



IMPACT OF DURATION OF SHIFT WORK ON CARDIOVASCULAR RISK FACTORS AND HEALTH PROBLEMS IN TEXTILE MILL WORKERS OF PALI DISTRICT

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Received: 16/02/2018

Edited: 23/02/2018

Accepted: 28/02/2018

Abstract: The study aimed to identify the impact of duration of shift work on alcohol, tea/coffee consumption, smoking, tobacco use, blood pressure, lipid profile and occurrence of health problems related to cardiac and gastric health of shift workers in comparison with non shift workers. Total 400 male workers were selected for the study out of which 200 were shift workers and 200 were non-shift workers. Questionnaire based on Standard Shift work Index was used to collect information regarding the risk factors and lipid profile estimation was done of selected subjects. Results showed that the alcohol intake and tea/coffee intake in subjects working in shifts for more than twenty years was respectively 192.49 and 40.63 percent higher than those in initial years of work. Also, in case of blood pressure, the subjects employed for more than twenty years in shift work had 26.96 percent higher mean systolic B.P. and 25.0 percent higher mean diastolic B.P. than those working for only two to five years. The difference in mean total cholesterol levels with increased duration was recorded to be higher in shift workers (96.20%) than non-shift workers (92.95%). In case of triglycerides, again, shift working subjects (54.02%) had higher difference than day workers (37.18%). Cardiac problems like dizziness (47.37%), breathlessness (50.0%) and swollen feet (44.74%) were found to be much higher among the subjects involved in shift work. The study concludes that working in shifts for longer durations increases the prevalence of risk factors among the subjects thus can lead to higher chances of cardiac and gastric troubles.

Key Words: Shift work, duration, cardiovascular, gastric, health, alcohol, smoking.

Introduction

We live in a 24 hour society and shift work is an integral part of it. In Rajasthan state particularly, textile mills represent an important economic sector. In Pali district, with highest number of textile mills in the state, the work never stops. It is a round the clock operating sector where shift work is highly prevalent. According to National Sleep Foundation (2014), a shift worker is anyone who follows a work schedule that is outside of the typical "9 to 5" business day. In the past, few decades the world has become increasingly dependent upon shift workers to meet the demands of globalization and our 24-hour society. From a competitive standpoint, shift work is an excellent way to increase production and customer service without major increases in infrastructure. However, while shift work does create potential productivity advantages, it also has many inherent risks.

According to American Academy of Sleep Medicine (2014), shift workers are at increased risk for a variety of chronic illnesses such as heart disease and gastrointestinal diseases. While some effects are acute, others lead to chronic syndromes that persist after retirement. Though health problems in shift workers are well established, we still do not properly understand the causal mechanisms underlying shift-work's effects on health (Juda et al., 2010).

The behavioral and metabolic risk factors for cardiovascular diseases includes smoking, tobacco use, unhealthy diet, harmful use of alcohol, raised blood pressure, raised blood lipids, overweight and obesity among others World Health Organization (2011). A review by Armstrong et al. (2011) brings together epidemiological evidence on the relationship between shift work and risk of major chronic diseases, including cancer and CVD. Reviewers have

identified a number of recent critical reviews of the literature and several subsequent reports containing new data. There is suggestive evidence for an association between night work and increased risk of breast cancer and between shift work and increased risks of CVD (including metabolic syndrome).

The study was conducted with the objectives to identify the impact of duration of shift work on alcohol consumption, smoking, tobacco use, blood pressure, lipid profile and occurrence of health problems related to cardiac and gastric health of shift workers in comparison with non shift workers.

Materials and Methods

The study was conducted at the textile mills in Pali District in the year 2015. A sample size of total 400 textile mill male workers was selected through purposive sampling technique. Out of these 400 workers, 200 engaged in shift work and rest 200 from non-shift working category was chosen. Workers were selected using the following criteria-

1. Age between 20-50 years.
2. Minimum 2 years of work experience in shift system (for shift workers).
3. Free from any degenerative disease like cancer, diabetes, osteoporosis etc.
4. Willing to participate in the study.

A structured interview schedule was developed keeping in view of the information to be collected for the study from shift workers. Standard Shift work Index (SSI) developed by Barton et al. (1995) was used in the questionnaire to collect information regarding shift duration and type, health problems etc. The interview schedule for non shift workers was kept same as shift workers, with the only difference of omission of questions pertaining to shift work.

