



Impact of Shift Duty on Anthropometric Measurements and Lipid Abnormalities among Diabetics

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Abstract

Background: India is considered as “Diabetic Capital of the world”. Patients of diabetics are more prone to lipid abnormalities. Indian Work force undergo irregular duty hours which aggravate the co-morbidities of diabetes. To increase the productivity of the nation, work force ought to remain healthy. This is a high time to protect them in terms of health by screening and creating awareness regarding the lifestyle management.

Objectives: Sickness absenteeism is commonly observed in working environment. By promoting the health of employees, we can prevent such events.

Materials and Methods: By adopting purposive random sampling method, about 200 diabetic subjects from ESIC Medical college and Hospital were selected (100 subjects from general shift and 100 subjects from rotation shift). Anthropometric profile and lipid profile were assessed and compared. Physical activity, dietary habits and personal habits were also taken into account. The obtained results were subjected to a statistical analysis.

Results: The Mean BMI was 26kg/m² and 29 kg/m² for general and shift workers, respectively. Total cholesterol was reported to be 186g/dl and 201g/dl for general shift workers and rotation shift workers, respectively. This observation was statistically significant. The respective LDL, VLDL, triglycerides levels were found to be 117g/dl, 32 g/dl, 161g/dl for general shift workers and 125 g/dl, 37g/dl and 183g/dl for rotation shift workers.

Conclusion: As per the proverb, “prevention is better than cure”, it is essential to prevent future cardiac complications by taking necessary precautionary measures to control the lipid abnormalities by balanced diet, adequate sleep, regular physical activity and monitoring the lipid profile.

Keywords: Lipid profile, Life style Modification, Diabetes, BMI.

Introduction

As per World Development Indicators of the World Bank, India had a total workforce of 503.8 million in 2015. During 2011-2016, on average, India added 6.6 million to the labour force per year. Formal employment in India is heavily reliant on medium skilled occupations. These include clerical, service

and sales workers, skilled agricultural and trade workers and plant mechanists. Nearly 60% workers are employed in this skill level, according to ILO data. Over 20% are employed in high skilled jobs as managers, professionals and technicians. The rest are elementary occupations such as cleaners and laborers (The Hindu, 2018)

India has a high burden of communicable and non-communicable diseases. This burden can be reduced effectively by focusing on preventative measures and lifestyle modifications initiated from the worksite. The Employee State Insurance Corporation (ESIC) is a government operated and the largest health insurance company in India and covers medical costs for lower income factory workers who make less than Rs.21,000 per month.

The recent statistics indicate that the majority of the working population is engaged in irregular or "non-standard" working hours, including shift and night work, week-end work, split shifts, on-call work, compressed weeks, telework, part-time work, variable or flexible working time, and prolonged duty periods (i.e. 12-hour shifts). According to third European survey on working conditions, the classical working day (7-8 a.m. to 5-6 p.m., Monday to Friday) is nowadays a condition affecting a minority of workers that constitutes, 27% of employed and 8% of self-employed people (Giovanni Costa, 2010).

Shift work, particularly work including night shifts, may interfere at several levels with human homeostasis and well-being. The misalignment of circadian rhythms of body functions is responsible of "jet lag" (or "shift-lag" in this case) syndrome, characterised by feelings of fatigue, sleepiness, insomnia, digestive troubles, irritability, poorer mental agility and reduced performance efficiency. A person recovers in a few days depending on the length and duration of the phase shift imposed, personal characteristics (e.g. age), and coping strategies. About 10% of night and rotating shift workers, aged between 18 and 65, have been estimated to have a diagnosable "shift-work sleep disorder" (Forsman, 2013).

The response to the chronic stress perceived with shorter sleep time and rotation night shift involves the release of hormones such as cortisol and adrenaline. The documented health risks attributed to elevated cortisol levels include dyslipidaemia, hypertension, obesity, noninsulin-dependent diabetes and stroke (Tae Won kim, 2015). The resultant health concerns for shift workers include

increased risks for colorectal cancer, breast cancer, chronic fatigue, anxiety, miscarriage, hypertension, obesity, diabetes and hypercholesterolaemia (Amanda Maria Cason Shandori, 2012).

