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ORIGINAL ARTICLE

Changes in Eating Pattern, Physical Activity and Sleep Quality among Night Shift Workers

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ABSTRACT

Aim: To study lifestyle changes which include eating pattern, physical activity, sleep quality and stress levels among night shift workers. **Methods and Material:** We collected our data using online search engines like Google Scholar, Research Gate & Pub Med. **Results & Conclusion:** It was concluded from our study that adults working on night shifts were found to have higher BMI therefore a positive association is found between night shift and BMI. Night shift workers have irregular meal patterns and their energy intake was also higher than the day workers. The consumption of snacks was more and fruits and vegetables intake was lower in night shift workers. The risk of developing metabolic disorder was also higher in night shift workers. The night shift workers also had poor sleep quality and more likely to suffer from psychiatric symptoms like fatigue, anxiety and stress.

Keywords: BMI, Metabolic disorder, Meal pattern, Physical activity, Anxiety, Stress

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Submited: 17-Jan-2021 **Accepted:** 22-Dec-2021 **Published:** 19-Jan-2022

INTRODUCTION

With times to fulfill demands socially and economically, we started following the new trend of night shift or graveyard shift along with traditional day timings. In Europe and USA alone, around 15-20% of employees work on night shifts[1]. Night shift workers work outside the regular timings of a 9 A.M to 5 P.M job and start their work from late night to early morning, fixed timings varying from jobs to jobs[2]. It is estimated that almost 20% of population works on night shifts.10% population of Brazil are night shift workers[3]. Professions like healthcare workers, emergency services, military services, transport services, law enforcement, several food services, BPO workers demand their workers to work at night[2].

Several studies suggest that night workers are more prone to develop health related problems which includes metabolic disturbances such as change in body weight, glycemic index, lipid profile, etc.[1] Metabolic and nutritional disorders such as type 2 diabetes, gastrointestinal diseases, dyslipidemia, cardiovascular diseases, and obesity are particularly seen in night shift workers[4]. Night shift is seen to increase mental, behavioral and physiological stress due to disruption in sleep cycle and sleep depreciation. Night shift is a risk factor for hypertension. It is difficult to maintain BP levels at normal levels due to disruption in circadian rhythms and also this disruption can reduce the insulin sensitivity. It is also seen that type 1 diabetes patients working on night shift have difficulty maintaining sugar levels[5].

Melatonin is a hormone that is released at peak during night time in human body, but due to exposure of artificial light at night the release of this hormone is reduced. This side effect is associated with circadian disruption that is commonly seen in night workers. It is observed that the exposure of light at night particularly in night shift workers leads to physiological changes in body that affect tumor development[6].

Night shift also disturbs our mental health leading to problems like fatigue, stress, anxiety and depression. This

Access this article online
Website: www.ijfans.org
DOI: 10.54876/ijfans_20_21

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How to cite this article: Priyanka, Gurmeen Rakhra, Gurseen Rakhra. Changes in Eating Pattern, Physical Activity and Sleep Quality among Night Shift Workers. Int J Food Nutr Sci 2022;11:13-20.

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works schedule also increased the risk of abortion, low birth weight in infants and premature birth in females[7].

When we look at the nutrition of night shift workers it is generally seen that night workers calorie intake is more or somewhat similar to day workers and the consumption of saturated fats and foods that have higher glycemic index is more in night workers.[4] Food habits and choices of night workers are different from day workers, night workers are more likely to consume snacks, confectionaries, alcoholic and carbonated drinks, and their fiber intake is also less. They have more refined sugar and fat intake and irregular meal patterns[8]. Lifestyle related habits, such as physical activity is lower in night workers. Night workers commonly follow a sedentary lifestyle[3]. The aim of this study is to review the lifestyle related changes that occur in adults working on night shift.

MATERIALS AND METHODS

We collected our review data from reliable search engines such as, Google Scholar, Research Gate & Pub Med. This study included articles that are published before January 2021. The articles which were published in English, were included in our study. The keywords used on search engines were “night shift”, “night workers nutrition”, “sleep”, “night workers eating pattern”, “mental health”, “night work risk factor”, “night shift India” “prevalence of night shift workers”.