Blood pressure was estimated by using Automatic Blood Pressure Monitor (Omron HEM 7132). B.P. of the subjects was compared according to categories given by JNC VIII classification (Bell et al., 2015) of hypertension. Lipid profile estimation was done of selected subjects which covered serum cholesterol, serum triglyceride and lipoproteins i.e. high density lipoprotein (HDL), low density lipoprotein (LDL) and very low density lipoprotein (VLDL). Serum cholesterol, Serum triglyceride and high density lipoprotein (HDL) were estimated by enzymatic methods, using estimation kits of ERBA diagnostic limited. Additional parameters like low density lipoprotein and very low density lipoprotein were calculated by using following standard formulas:

$$\text{VLDL-C} = \text{Triglyceride} / 5$$

$$\text{LDL-C (mg/dl)} = \text{Total cholesterol} - (\text{HDL cholesterol} + \text{Triglyceride} / 5)$$

Results and Discussion

Duration of Work and Smoking/Alcohol/Tobacco/Tea/Coffee Intake:

Smoking Habit: On the basis of number of bidis/cigarettes smoked per day, smoking habit during various work durations are portrayed in Fig. 1 and 2. It's evident that while the difference between average bidis/cigarettes smoked per day of those in initial years of work and those with more than twenty years of work in day workers was recorded to be 121.90 percent, the difference was as high as 386.39 percent in shift working subjects.

Alcohol Intake: The difference in alcohol intake between the extreme ends of work duration was found to be 112.73 percent in day workers and

192.49 percent in shift workers (Fig. 1 and 2). It means that the alcohol intake in subjects working in day hours for more than twenty years was 112.73 percent higher than those in initial years of work (2-5 years) whereas in shift workers it was found to be 192.49 percent higher.

Tobacco Intake: There was a difference in tobacco intake on the basis of duration of involvement in shift work but as compared to the above two heads, this difference was not found to be as prominent. However, the trend was similar to alcohol consumption and smoking habits.

Tea/Coffee Intake: The intake of tea/coffee in experimental group subjects working in shifts for more than twenty years was recorded to be 82.44

percent more than the tea/coffee intake of those working for two to five years. This difference was comparatively very low in control group subjects (40.63%).

The above data depicts that with the increase in duration of work, the intake of alcohol, tea/coffee, tobacco and smoking habits increased far greater in shift workers than day workers. This greatly affects their health and increases the risk of not only cardiac problems but gastric troubles as well. Similar results were observed by Morikawa et al. (2013), Fritschi et al. (2011) and Saksvik-Lehouillier et al. (2013).

Duration of Work and Blood Pressure and Lipid Profile:

Blood Pressure: As depicted in table 1 and 2, the non-shift workers involved in the job for more than 20 years had mean systolic B.P. of about 18.64 percent and diastolic B.P. of about 20.0 percent higher than those who are working for only two to five years. These differences were higher in shift workers as the subjects employed for more than twenty years had 26.96 percent higher mean systolic B.P. and 25.0 percent higher mean diastolic B.P. than those working for only two to five years. As per WHO (2010), worldwide, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8 percent of the total of all annual deaths. In a study by Lo et al. (2008), shift workers had a smaller drop in the systolic blood pressure during sleep than day workers, and they were more often categorized as “non-dippers”. Shift work has also been associated with higher 24-hour blood pressure levels, while the risk of non-dipper status yielded mixed results. The mean systolic blood pressure during a 24-hour measurement has been found to be higher among shift than day workers.

Lipid Profile: Levels of all the lipid profile fractions increased with time, with the exception of HDL-C which decreased (table 1 and 2). However, this difference between those having worked for longer times and those in the initial years was found to be different in shift and non shift workers. The difference in mean total cholesterol levels with increased duration was recorded to be higher in shift

workers (96.20%) than non-shift workers (92.95%). In case of triglycerides, again, shift working subjects (54.02%) had higher difference than day workers (37.18%). But, in case of HDL-C the difference in decrease was found to be higher in non-shift workers (49.56%) than shift workers (27.33%). The difference in case of LDL-C and VLDL-C, though higher in shift working group than day workers, was recorded to be very slight in comparison.

