Shift work effects on dietary habits and nutrients intake of security guards at Mansoura University.

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Abstract

Introduction: Security guards experience shifts that negatively affect their dietary behavior and nutritional status.

Objective: To assess the effect of shift work on dietary habits and nutrients intake among the security guards at Mansoura University.

Methodology: A cross sectional study of all (166) security guards at Mansoura University who were exposed to an interviewer-administrated questionnaire for socio-demographic data and occupational history, anthropometric measurement, evaluation of dietary habits and dietary survey.

Results: Mean ±SD of BMI (34.6 ± 8.8) and waist circumference (105.1 ± 15.9 cm) were statistically significantly higher among night shift guards than those with other shifts. Number of meals was statistically significantly fewer (2 meals/day) but snacks number was significantly higher (>3 snacks/day) among night shift guards. Night shift guards had the highest daily carbohydrate and fat intake and lowest daily protein intake with a statistically significant difference with other shifts. They also had the lowest daily intake of iron, calcium and vitamin.

Conclusion: Security guards with night shift experienced few meals intake with much snacks during their shift with reduced protein, iron, calcium and vitamin A with increased carbohydrate and fat intake.

Keywords: Security workers, Dietary habits, Nutrients, Shift work.

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Introduction

Shift work is working at times out of normal daylight hours (8:00 am to 2:00 pm) or work during the weekends [1]. Also it refers to a work schedule that involves irregular or unusual hours, such as night work and rotating shift work, in contrast to normal daytime work [2].

Security guards are responsible for guaranteeing the security and the physical integrity of employees, workers and visitors, in public institutions, like universities and they work in shifts to be constantly alert to any circumstance that threatens the security [3].

Shift workers preferred to eat fast foods and tend to have fewer meals over 24 hours. Several mechanisms explain weight gain in shift workers, such as higher calorie intake, changes in dietary habits such as eating fewer meals, more snacks and in the circadian distribution of food intake and lower physical exercise [4]. The impact of shift work on nutrient intake differed by age and the type of shift work. Also, agreed that shift work affects the distribution of food intake and the selection of food items over 24 hours [5]. Modifying external factors such as food and beverage intake patterns can help to reduce the destructive health effects of shift work [6].

Ohtsuka conducted a study on female workers in a computer factory in Japan and found that shift workers, particularly those with night shifts, took smaller amounts of energy, protein, fat, carbohydrate, calcium and iron than the daytime workers, implying that the former group's nutritional status has been worsened, judged from the recommended dietary allowance for Japanese. Their inadequate nutrient intake was due to lower meal frequency and poor meal quality, both of which were conditioned by shift work [7].

The study was conducted to assess the effect of shift work on the dietary habits and nutrients intake among the security guards at Mansoura University which represents a professional category that is still understudied in the occupational health field.

Aim of work

To assess the effect of shift work on dietary habits and nutrients intake among the security guards at Mansoura University.

Population and Methods

Study design: Cross sectional study.

Place and duration of the study: Mansoura University during the period from April 2016 till October 2016.

Study sample

A convenience sample of all (166) security guards (127 males, 39 females) who are classified according the type of their work shift into:

- Those with day shift (number=63), they work from 8.00 am-3.00 pm.
- Those with evening shift (number=39), they work from 3.00 pm-8.00 pm.
- Those with night shift (number=64), they work from 8.00 pm-8.00 am.

Study methods

An interviewer–administrated semi-structured questionnaire fulfilling the requirements of the study to collect:

- Socio-demographic data: such as age, gender, residence, marital status and educational level.
- Occupational history: as type of shift work, working hours/day and the duration of employment.

Anthropometry including:

- Measurement of weight and height according to WHO (World health organization) standard protocol. In the present study, first, the subjects' weight was measured in terms of Kg using a digital balance then their heights were measured in terms of meter using a mobile stadiometer [8].
- The BMI (defined as weight in kg/height in meter square) was also calculated for knowing the nutritional status of the security guards [9].
- The waist circumference was measured as the midway between the lower rib margin and the superior anterior iliac spine [10].