RESULTS

Table 1: Descriptive Table for Studies Reviewed[9-30]

Author, Year	Participants Profile	Number of Participants	Recorded Measures/ Intervention	Result/ Conclusion
Griep *et al.* [9] (2014)	Country: Brazil; Gender: Women & Men; Occupation: Nurses	Total: 2372; Women(n): 2100; Men(n): 272	Questionnaire consists of professional, socio-demographical, lifestyle, health behavior questions. BMI	BMI for females: 25.6 kg/m^2 [range, 25.0–26.2] BMI for males: 26.9 kg/m^2 [range, 25.6–28.1] Night work has more effect on BMI of men than women.
Silva-Costa *et al.* [10] (2016)	Country: Brazil; Gender: Women & Men; Age: 35-74 years	Women(n): 4935; Night shift(n):379; Men(n): 3918; Night shift(n): 305	Total cholesterol, Fasting glucose level, glucose tolerance test after 75 g oral intake of glucose, BMI, hip and waist circumference	Females: Higher fasting glucose level, glycated hemoglobin, 2 hour plasma glucose level in association with night work. Men: Increase in BMI and waist circumference was seen in men in association with night shift. No association was found between night work and LDL, HDL, TCG and waist-hip circumference.
Buchvold *et al.* [11] (2015)	Country: Norway; Occupation: Nurses	Total (n): 2059	BMI, smoking habits, alcohol consumption (AUDIT-C), caffeine consumption, exercise habits and Number of night shifts done last year	Mean BMI: 24.4(SD 4.0); Mean AUDIT-C: 3.7 (SD 2.0); Mean smoked: 9.4 (SD 5.2); Mean caffeine intake: 3.0 (SD 2.7); Positive association of increased BMI and caffeine intake with night work was found. No association between night work load with alcohol, smoking & exercise habits.
Kwon *et al.* [12] (2016)	Country: Korea; Gender: Men & Women; Age: 20-69 years; Full time wage workers	Total (n): 1605; Night work: 10.6% (Male: 11.9%; Female: 7.4%)	Involuntary weight change	Odds Ration of weight gain in females in association with night work: 2.83 (95% CI 0.12-69.83); Weight loss: 1.95 (95% CI 0.47-80.86); In males OR of weight loss: 0.34 (95% CI 0.16-0.76) Male workers have lower chances of losing weight whereas the chances of losing or gaining weight in females is more working in night shift.

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Table 1 (Cont.)

Hemio *et al.* [13](2015)	Country: Europe; Gender: Women & Men; Occupation: Airline employees	Total(n): 1478; Male(n): 55%; Female(n); 45%; Day work(n): 608; Shift work in flight(n): 329; Shift work without flight(n): 541	Laboratory tests, physical measurements, 16 item food intake questionnaire	2.2% of men and 0.7% of women worked on night shift permanently. Females: Consumption of saturated fats was more in shift worker than day workers. Males: Consumption of fruits & vegetables is less in shift workers than day workers. Vitamin C intake was higher in in-flight workers.
Nehme *et al.* [14] (2014)	Country: Brazil; Gender: Male; Occupation: Security guard	Total (n): 54	24 Hour dietary recall, Anthropometric measurements, sleep duration (Actigraph devices) & sleepiness (Karolinska sleeping scale) High protein and carbohydrate diet given.	62.5% participants admit to gain weight in the last year. Average BMI 28.9 kg/m^2 (SD = 4.2 kg/m^2); Sleep duration was prolonged in obese workers who consumed carbohydrate rich meal.
Joo *et al.* [15] (2019)	Country: South Korea; Gender: Male & Female; Age≥30	Total(n): 5,813; Male(n): 2821; Female(n): 2992	Diagnostic test for dyslipidemia,	Females: No association of dyslipidemia was found with night work. Males: Positive association of dyslipidemia with night work. (odds ratio=1.53, CI=95%: 1.05-2.24)
Pietroiusti *et al.* [16] (2010)	Country: Italy; Gender: Male & Female	Total(n): 738; Day shift (n): 336; Night shift (n): 402	Nurses staff that do not have any component of metabolic syndrome assessed for four years annually to see the development of MS.	Night shift worker Cumulative incidence of MS: 9.0%; Annual rate of incidence: 2.9%; Day shift worker; Cumulative incidence of MS: 1.8%; Annual rate of incidence: 0.5%; Night workers are greater at risk of developing metabolic syndrome.
Marquezea *et al.* [17] (2012)	Country: Brazil; Gender: Female;Occupation : Nurses	Total (n): 446; Average mean of day shift: 4.5 years (SD = 4.9 years); Average mean of night shift: 6 years (SD = 5.2 years)	Weight, height, Epworth questionnaire for sleepiness, Occupational stress indicator (OSI) for job satisfaction, lifestyle questionnaire	Night workers; Average BMI: 25.5 kg/m^2; Average weight gain: 5.8 kg (95% CI 5.1-6.6 kg); Day workers; Average BMI: 25.0 kg/m^2; Average weight gain: 5.9 kg (95% CI 5.1-6.7 kg); Sleep quality since last month: 67.9%; Job satisfaction: 50.5%; Night workers are more prone to increased BMI.
Bonnell *et al.* [18] (2017)	Country: Australia; Gender: Male; Occupation: Firefighter	Total(n): 55	BMI, 24 hour dietary recall	No difference in energy intake during day shift or night shift. More energy dense diet was consumed on night shift than day shift. Consumption of snacks was more on night shifts.

