Working Healthy? Exploring the Relationship between Shift Work and Health Behaviour in Spinning and Weaving Industry Workers

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Abstract: In Egypt, shift work is increasing tremendously in concomitant with its worldwide increase due to many cultural, financial and industrial needs. This necessitates an increasing demand to conduct scientific research to investigate potential health hazards of shift work. Objective of this study was to investigate the association between shift work and negative health behaviour among Egyptian workers. A cross-sectional study of 600 male Egyptian workers at the industrial zone, Sadat city, Menoufia governorate was carried out. Data were collected through face to face interviews using a validated questionnaire. Binary logistic regression was performed to examine potential associations between shift work and undesirable health behaviours. Shift work was associated with physical inactivity ($p=0.02$; adjusted OR=1.13; 95% CI:0.65–1.22) and inadequate sleep ($p<0.05$; adjusted OR=1.42; 95% CI:1.00–1.54). On the other hand, there was no significant statistical association between shift work and smoking ($p>0.05$). The authors concluded that an association between shift work and some undesirable health hazards such as physical inactivity and inadequate sleep has been revealed by this study, highlighting an urgent need for more in-depth research.

Key Words: health behaviour, inadequate sleep, physical activity, shift work, smoking.

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INTRODUCTION

Number of shift workers has been increasing rapidly over the last few decades. Many reasons stand behind this: in order to fulfil production necessities, provide population services and fill financial gaps (Roger and Micheael, 1997). Egyptian workers are not an exception with a tremendous labour force of more than 25 million and at a growing rate of 2.7% (Assaad and Krafft, 2013).

The global increase in shift work has sparked a parallel increase in health-related research to explore potential health effects. These studies have correlated shift work with a wide range of health hazards. The International Agency for Research on Cancer classified night shift work as a Group 2A carcinogen (probable human carcinogen) (IARC, 2010). Health hazards of shift work might include: work-related injuries; sleep disorders; peptic ulcer; stroke and ischemic heart disease; prostate and colorectal cancer; preterm labour and still birth; some behavioural changes were also reported (Wang et al., 2012; Bae et al., 2017).

Many hypotheses and mechanisms were suggested to explain potential negative health outcomes of shift work. It was hypothesized that as a result of disrupting suprachiasmatic nucleus, hormonal imbalance including growth hormone, thyroid hormone, corticosteroids, melatonin, serotonin, gastrin, and pepsinogen would be reflected on the circadian rhythm in shift workers. This disruption may result in a decrease in total sleep time and efficiency, and eventually, increase in insomnia prevalence and daytime sleepiness. (Knutsson et al., 1988; Colten and Altevogt, 2006)

Irregular working hours, and subsequently, daily routine disturbances could be considered as another probable mechanism pertaining to the shift workers' health behaviours. Having difficulty in maintaining daily health behaviours will increase shift workers' susceptibility to health hazards (Drake et al., 2004; Akerstedt et al., 2010)

In Egypt, data available on shift workers and their vulnerability to health hazards are scarce. More attention was paid to explore risk factors, work-related hazards, communicable and non-communicable diseases among Egyptian workers. Meanwhile, night shift and its impact on development and control of diabetes mellitus was examined (Ghazawy et al., 2014), therefore, in the present study, we evaluated the association between shift work and health behaviours such as smoking, physical activity, and the adequacy of sleep time among shift workers.

