
IRAJ MOHEBBI1, KAMRAN SHATERI2, and MIRHOSEIN SEYEDMOHAMMADZAD3

1 Urmia University of Medical Sciences, Urmia, Iran
Occupational Medicine Department
2 Urmia University of Medical Sciences, Urmia, Iran
Gastroenterology Department
3 Urmia University of Medical Sciences, Urmia, Iran
Cardiology Department

Abstract
Objectives: This study examined the effect of shift work on developing the metabolic syndrome by comparing groups of exposed and unexposed Iranian drivers. Methods: We considered as night-shift drivers those drivers whose shifts included at least 15 h per week between 9:00 p.m. and 7:00 a.m. Daytime drivers were defined as drivers working regularly without shift work. 3039 shift work drivers were selected. These were matched with non-shift workers. The differences in baseline characteristics and the prevalence of the components of the metabolic syndrome were assessed with Student’s t test, and chi-square tests. Results: We found central adiposity in 52.0% of the shift workers versus 42.6% of the day workers (p < 0.0001). The hypertension component was not significantly related to shift work (p > 0.05); but there were significant differences as regards other components of the metabolic syndrome (p < 0.0001). Among the shift workers, the odds ratios of the increased FBS, low HDL-C, higher TG levels, as well as higher waist circumference were 1.992 (95% CI: 1.697–2.337), 1.973 (95% CI: 1.759–2.213), 1.692 (95% CI: 1.527–1.874), and 1.460 (95% CI: 1.320–1.616), respectively. The metabolic syndrome was more common among the shift workers (OR = 1.495; 95% CI: 1.349–1.657). Conclusion: In evaluating such results, further consideration is needed to find pathophysiological clarification; in turn, stress linked to shift work must be considered to likely have had a relevant influence on the outcome. In our opinion, shift work acts as an occupational factor for the metabolic syndrome.

Key words:
Shift work, Insulin resistance, Metabolic syndrome, Abdominal obesity, Circadian clock

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Address reprint request to: I. Mohebbi, Occupational Medicine Center, Urmia University of Medical Sciences, Urmia, Iran, Post Box: 5756115111 (e-mail: mohebbi_iraj@yahoo.co.uk).
INTRODUCTION

Human natural body rhythms are called circadian rhythms which are regulated by a “circadian clock”, located in the hypothalamus. This biological clock is synchronized by receiving the photic information from light-sensitive ganglion cells in the retina, thereby entraining individuals’ physiology and behavior to the external day–night cycle [1,2]. Nearly all of the biological processes including the sleep-wake cycles, body temperature, energy metabolism, cell cycle and hormone secretion have a circadian rhythm and are controlled by this circadian clock [2–5]. Shift work disrupts the clock’s function and is linked to circadian and metabolic consequences such as altered plasma lipid metabolism and adiposity [6].

A disruption of the circadian rhythm plays a key role in the pathophysiology of numerous diseases. It has become obvious that even disturbances of single aspects of these circadian rhythms may be associated with major effects [7–9]. It has been suggested that work/rest schedules resulting from shift work impair the physiological adaptation in the majority of night shift workers [1]. The sleep disorders, jet-lag syndrome, and increased proneness to work-related injuries are known short-term manifestation of shift work. In the long run, medical problems may manifest as increased risks for gastrointestinal, psychoneurotic, and cardiovascular diseases [10]. Shift work-related abnormalities in circulating lipids, central obesity, and hypertension have been repeatedly reported, but evidence of elevated blood pressure or metabolic disorders in a comparison between shift workers with day workers has not been convincingly demonstrated [6,11–15]. The metabolic syndrome (MetS) or the insulin resistance syndrome constitutes a clustering of several interrelated abnormalities that increase the risk for cardiovascular events and progression to diabetes mellitus [16,17]. On the other hand, the risk for a cardiovascular disease among shift workers is well documented. Several population studies indicate a relationship between shift work and morbidity from cardiovascular diseases [18]. Shift work may trigger the effect of lifestyle-related risk factors on coronary heart disease [19]. The present study was designed to determine the role of shift work impact on development of MetS, by comparing groups of exposed and unexposed Iranian professional drivers.

METHODS

Study population

Iranian health surveys of professional drivers of commercial motor vehicles have looked to improve their occupational health. From 2006 to 2010, more than 22 000 long-distance motor vehicle drivers were referred to our clinic. All of them reside in the West Azerbaijan Province of Iran. In this community-based study, a total of 6078 participants aged 20–60 years were included. The study protocol was approved by the Medical Ethics Committee of the Urmia University of Medical Sciences, and each participant signed a consent form.

Sampling method

For the purpose of the present study, we considered as night-shift drivers those drivers working on night or rotating shifts whose shifts included at least 15 h per week between 9:00 p.m. and 7:00 a.m. The daytime drivers were defined as drivers regularly working between 7:00 a.m. and 7:00 p.m. whose work was not shift-based. At baseline, a total of 4500 male shift work drivers aged 20–60 years were randomly selected among 22 453 individuals. We used simple random sampling because the population was uniform and had similar characteristics in all cases, e.g. occupation and the socioeconomic level.

Then, we excluded the drivers:
- who had worked as shift workers for less than two years,
- whose driving schedule included less than 44 h/week,
- whose shift work duration included less than 15 h/week from 9.00 p.m. to 7.00 a.m.