International Journal of Basic and Applied Biology (IJBAB)
Print ISSN: 2349 – 5820; Online ISSN: 2349 – 5839 ; Volume 2, Number 1; October, 2014 pp. 44 – 50

http://www.krishisanskriti.org/ijbab.html

Shift Work and Diabetis

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1. INTRODUCTION

The current day lifestyle demands immediate and round the clock services from various indispensable sectors such as public health, transport, security (both internal and external) communication and media. All these sectors need men to be posted \deployed round the clock. With the vital need to extend services several millions had to work in shifts varying in length of time for a greater part of their age.

According to the International Labour Office, shift work is defined as a method of work organization under which groups or crews of workers succeed each other at the same work station to perform the same operations each crew working a certain schedule or shift so that the undertaking can operate longer than the stipulated weekly hours for any worker.

To survive and remain healthy, the human body has to keep a balance between different processes within the organism (Ader et al 1990; Anisman et al, 1996; and Mason, 1959). The homeostatic systems are regulated by several endogenous biological rhythms but under certain compelling circumstances, internally synchronized rhythms no longer exhibit comparable frequencies and this situation is referred as a state of internal desynchronization. It has been rigorously demonstrated that very often shift workers suffer from internal desynchronization (Reinberg et al, 1984, 1989; Pati and Saini, 1991; Gupta and Pati, 1993).The problems associated with shift work are most often attributed to the assumptions that employees are being required to do the opposite of what their sleep wake rhythm would predict i.e. to stay awake during the night and to sleep during the day. (Walker et al, 1985; Feeney et al, 1998). In Western countries several studies reported the problems of shift workers vis a vis three important factors, namely circadian, sleep and social / domestic factors (Monk, 1988; Folkard, 1988, 1990; Harma et al, 1990; Daniel and Potasova, 1989; Novak et al, 1990; Skipper, 1990)

In transportation sector like Railways, the moving of the trains is required for a continuous period, which extends to 24 hours and as such shift work is inevitable. Of the industrial workers, shift workers have the increased risk of suffering from occupational health hazards as compared to day workers (Minors and Waterhouse, 1989; Akerstedt 1990). Rotational shift work covers a variety of work schedules and can be continuous, semi-continuous or running two or three shifts per day with or without weekends

There are several concepts and mechanisms how the working hours and schedules could influence the workers health and well being (Smith et al, 1998 b). First biological disruption to physiological processes, including the sleep wake cycle (Akerstedt 1990; Harma et al, 1998), Second the impairment of physical health and psychological well being (Bohle and Tilley, 1989) and Third the disruption of domestic and social life (Walker 1985; Monk and Folkard 1992). Physiological disruptions are some of the major problems for the shift workers. Shift work has been shown to develop impaired metabolism and impaired tolerance or response to medications (Philips et al, 1991). Rutenfranz and co-workers have concluded that “perhaps the most important physiological problem regarding shift work particularly, shift work which includes night work, is the problem of the resynchronization of physiological functions after a phase shift of working and sleeping times (Rutenfranz et al, 1977).

It has also been reported that shift workers both rotating and stable night workers do have an increased risk for myocardial infarction and number of systemic illness, notably exacerbation of insulin dependent diabetes, epilepsy and neuropsychiatric disorders (Brief and Scala, 1986, Phillips et al 1991), gastrointestinal diseases (Gordon et al, 1986; Harrington, 1994;Costa, 1996) and diminished well-being (Costa, 1996).

Long hours of shiftwork brings about unhealthy lifestyle changes such as smoking, alcohol, abuse, and lack of physical activity, sleeplessness, poor eating habits and fewer chances for medical examination. In Japan (Maruyama, Morimoto, 1996; Nakamura et al. 1998) studies on some occupational groups with less physical work have shown have shown associations between long hours and weight gain increase which has led to stress and unhealthy lifestyle in men. Reinberg, (1986); Akerstedt, (1987); Akerstedt, (1990), Shah, (1990); Chang et al, (1993); Pati and Gupta, (1994); Gillberg, (1995) found that association between shiftwork and sleep disruption results in adverse medical and psychological consequences and may lead to increased use of alcohol and hypnotics (Phillips et al 1991). There is extensive evidence that shift work including night

work, increases the risk of developing psychological and physiological health problems (Andlauer 1960; Koller 1983;, Bohle and Tilley 1989; Scott et al, 1997). Moldofsky, (1995) suggests that disorganization or disturbance of the sleep wake system interferes with the immunological, neuroendocrine and thermal systems and contributes to pathological processes and is evident in diseases, such as infections etc. One such common disorder is diabetes.

