift workers (10.6%) ($p < 0.05$). The significant daytime sleepiness-related factors were found to be shift work, tenure and difficulties in falling back to sleep once woken ($p < 0.05$). Shift work was proved to be an important factor in workers aged less than 40 years ($p < 0.05$). However, this association was not evident in workers aged 40 years and over.

Conclusions: The shift workers showed a significantly higher prevalence of daytime sleepiness compared with the non-shift workers. The present study suggests a need for the implementation of sleeping and fatigue management programs for shift workers in order to improve working efficiency and control safety accidents during shift work.

Key Words: Shift workers, Daytime sleepiness, Sleep disturbance, Fatigue

가 . 가

(shift work) 가 (Yang, 2001).

9 5 8 가 (Stanford sleepiness scale)(Hoddes, 1973) Epworth (Epworth sleepiness scale)(John, 1991)가 .

(Kim, 2002). 가 (Johns Hocking, 1997).

가 , 19.6%가 25% 15~20%, (LaDou, 1997). 2004 5 가 .

가 15~30%가 73,884 19.6%가 (Ministry of Labor, 2004).

가 , 가 . 가

(Kim, 1996). 가 가 . 가

(Ong Kogi, 1990). 가 가 .

가 , 가 .

1.

(Yang, 2001). 가 1499 , 가 1917 300 , 300 가 254 (Kryger, 2000). 가 6.7% 122 (Hublin, 1996) 17.6%(Hyppa Kronholm, 1987) 가 9 18 (Asplund, 1996). Broughton (1981) 가 가 1 6 , , , , 4 3 , 8 16 , 16 23 , 23 8 1 가 (Findley, 1995). 가 가 9 6 . (Leiter, 1985; Carskadon, 1990; Roehrs, 1995). 4 1 , 4 1 (excessive sleepiness disorders) , 4 1 , 4

2 , ESS 9
 64 4 . 64 (Bloch , 1999).
 28 Schwartz (1993)
 48 48 3 . 29 Chang(2000)
 48 28 19
 . 168 (Multidimensional Fatigue Scale; MFS)
 64 . 56- MFS 19 (,
 ,) 133 ,
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 2. 4-5-6-7 .
 2004 6 3.
 가 , 2004 12 13
 2005 2 28 SPSS(Statistical Package for
 Social Science) Windows version 12.0
 .
 4 , 2 6 , X²
 , (Chi-Square Test) . ,
 , ,
 t- (t-test) .
 , , X² .
 , ,
 1979 National Institute for (multiple regression)
 Occupational Safety and Health(NIOSH) .
 (Patricia, 1992)
 Lee Chung(1995) ,
 , 가 ,
 ,
) 122 , (;
) 254 .
 가 Lee(2003)가 Epworth (가 가)
 (Epworth Sleepiness Scale; ESS) 30 가 가 38.0 ,
 . ESS 8가 1) , 36.3 .
 2) , 3) 20 가 가
 , 4) 33.1% 가 , 3~10 가
 , 5) 38.4% 가 ,
 , 7) 가 (p<0.05),
 , 8) 14.0 11.6 .
 ' 0 , 11.0%, 18.0%
 ' 1 , ' 2 , ' 가
 ' 3 ESS 24 가
 . ESS 10 24 78.7%, 77.9% ,

가 44.3% 가 42.1%, (p<0.05). (Table 1).
 2. 가 ?', ' ?' 가 (p<0.05).
 , 17.9 가 23.3 " " 0.8% ,
 , ' 40 가 1.6% (p>0.05)(Table 2).
 4.4%, 11.5% 가 (p<0.05). 3.
 1.5 가 0.9 ,
 2 , ' 가
 18.0%, 46.7% ?' ' 가
 가 ?', ' ?'
 (p<0.05). ?'
 가 (p<0.05)(Table 3).
 6.6 , 7.0

Table 1. General characteristics of study subjects Unit : N(%)