Evaluation of dietary and smoking habits: each participant was asked about the number of meals taken each day, the main meal taken, the number of snacks/day and their types, the time of last meal and smoking history.

Dietary survey: Dietary intake was assessed by using 24hour recall. Each participant was instructed to record the food items taken and the approximate quantity of each item consumed during each meal. Quantities were expressed in household measures. The inventories were checked by an experienced nutritionist, who verified the type and the quantities of the recalled foods. The daily dietary intakes of energy (carbohydrate, protein and fat), minerals (iron, calcium, sodium, potassium and phosphorus) and vitamins (vitamin A, vitamin C, thiamine and riboflavin) consumed in each meal by each participant were analyzed at the National Nutrition Institute using the food composition tables for Egypt [11].

Consent

Approval of the Institutional Review Board (IRB) of Faculty of Medicine, Mansoura University was obtained.

Ethical consideration

An informed verbal consent was obtained from the security guards at Mansoura University, to participate voluntarily in the study with assurance of confidentiality of data.

Data Management

Data were fed to the computer and statistically analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Qualitative data were described using number and percent. Quantitative data were described using median (minimum and maximum) & inter quartile range for non-parametric data and mean, standard deviation for parametric data after testing normality using Kolmogrov-Smirnov test. P value ≤ 0.05 (5%) was considered to be statistically significant.

The used tests were; Chi-square test: for categorical variables, to compare between different groups, One Way ANOVA: for parametric quantitative variables to compare between more than two studied groups with post hoc LSD for pairwise comparison, Kruskal Wallis test: for non-parametric quantitative variables to compare between more than two studied groups and Mann Whitney test: for non-parametric quantitative variables, to compare between two studied groups.

Results

Table 1 showed that 49.4% of the security guards at Mansoura university were below 30 years old, 76.5% were males, 80.1 % were rural residents, 77.1% were married, 50.0% completed the secondary level of education and 49.4 % had a duration of employment less than 5 years. There were no statistically significant differences as regards the socio-demographic characteristics of the security guards according to the type of their shift work (P>0.05).

Table 1: Socio-demographic characteristics of security guards at Mansoura University according to the type of their work shift.

Workers	Day shift N=(63)	Evening shift N=(39)	Night shift N=(64)	Test of significance	Total
Age (years)	**N (%)**	**N (%)**	**N (%)**		**N (%)**
Below 30	28 (44.4)	20 (51.3)	34 (53.1)	$\chi2=7.87$ P=0.09	82 (49.4)
30-40	26 (41.3)	10 (25.6)	13 (20.3)		49 (29.5)
Above 40	9 (14.3)	9 (23.1)	17 (26.6)		35 (21.1)

Sex					
Male	45 (71.4)	32 (82.1)	50 (78.1)	χ^2=1.7 P=0.44	127 (76.5)
Female	18 (28.6)	7 (17.9)	14 (21.9)		39 (23.5)
Residence					
Rural	49 (77.8)	34 (87.2)	50 (78.1)	χ^2=1.6 P=0.45	133 (80.1)
Urban	14 (22.2)	5 (12.8)	14 (21.9)		14 (21.9)
Marital status					
Single	15 (23.8)	5 (12.8)	18 (28.1)	χ^2=3.3 P=0.19	38 (22.9)
Married	48 (76.2)	34 (87.2)	46 (71.9)		128 (77.1)
Educational level					
Illiterate and basic	26 (41.3)	9 (23.1)	12 (18.8)	χ^2=8.9 P=0.06	47 (28.3)
Secondary	27 (42.9)	21 (53.8)	35 (54.7)		83 (50.0)
University	10 (15.9)	9 (23.1)	17 (26.6)		36 (21.7)
Duration of employment					
<5 years	28 (44.4)	20 (51.3)	34 (53.1)	χ^2=8.2 P=0.08	82 (49.4)
5-10 years	10 (15.9)	10 (25.6)	18 (28.1)		38 (22.9)
>10 years	25 (39.7)	9 (23.1)	12 (18.8)		46 (27.7)

Table 2 showed that the BMI was higher among security guards with night shift (34.6 ± 8.8) than those with evening (30.39 ± 4.7) and day shifts (28.8 ± 4.7) (P<0.001). Also, the waist circumference was higher among those with night shift (105.12 ± 15.9) than those with evening (91.88 ± 15.4) and day shifts (90.3 ± 18.9) (P<0.001).