The t test statistic was found to be statistically significant in case of B.P. in 6 to 10 years of work (3.19); total cholesterol in 6 to 10 years (2.93), 11 to 15 years (3.53) and 16 to 20 years (5.57); triglycerides level in 16 to 20 years (2.38) and more than 20 years (4.09); HDL-C levels in 2 to 5 years (3.59) and 6 to 10 years (4.73); LDL-C levels in 2 to 5 years (4.73), 16 to 20 years (3.47) and more than 20 years of work duration (5.88) based on α level of significance (0.05) thus proving significant difference between the impact of duration of shift and non-shift work over blood pressure and lipid profile fractions of the subjects.

Thus, it can be derived that with prolonged involvement in shift work, the blood pressure and lipid profile levels can increase at a faster pace, hence, augmenting the risk of cardiac troubles.

Duration of Shift Work and Gastric Problems:

There are two trends depicted in figure 3 and 4. Firstly, it shows consistent increase in the percentage of shift workers suffering from various gastric problems and secondly, the percentage of subjects suffering from these problems even during the initial years of work is vastly different in shift and non-shift workers. Like in case of disturbed appetite, the percentage of non-shift subjects working for more than twenty years and suffering from this problem were 55.85 percent higher than those working for only two to five years, whereas, in case of shift workers, this difference was found to be only 43.0 percent.

Another notable thing which pertains to the second trend is that in subject group working for only two to five years in non-shift work; merely 10.0 percent were suffering from disturbed appetite,

whereas the subject group involved in shift work for just two to five years had as high as 33.33 percent with disturbed appetite.

These trends were followed in problems like stomach upsets, nausea, heartburn, indigestion and constipation where shift workers not only had higher percentages suffering from majority of these problems as compared to those in non-shift working group, but also the subjects involved in shift work for barely two to five years and suffering from gastric problems mentioned above were far higher than subjects occupied in non-shift work for the same period. The most serious of these problems were found to be nausea, heartburn, indigestion and constipation.

The chi square test statistic in case of disturbed appetite (9.96, $p=0.0411$), stomach upsets (9.73, $p=0.0452$), stomach ache (10.1, $p=0.0389$) and constipation (9.88, $p=0.0424$) was found to be statistically significant based on α level of significance (0.05). Based on these results it was observed that duration of shift work influenced the occurrence of gastric problems among the subjects.

Duration of Shift Work and Cardiac Problems:

The problems like dizziness (47.37%), breathlessness (50.0%) and swollen feet (44.74%) were found to be much higher among the subjects involved in shift work (figure 5) for more than twenty years as compared to subjects occupied in

non-shift work (figure 6) for the same duration. However, non-shift workers had higher prevalence of chest pain (36.58%) among subjects working for longest periods as compared to shift workers (31.57%).

Another trend worth noting is that problems like dizziness and breathlessness had comparatively early onsets in shift workers (by 2 to 5 years) and affected large number of subjects when compared to non-shift workers who had late onsets and lower number of subjects suffering from these problems. Similar results were observed by Tucker et al. (2012), Vetter et al. (2016) and Souza et al. (2015).

Conclusion

The study revealed that there was higher prevalence of factors like alcohol consumption, smoking and tobacco use among shift workers as compared to day workers; and it further advanced with increase in duration of shift work. It is concluded that with increased exposure to shift work, the risk factors increased and thus the risk of health problems would be higher in such subjects. The study also concludes that long durations of shift work could increase the risk of cardiac as well as gastric troubles in the workers. There is an eminent need of awareness programmes on coping strategies of shift work. Lifestyle modifications, design of shift roster systems, stress management tips etc should be focused upon in these awareness programmes.

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Tables

Table 1: Duration of Work and BP, Lipid Profile in Non-Shift Workers

Parameters	Duration of Non-Shift Work				
	2-5 yrs (n=40)	6-10 yrs (n=32)	11-15 yrs (n=48)	16-20 yrs (n=39)	> 20 yrs (n=41)
Blood Pressure (mmHg)	118/75	126/80	132/85	135/86	140/90
Total- C (mg/dl)	123.07± 10.39	172.53± 12.43	176.44± 15.37	189.21± 19.56	237.46± 21.63
Triglycerides (mg/dl)	118.68± 8.43	126.42± 9.76	128.72± 1.47	134.88± 10.72	162.80± 16.24
HDL-C (mg/dl)	52.96± 4.26	48.68± 4.13	46.21± 3.97	39.84± 3.12	35.41± 3.68
LDL-C (mg/dl)	78.56± 5.81	101.75± 7.92	112.84± 8.41	115.41± 7.34	133.27± 10.96
VLDL-C (mg/dl)	21.42± 2.43	21.98± 2.59	22.99± 2.98	26.38± 1.48	30.63± 3.71

