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ORIGINAL ARTICLE

Shift work, sleep duration, and body image dissatisfaction among female workers in southern Brazil

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Abstract

We examined the association between shift work and sleep duration with body image dissatisfaction (BID) among shift-working women in southern Brazil. In this cross-sectional study, data of 505 women shift workers, between 18 and 60 years old, were collected between January and April 2011. BID was assessed using the Stunkard Figure Rating Scale. Information on shift work, sleep duration, and other explanatory variables was collected through a questionnaire. An aggregated exposure variable was created and termed "sleep deprivation," with the exposure category being night-shift workers who slept < 7 h/day. The respective prevalence ratio values were estimated using a Poisson regression. The prevalence of BID among shift-working women was 42.4 (95% CIs = 38.0 to 46.7%), and 199 (93.0%) of these women wished they had a smaller body size. Shift work (PR = 1.40; p = 0.006) and sleep duration (PR = 1.32; p = 0.010) were independently associated with BID. Additionally, workers with sleep deprivation exhibited a higher probability of BID than those without sleep deprivation (PR = 1.31; p = 0.012). These results reveal a situation of vulnerability and the need for strategies and actions directed at shift-working women with the aim of reducing the effects of sleep deprivation on mental health, particularly with regard to body image disorders.

Keywords Body image · Shift work · Sleep · Women

Introduction

Body image is a multidimensional construct that incorporates cognitive, affective, behavioral, and perceptual aspects (Bergstrom and Neighbors 2006). The affective domain, also considered the attitudinal portion of body image, is linked to feelings that individuals have about their appearance and body (Bergstrom and Neighbors 2006). Thus, feelings of dissatisfaction with the body or appearance characterize a type of body image disturbance called body image dissatisfaction (BID) (Bergstrom and Neighbors 2006). Studies have related higher levels of BID with attempts at losing weight, abnormal eating behavior (França et al. 2014; Nunes et al. 2001), and poorer physical health-related quality of life (Wilson et al. 2013).

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Those potentially at risk for BID include elderly individuals, women who live with a partner (Mintem et al. 2015; Silva et al. 2011), people who are physically inactive (Kruger et al. 2008), White women (Ginsberg et al. 2016; Kronenfeld et al. 2010), those with lower education (Garrusi and Baneshi 2017; Mintem et al. 2015), women with poor self-rated health (Ginsberg et al. 2016), women with depression (Jackson et al. 2014a), people with low self-esteem (Fortes et al. 2014), and those who are obese (Nikniaz et al. 2016). Regarding gender, women are more likely to have BID than men (Garrusi and Baneshi 2017), most likely because of cultural norms and social factors.

Shift work, including night work, has become common in modern societies, such as the European Union, where approximately 10% of all workers complete night shifts at least 5 days per week (Valeyre et al. 2009). Night work is related to various health problems, including sleep-related problems, such as sleep deprivation. Furthermore, research has discovered significant associations between sleep-related problems and numerous negative health consequences, including diabetes (Shan et al. 2015), metabolic syndrome (Canuto et al. 2015), obesity (Canuto et al. 2014), depression (Jackson et al. 2014b), low self-esteem (Lemola et al. 2013), and eating disorders (Trace et al. 2012).

Despite the higher prevalence of BID among women and the possible health changes that night work and sleep duration can cause among shift-working women, no studies have addressed this specific relationship to date. Thus, the major objective of the present study was to investigate the association between shift work and sleep duration with regard to BID among shift-working women.

Materials and methods

Outline and sample collection

The present study employed a cross-sectional analysis of a sample of women between 18 and 60 years old who work at a poultry processing plant in South Brazil that operates 24 h each day. This sample was derived from a case-control study performed between January and April 2011 that sought to investigate the factors associated with abdominal obesity among 541 female shift workers (Garcez et al. 2015). Data regarding BID, shift work, and sleep duration were retrieved from 505 of these workers who comprised the present study sample.