METHODS

Study subjects

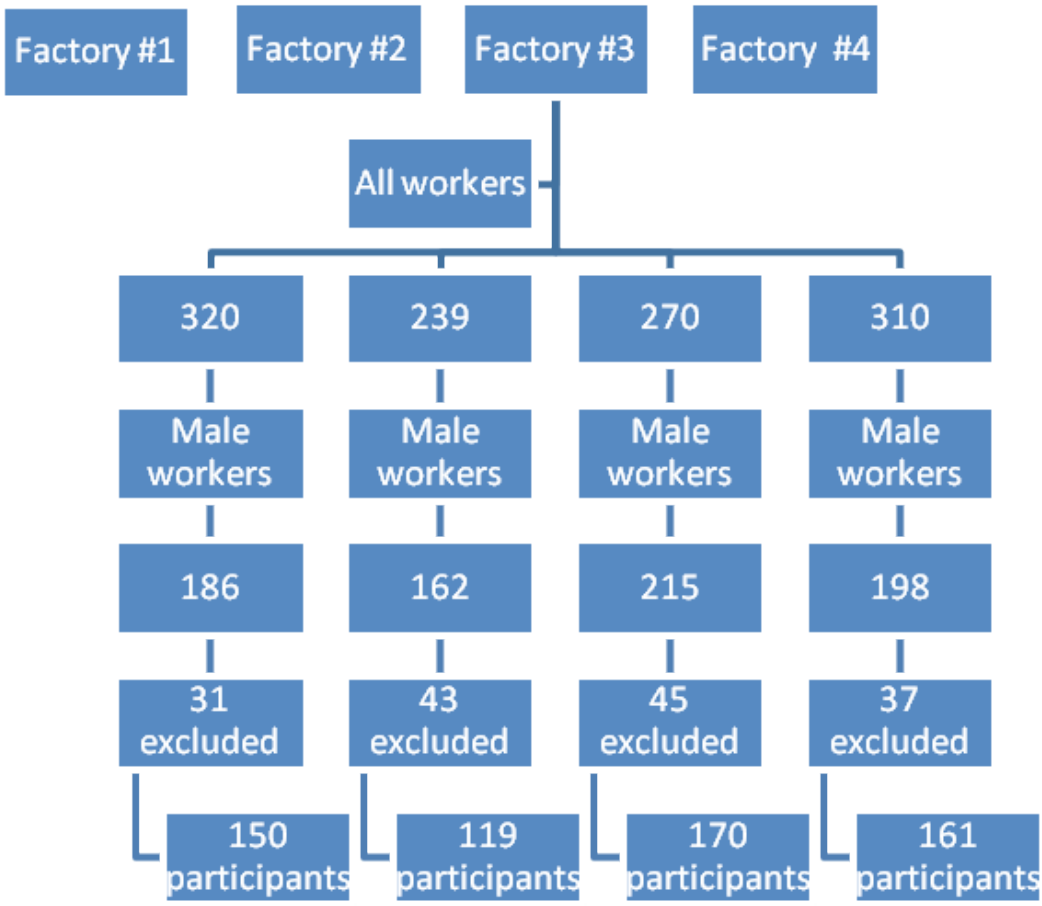

Figure 1. Enrolling methodology and sampling process

Four spinning and weaving factories located in Sadat Industrial zone, Menoufia Governorate, Egypt, were randomly chosen to be the place of this study. A total number of 600 male workers have been recruited according to an enrolment process summarized in *Figure 1.* This study was confined to male participants for Egyptian cultural reasons: so, female workers tend to be allocated for daily shifts only, and freed from night shift work "whenever possible". Excluded workers included female ones and male workers who refused to participate in this study or did not complete the questionnaire.

The authors designed and validated the questionnaire after reviewing the related literatures, and the participants were to go through face to face interviews from the beginning of January till April 2017.

Study variables

Participants were categorized according to the highest level of education into three groups: group A included basic education and lower, group B included high school certified workers, and group C included university qualifications and postgraduates.

According to marital status, the participants were categorized into two main groups: group A with those currently living with a spouse, and group B, the 'without spouse' group, which included those who never married, were divorced, or widowed.
The Egyptian average family income per year is 25.000 LE (Data available at Egypt Household Income, Expenditure, and Consumption Survey, HIECS 2012/2013). We calculated the total household income and divided it by the square root of the number of household members. Participants were classified based on monthly average family equivalent income quartiles into four groups: Group A (the lowest), group B, group C, and group D (the highest).

As there are many work schedules considered as shift, and there is no standardized definition, but there is a heterogeneity in the definitions used for analysis, we classified shift work based on the worker's answer to a relevant key question: "Do you work outside the normal daylight hours (7 am–6 pm)?". Workers who answered "I usually work in the normal daylight hours" were classified as day workers, while those who answered as being involved in evening/night shifts, day/night, or 24-hour rotating shifts were classified as shift workers.
Current smokers were classified those workers who reported they had smoked five or more packs of cigarettes during their lifetime and were still currently smoking on a regular basis.
Workers were classified according to physical activity into two main groups: Group A who practice vigorous exercise that was defined as physical activity such as jogging, high-speed cycling/swimming, soccer, and/or manual labour involving heavy loads, performed for a duration of >30minutes and /or ≥5 times a week, group B who were physically inactive as they performed any type of physical activity less than 30 minutes and / or < five times a week.
According to published data sleep duration of 7 to 8 hours per day is associated with lower risk of obesity, hypertension, diabetes, myocardial infarction, cerebral vascular accidents, and reduced risk of injuries and errors (Colten and Altevogt, 2006). Using this as a reference value, we categorized participants into two sleep groups: adequate sleep group (7 to 8 hours per day), or inadequate sleep group (≤6 hours or ≥9 hours), respectively.
The research ethics committee of the Faculty of Medicine, Menoufia governorate revised the research aims and methodology and approved it on January 2017. Written formal consents were taken from all the participants after being informed about the aim of this work. Management of the four factories approved to interview the workers during their break time.

