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RESEARCH ARTICLE

Prevalence of the Risk of Cardiovascular and Gastric Problems Among Male Workers of Textile Industries in Relation to Shift Work

Ragini Ranawat*, Raka Srivastava
Department of Home Science, Jai Narain Vyas University, Jodhpur

Abstract

Textile industry touches the lives of all people in one or the other ways. 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. Different shift work systems have potentially different impacts on the health of the workforce, disturbing the circadian rhythm, an essential biological function and also inducing sleep deprivation. This characteristic makes shift work one of the most widespread work environment risk factor. The disruption of circadian rhythm may have an adverse impact on cardiovascular and gastrointestinal functioning of the body. Right from the secretion of acid to digestion of food, appetite and diet, everything gets disturbed. The present study was conducted in textile mill of Pali city with the objective to study the risk of cardiac and gastric problems in relation to shift work among male workers. Total of 400 male workers were studied, out of which 200 were non-shift workers and 200 were shift workers. Anthropometric measurements, food intake, blood pressure and lipid profile of the subjects were taken along with data on cardiac and gastric problems. The results showed significant difference between BMI (χ^2 =14.2, p=0.0008) and waist hip ratio (χ^2 =5.2, p=0.0226) of shift and non shift workers. Majority (84.50%) of the shift workers faced sleep related problems. Results on food intake showed comparatively more deficient daily intake of nutrients like fiber (7.21 g), β - carotene (1842.89 µg), and folic acid (99.03 ìg) in shift workers with respect to recommended dietary allowances and an overconsumption of fats (37.72 g). Alcoholism (χ^2 =17.3, p=0.0001) and smoking habit (χ^2 =14, p=0.0029) was found to be significantly higher among shift workers. Comparatively higher segment of shift workers suffered from hypertension (56.0%), stress (70.50%), disturbed appetite (87.50%), stomach upsets (90.0%), nausea (88.50%), heartburn (85.0%) and breathlessness (34.0%). Shift workers also had higher mean levels of all lipid profile fractions and relatively more subjects fell into the category of high risk (20.50%) of CVD. Based on the results, it can be concluded that shift work affects sleep, food intake, BMI, WHR, BP, stress levels, alcohol intake, smoking habits and lipid profile of the subjects, thus increasing the risk of health problems like cardiovascular and gastric diseases.

Keywords: Blood Pressure, Body Mass Index, CVD, Food Intake, Gastric Problems, Lipid Profile, Shift Work, Textile Mills

Introduction

Industrialization has been recognized as the main solution to the problem of unemployment in developing countries like India, in recent years. There has been a steady increase in the number of persons employed in various factories, over the past few years. However, data on nutritional status of factory workers are lacking and thus more attention needs to be given to obtain data on the physical and nutritional status of different categories of workers in different income groups, their knowledge and practices regarding health and nutrition. Nutritional status, health status and occupational stress are distinct but interrelated factors. Any variation in one factor will affect other two factors.

Textile industry touches the lives of all people in one or the other ways. 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 word has become increasingly dependent upon shift workers to meet the demands of globalization and our 24-hour society. Shift work has many varied forms and does not solely include night shift as is the common belief, but

*Corresponding Author : Email : raginiranawat20@gmail.com

encompasses afternoon and evening shifts, nights, rotating shifts, on-call work and with the inclusion of regular dayshifts (Blachowicz and Letizia, 2006).

As per International Classifications of Sleep Disorders given by 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. Whether this is related to the fact that shift workers are awake and active during the night hours or because they tend to get fewer hours of sleep overall than traditional workers is not known. Shift-work seriously affects the health and well-being of millions of people worldwide, and the number of shift workers is constantly rising (currently approximately 20% of the workforce) (Juda *et al.,* 2010). There is evidence in the scientific literature of adverse physiological and psychological effects of shift work, including disruption to biological rhythm, sleep disorders, health problems, diminished performance at work, job dissatisfaction, and social isolation (Admi *et al.,* 2008).