Trained interviewers conducted interviews at the workers' homes by administering a standardized and pre-codified questionnaire developed by the authors based on standard questionnaires for data collection. The present study was performed in agreement with all ethics requirements for human research, and it was submitted to and approved by the Research Ethics Committee of the University of Vale do Rio dos Sinos under opinion number 3153/2009. All the women agreed to participate in the study, and they signed an informed consent document.

Evaluation of body image dissatisfaction

The outcome BID was assessed using a version of the Stunkard Figure Rating Scale (Stunkard et al. 1983) that was translated into Portuguese and validated for the Brazilian population (Scagliusi et al. 2006). The Stunkard scale is composed of nine drawings of women in bathing suits, arranged in increasing order of body size (Fig. 1). The interviewees then answered two questions: "Which of these silhouettes do you find most similar to yours?" and "Which of the silhouettes would you most like to have?" BID is determined by the silhouette discrepancy score, calculated as the absolute value of the difference between the number of the figure chosen as similar to the participant's silhouette and the number of the figure representing the participant's desired silhouette (Fallon and Rozin 1985). BID was classified using the following cut-off points: differences between −1 and +1 corresponded to body image satisfaction; those equal to or less than −2 corresponded to dissatisfaction caused by a body size smaller than desired; and differences equal to or greater than +2 represented dissatisfaction caused by a body size greater than that desired (Jackson et al. 2014a). For the final analysis, this variable was dichotomized as either body image satisfaction or BID, the latter of which included both types of dissatisfaction.

Evaluation of exposure: shift work and sleep duration

The company provided data regarding the participants' shifts, and these were confirmed during the home interview. The company operated 24 h a day with employees working 44-h weeks on the plant's production line and 1 day off on either Saturday or Sunday. Every 24-h (i.e., 1 day) period included 11 different shift start times. After obtaining information concerning all shift start times, a dichotomous work shift variable was created in which 1 represented the day shift (those who started their working hours between 6 a.m. and 2 p.m.), and 2 represented the night shift (those who worked more than 90% of their hours in the evening or at night, i.e., those who started their shift after 6 p.m.) (Macagnan et al. 2012). All participants were permanent shift workers (fixed-shift workers).

Information concerning sleep was obtained by assessing the bedtime and waking time of each worker. Based on these values, a continuous variable (hours of sleep per day) was obtained and dichotomized for analysis (<7 and ≥ 7 h/day) (Hirshkowitz et al. 2015; Macagnan et al. 2012). Based on the variables work shift (night or day) and dichotomized sleep duration, an aggregated exposure variable was created and