Table 2: Distribution of anthropometric measures of the security guards at Mansoura University according to the type of their work shift.

Anthropometric measures	Day shift (N=63)	Evening shift (N=39)	Night shift (N=64)	Test of significance	P value
BMI: Mean ± SD	28.8 ± 4.7[a]	30.39 ± 4.7[b]	34.6 ± 8.8[ab]	F = 8.8	P<0.001*
Waist circumference: Mean ± SD	90.3 ± 18.9[a]	91.88 ± 15.4[b]	105.12 ± 15.9[ab]	F= 9.79	P<0.001*
F: One Way ANOVA test; a/ b :Similar letters denote significant difference between groups in same row; P:Probability; *:Statistically significant					

Table 3 showed that the number of meals was fewer (2 meals/day) among security guards with night shift (68.7%) than those with evening and day shifts (38.5% and 23.8%; respectively). The number of snacks (>3 snacks/day) was higher among those with night shift (54.7%) than those with evening and day shifts (12.8% and 6.3%; respectively). The time of last meal was after 12 am in a higher percentage of security guards with night shift (60.9%) than those with evening and day shifts (53.8% and 12.7%; respectively). There was a high statistically significant difference between the three groups as regards the number of meals and snacks/day and the time of last meal (P<0.001). There was no statistically significant difference between the three groups as regards current smoking (P>0.05).

Table 3: Distribution of dietary and smoking habits among the security guards at Mansoura University according to the type of their work shift.

Dietary and smoking habits	Day shift (N=63)		Evening shift (N=39)		Night shift (N=64)		Test of significance (χ^2)	P value
	No	%	No	%	No	%		
No of meals/day								
2	15	23.8	15	38.5	44	68.7	27.7	P<0.001*
3	35	55.6	17	43.6	17	26.6		
<3	13	20.6	7	17.9	3	4.7		

No of snacks/day								
No Snacks	9 50 4	14.3 79.4 6.3	2 32 5	5.1 82 13	2 27 35	3.1 42 55	45.9	P<0.001*
1-3 times								
>3 times								
Time of last meal								
Before 9pm	18 37 8	28.6 58.7 12.7	5 13 21	12.8 33 54	3 22 39	4.7 34 61	37.5	P<0.001*
9pm-12am								
After 12am								
Current smoking								
No smokers	33 30	52.4 487.6	16 23	41.1 58.9	24 40	37.5 62.5	3.03	P<0.005*
Smokers								
χ2: Chi-Square test; P:Probability; *:Statistically significant								

Figure 1 showed a higher consumption of hot drinks, beverages, chips and cakes among security guards with night shift (85.9%, 68.8% and 73.4% respectively) than those with evening (82.1%, 46.2% and 48.7%) and day (82.5%, 25.4% and 20.6%) shifts. There was a high statistically significant difference between the three groups as regards beverages, chips and cakes (P<0.001). Fruits, fruit juices and nuts showed the least intake among all security guards.

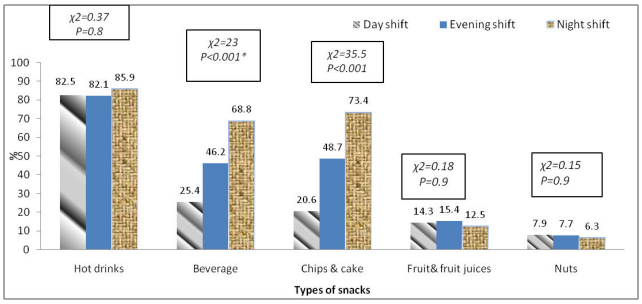

Figure 1: *Types of snacks among the security guards at Mansoura University according to the type of their work shift.*

Table 4 showed that night shift guards had the highest daily total caloric [2356.0 (1122.8-4778.2) kcal], carbohydrate [356.2 (167.3-584.6) gm] and fat [102.3 (40.2-135.6) gm] intake followed by those with evening [2231.0 (1129.2-4401.4) kcal, 289.5 (101.1-754.1) gm and 82.9 (22.2-184.6) gm] and day [2083.0 (1246.6-3009.8) kcal, 278.6 (157.8-430.2) gm and 73.3 (28.2-127.1) gm] shifts.