Materials and Methods

A sample size of total 400 textile mill male workers was selected through scattered purposive sampling technique so as to achieve a clear cut picture of the prevalence of risk factors and minimize the effect of individual factors. Out of this 200 engaged in shift work and rest 200 from non-shift working category were 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.
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, sleep patterns, health and well being 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. Measurements and indices like height (Jelliffe, 1966), weight, waist circumference and hip circumference of the subjects were taken and desirable body weight, body mass index and waist-hip ratio were calculated. The height was measured using vertical anthropometer rod. A platform spring balance was used for measuring weight. BMI was calculated by dividing the absolute weight (Kg) with absolute height (m) squared. Desirable or correct body weight (DBW) of the subjects was calculated using the formula:

Desirable body weight (DBW) = Height in cm – 100

Waist circumference was measured midway between the lower rib margin and the iliac crest. Hip circumference was measured at the point yielding maximum circumference over the buttocks. Measurements were taken by non-stretchable tape and their ratios were calculated using following formula:

$$\text{WHR} = \text{Waist Circumference (cm)} / \text{Hip Circumference (cm)}$$

A dietary survey was conducted using 24 hours recall method for one day. The quantity of different food items consumed by the subjects were asked and then converted in terms of their raw ingredients. The nutrient intake was calculated using nutritive value given in food composition table (Gopalan *et al.,* 2002). The intake of nutrients was compared with the RDA suggested by Indian Council of Medical Research (ICMR, 2010) for the adult male.

Blood pressure was estimated by using Automatic Blood Pressure Monitor. B.P. of the subjects was compared according to categories given by JNC VIII classification of hypertension. As per "The Risk Assessment Index for Cardiovascular Disease" given by Easwaran *et al.,* (2001), scores were given to each of the information provided by the subjects. The scores were summed up and the subjects were categorized on the basis of total scores obtained, in low, medium or high risk category. From each risk group 20% of the subjects, who were willing to cooperate, were selected for the estimation of their lipid profile.

The data were statistically analyzed as per the objectives of the study. z- test, t- Test and chi square tests were applied to find out the statistically significant difference between the data of shift and non-shift workers.

Results and Discussion

The average duration of shift work of the subjects was 13.86 years, with the subjects working in three shifts, viz. morning, day and night shift. The morning shift timings were 6:30 AM to 3:00 PM; day shift lasts from 3:00 PM to 11:30 PM and thereafter night shift starts from 11:30 PM and ends at 6:30 AM. The average age of shift working subjects was 31.94 years and that of non-shift workers was 33.72 years. The average family size of non-shift workers was $\leq$4 members whereas the shift working subjects had family consisting of on an average 5 to 6 members. Shift workers also had higher monthly income (>10,000 Rs) than non-shift workers (ranging between Rs 5,000-10,000) which can be attributed to their involvement in other occupational activities as well.

The shift system in which the subjects worked was found to be irregular type i.e. there was no roster. The subjects working in night shift for a particular time would then either be transferred to morning shift or day shift. The fixed roster of transferring night shift subjects to morning shift and then day shift was not followed. About 25.50% of shift working subjects wanted to give up shifts and work in a day time job whereas 37.0% refused to give up working in shifts as it provided them more time to work second jobs. Data on sleep duration and quality showed that majority of the subjects working in shifts (84.50%) faced difficulty in falling asleep as compared to only 18.0% of non-shift workers. Also, 33.50% of the shift workers were found to have a habit of consuming alcohol regularly to induce sleep and 57.50% subjects confirmed its use sometimes.

Anthropometric Measurements of the Subjects

Data in table 1 depicts that shift working subjects had higher weights, Body Mass Index and WHR than desirable levels as compared to non-shift working subjects who had more number of workers falling in normal categories of anthropometric measurements. As per the Asia Pacific classification of BMI (WHO, 2000), it was found that the percentage of shift workers falling into underweight (1.50%) and normal BMI category (22.0%) were lower than those of non-shift workers. However, in the higher weight categories, the picture changes as the number of overweight (36.50%) and obese (7.0%) shift workers were higher than the non-shift workers. Hence, the chi square test statistic in case of desirable body weight (11.9, p=0.0182), body mass index (14.2 p=0.0008) and waist hip ratio (5.2, p=0.0226) was found to be statistically significant based on α level of significance (0.05). Based on these results it was observed that shift work influenced the weight, BMI and WHR of the subjects. There can be many contributory factors like lack of exercise, higher intakes of tea and fried food items available during odd working hours, disrupted schedules etc. which can explain the higher weights in shift workers than non-shift workers. Suwazono *et al.,* (2008) also reported a significantly increased risk of $\geq$5% weight gain among shift compared to daytime workers. Similarly, another study showed that moderate sleep deprivation leads to an increase in the consumption of energy from snacks with a (slightly) higher carbohydrate content (Nedeltcheva *et al.,* 2009).