Statistical analysis

Data entry of this study, coding and analysis were conducted using PSW (20), IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. Data of this study were of both quantitative and qualitative types. Quantitative data were expressed in Mean ($\bar{x}$), and Standard Error of Mean (SEM), while qualitative data were expressed in frequency (number), and percent (%). Student t-test was used to estimate the difference in "Means" of quantitative parameters between shift workers and day time workers. Chi-square test was used to assess the relationship between two or more qualitative variables. Logistic regression was used to evaluate the association between shift work and health behaviour. We included age, average working hours per week, education level, income level, and marital status as covariates in the regression model. Level of significance of our data was 95%, so,

p-value>0.05 was considered a statistically non-significant difference, while p-value<0.05 was considered a statistically significant difference. On the other hand, a p-value<0.01 was considered a highly statistically significant difference.

RESULTS

General characteristics of the study participants

Total number of day workers was 470 participants representing 78.3% of the total number of participants. On the other hand, the total number of shift workers was 130 participants representing 21.7% of total participants. On an average, day workers were older compared to the shift workers (p=0.006). Shift workers were more likely to be "without spouse" than their day-work counterparts (p=0.00001). The education level showed no significant (p=0.06) difference between day workers and shift workers, yet data of this study showed that the proportion of participants with university degree and more showed a tendency for day working. Shift workers did not differ significantly (p=0.06) from day workers regarding income level. There was a highly significant difference (p=0.005) between day workers and shift workers regarding working time per week. Data of the study showed that both the longest (>60 hours) and shortest (<40 hours) working time per week were more prevalent among shift workers than among day workers. Smoking habit did not differ significantly (p=0.56) between day workers and shift workers. However, shift workers were more likely to be physically inactive than day workers (p=0.02). The distribution of average sleep hours was significantly different between day workers and shift workers (p=0.05). Data of the study showed that both the longest (≥9 hours) and the shortest (≤6 hours) sleeping time were more prevalent among shift workers than among day workers.

Association between shift work and health behaviour

Logistic regression analysis showed that shift working was associated with 1.72 times increase of smoking risk among shift workers compared to day workers after adjustment of covariates, and 1.13 times increase in physical inactivity among shift workers, furthermore, data of this study showed an increase of 1.42 times of inadequate sleeping time among shift workers than day workers.

Table I.

Characteristics of study participants in relation to type of work

Variable	Category	Type of work		p-value	Crude odds ratio	*Adjusted odds ratio
		Day work N=470 (78.33%)	Shift work N=130 (21.67%)			
Age in years						
Mean±SEM		48.62±1.1	41.21±0.94	0.0006**		
Range		29–60	18–55			
Marital status	With spouse	358 (76.17%)	35 (26.92%)	0.00001***		
	Without spouse	112 (23.83%)	95 (73.08%)			
Education	≤Basic	122 (25.96%)	28 (21.54%)	0.06***		
	High school	160 (34.04%)	59 (45.39%)			
	≥University	188 (40.00%)	43 (33.07%)			
Quartiles of income	1st (lowest)	48 (10.21%)	11 (8.46%)	0.51***		
	2nd	118 (25.11%)	37 (28.46%)			
	3rd	136 (28.94%)	43 (33.07%)			
	4th (highest)	168 (35.74%)	39 (30.00%)			
Working time/week	≤39.0 hours	94 (20.00%)	31 (23.85%)	0.0005***		
	40–48 hours	168 (35.75%)	26 (20.00%)			
	49–60 hours	126 (26.80%)	33 (25.38%)			
	≥61.0 hours	82 (17.45%)	40 (30.77%)			
Smoking	Current smokers	243 (51.70%)	71 (54.61%)	0.56***	1.57	1.72
	Ex/no smokers	227 (48.30%)	59 (45.39%)		(1.09–1.81)	(1.21–1.94)
Physical activity	Active	230 (48.93%)	49 (37.69%)	0.02***	1.48	1.13
	Inactive	240 (51.07%)	81 (62.31%)		(0.99–1.76)	(0.65–1.22)
Sleeping time per day	≤6.0 hours	188 (40.00%)	55 (42.31%)	0.05***	1.67	1.42
	7.0–8.0 hours	258 (54.89%)	62 (47.69%)		(1.21–1.94)	(1.00–1.54)
	≥9.0 hours	24 (5.11%)	13 (10.00%)			

*Adjusted for age, marital status, education, income, and working time/week.

