Relationship between shift work and liver enzymes: A cross-sectional study based on the Korea National Health and Examination Survey (2007-2015)

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감사의 글

본 논문의 처음 연구 계획에서부터 완성에 이르기까지 학문적 기틀을 잡아주시고 관심과 소상한 가르침으로 지도해 주신 고상백 지도 교수님께 진심으로 감사드립니다. 바쁜 일정 속에서도 귀중한 시간을 내어 논문 작성과 심사에 조언과 격려를 해주신 안연순 교수님, 오성수 교수님께도 깊이 감사드립니다.

또한 본 논문을 준비하는 동안 항상 관심을 가지고 지켜봐주신 장세진 교수님, 김춘배 교수님, 강희태 교수님, 김성경 교수님께도 감사드립니다. 논문 작성에 여러 도움을 주신 직업환경의학과 의국, 외래, 보건관리대행, 예방의학교실, 직업 및 환경의학연구소 모든 선생님들께도 감사드립니다.

논문의 시작부터 맺기까지 많은 분들의 도움이 있었기에 가능했습니다. 그 동안 저를 지도해주시고 격려해 주신 모든 분들께 이 자리를 빌어 감사의 말씀을 드립니다.

지금에 있기까지 언제나 사랑으로 지원해주신 부모님과 시부모님, 사랑하는 자매들에게 감사드리며, 가장 가까운 곳에서 든든한 버팀목이 되어준 사랑하는 남편 강희승에게 감사의 말을 전합니다.

2019년 6월

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Abstract

Relationship between shift work and liver enzymes: A cross-sectional study based on the Korea National Health and Examination Survey (2007-2015)

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(Directed by Professor Sang-Baek Koh)

Background : Shift work has well-known adverse effects on health. However, few studies have investigated the relationship between shift work and hepatic disorders. This study aimed to evaluate the association between shift work and abnormal level of liver enzymes.

Methods : The aggregated data from the 2007 - 2009, 2010 - 2012, and 2013 - 2015 cycles of the Korea National Health and Nutrition Examination Survey (KNHANES) was used for this study. The chi-square test and multiple logistic regression analysis were used to assess relationship between shift work and abnormal level of liver enzymes stratified by gender.

Results : The odds ratio of abnormal level of alanine aminotransferase (abnormal ALT) in female shift workers was higher with 1.31 (95% CI 1.00-1.71) compared with day workers after adjusting for covariates. After dividing into subgroups of the shift work pattern, the odds ratios of abnormal liver enzymes for each patterns compared with day work were not significantly higher.

Conclusion : This study provides limited support for the hypothesis that shift work is related to liver enzyme abnormalities, but offers some evidence in favor of the idea that shift work affects female workers more than males on abnormal ALT. Further studies are needed to define the relationship between shift work and abnormal liver enzymes to be carried out as well as the gender difference in the association.

Key words : Shift work, Abnormal level of liver enzymes, Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), KNHANES

Relationship between shift work and liver enzymes: A cross-sectional study based on the Korea National Health and Examination Survey (2007-2015)

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Ⅰ. Background

Hepatic disorder is a major concern in Korea and many other countries. Since the liver is a primary organ involved in biotransformation of food and drugs, hepatic disorders are very often. The determination of various liver enzymes in serum is used to evaluate the functional status of the liver. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) activities in serum are the most frequently used indicators for evaluation of liver dysfunction.[1-2] The increase in these liver enzymes can be caused by viruses, bacterial infections, alcohol or toxic substances,

excessive accumulation of fat or heavy metals, and abnormal immune responses.[3]

In addition, recent studies suggest that there is a relationship between liver health and specific occupations, especially shift work. Shift work has become universal throughout the world. At least 15% of workers are engaged in shift work in the European Union[4] and United States[5] and estimated 10.2 – 14.5 % of wage earners in Korea (1.27 – 1.97 million people) perform night shift work.[6-7] Shift work is an important and well-known health hazard in the modern workplace. Unlike day workers, shift workers are exposed to light at night and can interfere with sleep and circadian rhythms.[8] And it can cause various health problems. Shift work is known to be related with chronic diseases such as cardiovascular diseases, diabetes mellitus, metabolic syndrome, and breast cancer.[9] Interestingly, abnormal liver function is widespread among many occupations including shift work. Although inconclusive, several studies have shown that shift work is associated with abnormal level of liver enzymes.[10-13]