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Alefishat *et al.* [19] (2016)	Country: Jordan; Gender: Male & Female; Age: Male: 36±9; Female: 32±6	Total(n): 140; Male(n): 60; Female(n): 80; Night shift(n): 82; Day shift (n): 58	Vitamin D	25 OHD levels Male: Mean: 23 ng/ml; Female: Mean: 25 ng/ml; (p = 0.35); In summers: Mean: 24 ng/ml; In winters: Mean: 22 ng/ml; (p = 0.46); Night shift; Mean: 21 ng/ml; Day shift: 28 ng/ml; (p = 0.003); Females working on night shifts have lower level of Vitamin D in comparison with female working on day shifts. (p = 0.01); No difference in Vitamin D level was found between males working on day and night shifts.
Macagnan *et al.* [20] (2012)	Country: Brazil; Gender: Male & Female; Age: 18-50 years; Occupation: Poultry farm employees	Total(n): 1206; Male(n): 420; Female(n): 786	Waist circumference, Weight, Height	Night shift:; Prevalence of overweight: 42.2%; Prevalence of abdominal obesity: 24.9%; Day worker: Prevalence of overweight: 34.3%; Prevalence of abdominal obesity: 19.5%
Zoto *et al.* [21] (2019)	Country: Albania; Occupation: Nurses	Night Shift workers(n): 137; Control(n): 49	Waist circumference, hip circumference, blood pressure, Fasting blood samples, Sleep quality (PSQI)	Nurses working on night shift had poor sleep quality. There was no difference found in age, smoking habits, sex, blood pressure level & lipid profile between night shift workers and control. There was no significant difference was found in waist circumference.
Fujino *et al.* [22] (2001)	Country: Japan; Occupation: Garbage-collector & driver	Total(n): 384	Health status (GHQ questionnaire), job stress (NIOSH questionnaire)	The married permanent night workers had less mental health related problems than single permanent night workers.(OR = 0.49). Night workers working on lower position had less mental stress than workers at higher position.(OR = 0.46); Night workers with more work load had more mental health problems.(OR = 2.86)
Diniz *et al.* [23] (2012)	Country: Brazil; Occupation: Nurses	Total(n): 1134; Day workers(exclusively): 281; Night workers(former): 312; Night shift up to 5 in two weeks span: 289; Night shift more than 6 in two weeks span: 252	Minor psychiatric disorder(SRQ-20),	Higher odd ratio was seen in those who worked more night shifts(OR=2.1) than those who worked less on night shifts.(1.5); Prevalence of MPD, Total population: 33.7%;; Nurses who left night work: 23.8%; Nurses who are working on nightshift: 45.2%
Beltagy *et al.* [24] (2018)	Country: Finland; Gender: Male & Female	Total(n): 46010; Female(n): 92%; Male(n): 89%	Number of absent days due to metal issues, antidepressant purchase, Number of shift work(night shift), day work, shift work(excluding night shift)	Changing from day to night work was not associated with common mental disorder (CMD).(OR = 1.03); Recovery from CMD increased when shift changes from night to day work.(OR = 1.99); Changing from day to night shift increased the risk of CMD by 1.25 fold.