Nutrient Intake

As depicted in fig. 1, it is clear that difference between the nutrient intakes among the groups, though low, the intakes of all major nutrients were higher in shift workers than day workers, with exceptions of fiber and β carotene. The results further indicated that diet of all the subjects was improper and deficient in one or more nutrients. The situation is most alarming in the intakes of fiber, β carotene and folic acid where it isn't even half of the recommended levels. On the other hand, intake of fat exceeded the RDA in both groups, with shift working subjects' intake being as high as 150.88% of RDA. It can be attributed to the higher waking hours of shift workers which resulted in higher consumption of fried foods and tea. According to Atkinson *et al.,* (2008), meal frequency

Table 1. Anthropometric Measurements of Subjects

Parameters	Non-Shift Workers (n=200)	Shift Workers (n=200)
Desirable body weight (DBW)		
Less than DBW	*21.0*	*13.5*
Correct weight for height	*15.0*	*9.0*
Up to 10% above DBW	*31.0*	*39.0*
10% above DBW	*25.0*	*24.0*
20% above DBW	*8.0*	*14.5*
40% above DBW	*0*	*0*
Body mass index (BMI)		
<18.5 (Underweight)	*9.0*	*1.50*
18.5 – 22.9 (Normal)	*31.0*	*22.0*
23 – 24.9 (Overweight)	*27.0*	*36.50*
25 – 29.9 (Pre Obese)	*29.0*	*33.0*
□30 (Obese)	*4.0*	*7.0*
Waist hip ratio (WHR)		
□0.85	*31.0*	*21.0*
0.86 – 1	*69.0*	*79.0*
>1	*0*	*0*

is generally reduced but snacking is increased on the night shift. Unavailability of preferred foods in the workplace, a lack of time, and a reduced desire to eat at night explain these findings. 'Normal' eating habits with the family are also disrupted. The metabolic responses to food are also altered by shift work-mediated disruptions to sleep and circadian rhythms.

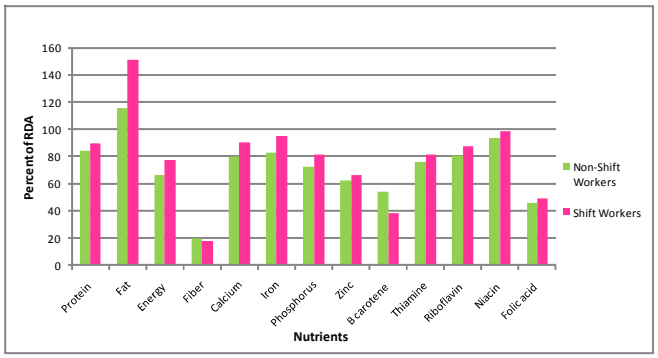

Fig.1. Nutrient Intake of Subjects in Relation to RDA

Alcohol Intake and Smoking Habit

Habit of alcohol intake (Table 2) was found to be higher in shift workers as nearly 47.50% subjects consumed more than two pegs per day as compared to 29.0 percent in day workers. Non users of alcohol were considerably higher in non-shift workers (32.0%) than shift workers (18.0%). Like alcohol, smoking habit was also higher in shift working subjects with 41.50% subjects smoking five to ten bidis/cigarettes per day, followed by 36.0% smoking more than ten bidis/cigarettes per day. Non-shift working subjects had comparatively lower smoking percentages.

The chi square test statistic in case of alcoholism (χ^2 =17.3, p=0.0001) and smoking habit (χ^2 =14.0, p=0.0029) was found to be statistically significant based on α level of significance (0.05).

