



## TO STUDY THE PREVALENCE OF PREDIABETES AND DIABETES IN ROTATIONAL SHIFT WORKERS (NURSES) OF DR. RPGMC TANDA

### Endocrinology

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### ABSTRACT

**Introduction:** Diabetes is one of the most common metabolic diseases with a complex, multifactorial etiology and has varied clinical and biochemical manifestations. Rotating shift work has an impact on each component of metabolic syndrome and it can be a risk factor for type 2 diabetes. This study was done at Dr RPGMC as further studies in the shift work population are needed to sort out its role in all elements of metabolic syndrome and diabetes which are closely related to each other.

**Material and Methods:** Conducted in the Department of Medicine of Dr. Rajendra Prasad Government Medical College and Hospital, Kangra (at Tanda) a tertiary care referral hospital. The study was conducted for a period of one year after approval from Institutional Ethics Committee.

**Results:** Mean age of the study subjects was  $34.6 \pm 6.42$  years, hypertension was the most common family history (44.3%) followed by dyslipidemia (41%), coronary heart disease (CHD, 31.1%), stroke (26.2%), and diabetes (23%). Study observed that all of the subjects up to 30 years were euglycemic while among subjects aged 41-50 years, 50% were pre-diabetic, and 10% were diabetic. Study observed that 100% of diabetic subjects and 50% of pre-diabetic subjects were hypertensive

**Conclusion:** Rotating night shift work accounted for approximately 19.7% prediabetes and 4.9% diabetes among nurses. The additional risk of type 2 diabetes may occur when rotating night shift nurses follow an unhealthy lifestyle, which may be the result of disrupted sleep and circadian rhythms affecting, hormones, other metabolic pathways.

### KEYWORDS

#### INTRODUCTION:

Diabetes mellitus has been known since ancient times. The term —diabetes, was first used by Aretaeus, from the Greek word for a syphon, which literally meant —to go through or siphon as the disease drained more fluid than a person could consume. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, blood vessels, heart, nerves, and kidneys. Chronic hyperglycemia may cause impairment of growth and increase the susceptibility to certain infections in some people with diabetes. The clinical symptoms include polyuria, polydipsia, polyphagia, weight loss, and blurring of vision which usually occur when prolonged hyperglycemia is severe. [1] Currently 65.1 million people in India are diagnosed with diabetes mellitus. India has been called —the diabetes capital of the world and —every fifth diabetic in the world is an Indian Preliminary results from a large community study conducted by the Indian Council of Medical Research (ICMR) revealed that a lower proportion of the population is affected in northern states of India (Chandigarh 0.12 million, Jharkhand 0.96 million) as compared to Maharashtra (9.2 million) and Tamil Nadu (4.8 million). Given the disease is now highly visible across all sections of society within India, there is now the demand for urgent research and intervention at regional and national levels to try to mitigate the potentially catastrophic increase in diabetes that is predicted for the upcoming years.[2] There is more than one definition of shift work. Council Directive 93/104/EC of 23 November 1993 concerning certain aspects of the organization of working time (as amended by Directive 2000/34 of 22 June 2000) defines shift work as —any method of organizing work in shifts whereby workers succeed each other at the same work stations according to a certain pattern, including a rotating pattern, and which may be continuous or discontinuous, entailing the need for workers to work at different times over a given period of days or weeks.[3] The metabolic syndrome is a complex of interrelated risk factors for cardiovascular disease and diabetes. Higher prevalence of metabolic syndrome has been demonstrated among shift workers. Rotating shift work has an impact on each component of metabolic syndrome and it can be a risk factor for type 2 diabetes. Only a few studies have reported the prevalence of impaired glucose metabolism and diabetes mellitus in relation to shift work. [4-7] Hence, this study was done at Dr RPGMC as further studies in the shift work population are needed to sort out its role in all elements of metabolic syndrome and diabetes

which are closely related to each other. Also, no study on the relationship between shift work and the prevalence of pre diabetes and diabetes has been reported from this part of the country; hence, this study reporting the prevalence of diabetes and prediabetes in rotational shift workers was conducted among the nursing staff of Dr RPGMC Tanda.

#### AIMS AND OBJECTIVES:

To assess the prevalence of pre diabetes and diabetes in rotational shift workers (nurses) of Dr RPGMC Tanda.

