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EFFECT OF ROTATING SHIFT WORK ON THE LEVEL OF SOME HORMONES AND QUALITY OF LIFE OF RESIDENT PHYSICIANS IN ZAGAZIG UNIVERSITY HOSPITALS

By

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Abstract

Introduction: Shift work is dividing working hours among two or more occupational groups in order to cover the time needed for duty performance or production process. Physicians participated in a shift-work environment since the early days of medicine. Shift work may alter the secretion levels and circadian pattern of cortisol, prolactin and melatonin. Night shift workers experience a variety of physical symptoms and adverse health effects especially those associated with gastrointestinal dysfunction, cardiovascular morbidity. Also shift work negatively affects quality of life. **Aim of work:** The current study aimed to assess the disturbances of the normal hormonal profile, quality of life and health status among rotating shift working resident physicians and evaluate the relationship between some occupational risk factors and these disturbances. **Materials and methods:** The work was conducted on 50 rotating shift working resident physicians as exposed group, matched with 50 day only working resident physicians and demonstrators as non exposed group using a questionnaire including demographic data, occupational history, Gastrointestinal and Cardiovascular symptoms, Quality of life. Cortisol, prolactin, melatonin serum levels were measured. **Results:** The prolactin and cortisol showed a statistically significant increase while melatonin showed statistically significant decrease among rotating shift working resident physicians compared to the day-time working physicians. Also Quality of life was worse and GIT and Cardiovascular disorders were more frequent among rotating shift working resident physicians in contrast to those of day-shift. In correlation

between hormones level and Cumulative working period, there was a statistically significant positive correlation with cortisol and prolactin and a statistically significant negative correlation with melatonin. **Conclusion:** The study reported that shift workers had disturbances in the normal hormonal profile, quality of life and health status and these disturbances increased by high work load.

Keywords: Rotating shift, Resident physicians, Melatonin, Cortisol , Prolactin and Quality of Life.

Introduction

Shift work is usually referred to as dividing working hours among two or more occupational groups in order to cover the time needed for duty performance or for production process.

Nearly 20% of the labor force worldwide, work shifts that include work hours outside 07:00 to 18:00. Shift work is common in many occupations that directly affect the health and safety of others e.g., protective services, transportation and healthcare (Wright et al., 2012).

Common shift-work schedules include evening, night, morning, rotating, and irregular shifts. The evening shift is generally defined as work hours between 14:00 h and midnight. Night-shiftwork hours generally range between 21:00 h and 08:00 h and rotating shifts include periodically changing and irregular work hours that vary with employer needs (Bousquet et al., 2016).

Physicians have been practicing in a shift-work environment since the early days of medicine. A comprehensive study in one of Harvard's intensive care units demonstrated a 56 percent increase in non-intercepted medical errors and more than a 5-fold increase in diagnostic errors made by residents working a 77- to 81 hours work week compared to errors made by those working a 60- to 63 hours work week (Kahol et al., 2008).

Sleep disruption, like that experienced by long-term rotating shift workers, is a stressor which causes a variety of adverse physical, psychological and cognitive symptoms. Cognitive psychomotor performance after 24 hours of sleep deprivation is equivalent to that of someone who has a blood-alcohol level of 0.1 percent. These cognitive symptoms are thought to be mediated by the direct effect of stress hormones on the hippocampus (Pavlis, 2007).

Working at night and exposure to artificial light at night have been proposed as potent circadian rhythm disruptors, which have been proposed as one mechanism contributing to the detrimental effects of shift work on human health. Particularly, misaligned circadian physiology is often found in night workers with fast rotating shift schedules. It is estimated that 11.6% of workers are exposed to shift work patterns that have the potential to alter circadian rhythm . Several biological indices have been studied in the field of shift work e.g. melatonin, cortisol, catecholamine and prolactin (Radwan, 2010).

