

Weight gain in relation to night work among nurses

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Abstract. Objective: To investigate the relationship between working at night and increased body weight in nursing. In addition, we evaluated the differences in the proportion of variables sociodemographic, work and health, according to the work shift and their association with body mass index. Methods: Based on questionnaires, we obtained data from 446 nursing professionals about aspects of their job, health and lifestyle. We performed linear and logistic regression analysis. Results: Working at night is associated with a weight gain greater than ($\beta=0.24$ kg/m²) working during the day ($\beta=0.15$ kg/m²), as well as with aging ($\beta=0.16$ kg/m²) and duration of working in nursing ($\beta=0.18$ kg/m²). Night workers have a higher educational level, have been working for more years in nursing and also in the current shift, do not have diabetes and have reported longer sleep than day workers. There are also a higher number of smokers among the night workers than day workers. Logistic regression analysis also showed the more time to work in nursing and as an assistant was more likely to develop overweight/obesity. Conclusion: Working at the night contributes to more weight gain than the day shift, aging and duration of working in nursing.

Keywords: shift work, weight gain, nursing professionals, night work, body mass index.

1. Introduction

Shift and night workers represent about 20% of the workforce of the European community [34] and also the United States [15]. Fischer [12] estimates that in Brazil, this percentage reaching 15% of the workforce. Schemes of work that alter the organization of work and sleep schedules of the individual can produce fatigue, mental irritability, tendencies toward depression, disturbances in appetite, intestinal organs and also in sleep [14].

Night work is usually associated with reduced duration and quality of sleep. In recent researches an association between sleep and obesity has been observed [4, 7, 16, 21-22, 24-25, 30], where the low

quality and short duration of sleep are closely related to weight gain.

However, obesity is a multifactorial syndrome in which disorders of energy balance, resulting from temporal desynchronization with the biological temporal organization, may have an important and decisive role in its genesis. Some authors suggest that chronic desynchronization of circadian rhythms, as observed among shift workers, can affect energy metabolism and body weight regulation, promoting the development of obesity [10-11, 31].

Karlsson et al [19] present that not only the sleep reduction, but also its change associated with the circadian desynchronization is associated with obesity. In animal models, Salgado-Delgado et al [28] found that obesity was caused by food intake during the rest

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phase, in which the change in food intake for the phase of normal activity prevented the increase in body weight. In summary, it can be concluded that eating habits can induce or prevent obesity.

Specifically in relation to nursing work, in which evening and irregular work hours are commonly observed, the scientific evidence is clear that shows that this organization of work can negatively affect the worker as much physiologically as psychologically [2]. Among the most frequent are sleep disorders and other health problems [17], such as coronary heart disease and stroke [5], in addition to accidents at work [6], decreased job performance and job satisfaction [2]. Zverev and Misiri [37] found among nursing professionals that this association persists for days off, indicating the accumulation of fatigue.

Considering that shift work leads to circadian misalignment and this, in turn, seems to be associated with obesity, our hypothesis in this study was that night work leads to increased body weight nursing staff higher than day work. This study aimed to investigate the relationship between working at night shift and increased body weight in nursing. In addition, we evaluated the differences in the proportion of variables sociodemographic, work and health, according to the work shift and their association with body mass index.

2. Material and methods

2.1. Design / participants

We conducted an epidemiological cross-sectional study with 941 nursing professionals from a public hospital. It was included on the study all the professionals who agreed to participate voluntarily in this research, a total of 548 people. Table 1 shows the comparison analysis of the losses of the population with the research group.

Table 1 - Test of proportions (χ^2) of the population studied and losses, by sex and work position.

Variables	Categories	Participants n (%)	Loss n (%)	p
Sex	Female	475 (86.7)	332 (84.7)	0.39
	Male	73 (13.3)	60 (15.3)	
Work position	Nurse	155 (28.4)	117 (29.8)	0.65
	Technician or Nurse Auxiliary	391 (71.6)	276 (70.2)	

No statistically significant differences were found between the two groups regarding gender and function ($p > 0.05$), showing that the groups are similar.

Of the 548 professionals, 68 (12.4%) were excluded because they were male and a small proportion of the female population and 34 (6.2%) were excluded because they had worked less than four months at the studied site. The remaining total of 446 nursing professionals (47.4% of the population) was distributed in the following proportions: 30.9% nurses, 69.1% nursing assistants (nurse technician and nurse auxiliary).