Table 3 depicts tremendous increase in the consumption of tea/coffee, alcohol and tobacco, along with smoking habit after working in shifts. The overall consumption doubled after workers started operating in shifts. Alcohol, tea/coffee and tobacco intake increased by 166.27, 140.15 and 94.57 percent respectively. Number of bidis/cigarettes smoked per day also increased by 136.42 percent. As far as comparison of intakes during various shifts is concerned, the night shift saw highest intake of tea/coffee, tobacco and bidis/cigarettes whereas the intake of alcohol was recorded to be highest in day shift as compared to other two shifts. While enrolled in day and morning shift, the worker can afford a good time to be spent on alcohol consumption in the evening, hence the higher intakes; whereas in night shifts, the workers are already in the factories as the evening begins. The need and intake of tea/coffee or chewing tobacco or even smoking bidis/ cigarettes back to back is high in night shift, given the odd hours and the constant requirement of staying vigilant while working. Based on Z test, there was significant difference ($p<0.05$) in the alcohol, tea, tobacco intake and smoking habit of the workers before and after working in shifts based on á level of significance.

High alcohol intake can be attributed to coping up with the difficulties in falling asleep and inducing a good night's sleep, the reason behind smoking such a high number of bidis/cigarettes can be the part of constant efforts by shift workers to stay awake and alert during their odd working hours. Caruso *et al.*, (2004) reported that "common unhealthy behaviours among workers who do not tolerate shift work include increased intake of caffeine, alcohol, sleeping medications and over-the-counter medications for gastric acid secretion reduction and/or bowel problems." The systematic review of Frost *et al.,* (2009) was based on 14 studies, of which six reported on smoking and found that it was generally more frequent among shift workers. In recent studies with information on smoking, results have been mixed, indicating either no increase (Radi *et al.,* 2007), a slight increase [3.9% (Fujino *et al.,* 2006) and about 10% (McNamee and Yadegarfar, 2008)], or a significant increase (Elovainio *et al.,* 2009) of smoking among shift workers.

Table 2. Percentage Distribution of Subjects with Respect to Alcohol Intake and Smoking Habit

Food Habits	Non-Shift Workers (n=200)	Shift Workers (n=200)
Alcoholism		
1-2 pegs/ day	*39.0*	*34.50*
>2 pegs/ day	*29.0*	*47.50*
Non user	*32.0*	*18.0*
Smoking habit		
1 – 5 cigarettes/ bidis per day	*28.50*	*13.50*
5 – 10cigarettes/ bidis per day	*31.0*	*41.50*
>10 cigarettes/ bidis per day	*26.50*	*36.0*
Non smoker	*14.0*	*9.0*

Table 3. Alcohol, Tea/Coffee, Tobacco Intake and Smoking Habits of Shift Workers

Parameters	Before Working in shift	After Working in shift	Morning Shift	Night Shift	Day Shift
Alcohol Intake (ml/ day)	*37.83*	*100.73**	*72.36*	*32.6*	*75.28*
*Tea/ Coffee Intake (Cups**/ day)*	*2.64*	*6.34**	*4.06*	*6.38*	*3.60*
*Tobacco Intake (Packets***/ day)*	*1.66*	*3.23**	*2.10*	*3.23*	*1.63*
Smoking Habit (No. of Bidis/ Cigarettes per day)	*7.03*	*16.62**	*11.86*	*16.54*	*9.46*

* Significant at 5% level of significance
**1 cup = 150 ml
***1 packet = 5g

Blood Pressure and Pulse Rate

Data pertaining to blood pressure (Table 4) revealed that according to JNC VIII classification (Bell *et al.,* 2015) majority of the subjects in non-shift working category (44.0%) had pre hypertension with systolic blood pressure ranging from 120-139 mmHg and diastolic blood pressure ranging from 80-89 mmHg, whereas majority of the shift workers (49.0%) were stage I hypertensive as they had blood pressure between 140-159/90-99 mmHg. Only 10.0 percent of shift workers had normal blood pressure (<120/ 80 mmHg) as compared to the 17.0 percent of non-shift workers. Stage II hypertension was found in 7.0 percent of shift workers as compared to 4.0 percent of day workers. The chi square test statistic in case of blood pressure (12.1, p=0.0023) was found to be statistically significant based on á level of significance (0.05) whereas no significant difference was found in case of pulse rate. Based on these results it was observed that shift work influenced the blood pressure of the subjects. Similar outcomes were found in a study by Kwatra and Singh (2012) which was carried out to assess the physiological and psychological cost of work; the descriptive data was collected with the help of interview schedule through interview method. The experimental data was gathered for different physiological test (blood pressure, heart rate, body temperature) and psychological parameters (letter cancellation, fatigue severity scale). The result revealed significant difference in physiological parameters i.e. blood pressure, heart rate and psychological test letter cancellation test of the respondents denoting their stress and fatigue due to shift work.

