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The association between shift work and body mass index among female nurses

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ABSTRACT

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Possibly due to a disturbance of biological rhythms, shift work is associated with several health problems, particularly an increased risk of coronary heart disease (CHD). Obesity is a well known independent cardiovascular risk factor and has been shown to be more prevalent among shift workers. The objective of this study was to examine the association between shift work and body mass index in nurses working in one hospital in Central Jakarta. A cross-sectional study was conducted among 152 female nurses, ranging from 22 to 55 years of age, with determination of body mass index (BMI), and systolic and diastolic blood pressure (SBP and DBP). The results show a mean age of 30.9 ± 7.2 years and mean job experience of 8.9 ± 7.6 years. There was no significant difference in the prevalence of gastrointestinal disorders between shift and day workers. Mean BMI (23.1 ± 3.6) and mean job experience (6.9 ± 5.9 years) in shift nurses were significantly different from those in day workers (BMI = 24.8 ± 3.8; job experience 15.4 ± 8.4 years). In shift working nurses the BMI increased significantly in proportion to job experience (p=0.014). In conclusion, the present study has proven that job experience significantly increased BMI in shift working nurses.

Keywords : Shif work, body mass index, job experience, female nurses

INTRODUCTION

Shiftwork can be defined as work performed outside the normal daylight hours. Shiftwork has been empirically linked to a variety of diseases, although evidence does not suggest an effect on all-cause mortality.(1) Three pathways have been implicated in the relationship between shiftwork and disease: (i) disruption of circadian rhythms (leading to sleep/wake disturbances, desynchronization of internal processes, and increased susceptibility to disease); (ii) disturbed socio-temporal patterns (resulting from atypical work hours leading to

family problems, reduced social support, and stress); and (iii) unfavorable changes in health behaviors (increased smoking, poor diet, and irregular meals).[2] Many workers complain of gastrointestinal problems resulting from irregularly timed meals and poor quality of food, as well as increased consumption of soft drinks and caffeine-containing beverages.[3,4]

Circadian disturbances affecting the intake, digestion, and absorption of food are thought to play a major etiological role, but loss of sleep, fatigue, and the social stress of shiftwork may also be implicated. Typically, shift workers have higher levels of gastric symptoms (e.g. indigestion, heartburn, constipation, loss of appetite, and nausea) than day workers, even with control for demographic, job, and lifestyle variables.[5] Gastrointestinal disorders are more common in shift workers, who complain of abdominal pain and alteration in bowel habit. There is strong evidence linking shift work to peptic ulcer disease and in lesser degree to coronary heart disease.[6] Shift work is associated with an increased risk of coronary heart disease (CHD), as reported in several studies performed on shift workers.[7]

Obesity is a well known independent cardiovascular risk factor, and interestingly, it has been shown to be more prevalent among shift workers.[8] Similarly, a more marked weight gain has been reported in shift-working subjects.[9-11] Obesity suffer from a high risk of insulin resistance and its metabolic complications, such as type 2 diabetes mellitus, hypertriglyceridemia, low levels of high density lipoprotein cholesterol, and hypertension.[12] Shift work is the most widely used tool of working time organization, as it enables round-the-clock activities not only in relation to rigid technological conditioning (e.g. chemical and steel industries, power plants) and necessary social services (e.g. health services, transport, electricity, telecommunications), but also to support of productive and economic choices (e.g. textile, paper, food, mechanical industry, banking). In the medical field, physicians, nurses and other ancillary staff are expected to be performing their jobs or to be on-call on a 24-hour basis.

There have been few studies undertaken in Indonesia on the extent to which shift work is related to health problems among health care workers, and this has been a neglected area in occupational health and safety issues in hospitals. The objective of the present study was to investigate the association between shift work schedules and health problems, particularly body mass index (BMI).

METHODS

Research design

A cross-sectional study was conducted during Februari – April 2007.