Characteristics	Non-shift workers (n=254)	Shift workers (n=122)	p-value
Age(year)			
< 30	29 (11.4)	27 (22.1)	0.138
30 ~ 39	126 (49.6)	56 (45.9)	
40	99 (39.0)	39 (32.0)	
Tenure(years)			
< 3	32 (12.6)	27 (22.1)	0.003
3 ~ 10	80 (31.5)	45 (36.9)	
11 ~ 20	58 (22.8)	22 (18.0)	
20 <	84 (33.1)	28 (23.0)	
Education level			
High school graduation	28 (11.0)	22 (18.0)	0.201
College graduation	53 (20.9)	14 (11.5)	
University graduation	148 (58.3)	81 (66.4)	
Graduate school graduation	25 (9.8)	5 (4.1)	
Marital status			
Unmarried	32 (12.6)	15 (12.3)	0.931
Married(living together)	200 (78.7)	95 (77.9)	
Married(limited divorce)	22 (8.7)	12 (9.8)	
Religion			
Christianity	54 (21.3)	23 (18.9)	0.416
Catholicism	43 (16.9)	15 (12.3)	
Buddhism	43 (16.9)	27 (22.1)	
None	107 (42.1)	54 (44.3)	
Others	7 (2.8)	3 (2.5)	

4.9 가 , 6.8 가 (p<0.05).
 30 가 (p<0.05), 62.7 가 , 70.5 가
 65.2 .

Table 2. Sleep conditions of study subjects

Unit : Mean ± SD or N (%)

Characteristics	Non-shift workers (n=254)	Shift workers (122)	p-value
Sleep onset latency (min)	17.91 ± 12.38	23.29 ± 17.38	0.003
Number of awakenings	0.86 ± 0.94	1.52 ± 1.27	0.000
Total sleep time (hours)	6.58 ± 1.10	6.95 ± 1.15	0.006
Sleep time in a day			
Only one time	213 (83.9)	15 (12.3)	
Over two times	34 (13.0)	13 (10.7)	0.000
Irregular	7 (2.8)	94 (77.0)	
Difficulty in falling asleep			
Never	120 (47.2)	21 (17.2)	
Sometimes	113 (44.5)	68 (55.7)	0.000
Frequently	18 (7.1)	29 (23.8)	
Always	3 (1.2)	4 (3.3)	
Quality of sleep			
Excellent	104 (40.9)	21 (17.2)	
Good	97 (38.2)	42 (34.4)	0.000
Fair	39 (15.4)	37 (30.3)	
Bad	14 (5.5)	22 (18.0)	
Use of hypnotic drug	2 (0.8)	2 (1.6)	0.264

Table 3. Fatigue or drowse of study subjects

Unit : N (%)

Characteristics	Non-shift workers (n=254)	Shift workers (n=122)	p-value
Fatigue or drowse in the morning			
Never	73 (28.7)	8 (6.6)	
Sometimes	119 (46.9)	54 (44.3)	0.000
Frequently	36 (14.2)	44 (36.1)	
Always	26 (10.2)	16 (13.1)	
Fatigue or drowse during the work			
Never	85 (33.5)	12 (9.8)	
1 ~ 2 times a month	82 (32.3)	44 (36.1)	
1 time a week	49 (19.3)	37 (30.3)	0.000
2 ~ 3 times a week	32 (12.6)	24 (19.7)	
over 4 times a week	6 (2.4)	5 (4.1)	
Fatigue or drowse after the work			
Never	79 (31.1)	7 (5.7)	
1 ~ 2 times a month	86 (33.9)	41 (33.6)	
1 time a week	46 (18.1)	33 (27.0)	0.000
2 ~ 3 times a week	37 (14.6)	29 (23.8)	
over 4 times a week	6 (2.4)	12 (9.8)	

30 가 가 5.
(p>0.05)(Table 4).

4. , ,

Epworth Sleepiness Scale 가 10 (p<0.05)(Table 6).

10.6% , 19.7% 40 40

(p<0.05). 40 가

30 11.9%, (p<0.05) , 40

25.0% (p<0.05), (Table 7).

30 40

(p>0.05).

3 ,

3 ~ 10 , 11 ~ 20 , 21

rhythms

1991

Biological
20%가

(p>0.05)(Table 5).