Stress

Familial stress was found to be most prevalent and comparatively higher in shift workers (70.50%) than day workers (58.50%). Followed by that, prevalence of both familial and educational stress was found to be more among non-shift workers (21.50%) than shift workers (9.50%). Nearly 9.50% of non-shift working subjects and only 4.50% of subjects working in shifts were recorded to have no stress. As mentioned earlier, shift workers were

Table 4. Percentage Distribution of Subjects with Respect to Blood Pressure and Pulse Rate

Parameters	Non-Shift Workers (n=200)	Shift Workers (n=200)
Blood pressure (mmHg)		
<120/ 80 (Normal)		*10.0*
120-139/ 80-89 (Pre Hypertension)	*17.0*	*34.0*
140-159/ 90-99 (Stage I Hypertension)	*44.0*	*49.0*
>139/ 89 (Stage II Hypertension)	*35.0*	*7.0*
	4.0	
Pulse rate (number/minute)		
<70	*12.0*	*6.50*
70 – 80	*40.50*	*26.50*
80 – 90	*37.0*	*44.0*
>90	*10.5*	*23.0*

involved in other occupational activities as well and this left them with very less time to be spent on proper diet or on a good night's sleep or with family. Also, the work timings in shift system are not in accordance with the social schedules. All these factors can greatly enhance the stress of the workers. Lack of rest and unfulfilled social responsibilities contribute to familial stress. According to Williams (2010) shift work may disrupt social and family relationships, by putting the worker's daily pattern of work and rest out of phase with that of family, friends and the social life of the community. This social disruption can also contribute to stress and thereby to adverse health outcomes.

The chi square statistic in case of stress levels (16.1) was found to be statistically significant (p=0.0011) based on α level of significance (0.05). Based on the hypothesis of differences in stress levels of the subjects by shift and non shift work, it was observed that stress level is influenced by work pattern.

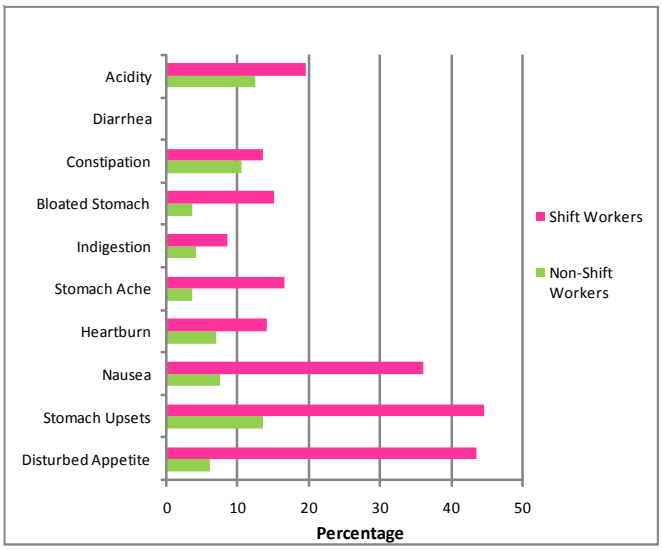

Fig.2. Percentage Distribution of Subjects Facing Gastric Problems on Regular Basis