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Selvi *et al.* [25] (2010)	Country: Turkey; Gender: Male & Female	Total(n): 87; Day shift(n): 42; Night shift(n): 45	Psychiatric symptoms (SCL-90-R), General health status (SF-36)	Nurses working on night shift had shown more psychiatric symptoms comparatively, with day workers. Quality of life was also lower in night shift workers.
Chen *et al.* [26] (2020)	Country: US; Gender: Female; Occupation: Nurses	Total(n): 12; Day shift(n): 5; Night shift(n): 5; Rotating shift(n): 2	Physical activity, sleep, light exposure & eating time, food diaries	There was no difference was found of BMI between day, rotating & night shift.($p = 0.8157$) Rotating shift workers had less energy intake, physical activity & sleep in comparison with day & night worker. Night workers consumed more calories comparatively and higher physical activity & less sleep.
Samhat *et al.* [27] (2020)	Country: Lebanon; Gender: Male & Female; Occupation: Nurses; Age: 24-45 years	Total(n): 307; Male(n): 101; Female(n): 206; Mean number of night shift(n):12.61	Night shift per month, physical activity, BMI, waist circumference, Number and types of meals and timings	78.2% nurses had irregular meal timings. Snack consumption increased during night shift ($p = 0.015<0.05$). BMI & waist circumference increased with number of working years and consecutive night shifts. Work aside 84% nurses do not perform any physical activity.
Freitas *et al.* [28] (2015)	Country: Brazil; Gender: Male & Female; Age: 18-50 years; Occupation: Poultry processing plant employees	Total(n): 1206	Number of meals, Types of meals, snacks	Night shift workers consumed more number of meals comparatively. The consumption of snacks in between meals was more in night workers. Night shift workers are more likely to skip breakfast.
Oyane *et al.* [29] (2013)	Country: Norway; Gender: Male & Female; Age: 21-63 years; Occupation: Nurses	Total(n): 2059; Females(n): 90.6%	Anxiety & depression (HADS), fatigue (FQ), sleepiness (ESS),	Insomnia and fatigue was positively associated with night work. No association was found between night work and depression & anxiety.
Buchvold *et al.* [30] (2018)	Country: Norway; Age: 21-63 years; Occupation: Nurses	Total(n): 1244	Weight, height, BMI, Number of night shifts	Night shift workers gained more weight in last four years resulting higher BMI in comparison with day workers. Day workers had no significant weight gain in this 4 years follow-up. No association was found between number of night shifts annually and change in BMI.

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DISCUSSION

In our review article we focused on the effects of night shift work on the eating pattern, physical activity, sleep quality, mental health and others physiological changes. Our study leads us to observe various changes that occur due to different working shift amongst the working population. The weight gain was seen especially amongst night workers in comparison with day workers. The BMI of night workers was found to have a positive association with night work[9-12, 14, 17, 27, 30]. From most of the studies it was observed that weight gain is associated with night work. The abnormal BMI can lead to lifestyle related disorders such as type 2 diabetes, Cardio-vascular disease, hypertension, dyslipidemiain future. The consumption of irregular meals was seen in night workers[4, 27]. The energy intake of night shift workers was more, in comparison with day workers[1, 26]. The night workers are more likely to eat snacks and confectionary items than day workers[18, 27-28]. The consumption of healthy foods such as vegetables and fruits was lower in night workers[4, 13]. The caffeine consumption was also higher in night workers. There was no effects of night work on the exercise habits, alcohol consumption and smoking[11]. Higher waist circumference i.e., abdominal obesity was observed in night workers[4, 20]. The night workers are at higher risk of developing metabolic syndrome like stroke, type 2 diabetes, heart diseases, hypertension, etc.[15, 16]

Due to abnormal working pattern it is difficult for night workers to attain good sleep-quality, it is observed that night workers had poor sleep quality, shorter sleep duration and are more likely to suffer from sleep disorder. Night shift workers suffered more from insomnia in comparison to day workers[21, 29]. Mental health related problems like anxiety, fatigue, stress was generally seen more in employees working on night shift than day shift workers[23-25]. We also observed from our study that due to working on night shifts the level of Vitamin D alters in night shift workers. The level of Vitamin D was less in females working on night shifts in comparison with females working on day shifts ; on the other hand no such difference was seen in males[19].

Most of the studies are performed on employees working in healthcare sectors that cannot be generalized to other professions. More such studies should be done on people from different profession to know the effects of night work on their lifestyle and physiological changes.

CONCLUSION

Our review article helped us to study the lifestyle changes and other physiological changes that are occurring due to night work. We concluded from our study that night shift workers are more prominent to follow an unhealthy eating behavior in comparison with day workers resulting in more weight gain. Night workers had increased BMI than day workers. Abdominal obesity is more common in night workers. Night workers consume more snacks and caffeine. Irregular eating patterns and excess calorie intake was observed in night workers. The consumption of vegetable and fruits is less in night workers that can cause deficiency of micronutrients. It is concluded that night work increase the risk of developing lifestyle related disorders. It is also concluded that night workers had shorter sleep duration and poor sleep quality. The symptoms of psychiatric disorders like fatigue, stress was more common in night workers. Health measures should be taken by night workers to attain good health and lowering the risk factors of developing lifestyle related disorder.

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