Cortisol, which is a reliable indicator of stress, displays pronounced variation across the time-of-day with high levels in the morning at 9 a.m. and low in the evening. Shift work alters the secretion levels and circadian pattern of the hormone. This alternation increases the risk of metabolic and cardiovascular disease. Personality types and susceptibility affect workers tolerance to shift work. It was found that low scores on the personality factors as morningness, ''languidity'' (languor) and neuroticism and high scores on other personality factors such as flexibility, extraversion and internal locus of control are associated with better shift work tolerance (Saksvik et al., 2012).

Prolactin which mirrors the dopaminergic activity in the brain seems to react to real life stressors in a systematic way (Bukowska et al., 2015). Real life stressors may be death of a partner or family member, divorce, injury or illness (oneself or a family member), money problems, unemployment, sleep problems, legal problems and excessive job demands or insecurity. It is also influenced by sleep and tends to rise among rotators after nightshift (Bukowska et al., 2015).

Melatonin is an internal–physiological factor that plays a role in circadian system regulation. It has a diverse range of physiological effects such as modulation of the sleep-wake, thermo-regulatory, cognitive, cardiovascular and immune systems. The melatonin-generating system is characterized by three basic features: photosensitivity, circadian rhythmicity and age related decline in its activity.

The concentration of melatonin is reduced by light, which inhibits its synthesis. Therefore, low nighttime illumination (≤200 lux) can directly suppress melatonin production. Circadian disruption by exposure to light at night (LAN) occurs during nocturnal activities demanded by shift-work schedules, which disrupt the natural sleep-wake cycle (Song et al., 2016).

Corticotrophin releasing factors (CRF) are responsible for coordinating the body's response to stress, and CRFs have potent effects on the gut through modulation of inflammation, increase of gut permeability, contribution to visceral hypersensitivity, increased perception to pain, and modulation of the gut motility. This hormone affects the hypothalamic-pituitary axis (HPA) to eventually stimulate the secretion of cortisol from the adrenal glands. Chronic exposure to stress may lead to the development of a variety of gastrointestinal diseases such as gastroesophageal reflux disease (GERD), peptic ulcer disease, IBD, IBS, and even food allergies (Konturek et al., 2011).

There is now considerable evidence that night shift workers experience a variety of physical symptoms and adverse health effects. Most notable are those associated with gastrointestinal dysfunction and cardiovascular morbidity (Anbazhagan et al., 2016).

The World Health Organization (WHO) add year defines quality of life as the degree of realization of a person's interests, expectations, ideals, and hopes according to his or her current value and cultural system, in his or her life. Quality of life is so comprehensive and extensive that it is sometimes classified into non-health-related quality of life (NHRQL) and HRQL. HRQL represents general well-being as well as elements that have direct effects on the individual's physical, psychological, and mental health (Hong et al., 2015).

Shift work negatively affects Quality of life (QOL) which can be defined as "the degree to which a person enjoys the important possibilities of his/her life". There may be specific domains of QOL are affected by work schedule of shift workers like social and domestic lives domains beside difficulties in family life and restriction of leisure activities (Guerra et al., 2016).

Aim of work

The current study aimed to assess the disturbances of the normal hormonal profile, quality of life and health status among rotating shift working resident physicians and evaluate the relationship between some occupational risk factors and these disturbances.

Materials and methods

- **Study design:** A comparative cross sectional study.
- **Place and duration of the study:** The study was conducted in Zagazig University Hospitals and Faculty of Medicine, Zagazig University from October 2013 to October 2016.
- **Study sample:** The sample size was calculated through Open Epi-Info (Epidemiological information package) software version 6.1, according to the following collected data:

The mean of cortisol level among rotating shift workers was 402 ± 23 nmol/L and among day time workers was 389 ± 23 nmol/L in previous studies (Axelsson et al., 2003). At a confidence interval of 95%, the power of the study 80%, the estimated sample size was calculated to be 50 rotating shift working resident physicians for the exposed group and 50 day time working resident physicians and demonstrators for the non-exposed group.

General surgery, gynecology, internal medicine and anesthesia departments were the highest participating departments in the study in Group I. In Group II pathology, microbiology, anatomy and physiology were most frequent departments.