Gastrointestinal Problems

The major problems regarding GIT (Fig. 2) faced by the subjects on a regular basis were disturbed appetite and stomach upsets, which were found to be more prevalent among shift workers (43.50% and 44.50%) than non-shift workers (6.0% and 13.50%). Nausea and heartburn along with indigestion and constipation were sometimes faced by a large number of subjects, especially in shift workers (52.50%, 71.0%, 53.0% and 64.50%) than non-shift working group (13.0%, 60.50%, 53.0% and 28.0%). The gastric problems least experienced were stomach ache, bloated stomach and diarrhea. The chi square statistic in case of regular occurrence (31.8) of gastric problems among the subjects was found to be statistically significant (p=0.0002) based on α level of significance (0.05). According to Blachowicz and Letizia (2006), shift workers experience more upset stomachs and general gastric discomfort, heartburn, dyspepsia, constipation, flatulence, stomach ulcers and bowel disease (such as constipation, diarrhoea, stomach, ulcers, gastroduodenitis, chronic gastritis and colitis) than day workers, which might result from digestion following its own circadian rhythm that is disrupted by the shift work schedule. As per Koradecka (2010), disorders of normal digestive system functions and metabolism, such as diarrhea, constipation or heartburn, may occur frequently in night shift workers compared to day workers. They result from improper nutrition, in terms of both the food quality and the time of meal consumption. Irregular meal times interfere with the production of hormones, acids and enzymes necessary for food digestion, a diurnal function. Like other body rhythms, the digestive process slowly and only partly can become accustomed to an atypical activity- sleep pattern.

Cardiac Problems

Breathlessness was found to be most prevalent on a regular basis (Fig. 3) among nearly a quarter of the shift working subjects (22.50%). Apart from this, dizziness was also more faced by shift workers sometimes (28.0%). Chest pain and swollen feet were least experienced cardiac problems for both groups. Fig. 3 also depicts that the cardiac problems are more prevalent among the shift workers than non-shift workers. The chi square statistic in case of regular occurrence of cardiac problems (7.92) among the subjects was found to be statistically significant (p=0.0477) based on α level of significance (0.05).

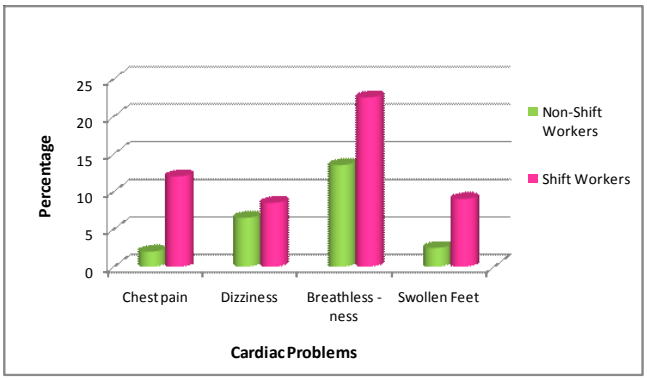

Fig. 3. Percentage Distribution of Subjects Facing Cardiac Problems on Regular Basis

Circadian disruption caused by shift work has been shown to affect a number of risk factors for developing CVD including blood pressure and blood lipids (De Backer, 2009). It has also been proposed that shift work might result in stress. Neuroendocrine responses to stress involve the increased secretion of glucocorticoids and

catecholamines from the adrenal gland and the activation of the sympathetic nervous system. The chronic activation of this stress system may in turn cause suppression of the gonadal, growth hormone and thyroid axes (Fountoulakis and Tsatsoulis, 2006). Such metabolic disturbances may lead to the clinical expression of a number of co-morbidities including central obesity, hypertension, dyslipidemia and endothelial dysfunction, all components of the metabolic syndrome and risk factors for CVD.

Categorization of the subjects on the basis of risk factors

Fig. 4 shows that although majority of the subjects in both groups fell into low risk of CVD category, there was a marked difference in the distribution of shift and non-shift working subjects in the three risk groups. Comparatively more number of non-shift work subjects (67.50%) fell into low risk category than shift workers (48.50%), whereas in medium risk group, shift workers (31.0%) were higher than day workers (23.0%). High risk category had shift work subjects (20.50%) that were more than twice the number of non-shift work subjects (9.50%) in the same category. The chi square statistic in case of risk groups (16.6) was found to be statistically significant (p=0.0002) based on α level of significance (0.05). It proves that the distribution of subjects among high, medium and low risk categories was different and got influenced by shift work.