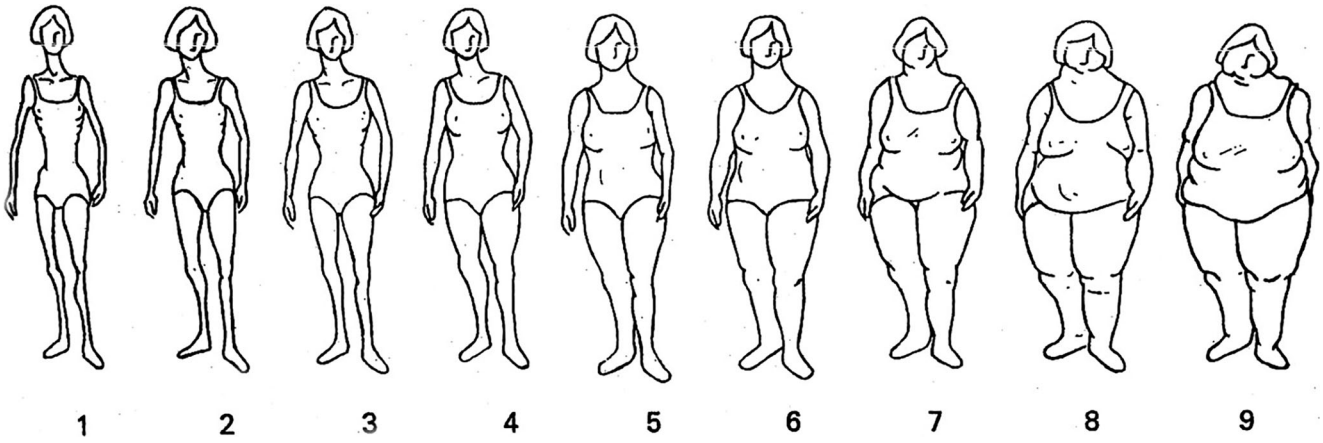


Fig. 1 Adult female figure rating scale adapted from Stunkard et al. (1983)

termed "sleep deprivation," in which 1 was "not exposed" (all day-shift workers and night-shift workers who slept ≥ 7 h/day) and 2 was "exposed to sleep deprivation" (night-shift workers who slept < 7 h/day).

Covariates

Questions were developed to assess demographic, socioeconomic, behavioral, and morbidity data for sample characterization, analysis of outcome distribution, and control of possible confounds. The demographic variables investigated were age (collected as a continuous variable in years and then categorized into three age groups of approximately 10 years: 18–30, 31–40, or 40 years and above), self-rated ethnicity (white or nonwhite), and marital status (with a partner or without a partner). Socioeconomic class was evaluated by the number of goods owned and the educational level of the head of the household via the Brazilian Economic Classification Criterion (Critério de Classificação Econômica do Brasil; ABEP); then, the workers were categorized into economic classes. The behavioral variables included smoking (smoker, ex-smoker, or non-smoker), leisure-time physical activity (active or non-active, defined as regular physical activity for at least 1 year), and number of meals per day (1 to 2 meals, 3 meals, or 4 meals or more). The morbidity variables were body mass index (BMI), which was calculated with measures of self-reported weight and height and then categorized into normal (BMI < 25 kg/m^2), overweight (BMI between 25 and 29.99 kg/m^2), and obesity (BMI ≥ 30 kg/m^2); self-reported depression (no/yes); and self-rated health status, which was based on the interviewees' responses and was categorized as either "good" (excellent, very good, and good) or "poor" (fair and poor). Another type of body image disturbance was evaluated that involves perceptual distortions in relation to body size. It was also assessed using the Stunkard Figure Rating Scale, where the nine silhouettes were stratified according to other studies (Jackson et al. 2014a): underweight (silhouettes 1, 2, and 3), normal/overweight (4, 5, and 6), and obesity (7, 8, and 9). Thus, the number of the figure chosen by the participant represented the perceived actual body size. Three categories of body image discordance were formed by comparing the perceived actual body size with the women's BMI: (1) women who perceived themselves as they were; (2) women who perceived themselves to be larger than they really were; and (3) women who perceived themselves to be smaller than they really were.

Statistical analyses

All statistical analyses were performed using Stata version 13.0. In the bivariate analysis, the associations between the independent variables and the outcome were assessed using the chi-square test. A Poisson regression with robust error variance was used to assess the association between sleep duration, shift work, and sleep deprivation (the aggregated variable of work shift and sleep duration) with BID. The prevalence ratios (PRs) and respective 95% confidence intervals (95% CIs) were calculated as the effect measure. The effect of the associations was evaluated using three analysis models, and the variables included in the multivariate models were determined based on a conceptual model of determination (Victora et al. 1997), in which model 1 was the unadjusted analysis; model 2 was adjusted for demographic (age, ethnicity, and marital status), economic (socioeconomic status), and behavioral (smoking) variables; and model 3 was adjusted for the same items plus the morbidity (depression, health perception, and body image discordance) variables. We checked the models' goodness-of-fit, and a non-significant result ($p > 0.05$) indicated that the model used was adequate.

The associations with a significance level below 5% were considered significant. BMI, physical activity, and number of meals were not included in the adjusted analysis as possible confounding factors because they were considered possible mediating variables in the association, as further discussed.