Table 2: Duration of Shift Work and BP, Lipid Profile in Shift Workers

Parameters	Duration of Shift Work				
	2-5 yrs (n=45)	6-10 yrs (n=37)	11-15 yrs (n=39)	16-20 yrs (n=41)	> 20 yrs (n=38)
Blood Pressure (mmHg)	115/76	130/82	136/88	140/90	146/95
Total Cholesterol	122.19 ±	181.21 ±	187.95 ±	204.56 ±	239.74 ±

Parameters	Duration of Shift Work				
	2-5 yrs (n=45)	6-10 yrs (n=37)	11-15 yrs (n=39)	16-20 yrs (n=41)	> 20 yrs (n=38)
(mg/dl)	9.68	11.22	18.63	19.84	19.30
Triglycerides (mg/dl)	117.53 ± 7.03	124.62 ± 13.41	131.28 ± 11.75	141.60 ± 12.95	181.02 ± 17.28
HDL-Cholesterol (mg/dl)	43.52 ± 3.19	40.50 ± 2.72	47.79 ± 4.63	37.41 ± 4.63	34.18 ± 2.36
LDL-Cholesterol (mg/dl)	88.08 ± 3.43	102.30 ± 6.82	113.79 ± 3.81	121.60 ± 9.42	150.28 ± 14.10
VLDL-Cholesterol (mg/dl)	22.18 ± 2.73	24.73 ± 2.50	25.71 ± 2.06	27.64 ± 1.56	31.49 ± 3.09

Figures

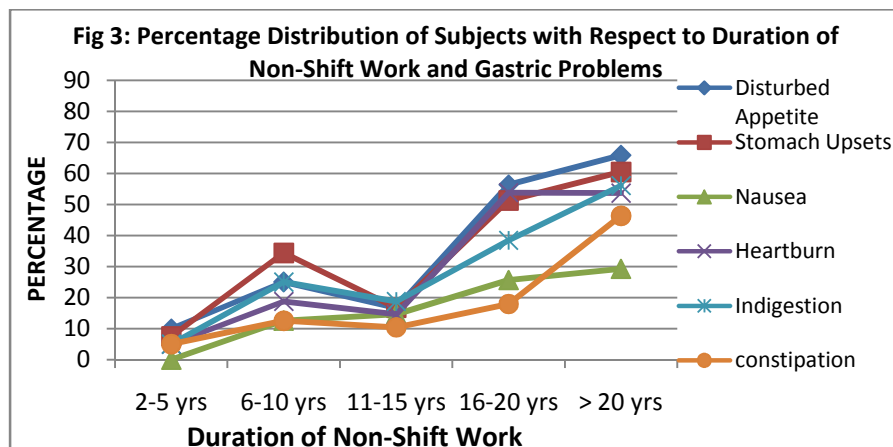
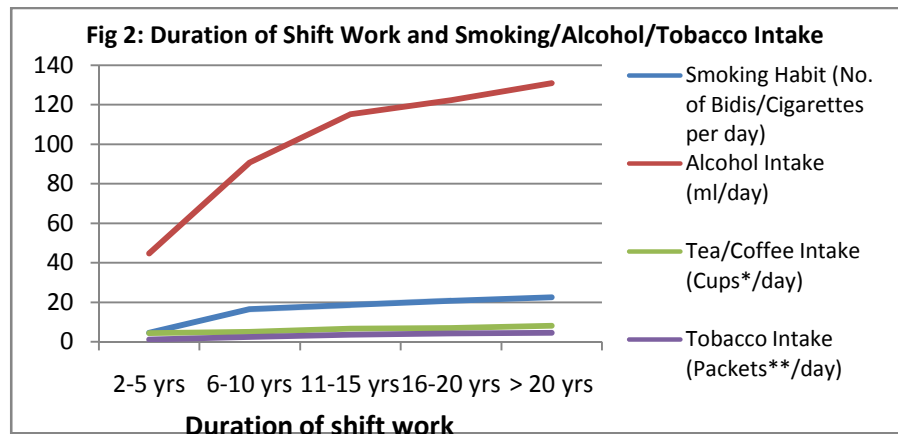
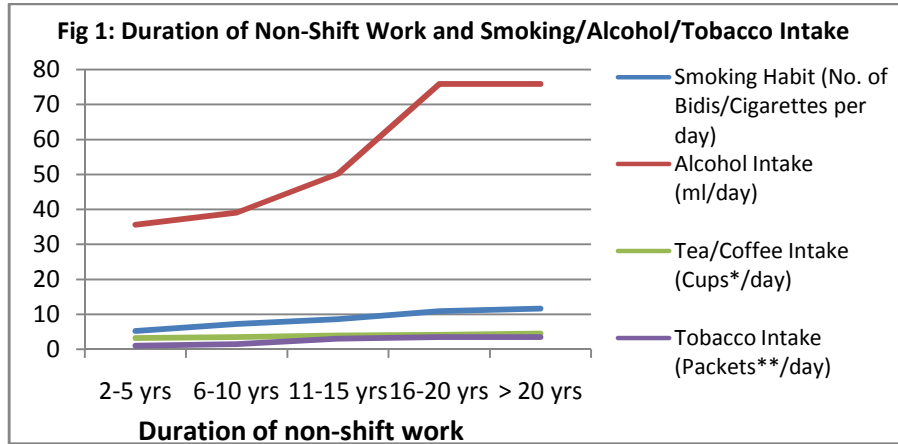