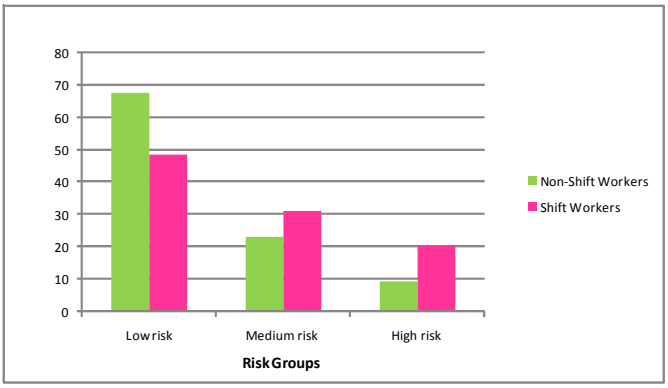

Fig.4. Percent Distribution of Subjects in Different Risk Groups

The study by Abbaszadeh *et al.,* (2014) aimed to determine the prevalence of disorders associated with shift work among security staff in a refinery complex. This cross-sectional study was carried out on 180 shift workers as case group and 90 day workers as control group at the security section of an oil refinery company. The prevalence of health problems among the shift workers was greater than day workers. Meanwhile, there were significant differences between case and control groups in terms of gastrointestinal distress (p=0.034), cardiovascular disease (p=0.028), hypertension (p=0.021), and the feeling of fatigue (p=0.004). The results of this study indicated that shift working could be associated with physical complications such as gastrointestinal diseases, cardiovascular diseases, and disturbances in circadian rhythm.

Lipid profile of selected subjects

Data in table 5 shows significant difference in total cholesterol, High Density Lipoprotein (HDL-C) and Low Density Lipoprotein (LDL-C) levels of shift and non-shift workers. Mean levels of all lipid profile fractions were found to be higher in shift working subject except HDL-C which was found to be lower. As per ATP III classification (National Heart, Lung and Blood Institute, 2001), the mean total cholesterol levels in both the groups were found to be in desirable category (<200 mg/dl). Normal levels were recorded in case of mean triglycerides (<150 mg/dl) and HDL-C (40-60 mg/dl) in both the groups, however the mean HDL-C level of shift workers (40.47 mg/dl) was extremely close to the low category (<40 mg/dl). The mean levels of LDL-C were found to be falling in above optimal category (100-129 mg/dl) in both the groups. The data reveals a comparatively higher risk of cardiovascular diseases for shift workers than those who are non-shift workers based on lipid profile levels.

Studies assessing lipids in shift workers have had variable results. Of 16 studies, 5 showed increased cholesterol levels; 3 of these were prospective studies. In a follow-up study by Morikawa *et al.,* (2007), the increases in total cholesterol were similar among day and shift workers. On the contrary, a methodologically similar 14-year follow-up study found a higher increase in total

Table 5. Lipid Profile of Selected Subjects

Lipid Profile	Non-Shift Workers (Mean±SE)	Shift Workers (Mean±SE)
Total-C (mg/dl)	*178.52±15.23**	*187.12±17.67*
Triglycerides (mg/dl)	*134.31±10.08*	*139.21±8.65*
HDL-C (mg/dl)	*44.20±2.13**	*40.47±1.88*
LDL-C (mg/dl)	*108.53±7.73**	*115.21±6.59*
VLDL-C (mg/dl)	*24.68±2.15*	*26.35±2.83*

* = significant at 5% level of significance

cholesterol among Japanese shift workers (Dochi *et al.,* 2009). In an Italian male cohort with repeated health examinations, night workers had significantly higher total cholesterol than their daytime colleagues (Biggi *et al.,* 2008). Regarding triglycerides, higher values were found among shift workers in 4 of 12 studies.

Conclusion

The present study revealed that majority of the shift workers were smokers, consumed alcohol, had deficient diet and were suffering from sleep related problems. The preference of fried and fatty foods over vegetables and fruits was also highly common amongst the shift working subjects. Furthermore, comparatively higher percentage of subjects involved in shift work was found to be at high and medium risk of cardiovascular diseases. High consumption of fatty foods, unhealthy habits like alcohol and tea consumption, smoking and stress contributed to the risk of CVD and GIT disorders among the subjects. Nutritional programs focusing on the industrial workers should be organized so as to make them aware about the impact of shift work and the possible lifestyle modifications like regular exercise, low saturated fat intake, high fiber intake etc. to prevent the occurrence of CVD and GIT disorders.

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