Study subjects

The participants were female nurses working in one hospital in Central Jakarta. From a total of 187 female nurses employed by the hospital, 152 healthy nurses (free of gastrointestinal disorders) participated in this study. Thirty five nurses were excluded because of gastrointestinal disorders.

Data collection

The investigators explained the purpose of the research and requested cooperation from each participant. An anonymous self-administrated questionnaire was used to collect the required data from each participant. The distribution and collection of questionnaires was performed through the head nurse. The items included in the questionnaire related to subject characteristics, e.g. age, gender, education, marital status, working unit, job experience, and working system (day worker/shift worker). In this study, shiftwork was defined as any regular

employment outside the usual working hours, defined arbitrarily to be between 08.00 hours and 16.00 hours. For gastrointestinal problems, several questions were combined into one, e.g. "Which one of the following problems have you experienced continuously?", viz. decreased appetite, constipation, diarrhoea, nausea, peptic ulcer, indigestion and eructation.

Measurements

Systolic and diastolic blood pressure (SBP and DBP) readings were recorded to the nearest 5 mm of mercury as the mean of two measurements with the subjects seated, using a mercury sphygmomanometer with an appropriate cuff size. Hypertension was defined according to WHO criteria.[13] Body weight was measured using the SEGA portable scale and recorded to the nearest 0.1 kg. Height was measured on barefooted subjects to the nearest centimeter using the microtois. BMI was calculated as weight in kilograms divided by the square of height in meters. For Asian populations, BMI is classified into the following categories: underweight (<18.5 kg/m^2), normal (18.5–22.9 kg/m^2), overweight (23.0–27.5 kg/m^2), and obese (≥ 27.6 kg/m^2).[14]

Statistical analysis

Statistical analyses were performed using SPSS version 10.0 and Epi Info 2000. The chi-squared test was used to assess univariate associations between shift variables and reported problems, and Student's t test for comparing continuous variables. Analysis of variance was applied for comparing BMI and duration of job experience. The level of statistical significance was set at 0.05.

RESULTS

Table 1 summarizes the characteristics of the participating nurses. The mean age was 30.9 ± 72.2 years, 91 nurses (59.9%) were married and mean job experience was 8.9 ± 7.6 years. Since only 2.6% of the nurses had a degree or higher qualification, the study population could not be regarded as being highly educated. Approximately 76.3% (116/152) of the nurses were engaged in a rotating shift schedule.

Table 1. Characteristics and work pattern of nurses in the hospital under study (n = 152)

Variables	Value	
	Mean (SD)	Range
Age (yrs)	30.9 (7.2)	22 – 55
Job experience (yrs)	8.9 (7.6)	1 - 33
	n	%
Marital status		
Single	61	40.1
Marrried	91	59.9
Education		
Diploma	148	97.4
Degree or higher	4	2.6
Work system		
Shift worker	116	76.3
Day worker	36	23.7
Working unit		
Outpatient	19	12.5
Inpatient	108	71.1
Intensive care /operating room	25	16.4

Table 2 presents the reported prevalence of shiftwork-related gastrointestinal problems, in which the difference in prevalence between shift and day workers did not reach statistical significance (p > 0.05).

Mean SBP and DBP were not significantly different between shift workers and day workers. The mean BMI in the group of shift workers was significantly lower (23.1 ± 3.6) compared with the group of day workers (24.8 ± 3.8) (p=0.012). Mean job experience among shift workers was significantly shorter duration (6.9 ± 5.9 years) in comparison with day workers (15.4 ± 8.4 years). (Table 3)

Table 2. Prevalence of shiftwork-related gastrointestinal problems reported among the nurses

Gastrointestinal problems	Work system		p
	Shift workers (n = 116) %	Day workers (n = 36) %	
Decreased appetite	18.1	13.9	0.557
Constipation	8.6	11.1	0.771
Diarrhoea	6.9	8.3	0.652
Nausea	19.8	19.4	0.960
Indigestion	29.3	30.6	0.886
Epigastric pain	25.6	33.3	0.325
Belching	46.6	41.7	0.607