The mean age was 34.8 years (SD 9.5 years), the average working time in nursing was 9.5 years (SD 7.5 years), mean 4.5 years (SD 4.9 years) on the day shift and 6 years (SD 5.2 years) on the night shift.

2.2. Working conditions

Nurses working in different shifts and are classified according to the schedule of shifts, which are:

- Day shift – To work between 07:00 and 19:00h. It could be to work either morning shift or afternoon shift, or both. Working hours reported by 279 nurses were 6 hours/day (5 day-work x 2 day-off or 6 day-work x 1 day-off), 8 hours/day (5 day-work x 2 day-off or 6 day-work x 1 day-off), or 12 hours/day (12-hours on duty x 36-hours off). Out of 279, 21 had a second job.

- Night shift - To work between 19:00 and 07:00h.

The working system was referenced to 12-hour on duty per 36-hour off (n= 166 nurses). A total of 27 nurses had a second job.

The second job was only used as an adjustment variable in linear regression analysis.

2.3. Data collection

For data collection, nursing professionals filled out a questionnaire on sociodemographics, work, health and lifestyle. Epworth questionnaire [18] was used in this study to evaluate sleepiness and the Occupational Stress Indicator (OSI) to estimate job satisfaction [27]. The OSI job satisfaction scale consists of twenty-two psychosocial aspects of work, resulting in a total score ranging from 22 to 132 points. The scale has no cutoff pre-defined for this study and was defined as high and low job satisfaction relative to the median (83.5 points). To calculate body mass index, we used self-reported body mass (kg) and height (m). Dekkers et al [9] present that self-reported body weight and height are valid measures in epidemiolog-

ical cross-sectional study, as is the case this study. The calculation and BMI classification followed the criteria of the World Health Organization/WHO [1]. Sleep duration and body weight in the last year were self-reported by the nurses. The information of the actual number of disease was obtained through the Work Ability Index (WAI)[35].

2.4. Ethical considerations

The research project was approved by the Ethics Committee of the Faculty of Medicine, University of São Paulo. After approval, we conducted a pilot study on the adequacy of the questionnaires and then started to collect data during the working hours of participants. Data collection was performed at the target hospital during working hours.

2.5. Data Analysis

We performed descriptive statistics on the independent and dependent variables. To test the normality of the variables we used the Kolmogorov-Smirnov test.

We used the Pearson's Chi-square test (χ^2) or Fisher's Exact Test to compare proportions, and Student's t-test or Mann-Whitney test to compare continuous variables. Univariate and multiple logistic regressions were used to analyze the independent variables with overweight and obesity (stepwise forward technique). The consistency of the models was verified by the Hosmer-Lemeshow Goodness-of-Fit Test.

Analysis was performed using univariate and multiple linear regressions with body mass index (BMI) as the dependent variable, with the β coefficients estimated at a confidence interval of 95%. Five models were constructed using multiple linear regression, taking as independent variables age, time working in nursing, working hours in the day shift, working hours on the night shift and duration of self-reported sleep, all adjusted for smoking, physical activity level, educational level, marital status and second job.

In all tests were considered significant when $P < 0.05$. All data analysis was carried out with software SPSS, version 17.0 (SPSS Inc. Chicago, USA) and Stata, version 9.1 (Stata corp, Texas, USA).

3. Results

Night workers working in nursing for a mean time of 10.4 years (95% CI 9.3-11.5 years), while the day

workers for 9.0 years (95% CI 8.1-9.9 years) ($P=0.01$). The mean working time in the current shift was also higher among night workers compared to day workers (6.0 years - 95% CI 5.2-6.8 years vs 4.5 years - 95% CI 3.9-5.1 years - $P=0.00$).

The mean Body Mass Index (BMI) of night workers was 25.5 kg/m² (95% CI 24.8-26.1 kg/m²) and day workers was 25.0 kg/m² (95% CI 24.5-25.5 kg/m²), showing no statistically significant difference ($P=0.25$). A total of 52.7% reported having increased weight in the last year, being the average increase in night workers of 5.8 kg (95% CI 5.1-6.6 kg) and day workers of 5.9 kg (95% CI 5.1-6.7 kg) ($P=0.55$). Most had a good or very good perception of sleep quality in the last month (67.9%) and did not feel excessive sleepiness (52.5%). About half of those surveyed had low job satisfaction (50.5%). In terms of diagnosed illnesses reported, 8.3% reported hypertension, 2% diabetes and 4.9% thyroid disease.

