

# Correlation of shift work and waist circumference, body mass index, chronotype and depressive symptoms

Correlação entre trabalho de turno e circunferência abdominal, índice de massa corporal, cronotipo e sintomas depressivos

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## ABSTRACT

**Objective:** Correlate shift work with body mass index (BMI), waist circumference, chronotype and depressive symptoms. **Subjects and methods:** This study comprising 14 shift workers and 13 day workers. Subjects were workers from the health area aged 25 to 60 years. Minor psychiatric disorders were accessed by Self Report Questionnaire (SRQ-20) and depressive symptoms by Beck Depression Inventory (BDI). Chronotype was accessed using Morningness-Eveningness Questionnaire (MEQ). Anthropometric measures were taken. **Results:** Shift workers presented higher BMI ( $P = 0.03$ ) and waist circumference ( $P = 0.004$ ) than day workers. Years on shift work were significantly correlated to waist circumference ( $r = 0.43$ ;  $P = 0.03$ ) and age ( $r = 0.47$ ;  $P = 0.02$ ). Shift work was not correlated with depressive symptoms and chronotype. **Conclusion:** These results may suggest a role played by shift work on the development and/or the early clinic manifestations of metabolic disturbances, becoming a risk factor to metabolic syndrome. *Arq Bras Endocrinol Metab.* 2010;54(7):652-6

## Keywords

Shift work; sleep-wake cycle; waist circumference; depressive symptoms; chronotype

## RESUMO

**Objetivo:** Correlacionar o trabalho de turno com índice de massa corporal (IMC), circunferência abdominal, cronotipo e sintomas depressivos. **Sujeitos e métodos:** Amostra de 14 trabalhadores de turno e 13 diurnos, com idade entre 25 e 60 anos. Transtornos psiquiátricos menores foram aferidos pelo Self Report Questionnaire (SRQ-20), sintomas depressivos pelo inventário de Depressão de Beck (BDI) e o cronotipo pelo Morningness-Eveningness Questionnaire (MEQ). As medidas antropométricas foram mensuradas. **Resultados:** Trabalhadores de turno apresentaram maior IMC ( $P = 0,03$ ) e circunferência abdominal ( $P = 0,004$ ) quando comparados aos diurnos. O tempo de trabalho de turno foi correlacionado à circunferência abdominal ( $r = 0,43$ ;  $P = 0,03$ ). Não houve correlação entre trabalho e sintomas depressivos e cronotipo. **Conclusão:** Os resultados podem sugerir que o trabalho de turno desempenhe um papel no desenvolvimento e/ou nas precoces manifestações clínicas de distúrbios metabólicos, tornando-se um fator de risco para a síndrome metabólica. *Arq Bras Endocrinol Metab.* 2010;54(7):652-6

## Descritores

Trabalho de turno; ciclo sono-vigília; circunferência abdominal; sintomas depressivos; cronotipo

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## INTRODUCTION

The major function of the circadian system is the internal cycling of physiological and metabolic events.

In fact, many physiological processes display day-night rhythms. The temporal organization of the human body has to be understood to appreciate the impact of night

and shift work on humans. The circadian rhythms of individuals synchronize the environment through light-dark phase and social rhythm. In night-day alterations, such as in shift workers, alterations in social routine and/or meal times are described as desynchronization (1). Endogenous biological clocks improve the efficiency of biological systems, by allowing them to anticipate future constraints on major physiological systems and cell energy metabolism. The temporal organization of a given biological function can be impaired in its coordination with astronomical time or with other biological functions. There are also external conditions that influence biological clocks. This temporal organization is complex, and it is possible that also many medical disorders such as cardiovascular (2-4), metabolic (2,5-7), psychiatric (8,9) and sleep disorders (10) involve primary or secondary changes in biological clocks (11). Previous studies have demonstrated that risks increase according to exposure, such as hypertension, diabetes, coronary artery disease and weight gain (12,13).

Some studies have demonstrated a relationship between shift work and metabolic alterations (2,10,14,15). The constellation of metabolic abnormalities, called metabolic syndrome, includes glucose intolerance (impaired glucose tolerance, or impaired fasting glycemia), insulin resistance, central obesity, dyslipidemia, and hypertension, predisposing subjects to an increased risk of type 2 diabetes and cardiovascular diseases (15). The fact that shift workers present a chronically reversed sleep-wake cycle may be associated to the higher incidence of metabolic syndrome in this population (2,16). Shift work related to circadian rhythmicity disruption, occur with alterations in one or more of the pathological components of the metabolic syndrome (17).