Results

A total of 505 women with a mean age (standard deviation) of 33.7 (± 8.6) years were evaluated, of whom more than 70.0% were younger than 40 years of age. In the total sample, the prevalence of BID was 42.4% (95% CIs = 38.0% to 46.7%). Approximately 93.0% (199 individuals) of these participants wished they had a smaller body size.

There were 152 (95.6%) day-shift workers and 67 (19.4%) night-shift workers who slept ≥ 7 h/day. Conversely, 7 (4.4%) day-shift workers and 279 (80.6%) night-shift workers slept < 7 h/day.

Most of the women in the total sample were White, lived with a partner, belonged to economic class C, consumed 3 or more meals per day, did not smoke, were classified as physically inactive, reported no depression, self-rated their health status as good, had a normal BMI, perceived themselves as they are, worked the night shift, and slept fewer than 7 h/day. There was a higher prevalence of BID among obese women (86.4%), those who perceived themselves larger than they actually were (87.5%), night-shift workers (46.2%), and those who slept < 7 h/day (46.8%). This percentage was maintained after considering the variable sleep deprivation (47.0%), which integrates both situations. Moreover, younger women and smokers wished for a larger body size, whereas women with 1–2 meals/day, who were obese, perceived themselves as larger than they really are, worked the night shift, slept < 7 h/day, and had sleep deprivation wished for a smaller body size (Table 1).

The size number 3 silhouette was the most commonly desired (42.6%) body size among the workers. Given the discrepancy between the "number of the chosen silhouette that represents your body" and the "number of the silhouette you desire" among the workers, higher differences were found among the sleep-deprived workers. The extremes of the differences (− 3 and 6) were found only among these workers (Fig. 2).

In the crude analysis, women in the night shift, with < 7 h of sleep/day and with sleep deprivation exhibited a higher probability of BID (Table 2). In the adjusted analysis, the effect measures remained the same (i.e., the effect of the association was independent of the demographic, socioeconomic, behavioral, and morbidity variables).

Additional adjusted analyses revealed a significant difference of BID between women in the day shift with ≥ 7 h of sleep/day (reference) and in women in the night shift with < 7 h of sleep/day (PR = 1.43; 95% CI = 1.12–1.84; $p = 0.005$). For the women working the day shift with < 7 h of sleep/day and those working the night shift with ≥ 7 h of sleep/day, the following results were obtained: PR = 1.39; 95% CI = 0.51–3.78; $p = 0.516$; and PR = 1.32; 95% CI = 0.93–1.88; $p = 0.122$, respectively (data not shown). No significant results were found for these last two categories; the PRs found for all three categories were very similar.

Discussion

Major findings of the study

The present study revealed a significant association between sleep deprivation and BID among shift-working women. Specifically, those who worked the night shift and slept < 7 h/day had a higher probability of exhibiting BID. No studies have investigated the association between sleep and body image in adult women; however, there are good reasons to speculate this association (Kilpela et al. 2015).

The relationship between work-related stress factors and health-related outcomes (i.e., the association between sleep deprivation, a work-related stress factor, and BID, a health-related outcome) can be elucidated via two mechanisms (Siegrist and Rodel 2006).

The first is a path mediated by behavioral factors, including the practice of physical activity and nutritional status. Changes in circadian rhythm due to night-shift work and sleep deprivation induce a reduction in leptin, a hormone that mediates satiety, and an increase in ghrelin, a hormone that promotes appetite (Chaput et al. 2007), thereby leading to increased energy intake among night-shift workers. Furthermore, night work itself is considered a stress factor (Ulhôa et al. 2011), and this stress can result in unhealthy behaviors such as exaggerated food consumption (Dweck et al. 2014) and reduced leisure-time physical activity (Mouchacca et al. 2013). Thus, these changes can deregulate the balance between energy intake and expenditure and consequently promote weight gain. Concomitantly, BMI is an individual characteristic that is associated with BID, i.e., individuals who are obese or overweight are more prone to BID than eutrophic individuals (Slevec and Tiggemann 2011).