Working in irregular shifts contributes to unhealthy eating habits, such as high calorie intake during night-time meals. Diet is one of the most important determinants of human health. Proper eating habits and rationally balanced food ratios positively affect the human body, whereas poorly balanced diet coupled with improper nutritional habits may give rise to many diet-related diseases such as diabetes, cardiovascular diseases, hypertension, stroke and some types of cancer.

The elevated serum lipid concentrations seen among irregular-shift drivers may be associated to the timing of meals, typically consumed at night time and during the early hours. Greater night-time carbohydrate consumption might also explain increased LDL-cholesterol levels. A change in the timing of meals can also promote alterations in enzyme activity of certain plasma hormones affecting gastric emptying, such as insulin and glucagon, as well as in some metabolites such as ketone bodies, cholesterol and triglycerides. It is also suggested that cardiovascular diseases may be mediated by metabolic responses to inadequate nocturnal meals (Elaine, 2013).

Shift work is one of the occupational factors that has been shown to be associated with elevated levels of triglycerides and total cholesterol. In the epidemiologic literature, the association between sleep quality and lipid levels has shown mixed results (Luenda, 2016).

A study conducted in Republic of Korea showed that individuals reporting poor sleep quality had a higher prevalence of elevated triglycerides and low HDL cholesterol among a group of 143 law enforcement officers. Sleep quality was not significantly related to any of the individual components of metabolic syndrome, including elevated triglycerides and reduced HDL cholesterol among 3,435 Taiwanese adults. Low HDL cholesterol was an independent predictor of having a higher global sleep score (i.e., being a poor

sleeper), as measured by the Pittsburgh Sleep Quality Index (PSQI) (Luenda, 2016).

Since the productivity of the nation depends on the work force, it is essential to maintain the health of the workers. Thus, it is essential to screen their lipid profile and anthropometric measurements for further evaluation and management.

Materials and Methods

A cross sectional study was conducted among 200 ESI beneficiaries at the Department of Diabetology, ESIC Medical College and Model Hospital, Chennai. Purposive random sampling was used to select the patients. The average census of the outpatient Department of the hospital per day is around 175 to 225. Thus, the authors took a sample size of 200. The patients were briefed about the purpose of the study, and after obtaining their consent, they were enrolled in the study. Permission

was obtained from the Hospital authority to conduct the study.

General information of the subjects was obtained using interview schedule. Anthropometric measurements such as height and weight were measured. From the height and weight, BMI was calculated. Lipid profile of the participants was measured using appropriate methods. Total cholesterol was measured using choline oxidase peroxidase ester method; HDL was measured by using poly ethylene glycol method. LDL was calculated by direct measure, whereas triglycerides level was measured by Enzymatic End point. The obtained data were subjected to statistical analysis. After obtaining anthropometric assessments, lipid profile and the general information, the data were subjected to statistical analysis using appropriate test.

Results and Discussion

Table-1: Gender profile of the subjects

Gender	General N=100	Rotation N=100	Total
Male	40	37	77 (38.5)
Female	60	63	123 (61.5)

Values within brackets denoted the percentage

Our study showed a greater number of female workers (61.5%) to be coming in general shift than

their male counterparts (38.5%). Equally interesting is to note that such a phenomenon was observed in general shift too.

