

Effect of Night Shift work on Risk Factors of Cardiovascular Diseases a Historical Cohort study

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Abstract: Cardiovascular disorders can cause disability or death, screening is helpful specially in workers who had risk factors. Night shift work is one of the occupational risk factors for cardiovascular disorders. Objective was the effects of night shift work on risk factors of cardiovascular diseases in shift workers. In a historical cohort study, workers who had night shift and who hadn't night shift selected and cardiovascular disorders risk factors had been followed for five years and gathered then data analyzed in SPSS with mean, t-test, linear regression with $P < 0.05$. 1000 workers had been participated in the historical cohort study, all of the cardiovascular disorders risk factors were in the normal range. In worker group with night shift, in comparison of variables between worker who work less than 15 years and worker with 15 years or more; age, low density lipoprotein, high density lipoprotein had significant difference. In linear regression worker group with night shift, at first age, total cholesterol and low density lipoprotein were significant after enter age less than 40 years; diastolic blood pressure, triglyceride, low density lipoprotein and total cholesterol were significant at the end with enter age 40 years or more none of them were significant. Diastolic blood pressure, triglyceride, low density lipoprotein and total cholesterol maybe increased with night shift. Screening of cardiovascular disorders risk factors were important and helpful in night shift workers for early diagnosis of disorders.

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Introduction:

Night shift work has many effects on mental and physical workers' health. Because of circadian rhythm changes secretion of hormones and transmitter agents were changed. Night shift work has early and late problem, early problem such as sleep disturbances and late problem such as digestive system ulcers and cardiovascular disorders.¹⁻⁴

Night shift work can affect on blood pressure, lipid profile ;triglyceride, total cholesterol ,low density lipoprotein (LDL) , high density lipoprotein (HDL) , according to these facts night shift work is a potential stress for body and cause hypertension and hyperlipidemia in a long period but studies had shown that these

disorders were related to night shift work program. If industries have perfect and suitable work program, workers will be healthy in both physical and mental background.^{4,5} According to these ,occupational health engineers' opinions can be helpful, in these industries.

Health of vital organ systems are important cardiovascular that it's disorders specially ischemic heart diseases can cause disability or death. Some people specially workers who work in night shift for a long time are more at risk of cardiovascular disorders.¹⁻³

There were many studies in occupational health and medicine but, study on risk factors of cardiovascular system disorders because of high morbidity and mortality rate and having the

modifiable risk factors are useful and beneficial.¹⁻⁴

According to these facts; cardiovascular disorders risk factors were measured by preplacement and periodic examination; such as triglyceride, total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), blood pressure, weight or body mass index. Also shift work, stress, smoking, solvents, noise, vibration, temperature, air pollution can affect on these parameters. By screening can find the high risk personnel with none occupational and occupational risk factors of cardiovascular disorders.

Mc Cubbin J.A. et al had been studied on increase of blood pressure in night shift personnel with positive family history specially higher diastolic blood pressure. The effects of night shift on resting blood pressure are related to sleep deprivation.⁶

Lieu S.J. et al had been demonstrated the effect of rotating night shift on blood pressure and it was related to darkness of skin.⁷

Brown D.L. et al had shown the risk of ischemic stroke on women who had night shift work. Because of disruption in circadian rhythm, night shift worker were in the high risk for coronary heart diseases.⁸ Ghiasvand M. et al in their study had shown that work in rail road industry as a night shift worker was a risk factor and can cause hyper low density lipoprotein.⁹

Nazri S.M. et al had studied on shift work effects and had found that high blood pressure and hypertension was higher in shift workers.¹⁰ In contrast to this study Sfreddo C. et al had demonstrated that night shift work was not a risk factor for hypertension.¹¹

Merijanti L.T. et al had studied about effect of night shift work on blood pressure and they had found the effect on systolic blood pressure not for diastolic blood pressure.¹²

In study of National Heart, Lung, and Blood Institute and some other studies had been shown that the other risk factors of cardiovascular disorders had a cumulative effect such as exposure to chemicals, physicals,

mental stress and diet for example work in tunnel can cause exposure to carbon monoxide and other study on foundry workers can cause the same exposure.¹³⁻¹⁵

Kang M.G. et al in their study had found that work in mental stress situation was related to amount of cholesterol and triglyceride, work in physical demand situation was related to systolic blood pressure.¹⁶

Objective was the effects of night shift work on risk factors of cardiovascular diseases in shift workers.

Materials and Methods:

Study Setting

This study was performed in Mashhad fruit and vegetables industries in 2008-2012, workers who divided to two groups; group with night shift and group without night shift.

Study design and target population

In a historical cohort study with simple randomized sampling method workers had been selected and had been followed in five years for risk factors of cardiovascular disorders. With $\alpha = 0.05$, $\beta = 0.80$, $P = 25\%$ population were at least 500 person in each group from 10 factories of Mashhad. About 2000 person had been evaluated for having inclusion criteria or excluded from study.