Also, Shift work is suggested to increase the risk of developing or aggravating mood disorders. That may be a consequence of alterations on rhythmic patterns in different levels (8,18). They are also characterized by spontaneous or induced changes in endogenous rhythms, as in the case of shift work schedules and time of exposure to this inversion of phase. Another factor that may be related to the vulnerability to depression may be the individuals' differences in the preferences about their sleeping time, known as chronotype (19). Chronotype is partially determined by clock genes (19). Sleep impairment can be a common factor in mood disorders that could be aggravated by work environments.

The aim of the present study was to verify the correlation among shift work with waist circumference, body mass index (BMI), chronotype and depressive symptoms.

## SUBJECTS AND METHODS

A total of 27 subjects, aged 25-60 years, were enrolled at this study. In the daily workers there 13 women enrolled and in the shift workers group, 14 subjects (men = 2) and (women = 12). These subjects comprise a convenience sample that was selected among workers involved in the health area from Hospital de Clínicas de Porto Alegre – RS, Brazil. All participants signed a written informed consent to be included into the study, which was approved by the Ethics Committee and performed in accordance to the guidelines proposed in the Declaration of Helsinki.

All subjects were asked about their work type/schedule, clinical history, and their life style. Since one of the inclusion criteria was to have at least 1 year of shift work, for the reason that constitutes latency for shift work to exert its effects. All subjects diagnosed with any metabolic disease or psychiatric disorder, pregnant women or with children less than 1 year, subjects under use of psychiatric, amphetamine and corticoid drugs were excluded from the study. In addition, shift workers (night workers) could not be employed or develop another regular activity, such as university students in the morning shift, neither on their rest days. Those submitted to current clinical treatment directed to lose weight or invasive procedures were also excluded.

Subjects answered Self-Report Questionnaire (SRQ-20) to identify minor psychiatric disorders and Beck Depressive Inventory (BDI) to assess the severity of depressive symptoms (20). The 21- items assess cognitive, affective, somatic, and behavioral symptoms on a four-point scale. The total BDI is the sum of all items ranging from 0 to 63. We used a Beck Scores 0-9, 10-18, > 18 to indicate none, mild or moderate/severe symptoms, respectively.

To determine the phenotype related with morningness-eveningness dimension the self-reported questionnaire named Morningness Eveningness Questionnaire (MEQ) was used. It is an instrument constituted of 19 items. The score is the sum of the item and ranges from 16 to 86, being the higher score to morningness.

Subjects underwent measurement of anthropometric parameters. The procedure was conducted in the early morning. Waist circumference was measured as the midway between the lower-rib margin and the su-

terior anterior iliac spine. Additionally, BMI was calculated as  $\text{kg}/\text{m}^2$  and was used as the index for relative weight. Overweight was defined as a  $\text{BMI} \geq 24$ , whereas obesity  $\text{BMI} \geq 29$ , according to World Health Organization (WHO) parameters. All measures were performed by one trained examiner blinded to the objective of the study, avoiding assessment bias.

Concerning the work schedule, the day sample worked from 08:00-17:00, whereas shift workers were engaged in regular 12-h night shifts (19:00-7:00). A self-report social-demographic questionnaire covering the characteristics of work and life style was performed before subjects underwent anthropometric evaluation and collected on this day.

The statistical analysis was performed using the SPSS 16 program for Windows software. Results are presented as median and percentiles for all parameters. Differences between shift workers and day workers were analyzed by non-parametric test for 2 independent samples. The statistical significance was defined as  $P \leq 0.05$  (Type I error). An error type II was estimated in 80%. Correlations were verified using Pearson Correlation Test.

## RESULTS

Table 1 shows the demographic characteristics. Shift workers presented higher BMI ( $P = 0.03$ ) and waist circumference ( $P = 0.004$ ) than the day workers. Moreover, a positive relationship was found between BMI and waist circumference ( $r = 0.87$ ;  $P < 0.001$ ). A correlation between years on shift and waist circumference ( $r = 0.43$ ;  $P = 0.03$ ) and age ( $r = 0.47$ ;  $P = 0.02$ ) was shown (Table 2). However, we did not find correlation with years on shift and depressive symptoms or chronotype. Furthermore, chronotype was inversely correlated with SRQ-20 ( $r = -0.4$ ;  $P = 0.04$ ) i.e. eveningness phenotype presented higher levels in the SRQ.