Spurgeon et al, (1997) and Van der Hulst, (2003) suggest a link between long working to adverse health, like diabetes, cardiovascular diseases and mental health problems. The stress induced by long working hours and disturbance of the physiological biological clock affects the circulatory system. Kawakami et al (1999) reported that 50 or more hours of *over time/ month* increased the risk for development of diabetes mellitus as compared with those worked for 25 hrs or less over time. Nakanishi et al (2001 a) reported that 11 hrs or more work a day was associated with a reduced risk as of developing diabetes mellitus compared with less than 8 hrs**.** Diabetes is one of the highly prevalent disorders among the Indian population, and it is also known to be hereditary. However, under normal circumstances, the disease affects only the middle-aged and above age groups.

As evident in the foregoing review of the studies on shift workers, it is unequivocal that shift work is linked to a series of acute and chronic effects on human beings. Thus, it seems unlikely that such temporal disorder should be completely harmless to human beings, while some could be more vulnerable. Thus, work schedules and work load factors need to be examined in combination to obtain a realistic picture of the effects of shift work on health. Together with the alarming relationship of shift work to fatigue, performance, accidents, diabetes and chronic heart disease, there is reason to believe that shift work may become a major challenge for the employer, employee and occupational health professionals. In view of the above, the present work entitled "*"Shiftwork and Diabetes"* has been contemplated with the following objectives:

1. To understand the occupational health problems among shift staff of different age groups with varying service experience;
2. To identify the different health disorders or diseases associated with the shift staff and the incidences of these health problems;
3. To assess the different types of stress associated with the shift work and understand the impacts on health;
4. To evaluate the present shift pattern with special reference to their impacts on health and to suggest the optimal pattern.

The present work entitled "Shiftwork and Diabetes" was carried out during June 2006 to February 2009. The staff of the E.Co. Division of the Indian Railways, who are working on shift duties constituted the main target group of the study.

2. METHODOLOGY

The study followed "Syndrome Approach" to realize the objectives of the study, by adopting a combination of the methods of obtaining data on the study respondents. The focus of the study being the health problems associated with the shift work, sampling was carried out by selecting the employees. Results obtained were analyzed statistically wherever necessary. The ***Standard Shift Work Index*** developed by the Shift work Research Team MRC/ERSC Social and Applied Psychology Unit was used in the present study with few modifications to suit the local conditions.

Questionnaire deals with the specific questions, dealing with their working hours as standard and long working hours and the respondents try to rank different stress indicators related to mental states and their frequency as they perceive. Respondents rated the frequency of consumption of vegetarian and non-vegetarian foods, sweets, fruit, salt, dairy products in their regular dietary habits and as such questions relating to weight loss and weight gain has been included. To measure alcohol consumption, respondents were asked the number of drinks they had before and after starting shiftwork. A drink was defined as one bottle of beer. Physical activity was assessed by questions on the frequency of vigorous exercise or leisure time physical activity that lasted more than 15 minutes covering a wide range of activities (and scored as the number of days per week in which any such activity was performed).

The Canadian guidelines for healthy weights use Body Mass Index (BMI) to determine an acceptable range of healthy weights and to identify conditions of excess weight and underweight. BMI is calculated by dividing weight in kilograms by height in meters squared.

Four weight categories are identified based on BMI Underweight : (BMI less than 20), Acceptable weight (20-24.9), Some excess weight: (25-27), Overweight : (>27). These guidelines are recommended for everyone aged 20 to 64 years, excluding pregnant women. The BMI scale is intended to be used as a "continuum" where the risk of developing health problems increases with shifts away from the "generally acceptable range." Rapid changes within and between BMI categories should be considered as important indicators of potential problems.