Table 4. Mean values * of the Epworth sleepiness scale and the Multidimensional fatigue scale by age Unit : Mean ± SD

Characteristics	Non-shift workers (n=254)	p value	Shift workers (n=122)	p value
ESS [†] (24score) Mean	4.85 ± 0.22		6.78 ± 0.32	0.000
Age(years) < 30	3.79 ± 4.27		6.96 ± 2.67	
30 ~ 39	4.84 ± 3.64	0.190	7.46 ± 3.02	0.026
40	5.18 ± 3.32		5.64 ± 3.79	
MFS [‡] (133score) Mean	62.67 ± 1.69		70.52 ± 2.43	0.001
Age(years) < 30	50.69 ± 34.49		71.37 ± 20.86	
30 ~ 39	63.60 ± 29.10	0.054	74.41 ± 23.63	0.116
40	64.99 ± 26.23		64.36 ± 23.92	

* Values are the age adjusted mean ± s.e.

[†]ESS ; Epworth sleepiness scale

[‡]MFS ; Multidimensional fatigue scale

Table 5. The prevalence of day time sleepiness* by age and tenure Unit: %

Characteristics	Non-shift workers (n=254)	Shift workers (n=122)	p-value
Age(years)			
< 30	10.3	14.8	0.613
30 ~ 39	11.9	25.0	0.026
40	9.1	15.4	0.285
Tenure(years)			
< 3	9.4	14.8	0.520
3 ~ 10	15.0	24.4	0.191
11 ~ 20	10.3	18.2	0.344
20<	7.1	17.9	0.099
Total	10.6	19.7	0.017

*Epworth sleepiness scale 10

75% (Akerstedt, 1992). 25% (5%)가 (Yang, 2001). (Gordon, 1986). Rutenfranz Knauth(1988) 95% 40% 가 (Yang, 2001). Hwang (1998) MFS 62.7±1.7, 70.5± 6.8±1.5 2.4 6.5±1.0 가 7.0±1.2 가 6.6±1.1 가 (Carskadon Dement, 1982). 40 2 Roehrs (1996) 가 Epworth 가 10 Lee Chung(1995) 10.6%, 19.7% 8 Smith Colligan(1982) 가 가 가 8 가

Table 6. Multiple regression analysis of selected variables for the Epworth sleepiness scale

Dependant variable	Independant variables	B	95% Confidence Interval	p-value
ESS [†]	Constant	5.094	-	0.000
	Shift work	1.051	0.308~1.794	0.006
	Tenure	-0.002	-0.003~-0.001	0.000
	Difficulty in falling asleep	1.941	0.951~2.932	0.000

[†]ESS ; Epworth sleepiness scale

Table 7. Multiple regression analysis of selected variables for the Epworth sleepiness scale in workers aged less than 39 years and workers aged more than 40 years

Dependant variable	Independant variables	Age < 40		Age ≥ 40	
		B	95% Confidence Interval	B	95% Confidence Interval
ESS [†]	Constant	5.040	-	5.101	-
	Shift work	1.751	0.794~2.708	-0.276	-1.446~-0.893
	Tenure	0.001	-0.005~-0.008	-0.002	-0.003~-0.001
	Difficulty in falling asleep	1.559	0.313~2.806	2.468	0.847~4.089

[†]ESS ; Epworth sleepiness scale

Epworth 5.5±
 3.6 Lee(2003) 6.8±3.2 : 122 ,
 Johns Hocking(1997) 4.6 254 , , ,
 ±2.8 , Parkes (1998) 4.5±3.3 , , ,
 가 NIOSH ,
 9.6±3.2 (Lee, Epworth ,
 2003), Gus (2002) ,
 4.7± :
 3.9 , 6.0±4.8 , 7.0±5.7 가 . (p<0.01),
 Kim (1998) 6.9±3.0 , Kim (p<0.01). Epworth
 8.7±3.0 가 10 ,
 4.9±0.2 6.8±0.3 19.7% 10.6%,
 가 (p<0.05).
 가 (p<0.05).
 40 40 가 (p<0.05) ,
 가 :
 가 .
 가 ,
 (healthy worker effect) 가 .

40

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