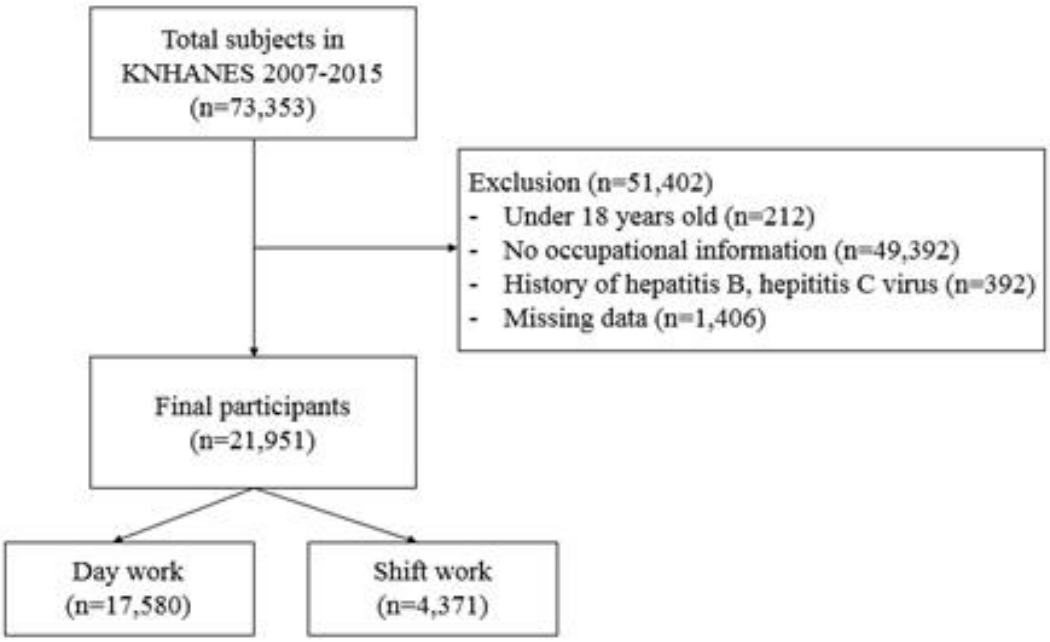
The aim of the present study was to investigate the relationship between shift work and abnormal level of liver enzymes, utilizing data from the Korea National Health and Nutrition Examination Survey (KNHANES).

Ⅱ. Methods

A. Participants

This study used aggregated data from the 2007 - 2009, 2010 - 2012, and 2013 - 2015 cycles of the KNHANES. The KNHANES is a national cross-sectional survey gathered annually by the Korea Centers for Disease Control and Prevention (KCDC), and is designed according to multistage stratified and cluster sampling. The data includes health questionnaire and blood test results. Participants who were at least 18 years old, and who had occupational information were included in this study. Individuals who had Hepatitis B and Hepatitis C were excluded from the analysis. In addition, individuals with missing values for major variables and covariates were also excluded. Finally, 51,402 were excluded from the analysis and a total of 21,951 participants were included in the analysis (Figure 1).

Fig. 1. A flow of the study design.



B. Shift work and Day work

In KNHANES, work groups were divided as follows. "Do you usually work during the day time (between 6 a.m. and 6 p.m.)? Or are you working in another time?". Participants who answered "Usually work during the day time (between 6 a.m. and 6 p.m.)" were classified as day workers, and other participants who answered "fixed-evening shift (between 2 p.m. and 24:00), fixed-night shift (between 9 p.m. and 8 a.m. next day), regular day and night rotating shift, 24-hours rotating shift, split shift (working two shifts in one day), irregular rotating shift, and others" were classified as shift workers.