3. RESULTS

3.1 Gender Distribution:

About 3-5% of the population was selected as samples that constitute 300 individuals. The population was stratified in to four Age groups, with an interval of 10 years, ie AG-1 as 21-30, AG-2 as 31-40, AG-3 as 41-50, and AG-4 as 51 and above. About 40% (120) of the individuals were in AG-1, while AG-2, AG-3, and AG-4 account for 33% (99), 18.67% (56) and 8.33% (25), respectively. The average age of the AG-1 was at 25.5 years; similarly, the average ages for the

AG-2, AG-3, and AG-4 were at 36.8 years, 44.4 years and 54.9 years, respectively.

On the whole, about 228 (76%) of the individuals were Men; and 72 (24%) were women. Among different age groups, the gender composition varied and the women's ratio has declined in the higher age groups.

3.2 Stratification of Employees:

Employees working in the Railways on Shift duties were broadly considered in two categories. The first category are those who are stationary and no long travel is involved in performing their duty as *Office Staff* and the *Technical Staff*; and the second category are those whose duty require traveling for several hours. The second category employees also were divided in to three types: (1) *Loco Pilots (LPs)*; (2) *Train Guards (GDs)*, who travel along with the train; and (3) *Train Ticket Examiners* (TTEs). On the whole, five types of employees were considered for the study.

3.3 General Health condition

The general health condition of the respondents was determined mainly basing on two criteria: (1) Having no general health complaints over the past two years; and (2) The Body Mass Index (BMI). The first category is herein often referred to as *Resistants.* Based on the BMI, the Underweight and the Overweight individuals were considered as the ***Vulnerables***.

Of the 300 respondents, 114 (38%) were found to be Vulnerables. Among them 73.68% were men and 26.32% were women. However, among the men, 36.84% were Vulnerables; while among women 41.67% were Vulnerables. Among the total Vulnerables, Underweight category accounts for 28.95% only, and of these, 54.54% were women. Among the Overweight category, 85.19% were men.

Of the Underweight Men respondents, 40.02% were in the AG-1, 26.68% in AG-2; 26.68% in AG-3; and 6.67% in AG-4. Of the Underweight Women respondents, 88.8% were in the AG-1, 5.55% in AG-2 and AG-4, while there were none in the AG-3.Of the Overweight Men respondents, 23.2% were in the AG-1, 42.05% in AG-2; 30.45% in AG-3; and 4.35% in AG-4. Of the Overweight Women respondents, 58.31% were in the AG-1, 24.99% in AG-2; and 8.33% each in AG-3 and AG-4.The distribution of the Vulnerables in different Age-sex groups is presented in **Table 1**.

Table 1 - Vulnerables in different Age-sex groups is presented

S.No.	Gender	AG-1	AG-2	AG-3	AG-4	TOTAL
Underweight Vulnerables						
1	Men	6 (40.02)	4 (26.68)	4 (26.68)	1 (6.67)	15 (45.45)
2	Women	16 (88.80)	1 (5.55)	0	1 (5.55)	18 (54.55)
3	Total	22 (66.67)	5 (15.15)	4 (12.12)	2 (6.06)	
Overweight Vulnerables						
1	Men	16 (23.20)	29 (42.05)	21 (30.45)	3 (4.35)	69 (85.19)
2	Women	7 (58.31)	3 (24.99)	1 (8.33)	1 (8.33)	12 (14.81)
3	Total	23 (28.40)	32 (39.51)	22 (27.16)	4 (4.94)	

- Values in parenthesis are percentages

Vulnerable to health problems by overweight was evident from the present study.

3.4 DIABETIC PROBLEM

Among all the 300 respondents, 41 (13.67%) have expressed the Diabetic problem, for which they were/had under the treatment. Among the men and women respondents, the incidence of the Diabetic problems was recorded at 14.91% and 9.72%, respectively. Nearly 12.12% of the underweight vulnerables and 12.35% of the Overweight Vulnerables were in this category. In case of 53.66% of the affected, Diabetes was traced to be hereditary.

The distributions of the respondents with the Diabetic problem in to different age groups indicates that the incidence of Diabetes in AG-4 is very high, while in other groups they are more or less evenly distributed. Among the AG-1 respondents, 12.5% were having Diabetic complaint. In case of AG-2, AG-

3 and AG-4, Diabetic patients account for 10.01%, 14.29% and 32%, respectively.