#### MATERIAL METHOD:

**STUDY TYPE:** Hospital-based cross-sectional observational study  
**STUDY SETTING:** Conducted in the Department of Medicine of Dr. Rajendra Prasad Government Medical College and Hospital, Kangra (at Tanda) a tertiary care referral hospital. The hospital provides specialized services to the needs of population residing in the physiogeographic region of Shivalik and lesser Himalayas and includes lower hills of Kangra, Hamirpur, Una, Bilaspur, lower parts of Mandi and Chamba districts of Himachal Pradesh. This hospital caters to more than 50% of the population of this state. Permission from the institutional ethical committee was taken.

**STUDY DURATION:** The study was conducted for a period of one year after approval from Institutional Ethics Committee.

**SAMPLE SIZE:** All the consenting nurses over a period of one year fulfilling the inclusion and exclusion criteria were included.

#### PATIENT SELECTION:

**1. INCLUSION CRITERIA:** •Nurses having rotating night shifts (defined as at least three nights/month in addition to having worked days or evenings in that month), were included.

**2.EXCLUSION CRITERIA:** •Those subjects who were not consenting to be part of this study. •Pregnant females •Known diabetics

For hypertension JNC 8 criteria were followed, for diabetes. BMI was subcategorized as per ATP III. NCEP ATP III cholesterol guidelines [8] were used for lipids classification., ADA2021 guidelines were followed.[9]

**DATA COLLECTION:**

A detailed case history was recorded on a structured proforma. Basic data on age, sex, education, smoking and tobacco-chewing status, alcohol consumption, diet, and physical activity were collected from all the subjects.

Physical activity was categorized, depending on WHO STEPS Instrument. Dietary history was taken as per WHO STEPS Instrument.

All the subjects were interviewed regarding history of hypertension, diabetes, gestational diabetes. A detailed physical examination was performed.

All anthropometric measurements like weight, height, waist girth, waist hip ratio and body mass index were recorded using standardized procedures.

The weight of the subjects was taken to the nearest decimal. The height as recorded in cm, with a stadiometer, with the subjects standing in an erect posture, without any shoes and standing with feet closed.

Waist girth was taken at the midpoint between xiphisternum and iliac crest, with the help of an inelastic tape.

Blood pressure was recorded in all the subjects included in the study. For this purpose, 2 consecutive readings of BP were taken, with the subject in a sitting position, with the help of Omron automatic BP apparatus and a mean of the two readings was considered as the actual value.

For the purpose of study, hypertension was defined as a patient previously labelled and on treatment for hypertension or a patient meeting the criteria for hypertension under JNC 8 guidelines. Systemic examination of cardiovascular, nervous, respiratory, abdomen and musculoskeletal system was performed.

All the subjects included in the study were investigated for all the investigations as mentioned in the proforma. The subjects were instructed/asked to remain fasting for a period of 8 hours, following which their venous blood sample was drawn in an amount of 5 ml, in an EDTA vial and a plain vial. The blood samples were sent 28 to the hospital laboratory of Dr RPGMC Tanda, for investigations such as the fasting blood glucose, lipid profile, HbA1c, as mentioned in the proforma. HbA1c was done on a NGSP approved machine. Abnormal values in the diabetic range were confirmed in the second reading.

**STATISTICAL ANALYSIS:**

Data were recorded into Microsoft® Excel workbook and exported into SPSS v21.0 (IBM< USA) for statistical analysis. Categorical variables were expressed as frequency and percentages, and compared using Chi square test. Quantitative variables were expressed as mean and standard deviation. P value was considered statistically significant.

**RESULTS:**

The present hospital-based cross-sectional observational study was aimed to determine the prevalence of prediabetes and diabetes in rotational shift workers (nurses) of Dr. RPGMC Tanda over the period of one year. A total of 61 subjects were included in this study. Results of the study are described below: Age Mean age of the study subjects was 34.6±6.42 years ranging from 24 years to 47 years. 52.5% of the subjects were aged 31-40 years followed by 31.1% aged ≤30 years, and 16.4% aged 41-50 years. In our study, the only symptoms in the study subjects at the time of enrollment were fatigue (31.15%) and paresthesia (4.9%). In this study, none of the study participants had history of alcohol consumption, smoking, and tobacco use.