** Test of significance used was Student's t-test.

*** Test of significance used was chi-square test.

DISCUSSION

In this study that aimed to provide further data to the relationship between shift work and health behaviour in a sample of Egyptian workers, we found that shift work was associated with physical inactivity and inadequate sleep, and there was no significant association between shift work and smoking.

Our data showed that Egyptian shift workers were more likely to be of younger age than day workers. This might be attributed to cultural, financial and work-force related factors. Culturally, it is a matter of showing respect to older workers through scheduling their working time by assigning them as day workers. Again, young workers are in more financial need therefore more likely to be assigned as shift workers for better salaries. Finally, younger workers tend to show better performance compared to older workers during extended shift work. Several studies (Pavard et al., 1982; Reid and Dawson, 2001; Gander and Signal, 2001) have stated that younger workers are less vulnerable to the changes in circadian rhythm, which could be positively reflected on quality and quantity of sleep, and consequently on quality and quantity of work outcome. The same explanation could be applied to marital status, educational level and financial income.

Many worldwide studies (Knutsson et al., 1988; Van Amelsvoort et al., 2006; Solanki et al., 2013; Buchvold et al., 2015) showed that workers are more prone to smoke cigarettes during shift work compared to day work for many reasons: to resist tiredness, to encounter sleepiness, and to avoid loneliness. Our study showed that current smokers represented 54.6% of shift workers and 51.7% of day workers. These findings are in agreement with previous studies that reported a higher prevalence of smoking among shift workers. With an adjusted odds ratio of 1.72 (1.21–1.94), our study results are consistent with a Japanese study that revealed a higher smoking rate among Japanese shift workers (RR=2.50; 1.39–4.51) (Pavard et al., 1982). Same finding was revealed by Knutsson et al., (1988) who stated that current smokers represented 54% of shift workers in contrast to 39% among day workers. Egyptians are ranked among the top ten per capita consumers of tobacco by the World Lung Foundation (Omar, 1999). Egyptian workers are not out of this. This might explain the high proportion of current smoking among both day workers and shift workers in our study (51.7%, and 54.6%) respectively. Again, formulation of our study question might be behind the insignificant statistical result revealed between Egyptian shift workers and day workers. Re-formulating the question to be “Do you smoke during your shift?” may reveal a significant statistical outcome.

Data of this study show that shift workers are less likely (37.69%) to be physically active than day workers (48.93%). These finding go in same line with other studies (Van Amelsvoortet al., 2006) that reported lack of physical activity among shift workers compared to day workers. A possible explanation of that may be inability of shift workers to schedule regular physical activity, and sleeping during day-time; that is the usual time to practice physical activities.

Previous studies (Pilcher et al., 2000; Akerstedt et al., 2010) reported that shift work was associated with higher risk of sleepiness at work, and greater difficulty in falling asleep when needed. Consistent with these findings, our study showed that shift workers were more prone to suffer from inadequate sleep than day workers. This may increase excessive sleepiness during work and/or insomnia (Kivimaki et al., 2001; Drake et al., 2004; Akerstedt et al., 2010).

Our study had some limitations. First, we did not include female shift workers in our study due to lack of resources, and low number of investigators conducting this study. These reasons stand also as obstacles against increasing number of participants and varieties of industrial areas investigated to include female shift workers. Second, we could only show associations but not causations due to the cross-sectional type of study design. Finally, more needed relevant informative shift-related risk factors, and work-related factors such as personality traits, in-depth questioning about stress and sleep disorders, then relating these findings to type of work. In conclusion, our findings revealed an association between shift work and some undesirable health hazards such as physical inactivity and inadequate sleep. These findings highlight the importance of conducting larger studies preliminary to implementing effective tailored strategies to reduce these health hazards.

Conflict of interest: None

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