Table-2: Occupation categorisation of the participants

S.NO	Occupation	General N=100	Rotation N=100	Total
1	Accountant	2	0	2
2	Attender	1	0	1
3	Baby Sitter	1	0	1
4	Carpenter	0	1	1
5	Cashier	1	0	1
6	Church Worker	1	0	1
7	Cleaner	2	1	3
8	Clerk	10	1	11
9	College Attender	1	0	1
10	Camp Service helper	1	0	1
11	Cook	1	3	4
12	Data Entry Operator	1	0	1
13	Driller	1	0	1
14	Driver	4	1	5
15	Electrician	3	3	6
16	Executive	1	0	1
17	Export Helper	1	0	1

18	Fisherman	0	1	1
19	Fitter	4	7	11
20	Housekeeping	4	10	14
21	Labour	0	1	1
22	Lift Operator	1	0	1
23	Light Man	0	1	1
24	Load Man	0	5	5
25	Machine Operator	2	3	5
26	Manager	2	0	2
27	Mason Work	2	3	5
28	Mechanic	1	0	1
29	Medical Transcripator	1	4	4
30	Nursing Orderly	1	1	2
31	Painter	1	1	2
32	Pappad Maker	0	1	1
33	Plumber	0	1	1
34	Radiographer	0	1	1
35	Receptionist	1	0	1
36	Salesman	6	4	10
37	Security	0	19	19
38	Servant Maid	3	2	5
39	Server	1	1	2
40	Shopkeeper	2	0	2
41	Storekeeper	2	0	2
42	Supervisor	6	5	11
43	Sweeper	0	1	1
44	Table Operator	4	3	7
45	Tailor	18	8	26
46	Teacher	1	0	1
47	Waiter	1	4	5
48	Welder	0	2	2
49	Vehicle Washe	1	0	1

About forty nine different types of workers participated in the present study. Among them tailor (26), security (19), housekeeping (14) workers were

more, followed by clerical workers, fitters, salesman, supervisors.

Table-3: Alcohol and Smoking habits of the participants

Alcohol and smoking habits of the participants		General N=100	Rotation N=100	Total
Alcohol Habit	Yes	24	36	60
	No	76	64	140
Smoking Habit	Yes	14	20	34
	No	86	80	166

When the alcohol and smoking habits among the male participants were observed in the present study, 78% were alcoholic and 44% were smokers. It was also evident that higher number of alcohol and smoking habits was found among rotation shift workers than their general shift counterparts. Work pressure, fatigue and peer pressure were the reasons mentioned by the participants for alcoholic and smoking habits. Moreover, alcohol and smoking habits are highly associated with abnormal lipid profile which leads to cardiac complication in future.

Low HDL level and smoking are known risk factors for coronary heart disease. A study by Batik, 2006 revealed that tobacco and smoking were significantly associated with low HDL levels. It is also suggested that smokers had significantly lower mean HDL level than non-smokers. Another study concluded that cigarette smoking also appears to disrupt lipid and lipoprotein metabolism, leading to elevated plasma Cholesterol, Triglycerides and LDL-cholesterol, and lower HDL-cholesterol levels as compared to non-smokers (He B.M, 2013)

Table-4: Alcohol accompaniments of the participants

Accompaniments	General N=100	Rotation N=100	Total
Fried Items	12	21	33
Fruits	1	0	1
No Accompaniments	83	69	152
Pickles	4	10	14