C. Definition of abnormal level of liver enzymes

According to the standard reference limit, abnormal serum level of aspartate aminotransferase (abnormal AST) was defined as AST > 40 IU/L, and abnormal serum level of alanine aminotransferase (abnormal ALT) was defined as ALT > 35 IU/L.[14]

D. Covariates

Age, sex, smoking status, drinking status, hours of sleep, body mass index (BMI), physical activity and history of disease (hypertension,

diabetes mellitus and dyslipidemia) were included as potential confounding variables. Information regarding demographic and social factors was obtained using a standardized questionnaire in health interviews. Age was divided into 6 groups: 18-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years and above 70 years. Smoking status was divided into non-smokers, ex-smokers, and current smokers. Drinking status was divided into non-drinkers, social-drinkers, and binge-drinkers. Social drinkers are categorized as drinking less than 5 units of alcohol per time, and binge drinkers are categorized as drinking 5 or more units of alcohol per time.[15] Hours of sleep were categorized into three groups (<7 hours, 7 - 9 hours and >9 hours per night) according to appropriate sleep durations recommended by the National Sleep Foundation.[16] BMI was calculated by dividing body weight by height squared (kg/m2). As for physical activity, the subjects were grouped according to whether they performed exercise over 10 minutes that are more strenuous than usual activities or not.

E. Statistical analysis

The t-test and the chi-square test were used to examine the general characteristics of the study population with regarding to the abnormal level of liver enzymes. Relationship between the shift work and abnormal level of liver enzymes was examined using multiple logistic regression after stratification for gender. To reflect the impact of each variable, age, smoking status, drinking status, and physical activity were adjusted in

model 1, and hours of sleep, BMI, and history of disease were additionally adjusted in model 2. The statistical analyses were performed using SPSS version 23.0 to take into account sample weights and complex sample design effects.

Ⅲ. Results

A. General characteristics

The general characteristics of participants are shown in Table 1. From a total of 21,951 participants included in the final analysis, 11,288 (51.4%) were male and 10,663 (48.6%) were female. In the mean age, shift workers were younger than day workers in both male and female. The proportion of day workers was higher in both male and female workers. In patterns of shift work schedule, the proportion of fixed-evening shift was the highest in both male and female shift workers. Among lifestyle factors, the smoking rate and the proportion of sleeping less than 7 hours were higher in shift workers and the proportion of binge drinker in female shift workers was higher compared with female day workers.

Table 1. General characteristics of the subjects.

Variable		Male			Female		
		Day work	Shift work	p-value	Day work	Shift work	p-value
Total(N[a])		8954	2334		8626	2037	
Shift work patterns	fixed-evening shift		795(34.06)			1318(64.70)	
	fixed-night shift		427(18.29)			232(11.39)	
	regular day and night rotating shift		450(19.28)			181(8.89)	
	24-hours rotating shift		312(13.37)			65(3.19)	
	split shift		135(5.78)			113(5.55)	
	irregular rotating shift		215(9.21)			128(6.28)	
Age (years)		48.04±14.43	44.24±15.74	<0.01*	46.82±14.87	41.65±14.35	<0.01*
Age group	18-29	965(10.78)	503(21.55)	<0.01†	1,314(15.23)	519(25.48)	<0.01†
	30-39	1,850(20.66)	483(20.69)		1,591(18.44)	370(18.16)	
	40-49	2,002(22.36)	458(19.62)		1,932(22.40)	481(23.61)	
	50-59	2010(17.81)	394(16.88)		1,938(22.47)	448(21.99)	
	60-69	1,420(15.86)	373(15.98)		1,177(13.64)	167(8.20)	
	≥70	707(7.90)	123(5.27)		674(7.81)	52(2.55)	
Smoking Status	Non-Smoker	1,747(19.51)	515(22.07)	<0.01†	7,721(89.51)	1,694(83.16)	<0.01†
	Ex-Smoker	3,347(37.38)	604(25.88)		406(4.71)	87(4.27)	
	Current Smoker	3,860(43.11)	1,215(52.06)		499(5.78)	256(12.57)	
Drinking Status	Non-Drinker	1,177(13.14)	286(12.25)	0.26†	2,568(29.77)	481(23.61)	<0.01†
	Social-Drinker	2,958(33.04)	750(32.13)		4,667(54.10)	1,059(51.99)	
	Binge-Drinker	4,819(53.82)	1,298(56.61)		1,391(16.13)	497(24.40)	
Hours of sleep	<7	3,804(33.70)	1,017(43.57)	<0.01†	3,632(42.11)	887(43.54)	<0.01†
	7-9	4,649(51.92)	1,152(49.36)		4,424(51.29)	945(46.39)	
	>9	501(5.60)	165(7.07)		570(6.61)	205(10.06)	
BMI (kg/m2)	<23	205(2.29)	54(2.31)	0.92†	521(6.04)	156(7.66)	<0.01†
	23-25	5,345(59.69)	1,403(60.11)		5,747(66.62)	1,376(67.55)	
	≥25	3,404(38.02)	877(37.57)		2,358(27.34)	505(24.79)	