Hypertension was the most common family history (44.3%) followed by dyslipidemia (41%), coronary heart disease (CHD, 31.1%), stroke (26.2%), and diabetes (23%)

In this study, majority of the subjects were vegetarian (62.3%) while remaining (37.3%) subjects were non-vegetarian. In the present study, refined oil (45.9%) was the most commonly used cooking oil in participants home followed by mustard oil (37.7%), sunflower oil (11.5%), olive oil (3.3%), and Dalda (1.6%)

Majority of the subjects in our study were consuming fried food for a

day (62.3%) followed by (29.5%) for 2-days, (3.3%) for 3-days, and (1.6%) for 4-days. There were (3.3%) subjects who were not consuming fried food at all.

In our study, 21(34.4%) subjects were involved in vigorous physical activities. Out of these 21 subjects, 61.9% were doing vigorous physical activities for 1-day, 28.6% for 2-days, and 9.6% for 3-days within a week. We also observed that 59(96.7%) subjects were involved in moderate physical activities. Out of these 59 subjects, 3.4% were doing moderate physical activities for 1-day, 20.3% for 2-days, 44.1% for 3-days, 23.7% for 4-days, and 8.5% for 5- days within a week.

In this present study, all of the subjects were aware about diabetes. 23.3% subjects were evaluated in the past for diabetes.

In our study, mean BMI of the study subjects was 23.54±1.61 Kg/m<sup>2</sup>. None of the subjects was underweight, 44.3% were normal weight, 31.1% were overweight, and 24.6% were obese

In our study, mean waist-hip ratio of the study subjects was 0.79±0.026. 26.2% of the subjects had abdominal obesity as per WHR. In the present study, 9.8% of the study subjects were hypertensive. Our study observed that 11.5% of the subjects had hypothyroidism. Our study observed that 24.6% of the subjects had dyslipidemia.

In our study, prevalence of pre-diabetes and diabetes was 19.7% and 4.9% respectively.

Our study observed that all of the subjects up to 30 years were euglycemic while among subjects aged 41-50 years, 50% were pre-diabetic, and 10% were diabetic. We also observed that age was significantly associated with pre-diabetes and diabetes (P=0.009)

Our study observed that out of 19 subjects who had fatigue, 8 subjects were prediabetic while 3 were diabetic while among the 3 subjects with paresthesia, 1 subject each was pre-diabetic and diabetic while 1 subject was euglycemic.

Our study observed that out of 27 subjects with normal BMI, 92.6% were euglycemic. We also observed that normal BMI was significantly associated with euglycemic status (P=0.005).

Our study observed that 67% of the diabetic and 67% of the pre-diabetic subjects had abdominal obesity. We also observed that abdominal obesity was significantly associated with pre-diabetes and diabetes (P<0.0001).

Our study observed that 100% of the diabetic subjects and 50% of the pre-diabetic subjects were hypertensive. We also observed that hypertension was significantly associated with pre-diabetes and diabetes (P<0.0001).

Our study observed that 100% of the diabetic subjects and 83.3% of the prediabetic subjects were dyslipidemic. We also observed that dyslipidemia was significantly associated with pre-diabetes and diabetes (P<0.0001)

**DISCUSSION:**

The delay in diagnosing T2DM is a significant problem of modern medicine. T2DM may be asymptomatic for many years. Therefore, it is often detected incidentally during routine diagnostic evaluations. Considering the high cost of treatment, which is mostly due to diabetic complications, it seems necessary to introduce preventive programs. Most shift workers spend their working lives with a good deal of circadian dyssynchrony and sleep restriction.[10,11] Sleep is shortened by an average of about 2 hours every time a shift worker pulls a night shift. The circadian dyssynchrony experienced by shift workers (often for several decades) can be compared to that associated with weekly round-trip flights, with some workers on irregular 51 schedules suffering even worse assaults on the circadian system. Various adverse health consequences have been attributed to shift work. Several studies have shown that shift work adversely affects metabolic health. A study in the Netherlands concluded that body mass index (BMI) increases with shift work experience. [12] Current shift work has been shown to be associated with increased metabolic syndrome. Night shift working and or rotating shift working increases the physical stress and also alters the circadian rhythm. These