Table 2 presents the differences in the proportion of sociodemographic, lifestyle, work and health variables according to work shift. Night workers have a higher educational level, have another job, do not have diabetes and have reported longer sleep than day workers. There are also a higher number of smokers among night workers than day workers.

Table 2
Chi-square (χ^2) test of social demographic, lifestyle work and health variables by shift work.

Variables	Categories	DW	NW	p
Sociodemographic				
Age (years) (n=446)	≤ 32 ¹	146	81	0.49
	> 33	134	85	
Married Status (n=446)	With Partner	139	67	0.06
	Without Partner	141	99	
Education Level (n=446)	Incomplete College or Higher	155	108	0.04*
	Secondary Education Completed	125	58	
Lifestyle				
Smoker (n=446)	No	264	144	0.01*
	Yes	16	22	
Alcohol Consumption (n=446)	No	139	68	0.08
	Yes	141	98	
Level of Physical Activity (n=446)	Active	176	95	0.23
	Sedentary	104	71	
BMI (kg/m ²) (n=446)	≤ 24.99	154	92	0.93
	> 25	126	74	
Work				
Work Position (n=444)	Nurse	79	58	0.15
	Nursing assistant	199	108	

Duration of Work in Nursing (years) (n=446)	≤ 8 years ¹	172	86	0.05*
	> 8 years	108	80	
Duration of Work in Current Shift (years) (n=445)	≤ 3 years ¹	157	67	0.00*
	> 3 years	122	99	
Possesses Second Job (n=446)	No	260	138	0.00*
	Yes	20	28	
Job Satisfaction (n=446)	High	138	83	0.88
	Low	142	83	
Health				
SAH (n=446)	No	258	151	0.66
	Yes	22	15	
Diabetes Mellitus (n=446)	No	271	166	0.02*
	Yes	9	0	
Thyroid disease (n=446)	No	264	160	0.32
	Yes	16	6	
Excessive Sleepiness (>10 points) (n=446)	No	142	92	0.34
	Yes	138	74	
Self-reported Sleep Duration (hours/day) (n=445)	< 7	155	57	0.00*
	7 -- 9	92	60	
	≥ 9	32	49	

DW = Day-workers / NW = Night-workers

SAH = Systemic Arterial Hypertension

¹Median Value

* p<0.05

When analyzing the variables married status, education level, work position, duration of work in nursing, second job, job satisfaction and diabetes associated with overweight and obesity (≥ 25 .Kg/m²), we found that more time to work in nursing and as a nursing assistant was more likely to develop overweight/obesity (Table 3).

Table 3
Logistic regression analysis predicting overweight/ obesity (BMI ≥ 25 kg/m²). (n=443)

Variables	Categories	OR crude	95% CI	p
Duration of Work in Nursing	≤ 8 years	1		0.00
	> 8 years	3,34	2.24-5.00	
Work Position	Nurse	1		0.03
	Nursing assistant	1.93	1.25-2.99	

¹Adjusted by age, smoking, alcohol consumption, physical activity level, hypertension, thyroid disease, shift work and sleep duration. (Hosmer-Lemeshow = 0.77)

The linear regression analysis showed a greater increase in BMI for those who work the night shift compared to those working the day shift: 0.24 kg/m² and 0.15 kg/m² per year of work, respectively (Table 4). Each year of life led to an increase in BMI of 0.16 kg/m², while each year's work in nursing increased by 0.18 kg/m² per year of work.

Table 4 –
Results of linear regression analysis of body mass index (kg/m²).

Models	β crude	95% CI	β Adj [§]	95% CI
[1] Age (years) (n=446)	0.16	0.12-0.20*	0.16 ¹	0.13-0.20*
[2] Duration of work in nursing (years) (n=446)	0.17	0.12-0.22*	0.18 ²	0.13-0.23*
[3] Duration of work on day shift (years) (n=279)	0.15	0.06-0.25*	0.15 ³	0.06-0.25*
[4] Duration of work on night shift (years) (n=166)	0.24	0.12-0.36*	0.24 ⁴	0.12-0.37*
[5] Self-reported sleep duration (hours/day) (n=445)	-0.01	0.21-0.20	0.00 ⁵	0.21-0.20

¹r²=0.16 / ²r²=0.13 / ³r²=0.05 / ⁴r²=0.11 / ⁵r²=0.02

[§] Adjusted by smoking, physical activity level, educational level, marital status and second job.