Physical activity	No	1,597(17.84)	293(12.55)	<0.01†	1,908(22.12)	383(18.80)	<0.01†
	Yes	7,357(82.16)	2,041(87.45)		6,718(77.88)	1,654(81.20)	
Hypertension	No	7,258(81.06)	1,956(83.80)	<0.01†	7,235(83.87)	1,817(89.20)	<0.01†
	Yes	1,696(18.94)	378(16.20)		1,391(16.13)	220(10.80)	
Diabetes Mellitus	No	8,272(92.38)	2,186(93.66)	0.03†	8,216(95.25)	1,974(96.91)	<0.01†
	Yes	682(7.62)	148(6.34)		410(4.75)	63(3.09)	
Dyslipidemia	No	8,090(90.35)	2,146(91.95)	0.01†	7,766(90.03)	1,869(91.75)	0.01†
	Yes	864(9.65)	188(8.05)		860(9.97)	168(8.25)	
AST (IU/L)		24.77±14.65	23.85±11.88	<0.01*	20.03±8.51	19.81±8.51	0.29*
AST status	Normal	8,350(93.25)	2,203(94.39)	0.05†	8,439(97.83)	1,986(97.50)	0.35†
	Abnormal	604(6.75)	131(5.61)		187(2.17)	51(2.50)	
ALT (IU/L)		26.64±21.94	25.87±18.01	0.12*	17.25±12.86	17.01±12.51	0.44*
ALT status	Normal	7,304(81.57)	1,895(81.19)	0.67†	8,195(95.00)	1,921(94.31)	0.19†
	Abnormal	1,650(18.43)	439(18.81)		431(5.00)	116(5.69)	

[a] unweighted count

Data are shown as N[a] (estimated percentage) for categorical variables and as mean ± standard error for continuous variables.

* : p-value by independent two sample t-test

† : p-value by chi-square test

B. Odds ratios of abnormal AST and abnormal ALT according to shift work

Association between shift work and abnormal AST, and between shift work and abnormal ALT by multiple logistic regression analysis are shown in Table 2. For male, the odds ratios (ORs) of abnormal AST and abnormal ALT in shift workers were found to be low, but the difference was not significant. For female, the OR of abnormal ALT in shift workers was 1.19 (95% CI 0.92 - 1.54) compared with day workers. After adjusting for age, smoking status, drinking status, and physical activity, the OR of abnormal ALT was significantly higher with OR 1.30 (95% CI 1.00 - 1.69). After additionally adjusting for hours of sleep, BMI, and history of disease, the same results were obtained 1.31 (95% CI 1.00-1.71).

Table 2. Crude and adjusted odds ratio for abnormal AST and abnormal ALT by shift work in male and female subjects.

		Abnormal AST		Abnormal ALT	
		Male	Female	Male	Female
Crude OR (95% CI)	Day work	Reference	Reference	Reference	Reference
	Shift work	0.81 (0.65-1.02)	1.20 (0.83-1.72)	0.99 (0.87-1.14)	1.19 (0.92-1.54)
Model 1	Day work	Reference	Reference	Reference	Reference
	Shift work	0.85 (0.68-1.06)	1.30 (0.90-1.87)	0.95 (0.83-1.09)	1.30 (1.00-1.69)
Model 2	Day work	Reference	Reference	Reference	Reference
	Shift work	0.85 (0.68-1.07)	1.30 (0.90-1.87)	0.96 (0.84-1.11)	1.31 (1.00-1.71)

OR, odds ratio; CI, confidence interval.

Model 1: Adjusted by age, smoking status, drinking status, physical activity.