The second mechanism occurs via personality characteristics, such as self-esteem. Sleep deprivation can deregulate the endocrine metabolism of the hypothalamic-pituitary-adrenal axis, resulting in increased cortisol secretion. Given that this hormone is related to self-esteem (Pruessner et al. 2005), sleep-deprived individuals are more prone to have low self-esteem than those with normal sleep durations (Lemola et al. 2013). Low self-esteem can predispose individuals toward stronger internalizations of the beauty ideal of thinness, which is spread through social media and peers, thereby negatively affecting body image satisfaction (Fortes et al. 2014; Lev-Ari et al. 2014).

Both of these mechanisms support the hypothesis of a model that involves psychological (self-esteem) and biological (BMI) factors in the determination of BID (Rodgers et al. 2014). As mentioned earlier, women with low self-esteem tend to internalize the thin-ideal more easily and are therefore more dissatisfied with their bodies. In turn, the relationship between BMI and BID occurs because obesity is stigmatized

Table 1 Demographic, socioeconomic, behavioral, morbidity characteristics, and prevalence of body image dissatisfaction in shift-working women of southern Brazil

Variables	*n* (%)	Dissatisfaction (*n* = 505)		Wished larger body size (*n* = 306)		Wished smaller body size (*n* = 490)	
		n (%)	*p*	*n* (%)	*p*	*n* (%)	*p*
Age (years)			0.859[a]		0.045[a]		0.536[a]
18 to 30	214 (42.4)	90 (42.1)		10 (7.5)		80 (39.2)	
31 to 40	161 (31.9)	68 (42.2)		4 (4.1)		64 (40.8)	
≥ 41	130 (25.7)	56 (43.1)		1 (1.3)		55 (42.6)	
Race			0.678		0.469		0.546
White	440 (87.1)	188 (42.7)		12 (4.6)		176 (41.1)	
Other	65 (12.8)	26 (40.0)		3 (7.1)		23 (37.1)	
Marital status			0.947		0.123		0.680
Without partner	114 (22.6)	48 (42.1)		6 (8.3)		42 (38.9)	
With partner	391 (77.4)	166 (42.5)		9 (3.9)		157 (41.1)	
Economic class[b]			0.463[a]		0.934[a]		0.433[a]
B (higher)	84 (16.6)	35 (41.7)		2 (3.9)		33 (40.2)	
C	393 (77.8)	164 (41.7)		13 (5.4)		151 (39.7)	
D (lower)	28 (5.5)	15 (53.6)		0 (0.0)		15 (53.6)	
Physical activity			0.398		0.251		0.944
Active	172 (34.1)	72 (41.8)		3 (2.9)		69 (40.8)	
Inactive	333 (65.9)	142 (42.6)		12 (5.9)		130 (40.5)	
Meals/day			0.094[a]		0.337[a]		0.049[a]
1–2	55 (10.9)	30 (54.5)		1 (3.9)		29 (53.7)	
3	229 (45.3)	96 (41.9)		5 (3.6)		91 (40.6)	
≥ 4	221 (43.7)	88 (39.8)		9 (6.3)		79 (37.3)	
Smoking			0.111		0.002		0.154
Never smoked	449 (88.9)	183 (40.7)		11 (4.0)		172 (39.3)	
Ex-smoker	39 (7.7)	22 (56.4)		1 (5.6)		21 (55.3)	
Smoker	17 (3.4)	9 (52.9)		3 (27.3)		6 (42.9)	
Depression			0.102		0.666		0.102
No	413 (81.8)	168 (40.7)		12 (4.7)		156 (38.9)	
Yes	92 (18.2)	46 (50.0)		3 (6.1)		43 (48.3)	
Poor self-rated health			0.072		0.550		0.077
No	388 (76.8)	156 (40.2)		11 (4.5)		145 (38.5)	
Yes	117 (23.2)	58 (49.6)		4 (6.4)		54 (47.8)	
BMI			< 0.001		0.061[a]		< 0.001
Normal	295 (58.4)	65 (22.0)		15 (6.1)		50 (17.9)	
Overweight	144 (28.5)	92 (63.9)		0 (0.0)		92 (63.9)	
Obesity	66 (13,1)	57 (86.4)		0 (0.0)		57 (86.4)	
Body image discordance			< 0.001		0.526		< 0.001
Perceived same	340 (67.3)	163 (47.9)		7 (3.8)		156(46.9)	
Perceived smaller	157 (31.1)	44 (28.0)		8 (6.6)		36 (24.2)	
Perceived larger	8 (1.5)	7 (87.5)		0 (0.0)		7 (87.5)	
Work shift			0.009		0.204		0.015
Day	159 (31.5)	54 (33.9)		3 (2.8)		51 (32.7)	
Night	346 (68.5)	160 (46.2)		12 (6.1)		148 (44.3)	
Sleep duration			0.020		0.275		0.027
≥ 7 h/day[c]	219 (43.4)	80 (36.5)		5 (3.5)		75 (35.1)	
< 7 h/day[d]	286 (56.6)	134 (46.8)		10 (6.2)		124 (44.9)	