There was a statistically significant difference between those with night and evening shifts and those with night and day shifts as regards daily carbohydrate (P<0.01) and fat intake (P<0.001). Also, night shift guards had the lowest daily protein intake [76.7(19.4-174.8) gm] with a statistically significant difference between night and day shift guards (P<0.05).

Table 4: *Distribution of the daily nutrients intake (macronutrients, minerals and vitamins) among the security guards at Mansoura University according to the type of their work shift.*

Nutrient	Day shift (N=63)	Evening shift (N=39)	Night shift (N=64)	Test of significance
A. Macronutriens				
Total calories(Kcal)	2083.0(1246.6-3009.8)	2231.0(1129.2-4401.4)	2356.0(1122.8-4778.2)	KW=5.4 P>0.05*
Carbohydrate (gm)	278.6(157.8-430.2)[a]	289.5(101.1-754.1)[b]	356.2(167.3-584.6)[ab]	KW=12.5 P<0.01*
Protein (gm)	95.3(28.4-160.7)[a]	81.4(32.8-156.2)	76.7 (19.4-174.8)[a]	KW=8.18 P<0.05*
Fat (gm)	73.3(28.2-127.1)[a]	82.9(22.2-184.6)[b]	102.3 (40.2-135.6)[ab]	KW=20.0 P<0.001*
B. Minerals				

Iron (mg)	14.7(5.4-27.7)[a]	12.7(5.1-30.4)[b]	9.6 (4.8-18.1)[ab]	KW=15.2 P<0.001*
Ca (mg)	673.1(182.6-2224.6)[a]	635.3(159.7-3393.3)[b]	488.9 (166.7-1403.8)[ab]	KW=7.5 P<0.01*
Na (mg)	2599.0(567.4-6389.5)	3203.0(1304.0-7630.1)	3070.0 (1260.3-7141.5)	KW=4.3 P>0.05*
K (mg)	2051.0 (800.4- 4646.9)	2335.0 (648.4-5663.2)	2212.0 (828.1-5444.5)	KW=5.2 P>0.05*
Ph (mg)	912.2 (257.9-1821.9)	962.2 (195.4-1821.9)	1085.0 (142.2-1821.9)	KW=2.4 P>0.05*
C. Vitamins				
Vitamin A (IU)	255.5 (10.3-1419.2)[a]	247.4 (41.8-2077.9)[b]	164.4 (47.5-845.6)[ab]	KW=8.15 P<0.01*
Vitamin C (mg)	34.25 ± 3.7	33.16 ± 4.8	32.59 ± 5.02	F=1.5 P>0.05*
Thiamine,B1 (mg)	0.7 (0.1-2.6)	0.7 (0.1-2.3)	0.5 (0.1-1.8)	KW=4.5 P>0.05*
Riboflavin,B2 (mg)	0.9 (0.1-3.0)[a]	0.7 (0.2-3.9)	0.5 (0.2-3.8)[a]	KW=6.75 P<0.05*

KW: Kruskal Wallis test; F: One Way ANOVA test; ph: phosphorus; a/b Similar letters denote significant difference between groups in same row; P:Probability; * Statistically significant if P <0.05; All parameters described as median (Min-Max) except Vit C as mean ±SD

As regards minerals, night shift guards had the lowest daily intake of iron [9.6 (4.8-18.1) mg] and calcium [488.9 (166.7-1403.8) mg] followed by evening [12.7 (5.1-30.4) mg and 635.3 (159.7-3393.3) mg] and day shift guards [14.7 (5.4-27.7) mg and 673.1 (182.6-2224.6) mg]. There was a statistically significant difference between those with night and evening shifts and those with night and day shifts as regards daily iron (P<0.001) and calcium intake (P<0.01).