*p<0.05

The coefficients of determination (the closer r² to 1, the more the model is adjusted) show that increased BMI may be explained 16% by the variable age, 13% by the time working in nursing, 5% by the time working on the day shift and 11% by the time working on the night shift. Despite the low explanatory power of the variables, they are relevant, especially the difference found by day shift and night shift leading to a higher increase in BMI compared to the other variables, even from the aging process itself.

4. Discussion

In this study, we found that working the night shift leads to a greater increase in body mass index (BMI) compared to working during the day. The results obtained in this study were similar to studies by Niedhammer et al [23], van Amelsvoort et al [36], Gelliebte et al [13] and Szpak et al [33] who found an association between weight gain and night shift.

The coefficient observed in this study was higher than that found by van Amelsvoort et al [36] in a cohort study of shift workers (who observed 0.12 kg/m² increase per year). These results show that schedules usually adopted for nursing work can affect the meta-

bolism of workers. These findings are supported by other studies that say that the shift work is an independent risk factor for weight gain [8, 32].

What calls our attention in these results is the fact that we did not find a difference between the groups either in current body mass index or in the increased weight during the last year. This means that both groups had gained weight. However, as we have mentioned, working at night leads to a greater increase in BMI than the day work. A possible explanation for these results might be the difference of weight when they have started working in nursing. Night workers might be thinner than day workers at that time. In fact, the lack of this information is a limitation of the present study, since it is not a longitudinal study.

Geliebte et al [13] found that the weight increase was greater among night shift nurses compared to the diurnal nurses. However, they also have not found statistically significant differences in current weight between the two groups.

Although the results of this study have confirmed the hypothesis that night work leads to weight gain, the same did not occur in connection with the duration of sleep. The duration of reported sleep was significantly higher for those who work at night compared to those who work during the day shift.

In other words, although short sleep duration is associated with weight gain, in the present study it was not associated with night work. This finding is against expectations, particularly because it is much known the reduced sleep duration among night workers. On the other hand, the interesting side of our findings is the need to investigate metabolic changes that may be involved in weight gain in night workers. Duez and Staels [10] present that many metabolic functions have circadian rhythms, indicating a strong interaction between circadian rhythms and metabolism, a concept reinforced by the association between circadian desynchronization and increased of the incidence of metabolic disorders and increased risk of obesity.

Scheer et al [29] found that the circadian desynchronization, by itself, has an impact on levels of leptin (the hormone responsible for satiety), without influence of sleep efficiency. There is appetite stimulation with the decrease in leptin level and if it is maintained chronically, could contribute to the development of obesity [29]. Karlsson et al [19] had already put that not only reduced sleep duration may be associated with weight gain, but also the inversion of the sleep/wake cycle associated with the circadian desynchronization are associated with obesity.

It is also important to consider the inversion of the feeding schedules and as presented by Salgado-Delgado et al [28] and Ekmekcioglu and Touitou [11], which could be a possible explanation for weight gain among night workers. In a review about shift work and obesity, Antunes et al [3] present that there are epidemiological evidence of association between these two variables and that this occurs as a result of poor physiological adaptation of chronic sleepiness and/or feeding schedules on circadian abnormal, reinforcing the results found in this study.

This entire situation will be exacerbated with longer working time, a result verified in the logistic regression analysis, in which work more than eight years in the profession, raises the risk of overweight/obesity in three times more after controlling for factors confusion. The role of nursing assistant is also an important risk factor for weight gain, and nearly twice the risk as compared to nurses.

Almost 11% had another job; however, among those who worked the night shift, 16.9% had another job. Having a second job during the day after a night shift enhances the effects of work at night, with a view to greater sleep deprivation, notes Pontes [26]. Moreover, the 12-hour shifts, often employed in hospitals, require a larger overhead when compared to working 8 hour shifts, commonly adopted in industries [20]. One can therefore consider that the workload usually observed in this category involves a paradox, since these workers, who are dedicated to caring for the health of others, have little time to care for themselves, which in itself constitutes a risk factor for health.

Despite the limitation of the results by cross-sectional nature, which precludes identifying a cause-effect relationship, this study is notable for evaluating workers in real condition of work, showing that shift work is an important occupational risk factor for weight gain.

Our conclusion is there is likely to be an increase in body weight with age and with years of work in the profession. In addition, working at night is associated with a weight gain greater than during the day.

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