Among the different employee types, 15.32% of the LPs, 4.76% of the GDs; 20% of the TTEs; 7.35% of the OSs and 17.91% of the TNs were with Diabetic problems. Of the 19 LPs with the Diabetic problem, 31.58% each were in AG-1 and AG-2 groups, 26.32% were in AG-3; 10.53% were in AG-4 class. The Lone GD was in AG-4. Of the 4 TTEs with the Diabetic problem, 50% were in AG-1, 25% each were in AG-2 and AG-4 classes; and were none in AG-3.

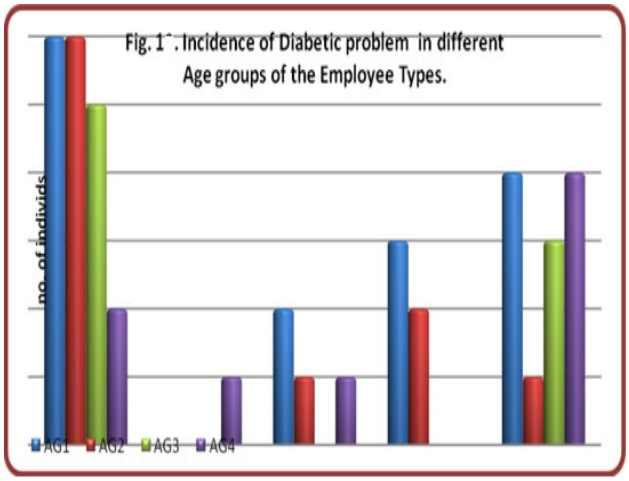
Of the 5 OSs with the Diabetic problem, 60% were in AG-1, and 40 % were in AG-2; none were in AG-3 and AG-4 classes. Of the 12 TNs with the Diabetic problem, 33.33% each were in AG-1 and AG-4 classes, 25% were in AG-3; and only 8.33% were in AG-2 group (**Fig. 1**). The distribution of the Diabetic complainants among different employee types and Age groups is presented in **Table 2**.

Table 2 - Distribution of the Diabetic complainants among different employee types and Age groups

S.No.	Gender	AG-1	AG-2	AG-3	AG-4	TOTAL
1	Men	9 (26.47)	9 (26.47)	8 (23.53)	8 (23.53)	34 (14.91)
2	Women	6 (85.71)	1 (14.29)	0	0	7 (9.72)
3	Total	15 (12.5)	10 (10.10)	8 (14.29)	8 (32.00)	41 (13.67)
Employee Types						
1	LP	6 (31.58)	6 (31.58)	5 (26.32)	2 (10.53)	19 (15.32)
2	GD	0	0 0	0	1 (100.00)	1 (4.76)
3	TTE	2 (50)	1 (25)	0	1 (25)	4 (20.00)
4	OS	3 (60)	2 (40)	0	0	5 (7.35)
5	TN	4(33.33)	1 (8.33)	3 (25)	4(33.33)	12 (17.91)

- Values in parenthesis are percentages

Fig. 1 – Incidence of Diabetic problem in different Age groups of the Employee Types



It is alarming to note that diabetes was found even among the lower age groups of the respondents in the study. Among the affected women, 85.71% were in AG1, which is an alarming sign. In the Men also, a majority of the affected were in the AG1 and AG2 groups. Only 36% of these lower age group affected have a family history of diabetes. This indicates that the diabetes appears to be stress induced diabetes and as such the symptoms of health problems related to stress were considered and were found to be very significant.

4. CONCLUSION

Health hazards and stresses of work by itself, as well as intervening factors from outside the working life may influence and impair the state of health. There is an agreement that shift workers are a population at risk. This is due to the fact that, they are exposed to psychobiological desynchronization and reduced coping associated with shift work. Therefore it is essential that employees involved in shift work need to ensure healthy dietary habits, their lifestyle patterns and the measures needed to mitigate the stress conditions so as to minimize the vulnerability to various health problems due to shift work.

However, the study has broadly brought out the trends of shift patterns and signifies the importance of such studies to be taken up by the employers or the state policy makers, so as to ensure greater safety of the railway transportation and even other sectors also where shift work is unavoidable.

5. ACKNOWLEDGEMENTS

The author is thankful to the Almighty for giving the strength and health to do this research work until it is done, a heartfelt gratitude to her Research Guide, Prof. K. Kameswara Rao, and a deep sense of gratitude to her parents and her husband for moral support throughout the research work. This would not have existed without their blessings..

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