**Table 1.** Demographic characteristics of daily and shift workers. Data are presented as median and percentiles. Non-parametric test for 2 independent samples

	Daily workers	Shift workers
Age (years)	34.00 (27.00-41.50)	43.50 (38.75-50.50)
Body weight (kg)	59.60 (54.00-66.25)	73.10 (64.80-82.12)
Height (m)	1.62 (1.57-1.73)	1.63 (1.58-1.65)
BMI ( $\text{kg}/\text{m}^2$ )	23.07 (20.70-25.04)	29.22 (24.68-32.05)*
Waist circumference (cm)	77.00 (71.00-82.10)	93.00 (88.88-99.25)**

\*  $P < 0.05$ ; \*\*  $P < 0.01$ .

**Table 2.** Pearson correlation coefficients among years on shift work and waist circumference and BMI

	Years on shift work
Waist circumference	0.438*
BMI	0.401
Chronotype	-0.113
Depressive symptoms	0.267
Minor psychiatric disorder	0.089
Age	0.475*

\*  $P < 0.05$ .

## DISCUSSION

We observed a correlation between years on shift work and waist circumference. Besides this, shift workers presented higher BMI and waist circumference than day workers. These results may suggest a role played by shift work on the development and/or the early clinic manifestations of metabolic disturbances, becoming a risk factor to metabolic syndrome. The misalignment between the endogenous circadian system and the sleep-wake cycle, promoted by shift work, might contribute to the clinical status of subjects suffering from a variety of metabolic disorders as showed in our study. These results seem to be supported and replied to by previous studies (2,3,5,7,13,21-25).

BMI and waist circumference were also correlated. Shift workers presented a higher age; this could be a confounding variable, but we did not find correlation between age and BMI or waist circumference. Human rhythms are synchronized to diurnal activity by the environmental light-dark cycle and their social routine, then undergoing into phase readjustment when forced to adhere to a new sleep-wake pattern. In shift work, central and peripheral oscillators must adapt to a new rhythmicity imposed by the work schedule. It is necessary that some sleep-wake cycles adjust to the changed phase of the environmental synchronizer. It is known that even after a prolonged duration of time on shift, only a minority of night workers show phase adaptation of their circadian system to the nocturnal activity pattern. Even receiving daylight on the way home, shift workers face a problem originated by their labor journey regarding their meals which will be mostly taken at night, period where they are active. Therefore, we hypothesize that this internal misalignment associated with night eating and life style may induce profound effects on metabolic parameters, demonstrated by their increased BMI and waist circumference. It is known

that the caloric intake of shift workers is very similar to that of day workers (26), however their metabolic efficiency may be impaired once major caloric intake is often at night (27). In addition, it is important to highlight that leptin and ghrelin, anorexin and orexin hormones, respectively, are secreted, as most hormones, in a circadian pattern (14,28-31). Light exposure at night may contribute to a decreased and/or delayed secretion of leptin, which usually occurs at night and has its acrophasis around midnight, further contributing to an enhanced hunger and food intake pattern. This leads to weight gain and visceral fat accumulation in the abdominal region which simultaneously with stress, job strain and psychosocial factors, predisposes shift workers to a cortisol hypersecretion, hyperstimulation from the hypothalamic-pituitary-adrenal axis leading the adipose tissue to produce even more fat tissue.

Regarding shift work and depressive symptoms, we did not find any correlation, although chronotype is correlated to minor psychiatric disorders in this study. Also, eveningness chronotype was correlated to minor psychiatric disorders. This finding is in accordance to previous studies from our group: the evening chronotype seems to be more susceptible, predisposing subjects with this phenotype to mood disorders (18). In a previous study, the author proposes that the effect of shift work on depressive symptoms is explained by the association between job characteristics and psychosocial factors, once this population also suffers from deprivation of their social life (8), however, in this study they did not analyze chronotype. Once chronotype was related to mental disorders, it is clear that in our study it did not exert an influence on shift work, independent from the stress demanded by this kind of labor journey.

In conclusion, we suggest a new model of shift work physiopathology, where chronotype is not associated to shift work, although chronotype was correlated to mental symptoms. In addition, we provide evidence that shift work is directly correlated to BMI and waist circumference. Further studies are necessary to clarify how shift work influences metabolic disturbances and what components of metabolism and biological oscillators are altered in shift workers.

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