Fig 4: Percentage Distribution of Subjects with Respect to Duration of Shift Work and Gastric Problems

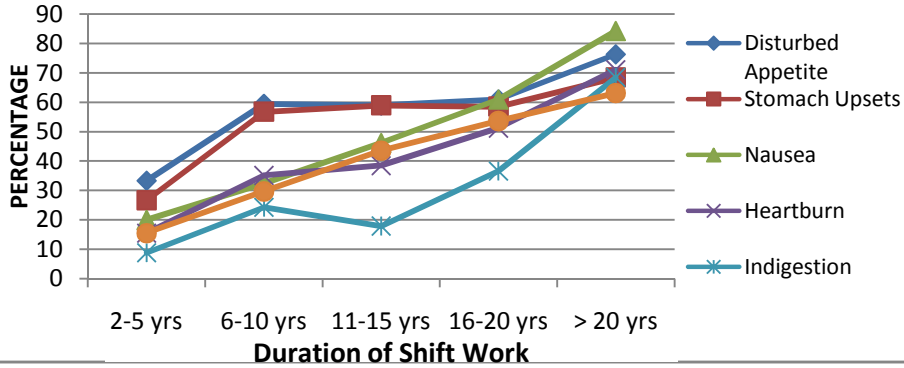


Fig 5: Percentage Distribution of Subjects with Respect to Duration of Non-Shift Work and Cardiac Problems

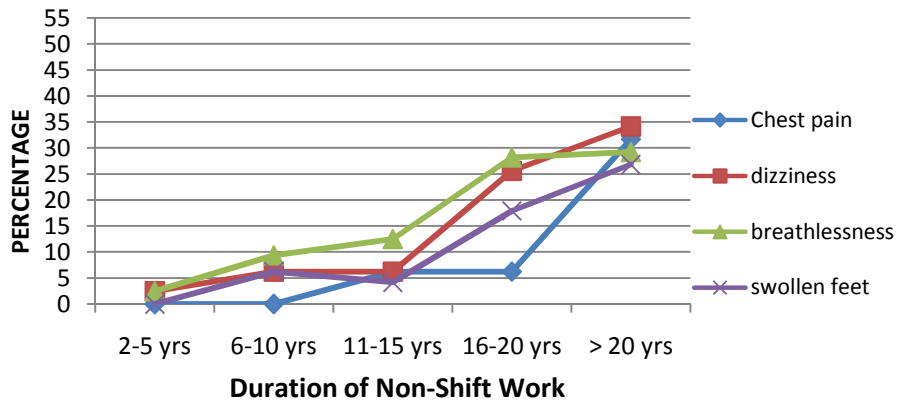


Fig 6: Percentage Distribution of Subjects with Respect to Duration of Shift Work and Cardiac Problems