Table 3. Comparison of the continuous variables age, job experience, BMI, SBP, and DBP between day and shift workers

Variables	Work system		p
	Shift workers (n=116) Mean (SD)	Day workers (n=36) Mean (SD)	
Job experience (yrs)	6.9 (5.9)	15.4 (8.4)	0.000
Body mass index	23.1 (3.6)	24.8 (3.8)	0.012
Systolic blood pressure	110.7 (8.8)	112.1 (13.9)	0.483
Diastolic blood pressure	74.1 (8.2)	72.9 (8.9)	0.455

Table 4. Means and SD of BMI distributed for classes of job experience in day workers and shift workers (152 subjects)

		Class of job experience (yrs)				p
		< 5	5-15	16-30	>30	
Day workers (n=36)	N	4	14	15	3	0.644
Body mass index	Mean (SD)	23.2 (4.7)	24.4 (3.4)	25.3 (4.3)	26.7 (3.2)	
Shift workers (n=116)	N	58	48	10	0	0.014
Body mass index	Mean (SD)	22.3 (3.7)	23.5 (3.3)	25.5 (3.1)		

These data were subjected to further analysis to determine the influence of job experience on BMI, by using one-way analysis of variance and Tuckey HSD multiple comparison. One-way analysis of variance determined the values of BMI distributed for classes of job experience in day workers and shift workers. On average the BMI increased significantly with job experience in the shift workers (p=0.014), but not in the day workers (p=0.644). (Table 4)

The Tuckey HSD multiple comparison showed that the mean difference (-3.2613) was statistically significant between nurses with job experience of less than 5 years and 16-30 years. (Table 5)

Table 5. Multiple comparisons of BMI between the class job of experience in the shift workers

	Class of job experience (A)	Class of job experience (B)	Mean difference (A-B)	p
Body mass index	< 5 yrs	5-15 yrs	-1.2871	0.149
	< 5 yrs	16-30 yrs	-3.2613	0.021

DISCUSSION

This study has demonstrated that mean BMI was lower in shift workers than in day workers. However, after adjustment for job experience, the BMI was significantly higher in shift workers compared with day workers. The results are in agreement with the study done by Karlssona et al,[8] indicating a significantly higher BMI in shift workers in comparison with non-shift workers. Obesity was also more common in shift workers than in day workers. A longitudinal observational study among 469 nurses aged 21-58 years showed that exposure to night work can lead to weight gain and overweight.[11] Essentially identical results were obtained in offshore workers, viz. that continued exposure to day-night shift work gives rise to increased BMI.

Another study on shift workers revealed the ocurrence of weight gain, where body weight in shift workers increased 4.3 kg as compared with 0.9 kg in day workers (p=0.02).[15] There was a tendency for shift workers to report eating more and taking more naps than did the day workers. A cohort study on 377 shiftworkers and non-shiftworking controls showed a positive relationship between BMI and waist-to-hip ratio (WHR) in comparison to duration of shiftwork experience, with adjustment for age.[16] The study undertaken by Di Lorenzo et al. on 319 workers in Southern Italy indicated that shift work was responsible for excessive body mass index.[17]

However, Nakamura et al[18] did not find any difference in body weight when comparing day workers and shift workers, although workers in a three-shift rotation had an increased abdominal to hip ratio, indicating a higher proportion of central obesity among shift workers. A possible explanation for these findings could be insufficient adjustment for possible confounding variables, such as socioeconomic factors. Another possibility is that the duration of follow-up could influence the change in body weight as suggested by Karlsson.[8] Shift workers commonly have a disturbed appetite dan tend to disregard food quality and quantity; they tend to consume "junk" food instead of complete nutritionally balanced meals.[19] The present study did not find any differences in prevalence of hypertension between shift and day workers, which is consistent with previous studies.[20]

The shift system in hospital X, where the nurses were employed, had work shifts of 6 hours duration rotated as follows: the first shift lasted from 08.00 to 14.00 local time, the second from 14.00 until 20.00, and the third was from 20.00 to 08.00. Each shift was maintained for 2 days, with one day off after 6 working days. There is still a difference of opinion as to which system is the better one: weekly or twice weekly shifts, as each has its strengths and weaknesses.