Model 2: Model 1+hours of sleep, BMI, hypertension, diabetes mellitus, dyslipidemia

C. Odds ratios of abnormal AST and abnormal ALT according to work patterns

The work patterns were divided into 7 groups of day work, fixed-evening shift, fixed-night shift, regular day and night rotating shift, 24-hours rotating shift, split shift (working two shifts in one day), and irregular rotating shift (Table 3). The ORs of abnormal AST and abnormal ALT for all patterns of shift work compared with day work were not significantly higher in analysis stratified by sex.

Table 3. Crude and adjusted odds ratio for abnormal AST and abnormal ALT by shift work patterns male and female subjects.

		Abnormal AST		Abnormal ALT	
		Male	Female	Male	Female
Crude OR (95% CI)	day work	Reference	Reference	Reference	Reference
	fixed-evening shift	0.85(0.63-1.15)	0.88(0.54-1.42)	1.08(0.90-1.30)	1.20(0.85-1.69)
	fixed-night shift	1.13(0.67-1.89)	1.68(0.71-3.98)	1.02(0.73-1.43)	1.35(0.76-2.39)
	regular day and night rotating shift	0.89(0.52-1.53)	1.31(0.53-3.27)	1.07(0.77-1.50)	0.74(0.36-1.54)
	24-hours rotating shift	0.91(0.45-1.86)	0.17(0.02-1.23)	1.01(0.64-1.58)	0.49(0.22-1.11)
	split shift	1.78(0.88-3.58)	1.22(0.27-5.44)	1.48(0.92-2.38)	0.96(0.36-2.58)
	irregular rotating shift	0.69(0.36-1.35)	1.46(0.46-4.67)	1.12(0.73-1.71)	1.59(0.79-3.19)
Model 1	day work	Reference	Reference	Reference	Reference
	fixed-evening shift	0.86(0.63-1.16)	0.91(0.56-1.47)	1.06(0.88-1.28)	1.24(0.88-1.74)
	fixed-night shift	1.11(0.66-1.87)	1.74(0.73-4.17)	0.98(0.70-1.37)	1.39(0.78-2.47)
	regular day and night rotating shift	0.92(0.53-1.59)	1.29(0.52-3.21)	1.04(0.75-1.46)	0.75(0.36-1.54)
	24-hours rotating shift	0.89(0.43-1.81)	0.18(0.03-1.30)	1.00(0.64-1.57)	0.50(0.22-1.15)
	split shift	1.74(0.85-3.54)	1.41(0.32-6.31)	1.46(0.90-2.37)	1.06(0.40-2.84)
	irregular rotating shift	0.75(0.38-1.47)	1.67(0.52-5.39)	1.10(0.72-1.69)	1.76(0.88-.3.56)
Model 2	day work	Reference	Reference	Reference	Reference
	fixed-evening shift	0.86(0.63-1.17)	0.92(0.56-1.49)	1.06(0.87-1.30)	1.27(0.91-1.78)
	fixed-night shift	1.11(0.66-1.87)	1.75(0.74-4.15)	1.00(0.72-1.38)	1.40(0.80-2.46)
	regular day and night rotating shift	0.92(0.53-1.60)	1.33(0.53-3.34)	1.07(0.76-1.51)	0.77(0.36-1.61)
	24-hours rotating shift	0.91(0.44-1.86)	0.18(0.03-1.35)	1.07(0.69-1.67)	0.53(0.23-1.22)
	split shift	1.74(0.86-3.55)	1.39(0.31-6.21)	1.47(0.89-2.43)	1.03(0.38-2.77)
	irregular rotating shift	0.69(0.35-1.36)	1.67(0.53-5.24)	0.97(0.61-1.54)	1.77(0.85-3.68)

OR, odds ratio; CI, confidence interval.

Model 1: Adjusted by age, smoking status, drinking status, physical activity.

Model 2: Model 1+hours of sleep, BMI, hypertension, diabetes mellitus, dyslipidemia

Ⅳ. Discussion

This study analyzed relationship between shift work and abnormal level of liver enzymes in Koreans, using large-scale survey data. Gender difference on the association between shift work and abnormal liver enzymes was shown in this study. The results of the current study showed that shift work was associated with abnormal ALT in female workers (adjusted OR: 1.31, 95% CI 1.00-1.71). The association between shift work and abnormal AST in female was shown as the OR 1.30 (95% CI 0.90 - 1.87), but not statistically significant. However, there was no significant association between shift work and abnormal liver enzymes among male workers. When patterns of shift work were divided into subgroups, there were no significant differences between all patterns of shift work and risk of abnormal liver enzymes stratified by gender.