- **Study methods:** All physicians who were participating in the study were subjected to:

A) Pre-designed questionnaire to collect information about:

1. Personal and socio-demographic data:Age, sex, residence, marital status, income and Body Mass Index (BMI).
2. Occupational history: Cumulative working period: (No of hours worked/day × No of days worked/ week × No of weeks worked/year × No of years of work as resident physicians), No of night shifts per week and No of working hours in each shift, presence of a side job

and No of day and night shifts in this job.

3. Medical history: any past medical problems, any present medical problems in gastro intestinal tract (GIT) (hyperacidity, reflux, mal-digestion, flatulence, Irritable Bowel syndrome (IBS), spasms and peptic ulcer) or cardio vascular troubles (Hypertension, irregular heart beat and hyperlipidemia or hypercholesterolemia).
4. Quality of life: Using The Quality of Life Profile Questionnaire (Raphael et al., 1995) which include three major domains of QOL: 'being', 'belonging' and 'becoming', each of them had three subdomains: Being (Physical - Psychological – Spiritual), Belonging (Physical – Social – Community), Becoming (Practical -Leisure – Growth). QOL score = [(Importance Score /3)*(Satisfaction Score-3)]. The scores can range from -3.33 to 3.33. QOL Score above '0' indicate positive (Good) quality of life and QOL score below '0' negative (bad) quality of life (Kaliterna et al., 2004).

B) Laboratory investigation:

4 ml of whole blood sample was taken from every participant at 9 am in the morning by laboratory technician under complete aseptic conditions and collected in sterile yellow gel containing tubes. The tubes were put in centrifuge to separate serum from RBCs. The serum from each tube was divided into two parts:

(I) 1ml is collected to measure cortisol and prolactin by electro chemo-luminance assay.

(II) 1 ml is collected to measure melatonin by enzyme linked immunoassay. 1–31 (Elmlinger, 2011)

Consent

The study group was informed about the nature and the purpose of the study and verbal consent was taken before interview. The study group was not exposed to any harm or risk.

Ethical consideration

The Scientific Ethical Committee of the college was respected (Institutional Review Board).

Data management

The collected data were computerized and statistically analyzed using SPSS program (Statistical Package for Social Science) version 18.0 .Qualitative data were represented as frequencies and relative percentages. Chi square test was used to calculate difference between qualitative variables in different groups and Odds ratio was calculated to find how strongly the presence or absence of property.

Quantitative data were expressed as mean ± SD (Standard Deviation), median and range. Independent T test was used to calculate difference between quantitative variables in 2 groups in normally distributed data. While Mann Whitney test was used to in not normally distributed data. Spearman correlation coefficient used to calculate correlation between quantitative variables.We consider (+) sign as indication for direct correlation and (-) sign as indication for inverse correlation also we consider values near to 1 as strong correlation and values near 0 as weak correlation. The threshold of significance for all previous tests was fixed at 5% level and P value of >0.05 indicates non-significant result, P value of <0.05 indicates significant results and P value of <0.01 indicates highly significant results.

Results

The study was conducted in Zagazig University Hospitals, Faculty of Medicine on 100 physicians divided into two groups: Group I (Rotating shift working physicians) and Group II (Day time only working physicians).

Table (1): Socio-demographic characteristics and occupational history of the studied groups.

Variables	Group I (No= 50)	Group II (No = 50)	Test	p
Age (years)				
Mean ±SD	26.7 ± 1.66	27.54 ± 2.51	1.97 #	>0.05
Range	25 – 30	25 – 30		
BMI (Kg/m²)				
Mean ±SD	25.95 ± 3.51	27.12 ± 3.19	1.75 #	>0.05
Range	18.78 - 38.39	22.86 – 32.87		
Sex:				
Male No (%)	17 (34%)	2 (4%)	14.62 $	
Female No (%)	33 (66%)	48 (96%)		
Residence:				
Rural No (%)	10 (20%)	7 (14%)	0.64 $	>0.05
Urban No (%)	40 (80%)	43 (86%)		
Income:				
Not enough No (%)	11 (22%)	0 (0%)		
Enough No (%)	33 (66%)	45 (90%)	12.94 $	
Enough and Exceed N (%)	6 (12%)	5 (10%)		
Marital status:				
Unmarried No (%)	23 (46%)	17 (34%)	1.5 $	>0.05
Married No (%)	27 (54%)	33 (66%)		
Working years:				
Mean ±SD	2.91 ± 1.66	3.3 ± 2.07	2.17 ^	>0.05
Median (Range)	2.5 (1 – 6)	3 (1 – 6)		
CWP (Hours)				
Mean ±SD	12833 ± 5644	3512 ± 2481	8.06 ^	
Median (Range)	12000 (5100-28500)	2640 (1080 – 11040)		
Night shifts/week:				
< 4	31 (62%)	----------	---	----
≥ 4	19 (38%)			
Night shift hours:				
12 h	13 (26%)	----------	---	----
24 h	37 (74%)			
Other work:				
NO	46 (92%)	50 (100%)	4.17 $	< 0.05*
Yes	4 (8%)	0 (0%)		