CONCLUSIONS

Shift nurses tend to have a gain in BMI proportional to job experience. However, no significant differences in SBP and DBP were found in shift workers as compared to day workers.

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REFERENCES

1. Knutsson A. Health disorders of shift workers. Occup Med 2003; 53: 103-8.
2. Knutsson A, Boggild H. Shiftwork and cardiovascular disease: review of disease mechanisms. Rev Environ Health 2000; 15: 359-72.
3. Caruso CC, Lusk SL, Gillespie BW. Relationship of work schedules to gastrointestinal diagnoses, symptoms, and medication use in auto factory workers. Am J Ind Med 2004; 46: 586-8.
4. Morshead DM. Stress and shift work. Occup Health Saf 2002; 71: 36-8
5. Costa G. The 24-hour society: Between myth and reality. J Hum Ergol 2001; 30: 15-20.
6. Harrington JM. Health effects of shift work and extended hours of work. Occup Environ Med 2001; 58: 68-72.
7. Knutsson A, Hallquist J, Reuterwall C, Theorell T, Akerstedt T. Shift work and myocardial infarction: a case–control study. Occup Environ Med 1999; 56: 46-50.
8. Karlsson B, Knuttsson A, Lindahl B. Is there an association between shift work and having a metabolic syndrome? Results from a population based study of 27485 people. Occup Environ Med 2001; 58: 747-52.
9. Geliebter A, Gluck ME, Tanowitz M, Aronoff NJ, Zammit GK. Work-shift period and weight change. Nutrition 2000; 16: 27-9.
10. Yamada Y, Kameda M, Noborisaka Y, Suzuki H, Honda M, Yamada S. Excessive fatigue and weight gain among cleanroom workers after changing from an 8-hour to a 12-hour shift. Scand J Work Environ Health 2001; 27: 318–26.
11. Parkes KR. Shift work and age as interactive predictors of body mass index among offshore workers. Scand J Work Environ Health 2002; 28: 64–71.
12. Pusparini. Central obesity, metabolic syndrome and type 2 diabetes mellitus. Univ Med 2007; 26: 195-204.
13. Chalmers J, MacMahon S, Mancia G, Whitworth J, Beilin L, Hansson L, et al. World Health Organization International Society of Hypertension Guidelines for the Management of Hypertension. Guidelines subcommittee of the World Health Organization. Clin Exp Hypertens 1999; 21: 1009-60.
14. World Health Organization. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004; 363: 157-63.
15. Niedhammer I, Lert F, Marne MJ. Prevalence of overweight and weight gain in relation to night work in a nurses' cohort. Int J Obes Relat Metab Disord 1996; 20: 625-33.
16. van Amelsvoort LG, Schouten EG, Kok FJ. Duration of shiftwork related to body mass index and waist to hip ratio. Int J Obes Relat Metab Disord 1999; 23: 973-8.
17. Di Lorenzo L, De Pergola G, Zocchetti C, Abbate NL, A Basso1, Pannacciulli N, et al. Effect of shift work on body mass index: results of a study performed in 319 glucose-tolerant men working in a Sourthern Italian industry. Int J Obes 2003; 27: 1353-8.
18. Nakamura K, Shimai S, Kikuchi S. Shiftwork and risk factors for coronary heart disease in Japanese blue-collar workers: serum lipids and anthropometric characteristics. Occup Med 1997; 47: 142-6.
19. Costa G. Shift work and occupational medicine: an overview. Occup Med 2003; 53: 83-8.
20. Bøggild H, Knutsson A. Shiftwork, risk factors and cardiovascular disease. Scand J Work Environ Health 1999; 25: 85-99.