Also night shift guards had the lowest daily intake of vitamin A [164.4 (47.5-845.6)IU] , vitamin C [32.59 ± 5.02], thiamine [0.5 (0.1-1.8)] and riboflavin [0.5 (0.2-3.8)] followed by those with evening [247.4 (41.8-2077.9), 33.16 ± 4.8, 0.7 (0.1-2.3) and 0.7 (0.2-3.9)] and day [255.5 (10.3-1419.2), 34.25 ± 3.7, 0.7 (0.1-2.6) and 0.9 (0.1-3.0)] shifts. There was a statistically significant difference between those with night and evening shifts and those with night and day shifts as regards daily vitamin A intake (P<0.01) while there was a statistically significant difference between those with night and day shifts as regards daily riboflavin intake (P<0.01).

Discussion

The current study showed that BMI was significantly higher among security guards with night shift than those with evening and day shifts (Table 2). This is in agreement with Antunes et al. who reported that higher BMI was more prevalent among shift workers independently of age and work duration [12]. Moreover, Ghanbary et al. conducted a study on military personnel in Southern Iran and revealed that 81.6% of shift workers had a BMI of higher than 25 while 86.2% of day workers had a BMI of less than 25 [13]. Also, Zayeri et al. assessed the relationship between shift work and BMI in petrochemical staff and found that the average annual trend of BMI in shift workers was about 0.12 kg/m2 higher than day workers which confirms the findings of the present study [14].

Also, the present study revealed that the waist circumference was significantly higher among those with night shift than those with evening and day shifts (Table 2). This is in agreement with Ghanbary et al. who conducted a study on military personnel in Southern Iran and revealed that that waist circumference was higher in shift workers than day workers [13]. They found that 80.3% of shift workers had a WHR higher than 0.9 while day workers had a WHR of less than 0.90. Also, Di Lorenzo et al. studied the effect shift work on waist circumference and found that shift work has impact on waist circumference [15]. The explanation of increased body weight among shift workers may be due to changes in their dietary habits and also the disruption of the circadian clock [16].

The present study showed that the number of meals was significantly fewer (2 meals/day) and the number of snacks was significantly higher (>3 snacks/day) among security guards with night shift than those with evening and day shifts (Table 3). This is in accordance with Sahu and Dey who conducted a study among nurses in the Paschim Medinipur district, West Bengal and concluded that in night shift nurses, the number of full meals per 24 hour was significantly low and the number of snacks was significantly higher compared to morning and afternoon shift and off day [17]. Similarly, Wong et al. on their study on nurses in Hong Kong reported that shift duties were positively associated with abnormal eating behavior among nurses working in hospitals [18]. In the contrary to the present study, Seibt et al. conducted a study among hotel staff in Germany working with alternating and regular shifts and found that there was no significant difference in their nutritional behavior [19].

The present study revealed that the time of last meal was after 12 am in a significantly higher percentage of night shift guards than those with evening and day shifts (Table 3). In contrast, Sahu and Dey reported that nurses with night shift take dinner too early before leaving for the duty (22.05 ± 0.41hrs) with a statistical difference compared to other two shifts and off day [17].

This study reported that night shift guards had the highest daily total caloric, carbohydrate and fat intake followed by those with evening and day shifts. There was a statistically significant difference between those with night and evening shifts and those with night and day shifts as regards daily carbohydrate and fat intake (Table 4). This is in accordance with the study carried out by Morikawa et al. who found that the total energy and carbohydrate intake were the highest in shift workers >30 years with midnight shifts, followed by shift workers without midnight shifts and fixed day workers; there was a significant difference as regards total energy intake between shift workers with midnight shifts and fixed day workers among age groups 30-39 and 50-59-yr-old workers. However, they found that shift workers with midnight shifts had the lowest fat intake [4].