#: Independent t test
^: Mann Whitney test
*: Significant (P< 0.05)
BMI: Body Mass Index.
$: Chi square test ($\chi 2$)
NS: Non significant (P>0.05)
**: Highly significant (P<0.01)
CWP: Cumulative working period.

Table (1) also shows that there was no statistical significance difference between Group I and Group II in No. of working years but there were highly statistical significance difference between them in Cumulative working period with marked increase among Group I. About sixty two percent of Group I had less than 4 night shifts/week and 74% of them had 24 hours shift. Eight percent of Group I worked in other hospitals with significance difference with Group II.

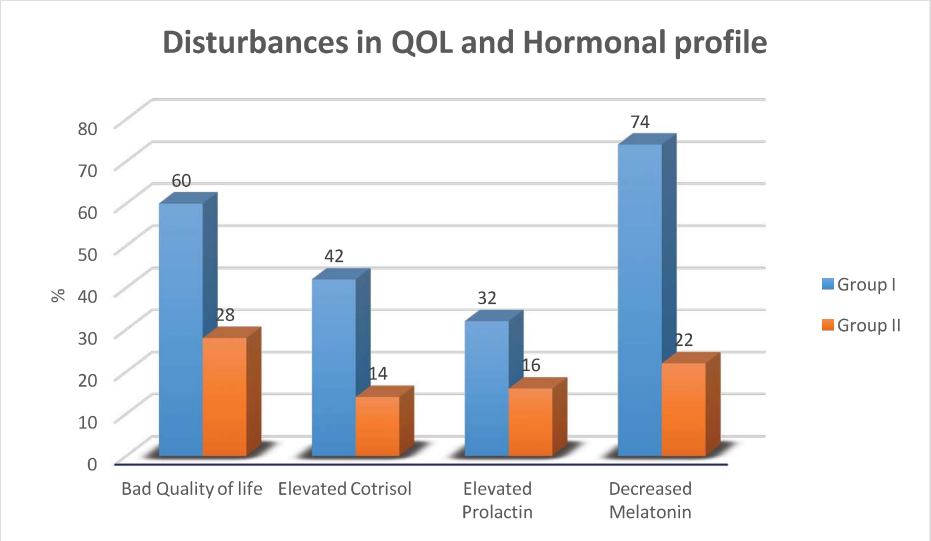

Figure (1): Disturbances in Quality of Life and hormonal profile among the two studied groups.

Figure (1) showed that there were highly statistical significance difference between them in total Quality of Life with marked increase of poor quality of life among Group I (P=0.001**, OR=3.68 and CI=1.54 – 9.77) mainly in domains of Community belonging (OR=8.14, 95% CI 3.05 – 22.25), Social belonging (OR=6.64, 95% CI 2.55 – 17.66), Leisure becoming (OR=6.16, 95% CI 2.21-17.68), Spiritual being (OR=3.78, 95% CI 1.53 – 9.47), and Psychological being (OR=3.27, 95% CI 1.27 – 8.59). (P value, OR and CI not tabulated).

Table (2): Medical history, health status and hormones levels among the studied groups.