Abnormal liver function, usually indicated by liver enzyme abnormalities is common among workers in many occupations, which involve shift work.[10,11,13] The circadian clock system is the main factor in the association between shift work and the abnormal level of liver enzymes. Circadian clock system consists of a central clock located in the suprachiasmatic nucleus in the hypothalamus and peripheral clocks in peripheral tissues. Peripheral clocks in the liver play a fundamental role in maintaining liver homeostasis, including the regulation of energy metabolism and the expression of enzymes regulating the absorption and metabolism of xenobiotics.[17] Many experimental animal studies and clinical trials revealed

that significant genes, proteins and enzymes levels in livers are controlled by circadian rhythms to a great extent.[18-20] Also, there is still more evidence to support that the disruption of circadian rhythm is a crucial molecular mechanism in the pathogenesis from organic injury to fibrosis.[21-24] Shift work causes circadian disorganization between workers' activity and the normal rhythm of the liver. Such disorganization might exacerbate liver diseases, including fatty liver, cholestasis, hepatitis, cirrhosis and liver cancer, and these diseases can in turn disrupt the circadian clock system.[17]

Several previous studies have shown that shift work affects the risk of liver disorder. A 5-year retrospective cohort study by Lin et al. evaluated the impact of shift work on liver health and concluded that night shift work hindered the normalization of ALT.[12] In another study, it was found that persistent rotating shift work exposure significantly aggravates the development of abnormal ALT among employees with preexisting sonographic fatty liver.[11] A prospective cohort study by Wang F et al. examined the relationship between night shift work and abnormal ALT showed that compared with day workers, current night shift workers had a higher risk of abnormal ALT (OR: 1.19, 95% CI 1.00-1.42) after adjusting confounding factors. And an increasing trend (p=0.031) of abnormal ALT risk was observed in night shift workers without non-alcoholic fatty liver, the prevalence of abnormal ALT increased from 9.7% to 13.3% as the number of night shift work years increased.[13]

In our study, we expected that shift work, which interferes circadian rhythms, would be related to abnormal level of liver enzymes, and the results showed a significant association between shift work and abnormal

ALT among female workers. This result partially supported previous studies which reported the positive association of abnormal ALT.[10,11,13] There was no significant association between shift work and abnormal AST. It may have occurred as a characteristic difference between ALT and AST. ALT is a highly specific marker of liver pathology, restricted to the cytosolic component of the hepatocytes. However, AST is less liver specific, as it is released by damage to the liver, and also to the heart, skeletal muscle, kidney, brain, pancreas, and erythrocytes.[25-26]

In addition, there was no significant association between shift work and abnormal level of liver enzymes among male workers. The reasons for this finding are not clear. The published data on the liver function of shift workers are limited, and no research of gender specific differences between liver functions and shift work was found. However, there are several possible factors for this gender difference. While disturbance of circadian rhythm is the most important factor of abnormal liver enzymes in shift workers, shift work related factors such as insulin resistance[27-31], sleep disorder[32-33] and poor eating habits[34] can also affect liver disorders indicated by abnormal liver enzymes. In the Swedish study, although insulin resistance was not possible to estimated, it was found that the prevalence of subjects with impaired glucose tolerance was higher among women than men, and the proportion with impaired glucose tolerance among shift working women was significantly higher than among corresponding day working women.[35] Marquie et al. examined the effects shift work experience on sleep, it was found that female shift workers report more sleep problems and more use of hypnotics to fall asleep than male shift

workers.[36] In addition, according to two studies of sleep and insulin resistance, it was reported that short sleep duration or sleep disturbance may lead to the development of insulin resistance in women only, supporting a possible gender difference.[37-38] Lastly, in a study of industrial workers who work day and night shifts in Korea, the eating habits and nutrient intake of the female night workers was the worst.[39] Therefore, another biological factor may play a role in the association between shift work and risk of abnormal liver enzymes in women. Further research is needed to reveal the potential gender difference underlying this association.