Checklist design

This study has been done by completing checklist from medical issues of workers. For validity and reliability of research tool; checklist have been written and improved in educational department with professors opinions, it had pilot study in a sample with correlation coefficient of 85% and it have been used.

Checklist of this study had non occupational and occupational risk factors for cardiovascular disorders. Data were gathered from medical issues because all workers had periodic physical and paraclinic examinations such as blood pressure, blood sampling for triglyceride, total

cholesterol , low density lipoprotein, high density lipoprotein ,Fasting blood sugar, age, body mass index, work duration, smoking , shift work.

Inclusion criteria was at least five years work duration in the night shift and exclusion criteria were previous cardiovascular disorders or dyslipidemias .

Three groups had been observed for age , work duration , body mass index.

Statistical analysis

Data were gathered in SPSS 11.5 and analyzed for calculation of frequency,

means, t-test, linear regression with $P < 0.05$. In regression cardiovascular risk factors such as Hypertension, Hyper triglyceridemia, Hyper cholesterolemia, Hyper low density lipoproteinemia (LDL), Lower high density lipoproteinemia (HDL), Diabetes Mellitus, Smoking has been analyzed.

Ethical consideration

This study has been approved by university board, author got written satisfaction and told that cumulative data have been used result will be without name of industries.

Results:

Results are in three sections, demographic information ,job information and cardiovascular disorders risk factors from 1000 workers of industries.500(50.0%) had night shift ,500(50.0%) hadn't night shift, all of them had participated in this study that none of them were smoker and had the same diet.

In general mean of age ,work duration , body mass index had been calculated. The mean of age in night shift worker was 32.98 ± 6.46 years old , in without night shift worker was 34.28 ± 7.06 years old , had significant difference with $P = 0.005$.

The mean of work duration in night shift worker was 8.98 ± 5.37 years , in without night shift worker was 7.95 ± 3.85 years , had

significant difference with $P = 0.004$. The mean of body mass index in night shift worker was 25.41 ± 3.36 kg/m^2 , in without night shift worker was 25.52 ± 3.34 kg/m^2 , hadn't significant difference with $P = 0.719$.

In worker group without night shift, in comparison of variables between worker who work less than 15 years and worker with 15 years or more ; age, body mass index, triglyceride and total cholesterol had significant difference with $P < 0.05$. In worker group with night shift, in comparison of variables between worker who work less than 15 years and worker with 15 years or more; age, low density lipoprotein, high density lipoprotein had significant difference with $P < 0.05$. (table 1) Table 1 has shown the comparison of risk factors of cardiovascular disorders between with night shift and without night shift workers according to their work duration.

For demonstration the night shift work duration on the cardiovascular disorders risk factors, this study had a linear regression. In worker group without night shift, at first age was significant after enter age less than 40 years; just low density lipoprotein was significant at the end with enter age 40 years or more none of them were significant. (table 2) Table 2 has shown the effects of cardiovascular disorders risk factors in without night shift workers after regression.

In worker group with night shift, at first age, total cholesterol and low density lipoprotein were significant after enter age less than 40 years; diastolic blood pressure, triglyceride, low density lipoprotein and total cholesterol were significant at the end with enter age 40 years or more none of them were significant. (table 3)

Table 3 has demonstrated the effect of cardiovascular disorders risk factors in with night shift workers after regression.

Discussion:

According to the results in worker group without night shift, in comparison of variables between worker who work less than 15 years and worker with 15 years or more ; age, body mass index, triglyceride and total cholesterol

had significant difference. In worker group with night shift, in comparison of variables between worker who work less than 15 years and worker with 15 years or more; age, low density lipoprotein, high density lipoprotein had significant difference.

In worker group without night shift, at first age was significant after enter age less than 40 years; just low density lipoprotein was significant at the end with enter age 40 years or more none of them were significant.

In worker group with night shift, at first age, total cholesterol and low density lipoprotein were significant after enter age less than 40 years; diastolic blood pressure, triglyceride, low density lipoprotein and total cholesterol were significant at the end with enter age 40 years or more none of them were significant.

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In this study shift workers who had less than 40 years old ,had higher diastolic blood pressure than others. Merijanti L.T. et al had studied about effect of night shift work on blood pressure and they had found the effect on systolic blood pressure not for diastolic blood pressure.¹²

In this study shift workers who had less than 40 years old, had higher triglyceride, low density lipoprotein and total cholesterol levels than others. Ghiasvand M. et al in their study had

shown that work in railroad industry was a risk factor for cardiovascular diseases and can cause hyper low density lipoprotein and total cholesterol in blood , specially in workers who had shift work.⁹

Cardiovascular disorders can cause hypertension , stroke , myocardial infarction that are relation to long time absenteeism and disability. Forbidden the smoking , control of diet were popular advices for managers of industries to have healthy workers.^{15,17-22}

There were chemicals, physicals, mental stress that affect the cardiovascular system and should be controlled. In study of National Heart, Lung, and Blood Institute had been shown that the work and exposure to some chemicals can cause heart diseases¹³ Screening of cardiovascular disorders risk factors in all works and industries can helpful and benefit.²³⁻²⁵

In this study had been not the exact job analysis and these data were gathered from personnel's medical issues. It seems that complementary study can be helpful.