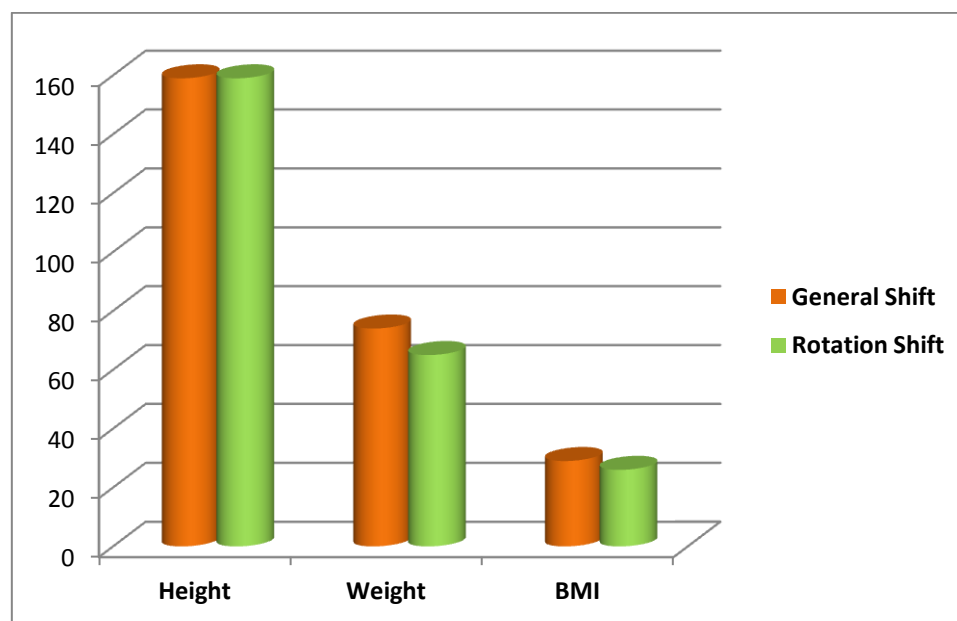
Most of our study participants consumed accompaniments along with the alcohol. About 55% and 23.4% consumed fried foods and pickles respectively. Only 1.6% consumed fruit along with alcohol whereas 20% never consumed any

accompaniment. The accompaniments like fried foods and pickles consumed by the participants are rich in fat and sodium. This aggravates the lipid profile and blood pressure among the consumers.

Table-5: Anthropometric assessments of the participants

Anthropometric Measurements	General Mean± SD	Rotation Mean± SD	'p' value	't' value
Height	159.03+ ₋ 7.39	159.91+ ₋ 9.14	0.455	N.S
Weight	74.8+ ₋ 9.72	65.3+ ₋ 11.5	0.331	N.S
BMI	29.6+ ₋ 4.37	26.15+ ₋ 4.53	0.700	N.S

N.S –Not Significant



The mean height was found to be 159cm for both general and rotation shift workers. It was noted that the weight of the general shift workers was higher than that of the rotation shift workers (74.8kg and 65.3kg respectively). Mean BMI was reported to be 29.6kg/m² and 26kg/m² for general and rotation shift workers, respectively. Even though the weight and BMI were not statistically significant, the rotation shift workers had low weight and BMI when compared to the general shift workers.

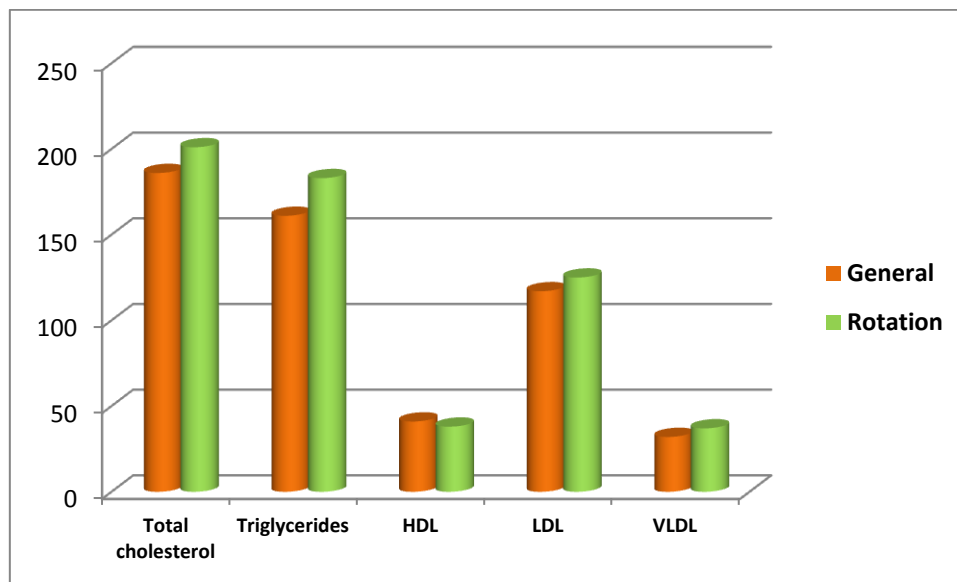
According to Saber, in 2010, obesity was more frequent among nightshift nurses than that in day shift nurses in the Islamic Republic of Iran. Irregular meal consumption is one of the factors leading to obesity and this was found to be significantly higher among night shift workers than day shift workers. Another study by Peplonska, 2015 reported both current and cumulative night shifts were associated with obesity.

