

Association of inflammatory markers with shift-work and sleep disorder in Korean firefighters: a cross-sectional study.

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BACKGROUND

- Firefighters are generally exposed to known harmful factor: shift work.
- In previous studies, elevation of inflammation markers (Tumor necrosis factor-alpha(TNF- α), high-sensitivity c-reactive protein(hsCRP) interleukin-6(IL-6) was observed in shift workers.
- A study of meta-analysis of sleep disturbances, sleep duration and inflammation markers has shown a link between sleep disturbances and CRP and IL-6.

STUDY OBJECTIVES

- To assess the association of sleep disturbances and inflammatory markers (hsCRP, TNF- α , IL-6 and granulocyte-macrophage colony-stimulating factor(GM-CSF)) in Korean Firefighters doing shiftwork.

METHODS

- 516 firefighters randomly sampled from fire departments in Korea were surveyed about sociodemographic and occupational characteristics.
- 88 firefighters working only in the daytime were excluded.
- Blood was collected for inflammatory markers. In shiftwork firefighters, we measured twice each before and after shiftwork.
- Insomnia severity index(ISI) and the Epworth sleepiness scale (ESS) were measured for sleep disturbances.
- Blood level of hsCRP, IL6, TNF- α before shiftwork and after shiftwork were compared and Wilcoxon signed-rank test was used for analysis.
- Blood level of hsCRP, IL6, TNF- α , GM-CSF and WBC between each sleep disturbance group were compared and Wilcoxon rank-sum test was used for analysis.

RESULTS

- There was no significant difference in CRP before and after nightwork, but decrease of IL-6 and TNF- α were observed after nightwork.

*geometric mean \pm geometric standard deviation

†arithmetic mean \pm arithmetic standard deviation

TABLE 1. Change of Inflammatory markers before-after nightwork

Outcomes	Before nightwork	After nightwork	P-value	Signed-Rank
hsCRP (N=227)†	0.66 \pm 2.77	0.66 \pm 2.58	0.106	1549.5
IL-6 (N=218)*	1.154 \pm 1.010	1.174 \pm 2.133	0.046	-1805
TNF- α (N=227)*	0.764 \pm 0.283	0.724 \pm 0.244	0.001	-3092

- We set ISI cutoff for insomnia by 15 points. And there was no significant difference between insomnia group and non-insomnia group in general characteristic and inflammatory marker level.

TABLE 2. Participant Characteristics and Outcome by Insomnia Severity Index

Characteristic	Non-Insomnia (N=384)	Insomnia (N=44)	P-value
Age †	39.9 \pm 8.77	41.5 \pm 8.09	0.245
Years of Service†	11.8 \pm 9.07	13.2 \pm 7.60	0.174
Years of shiftwork†	10.5 \pm 8.27	11.6 \pm 7.23	0.423
BMI†	24.2 \pm 2.53	23.8 \pm 2.43	0.309
Shiftwork schedule			
3-day cycle	67(17.5%)	8(18.2%)	0.996
6-day cycle	79(20.5%)	9(20.5%)	
9-day cycle	83(21.6%)	10(22.7%)	
21-day cycle	155(40.4%)	17(38.6%)	
Job			
Fire Suppression	126(32.8%)	11(25.0%)	0.394
Non-Fire Suppression	258(67.2%)	33(75.0%)	
Outcome			
hsCRP*	0.66 \pm 2.805	0.61 \pm 2.494	0.637
IL-6†	1.17 \pm 1.023	1.04 \pm 0.884	0.701
TNF- α †	0.77 \pm 0.292	0.71 \pm 0.172	0.748
GM-CSF†	0.24 \pm 0.247	0.22 \pm 0.125	0.704
WBC†	5.98 \pm 1.490	6.34 \pm 1.629	0.362

- We divided Firefighters into two group, Excessive Daytime Sleepiness group(EDS group) and non-EDS group by ESS score 11 GM-CSF was the only inflammatory marker which had significant difference between EDS group and non-EDS group in general characteristic and inflammatory marker level.

TABLE 3. Participant Characteristics and Outcome by Epworth sleepiness scale

Characteristic	NON-EDS (N=354)	EDS (N=74)	P-value
Age †	40.1 \pm 8.60	39.9 \pm 9.24	0.845
Years of Service†	11.8 \pm 9.07	13.2 \pm 7.60	0.909
Years of shiftwork†	10.7 \pm 8.08	10.2 \pm 8.70	0.667
BMI†	24.1 \pm 2.50	24.3 \pm 2.58	0.627
Shiftwork schedule			
3-day cycle	63(17.8%)	12(16.2%)	0.675
6-day cycle	69(19.5%)	19(25.7%)	
9-day cycle	77(21.8%)	16(21.6%)	
21-day cycle	145(40.9%)	27(36.5%)	
Job			
Fire Suppression	115(32.5%)	22(29.7%)	0.683
Non-Fire Suppression	239(67.5%)	52(70.3%)	
Outcome			
hsCRP*	0.64 \pm 2.683	0.76 \pm 3.207	0.344
IL-6†	1.12 \pm 0.980	1.31 \pm 1.140	0.357
TNF- α †	0.76 \pm 0.289	0.77 \pm 0.254	0.696
GM-CSF†	0.23 \pm 0.244	0.28 \pm 0.190	0.006
WBC†	5.95 \pm 1.466	6.30 \pm 1.663	0.432

CONCLUSIONS

- There was no significant difference in CRP before and after nightwork. But IL-6 and TNF- α level decreased after work but, this could be the result of heterogenous nightwork intensity of firefighters.
- In the analysis with sleep disorders, only EDS group showed higher GM-CSF level compared to normal group.
- GM-CSF was correlated to EDS after adjustment for confounding factors (β =0.282, 95% CI=0.083~0.4816, $p < 0.05$)
- There was positive relationship with excessive daytime sleepiness with GM-CSF. GM-CSF may be biological marker for EDS.

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