In this study, after linear regression; diastolic blood pressure, triglyceride, low density lipoprotein and total cholesterol were significant and the most in workers had less than 40 years old age. According to these results, this study recommend that medical surveillance with periodic examination for screening of none occupational and occupational risk factors of cardiovascular disorders can be helpful for night shift workers.

Conclusion:

Diastolic blood pressure, triglyceride, low density lipoprotein and total cholesterol maybe increased with night shift. Screening of cardiovascular disorders risk factors were important and helpful in night shift workers for early diagnosis of disorders.

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Table1: Comparison of risk factors of cardiovascular disorders between with night shift and without night shift workers according to their work duration.

Shift work		Without night shift			With night shift		
Work duration	Work duration <15yr $\mu \pm SD$	Work duration ≥ 15 yr $\mu \pm SD$	P<0.05	Work duration <15yr $\mu \pm SD$	Work duration ≥ 15 yr $\mu \pm SD$	P<0.05	
Variable							
Age	31.51 \pm 5.40	42.11 \pm 5.98	<0.001	33.65 \pm 6.99	40.87 \pm 3.73	<0.001	
Body mass index	25.13 \pm 3.24	26.82 \pm 3.61	0.001	25.42 \pm 3.37	26.07 \pm 3.17	0.113	
Systolic blood pressure	113.43 \pm 12.54	115.88 \pm 14.55	0.216	115.04 \pm 12.06	113.12 \pm 13.18	0.394	
Diastolic blood pressure	74.98 \pm 9.13	77.54 \pm 9.91	0.071	76.29 \pm 7.56	77.65 \pm 9.33	0.340	
Triglyceride	154.84 \pm 90.23	194.90 \pm 113.13	0.006	172.43 \pm 95.18	201.46 \pm 162.27	0.136	
Total cholesterol	176.01 \pm 40.57	191.66 \pm 35.49	0.011	181.01 \pm 33.72	186.59 \pm 36.29	0.380	
Low density lipoprotein (LDL)	105.44 \pm 33.67	110.49 \pm 26.95	0.315	102.48 \pm 24.15	134.90 \pm 52.38	0.002	
High density lipoprotein (HDL)	43.37 \pm 27.33	41.56 \pm 13.09	0.646	47.52 \pm 18.59	33.87 \pm 9.27	<0.001	
Fasting sugar	83.77 \pm 12.72	89.09 \pm 29.81	0.216	83.44 \pm 8.71	92.03 \pm 28.35	0.09	
P<0.05							

Table2: Effect of cardiovascular disorders risk factors in without night shift workers after regression.

Shift work			Without night shift			
Test	Regression test	Significant P<0.05	Regression test	Significant P<0.05	Regression test	Significant P<0.05
			Enter age ≥40		Enter age <40	
Variable						
Age	27.166	<0.001				
Body mass index	0.345	0.730	0.507	0.615	0.941	0.348
Systolic blood pressure	-0.225	0.822	-1.791	0.080	-0.842	0.401
Diastolic blood pressure	0.523	0.601	1.711	0.094	0.696	0.487
Triglyceride	0.550	0.583	-0.721	0.475	1.805	0.072
Total cholesterol	-0.921	0.358	0.887	0.380	-1.545	0.124
Low density lipoprotein (LDL)	0.343	0.732	-0.742	0.462	2.003	0.046
High density lipoprotein (HDL)	-0.684	0.495	-0.284	0.778	-0.442	0.659
Fasting Blood sugar	-0.417	0.677	-0.841	0.405	-0.486	0.627

P<0.05

Table3: Effect of cardiovascular disorders risk factors in with night shift workers after regression.

Shift work			With night shift			
Test	Regression test	Significant P<0.05	Regression test	Significant P<0.05	Regression test	Significant P<0.05
Variable			Enter age ≥40		Enter age <40	
Age	16.801	<0.001				
Body mass index	0.693	0.489	-0.445	0.660	1.000	0.319
Systolic blood pressure	-1.092	0.276	0.666	0.511	-1.169	0.244
Diastolic blood pressure	1.126	0.262	-0.511	0.613	2.969	0.003
Triglyceride	1.237	0.217	0.059	0.953	2.064	0.041
Total cholesterol	-2.946	0.004	-1.394	0.174	-2.078	0.039
Low density lipoprotein (LDL)	3.675	<0.001	-1.358	0.185	3.940	<0.001
High density lipoprotein (HDL)	-0.853	0.395	0.548	0.588	-1.558	0.121
Fasting Blood sugar	1.612	0.109	1.651	0.109	0.272	0.786

P<0.05