Table 1 (continued)

Variables	*n* (%)	Dissatisfaction (*n* = 505)		Wished larger body size (*n* = 306)		Wished smaller body size (*n* = 490)	
		n (%)	*p*	*n* (%)	*p*	*n* (%)	*p*
"Sleep deprivation"			0.021		0.232		0.030
No[e]	226 (44.7)	83 (36.7)		5 (3.4)		78 (35.3)	
Yes[f]	279 (55.2)	131 (47.0)		10 (6.3)		121 (45.0)	

[a] Chi-square test for linear trend

[b] There was not A and E class in this sample. ABEP—Brazilian Association of Research Companies. Brazil Economic Classification Criterion. Available on: http://www.abep.org/criterio-brasil;

[c] Amplitude: 7 to 11 h

[d] 2 to 6.5 h

[f] All day-shift workers and night-shift workers who slept ≥ 7 h/day

[e] Night-shift workers who slept < 7 h/day

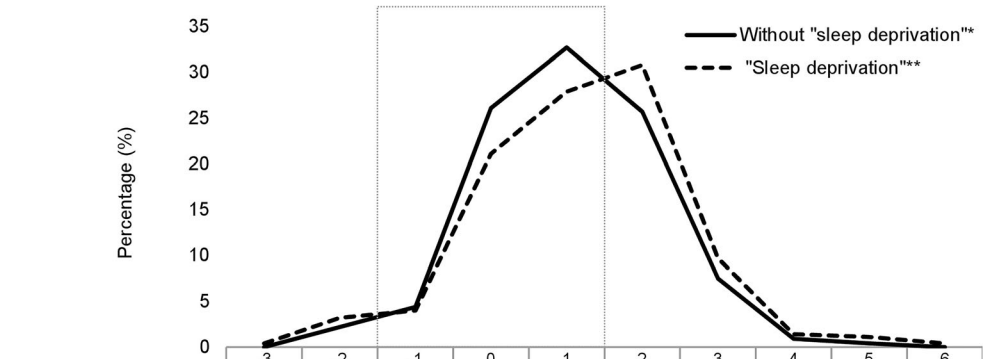
in western cultures; thus, individuals who feel fat tend to be less satisfied with their body.

The prevalence of body image dissatisfaction

Given that body image is a multidimensional construct and that several instruments can be used to evaluate its dimensions, comparing the results in this area is often difficult (Banfield and McCabe 2002). Nevertheless, the prevalence of BID in the present sample of women performing shift work was similar to that observed in a cross-sectional study that used the same instrument and cut-off point to identify BID among North American women; however, that study did not consider the aspect of shift work (Jackson et al. 2014a). In addition, the results of this study are consistent with the findings that the prevalence of BID remains stable from adolescence to adulthood (Kilpela et al. 2015).