alterations also impose effect over the hormone synthesis, release and the regulation of effect of those hormones. Added to this, the night shift working will expose to the unwanted dietary habits at night and also altered dietary pattern. This will enhance the risk of developing diabetes mellitus among the shift workers compared to their counterpart who work in the day shift. [13] Night shift workers experience schedule changes differently from usual people with regard to mealtime, temperature, exercise, or other environmental factors and is known as zeitgeber. The synchronization between the circadian system and zeitgebers of night shift workers can cause circadian misalignment, which is detrimental to their health. The night shift workers are known to have a bad effect on their general health, which is associated with several diseases related to lifestyle. A study reports that night shift workers have more systemic diseases, one of these is type 2 diabetes mellitus. [14] In the largest study to date, Pan et al found that rotating night shift work is 52 associated with diabetes incidence in 177184 American nurses from Nurses' Health Study I and II. [15] Similarly, Vimalananda et al has, in the Black Women's Health Study with 28,041 participants, detected association between night shift work and diabetes incidence [16], and like Pan et al, detected a dose-response relationship of increasing diabetes incidence with increasing numbers of years working night shift. In a recent meta-analysis, Gan et al reported that diabetes risk was higher for those working rotating night shifts than those working night, mixed, evening or unspecific shifts, and called for more studies, especially on night shift work to address the limited power of existing studies, and the heterogeneity between the working time definitions used in the studies. [17] In this hospital-based cross-sectional observational study, we investigated prevalence of pre-diabetes and diabetes in rotational shift workers (nurses) of Dr RPGMC Kangra at Tanda. A total of 61 rotational shift nurses working at least three nights every month in addition to having worked days or evenings in that month, were included. In the present study, prevalence of pre-diabetes and diabetes was 19.7% and 4.9% respectively. Rongies et al, in Polish healthcare professionals reported that a vast majority of subjects (82.4%) had normal HbA1c levels. [18] High risk of diabetes was detected in 73 subjects (15.7%), while only 1.9% of subjects met diagnostic criteria for diabetes. In a study by Hansen et al, of 19873 women, in the final analyses, 873 (4.4%) developed diabetes during the mean follow-up of 15.1 years, or 308,078 person-years, with diabetes incidence rate of 2.7 per 1000 person-years. [19]. Pareek S studied workers of Northern Railway divisional hospital, and reported that the prevalence of Pre-diabetes and DM were 12.05% and 8.45% respectively. [20]

We also observed that normal BMI was significantly associated with euglycemic status ( $P=0.005$ ). Our findings are in concordance with Rongies et al who reported an increase in HbA1c levels with increase in BMI ( $r=0.3$ ,  $P<0.0001$ ). [18] Our study observed that 67% of the diabetic and 67% of the pre-diabetic subjects had abdominal obesity. We also observed that abdominal obesity was significantly associated with pre-diabetes and diabetes (P78 cms for men and >72 cms for women...should be advised to avoid weight gain and maintain increased physical activity. We also observed that hypertension was significantly associated with pre-diabetes and diabetes ( $P< 0.001$ ). [21]

Our study observed that 100% of diabetic subjects and 83.3% of pre-diabetic subjects were dyslipidemic. We also observed that dyslipidemia was significantly associated with pre-diabetes and diabetes Ginsberg et al and Krauss RM reported that patients with T2DM, even when in good glycemic control, have abnormalities in lipid levels. [22, 23] Low Wang et al estimated that 30-60% of patients with T2DM have dyslipidemia. [24]

Rotating night shift work accounted for approximately 19.7% prediabetes and 4.9% diabetes among nurses. The chances of diabetes were higher with advancing age, increased BMI, abdominal obesity, hypertension, and dyslipidemia

## CONCLUSION:

- Rotating night shift work accounted for approximately 19.7% prediabetes and 4.9% diabetes among nurses.
- The chances of diabetes were higher with advancing age, increased BMI, abdominal obesity, hypertension, and dyslipidemia.
- The additional risk of type 2 diabetes may occur when rotating night shift nurses follow an unhealthy lifestyle, which may be the result of disrupted sleep and circadian rhythms affecting,

hormones, other metabolic pathways.

- However further studies with a larger sample size are required to generalize our findings and to further determine the impact of rotational night shift among the healthcare nurses.

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