This study did not find significant differences between patterns of shift work and abnormal liver enzymes when shift work were divided into 6 groups. Previous studies have reported that the duration and pattern of the shift work appear to have different biological effects on humans.[40-42] However, the pattern of shift work cannot always be categorized clearly, and workers are not permanently engaged in the same pattern of shift work. We could not get precise information on the duration of each pattern, extra work and other possible differences between the shift groups, which could have helped us better interpret the results. This is a limitation of our study and more studies should be conducted between the type of shift work and the risk of liver enzyme abnormalities.

This study has some limitations. First, as the KNHANES is a cross-sectional study, only relation between shift work and abnormal level of liver enzymes could be established, not causal relationships. Second, there was no information about the duration of the shift work, so we could not investigate the dose response relationship with shift work and liver

enzymes. Lastly, we could not get detailed information on the possible differences between shift patterns.

Despite these limitations, the strengths of this study are the use of a nationally representative large scale survey, and data was analyzed after stratification for gender considering multiple variables such as age, smoking status, drinking status, hours of sleep, BMI, physical activity. Additionally, to our knowledge, this is the first study that shows gender differences between abnormal ALT and shift work, though there are previous studies reported that shift work is associated with abnormal level of liver enzymes.[10-12]

Ⅴ. Conclusion

There was a relationship between shift work and abnormal ALT in female workers. This study provides limited support for the hypothesis that shift work is related to liver enzyme abnormality, but offers some evidence in favor of the idea that shift work affects female workers more than males on abnormal ALT. Therefore, the results of this study are regarded as preliminary and further studies are needed to define the relationship between shift work and abnormal liver enzymes to be carried out as well as the gender difference in the association.

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국 문 요 약

한국인 근로자에서 교대근무와 간수치의 관련성 : 국민건강영양조사 (2007-2015)를 이용한 단면연구

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배경 : 주간근무와 달리 교대근무는 일주기 리듬에 영향을 미칠 수 있고, 심혈관질환, 당뇨병, 대사증후군 및 유방암과 같은 다양한 건강문제를 일으킬 수 있다. 교대근무의 건강영향에 대한 많은 연구가 이루어졌으나, 교대근무와 간 건강 사이의 관계를 조사한 연구는 많지 않다. 이 연구는 교대근무와 비정상 간수치 사이의 관련성을 평가하고자 하였다.

대상 및 방법 : 본 연구는 2007 - 2009, 2010 - 2012, 2013 - 2015년 국민건강영양조사 자료를 이용한 단면 조사 연구이다. 직업력, 혈청 내 아스파르테이트 아미노전이효소(AST), 알라닌 아미노전이효소(ALT)수치, 연령, 성별, 흡연상태, 음주상태, 수면시간, 체질량지수, 신체활동 및 과거력 자료를 이용하였다. 그룹 간 일반적 특성은 Chi-square test 및 t-test를 사용하였으며, 교대근무와 비정상 간수치 사이의 관계를 평가하기 위해 Multiple logistic regression을 사용하였다. 통계분석은 연도별 가중치를 적용하여 SPSS version 23을 사용하였다.

결과 : 연령, 성별, 흡연상태, 음주상태, 수면시간, 체질량지수, 신체활동 및 과거력을 보정한 후 주간근무자에 비해 여성 교대근무자에서 비정상 ALT에 대한 오즈비가 1.31 (95% CI 1.00-1.71)로 유의한 결과를 보였다. 교대 근무 패턴별로 나누어 분석하였을 때 비정상 간수치에 대한 오즈비는 유의한 결과를 보이지 않았다.

결론 : 본 연구의 결과는 교대근무가 비정상 간수치와 관련이 있다는 가설을 제한적으로 뒷받침하였다. 또한 교대근무가 남성보다 여성 교대근무자에게 비정상 ALT에 영향을 미친다는 결과를 제시하였다. 교대근무와 비정상 간수치와의 관련성와 그 성별에 따른 차이에 대한 추가적인 연구가 필요하다.

핵심되는 말: 교대근무, 비정상 간수치, 아스파르테이트 아미노전이효소, 알라닌 아미노전이효소, 국민건강영양조사