In the present study, most women with BID were dissatisfied because they wished to have thinner bodies, which is consistent with other studies (Ginsberg et al. 2016; Mintem et al. 2015; Silva et al. 2011). This finding might be explained by the fact that women usually desire a thinner body, and this desire might be because of the sociocultural perspectives that are represented by the media-family-friends triad (Berg et al. 2002; Swami 2015). Mass media images incentivize a universal beauty standard characterized by a thin body that is difficult to attain, thereby resulting in less satisfaction with one's own body and appearance (Krug et al. 2015; Polivy and Pliner 2015). Family members, friends, or both can influence the practice of physical activity, adhesion to restrictive diets, and self-comparisons, which can be risk factors for developing BID (Krug et al. 2015).

In this study, the most desired silhouette by approximately all of the evaluated workers was number 3. Likewise, another



	-3	-2	-1	0	1	2	3	4	5	6
Without "sleep deprivation"*	0	2.2	4.4	26.1	32.7	25.7	7.5	0.9	0.4	0
"Sleep deprivation"**	0.4	3.2	4	21.1	27.9	30.8	9.7	1.4	1.1	0.4

Fig. 2 Percentage of the values obtained in the difference between "perceived silhouette" and "desired silhouette" of the shift-working women by sleep deprivation (*n* = 505). *All day-shift workers and night-shift workers who slept ≥ 7 h/day. **Night-shift workers who slept < 7 h/day. The dark chart area (values between − 1 and 1) indicates shift-working women without body image dissatisfaction; values of 2 to 6 indicate body image dissatisfaction caused by a body size smaller than that desired; values of − 3 and − 2 indicate body image dissatisfaction caused by a body size greater than that desired

Table 2 Crude and adjusted prevalence ratios (PR) of body image dissatisfaction by work shift, sleep duration, and "sleep deprivation" in shift-working women of southern Brazil (n = 505)

	Model I[a] PR (95% CI)	Model II[b] PR (95% CI)	Model III[c] PR (95% CI)
Work shift			
Day	1.00	1.00	1.00
Night	1.36 (1.07 to 1.74)	1.37 (1.07 to 1.75)	1.40 (1.10 to 1.79)
	$p = 0.014$	$p = 0.013$	$p = 0.006$
Sleep duration			
≥ 7 h/day[d]	1.00	1.00	1.00
< 7 h/day[e]	1.28 (1.04 to 1.59)	1.29 (1.04 to 1.60)	1.32 (1.07 to 1.63)
	$p = 0.023$	$p = 0.020$	$p = 0.010$
"Sleep deprivation"			
No[f]	1.00	1.00	1.00
Yes[g]	1.28 (1.03 to 1.58)	1.28 (1.04 to 1.58)	1.31 (1.06 to 1.61)
	$p = 0.023$	$p = 0.022$	$p = 0.012$

[a] Unadjusted prevalence ratio

[b] Adjusted for age, race, marital status, economic class, and smoking

[c] Adjusted for age, race, marital status, economic class, smoking, depression, poor self-rated health, and body image discordance

[d] Amplitude: 7 to 11 h

[e] 2 to 6.5 h

[f] All day-shift workers and night-shift workers who slept ≥ 7 h/day

[g] Night-shift workers who slept < 7 h/day

study found that over half of American women in the sample chose silhouette number 3 (Jackson et al. 2014a), indicating a standardization of the thin body ideal.

Limitations

Certain limitations of the present study should be acknowledged. First, the Stunkard Figure Rating Scale has been criticized in the literature, mainly for the inconsistent size differences between successive silhouettes and the limited number of answers, which force women to choose silhouettes from categories that differ from reality (Gardner and Brown 2010). However, this limitation was attenuated in the present study because of the more flexible cutoff point used to identify BID (i.e., the values of the discrepancy between the number of the figure chosen as the current silhouette and the number of the desired silhouette between − 1 and + 1 were used to determine body image satisfaction). Nevertheless, figure rating scales are considered adequate to assess BID (Thompson and Altabe 1991), particularly in population studies, because of their simplicity and low cost (Kakeshita et al. 2009).