In contrast, Sahu and Dey found that the energy, carbohydrate and fat intake in night shift nurses were significantly lower than the other two shifts and off day [17]. Moreover, Naghashpour et al. conducted a study on female nurses from six educational hospitals in Ahvaz, Iran and reported that total caloric intake was lower in shift workers (1637.1 ± 542.6 kcal/d) compared to day time workers (1859.7 ± 539.8 kcal/d) [20].

It is obvious that the previous studies although few but revealed low fat intake among night shift workers unlike the current study which reported highest fat intake among night shift workers. This may be explained that although guards with night shifts took few meals per day, they try to compensate it by taking more snacks which contain higher fat and sugar content. Moreover, guards with night shift work from 8.00 pm-8.00 am so their shift is long enough to take more snacks and fast foods. It has been reported that the total energy and nutrient intakes in-crease when individuals eat with others [21]. The current study reported a significantly higher consumption of beverages, chips and cakes among security guards with night shift than those with evening and day shifts (Figure 1).

Also, night shift guards had the lowest daily protein intake with a statistically significant difference between night and day shift guards (Table 4). This is in agreement with Morikawa et al. who found that the protein intake was the lowest among shift workers with midnight shift [4]. Similarly, Sahu and Dey found that protein intake was significantly low in nurses when they work in night shift than the other two shifts and off day [17].

Also, the current study revealed that night shift guards had the lowest daily intake of iron and calcium followed by evening and day shift guards. There was a statistically significant difference between those with night and evening shifts and those with night and day shifts as regards daily iron and calcium intake (Table 4). This is in agreement with Morikawa et al. who found that iron and calcium intake were the lowest among shift workers of all age groups with midnight shift than workers without midnight shifts and fixed day workers. There was a statistically significant difference as regards calcium intake between workers of the age group 20-29 yrs with midnight shift and those without midnight shifts and fixed day workers [4].

Similarly, Naghashpour et al. conducted a study on female nurses from six educational hospitals in Ahvaz, Iran and reported that iron and calcium intake were lower in shift workers compared to day time workers with a statistically significant difference as regards iron intake [20].

The present study reported that night shift guards had the lowest daily intake of vitamin A, vitamin C, thiamine and riboflavin followed by those with evening and day shifts. There was a statistically significant difference between those with night and evening shifts and those with night and day shifts as regards daily vitamin A intake while there was a statistically significant difference between those with night and day shifts as regards daily riboflavin intake (Table 4). This is in accordance with Morikawa et al. who found that vitamin A and thiamine intake were the lowest among shift workers of age groups <50yrs with midnight shift than workers without midnight shifts and fixed day workers. There was a high statistically significant difference as regards vitamin A intake between workers of the age group 20-29 yrs with midnight shift and those without midnight shifts and fixed day workers. There was a statistically significant difference as regards thiamine intake between workers of the age group 30-39 yrs with midnight shift and those without midnight shifts and fixed day workers ($P< 0.05$)[4].

Similarly, Naghashpour et al. reported that retinol, ascorbate, thiamine and riboflavin intake were lower in shift workers compared to day time workers with a statistically significant difference as regards thiamine and riboflavin intake ($p < 0.05$) [20].

Limitations of the Study

This is a cross-sectional study which does not prove cause effect relationship (it is an association between shift work and dietary intake) that needs a longitudinal study.Also it involved a small number of a single occupational group (security guards) at a single university, thus its results cannot be generalized to both security guards in other sectors and other shift workers in different jobs at the community level.

Conclusion and Recommendations

Shift work is associated with faulty dietary habits and nutritional imbalances accompanied by deficiencies of protein, iron, calcium, vitamins A, thiamine and riboflavin intake and increase both carbohydrate and fat intake among the security guards. The effect of work shift is much more observed on security guards with night shift followed by those with evening

and day shifts. This is explained by intake of fewer meals with many snacks during their shift.

Health education programs should be directed to security guards whose duties require night shifts in order to improve their faulty dietary habits. It is recommended that in El-Mansoura University where shift work is mandatory, trained health care personnel should frequently assess the nutritional status of the security guards in order to minimize the occupational health hazards and enhance their performance.

Conflict of Interest

Authors have declared that no conflict of interests exists.

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