Table-6: Lipid profile of the study group

	General Mean ± SD	Rotation Mean ± SD	't' value	'p' value
Total Cholesterol	186.1+_34.9	201.5+_45.9	0.008	<0.001
Triglyceridees	161+_106	183+_112	0.162	N.S
HDL	41.2+_10.6	38+_10	0.984	<0.001
LDL	117.4+_33.4	125.9+_37.2	0.090	N.S
VLDL	32.4+_20.7	37.1+_20.8	0.112	N.S

N.S- Not Significant

<0.001- significant at 1% level



It is evident that, lipid profile is elevated among the rotation shift workers. Total cholesterol was reported to be 186g/ dl and 201g/dl among general and rotation shift workers, respectively, which is also statistically significant at 1% level.

Triglycerides were found to be 161g/dl and 183g/dl among general and rotation shift workers respectively but it not statistically significant. Inversely, HDL was found to be less among the rotation shift workers (38g/dl) when compared to general shift workers (41g/dl) which is significant at 1% level. LDL was also reported to be higher in rotation shift than the general shift workers (125g/dl and 117g/dl respectively). VLDL was also found be higher among rotation shift workers (37g/dl) than general shift workers (32g/dl). Even though LDL and VLDL were higher among rotation shift workers than general shift workers, it is not statistically significant. Irregular dietary habits, improper sleep and less physical activity among the

rotation shift workers lead to elevated lipid profile among the rotation shift workers.

Nurses working in rotation night shifts had a significantly higher level of (abnormal) LDL than those working in day shifts (Mohnson, 2017). Another study by Albert, in 2014 showed that the majority of participants ate semi-healthy food; some ate unhealthy food such as processed meat, sweets, caffeinated beverages, and meat or poultry with skin; and others ate healthy food such as fruits and vegetables. This showed that dietary habits during rotation shift have an influence on the lipid profile of the workers.

A cross-sectional study on 319 Italian workers showed no significant difference in HDL between day and night shift workers. However, other studies have shown that low HDL serum level was more prevalent (Hameed Akbari, 2015).

The total cholesterol > 200 mg/dl and LDL > 130 mg/dl were more prevalent in shift workers than day workers. Other studies have been shown low HDL

level to be more prevalent between the shift workers than the day workers. No difference in the prevalence of hypertension was found when comparing shift workers and day workers. But one study has shown hypertension to be more prevalent between the shift workers than the day workers (Masoumeh, 2006)

Conclusion

The present study discovered the fact that total cholesterol, triglycerides, LDL and VLDL were found to be higher among rotation shift workers than general shift workers whereas HDL was lower among the rotation shift workers. When the anthropometric measurements were analysed, weight and BMI were reported to be lower among rotation shift workers than general shift workers.

Life style modification is essential to maintain the health of the workers. Health of the Rotation shift workers became an alarming problem. Combined action by the employees and employers is essential in this regard. An employee or worker should consume a balanced diet, with sound sleep of 7 to 8 hours and abstinence from smoking and alcohol habits. Employer should regularly conduct health camps and provide balanced and nutritious diet preferably in a subsidised price. Going by the saying, "prevention is better than cure", it is essential to prevent future cardiac complications by necessary precautionary measures to control the lipid abnormalities by balanced diet, adequate sleep, regular physical activity and monitoring the lipid profile.

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