Second, the external validity (generalizability) of the study must be considered because the current sample of shift-working women was derived from a case-control study. However, representative samples do not necessarily result in valid scientific inferences (i.e., in some cases, they do not cause the results to be generalizable to the real world, and their use might be unnecessary, particularly in association studies) (Rothman et al. 2013).

Third, the adjusted analyses were not performed considering the two BID groups because only 15 women wished to have a larger body size. However, in additional analyses (data not shown), the results were in the same direction for both groups of BID; that is, the PRs ranged between 1.2 and 1.4 for the three exposures, shift work, sleep duration, and sleep deprivation.

Finally, because the present study employed a cross-sectional design, it is not possible to establish a causal relationship between exposure and outcome (i.e., the association might be subject to reverse causality). Nevertheless, our findings provide support for new hypotheses to be tested via longitudinal studies.

Strengths

Despite the limitations discussed, the present study identified an important effect of sleep deprivation on BID in a sample of shift-working women. This finding is important because BID can lead to unhealthy behaviors such as inadequate nutritional practices (Nunes et al. 2001).

Another point to note is the multivariate analysis performed in the present study. Given that night work and sleep duration were strongly related, an exposure variable was created to aggregate work shift and sleep duration. After relating these variables, we found that more than 95% of the day-shift workers slept ≥ 7 h/day, and more than 80% of the night-

shift workers slept < 7 h/day. Furthermore, the changes in the endocrine system of the night-shift workers might be because of the isolated effect of night work, their low sleep duration, or both (Ulhôa et al. 2015), thereby justifying the use of an aggregated variable.

In addition, the adjustment was made for all study covariates, including those that did not reach statistical significance, since the PRs, 95% CIs, and significance values of the main exposures (shift work, sleep duration, and sleep deprivation) did not change (< 5%) without their use in all the multivariate models (Kleinbaum and Klein 2010).

Finally, to the best of our knowledge, this study is the first to explore the reality of BID in a specific population of female shift workers. Importantly, most of the women from this sample belonged to a lower economic class, considered themselves physically inactive, had brief sleep durations, and worked the night shift. Thus, even if the sample is not representative of the general female population, the shift-working women of the present study constitute a part of the population with higher health vulnerability. These characteristics differ from the focus of most studies on body image, which investigate body image disturbances among female adolescents or college students (which may occur differently from that of adult women). Throughout the lifespan, other concerns arise, such as family demands and work, resulting in less time for self-care. Therefore, the sample of this study was composed of shift-working women who may experience a greater burden of concerns because they may also have family obligations. All these influences can modify the body image of adult women and can make understanding their condition more complex (Kilpela et al. 2015).

Conclusion

The present study found that sleep deprivation increases the probability of BID among shift-working women. Our findings reveal a vulnerability not yet described in the scientific literature and highlight the social significance of our subject of study. As mentioned previously, women who are not satisfied with their body or appearance might resort to alternatives for body weight reduction and control that are harmful to their health. Furthermore, increased rates of self-inflicted non-suicidal injuries (Cucchi et al. 2016) and suicide attempts (Smith et al. 2018) exist among individuals with some type of eating disorder, generating an even greater negative effect on the health and quality of life of these individuals. These effects indicate the need for strategies and actions directed at shift-working women with the aim of reducing the effects of sleep deprivation on mental health, particularly with regard to body image disorders.

New studies will be necessary to explore different measures and instruments to evaluate body image and its relationship with sleep deprivation among shift-working women and to identify better conceptual models to describe this relationship. Appropriate knowledge of the reality of BID and its possible risk factors should direct strategies to promote health for specific and vulnerable populations.

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Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest.

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