Variables	Group I (No = 50)	Group II (No = 50)	Test	p	OR
Previous diseases:					
NO	50 (100%)	48 (96%)	2.04 $	>0.05	----
Yes	0 (0%)	2 (4%)			
GIT troubles:	30 (60%)	18 (36%)	5.77 $	< 0.05*	2.76 (1.1 – 6.51)
Hyperacidity and reflux	28 (56%)	13 (26%)	9.30 $	<0.001**	3.62 (1.44 – 9.23)
Mal digestion	12 (24%)	8 (16%)	1 $	>0.05	1.66 (0.55 – 5.04)
IBS	16 (32%)	5 (10%)	7.29 $	<0.001**	4.24 (1.28 – 14.8)
Peptic Ulcer	4 (8%)	2 (4%)	0.71 $	>0.05	2.09 (0.31 – 7.36)
Cardiovascular troubles:	16 (32%)	7 (14%)	4.57 $	< 0.05*	2.89 (1.07 – 8.84)
Hypertension	5 (10%)	0 (0%)	5.26 $	< 0.05*	---
Tachycardia	14 (28%)	6 (12%)	4 $	< 0.05*	2.85 (1.09 – 9.36)
Hyper cholesterolmia	8 (16%)	2 (4%)	4.1 $	< 0.05*	4.57 (1.83 – 33.2)
Hormonal disturbances:					
Elevated cortisol	21 (42%)	7 (14%)	9.72 $	<0.01**	4.45 (1.53 – 13.34)
Elevated Prolactin	16 (32%)	8 (16%)	4.32 $	<0.05*	2.47 (1.86 – 7.23)
Decreased Melatonin	37 (74%)	11 (22%)	27.08 $	<0.001**	10.09 (3.68 – 28.47)
Cortisol (ug/dL)					
Mean ±SD	15.65 ± 5.8	11.56 ± 4.8	3.42 ^	<0.001**	
Median (Range)	16.05 (5.3 – 28.3)	11.45 (1.7 – 21.4)			
Melatonin (ng/L)					
Mean ±SD	103.66 ± 82.13	254.21 ± 146.4	4.94^	<0.001**	
Median (Range)	55.2 (23.95 – 455)	229.6 (32.4 – 390)			
Prolactin (ng/mL) (Male)	(n=17)	(n=2)			
Mean ±SD	15.63 ± 7.43	7.65 ± 4.45	2.99 ^	<0.01*	
Median (Range)	14.6 (3.7 – 27.6)	7.65 (4.5 – 10.8)			
Prolactin (ng/mL) (Female)	(n=33)	(n=48)			
Mean ±SD	27.26 ± 10.75	14.78 ± 9.52	4.05 ^	<0.001**	
Median (Range)	26.8 (4.6 – 42.4)	13.5 (5 – 31.6)			

$: Chi square test ($\chi 2$) ^: Mann Whitney test

Non significant (P>0.05) *: Significant (P< 0.05)

**: Highly significant (P<0.01)

GIT: Gastro intestinal tract IBS: Irritable bowel syndrome.

Table (2) showed that there was no statistical significance difference between Group I and Group II about the presence of previous diseases. But there was highly statistical significance difference between them in GIT and Cardiovascular symptoms with marked increase among Group I.

Table (2) also showed that there were highly statistical significance increase in No. of cases who had abnormal hormonal profile among Group I compared to Group II. There was a marked elevation in cortisol (P=0.002**, OR=4.45 and CI=1.53 – 13.34) and prolactin (P=0.04*, OR=2.47 and CI=1.86 – 7.23) and marked decrease of melatonin among Group I (P=<0.001**, OR=10.09 and CI=3.68 – 28.47).

Table (2) also showed that there was statistical significance differences between Group I and Group II in all hormones levels with marked elevation of cortisol (median 16.05 ug/dL among Group I compared to 11.45 ug/dL among Group II) and prolactin (median 20.8 ng/mL among Group I compared to 13 ng/mL among Group II) and marked decrease of melatonin (median 55.2 ng/L among Group I compared to 229 ng/L among Group II).

Table (3): Correlation between Cortisol, Prolactin and Melatonin level of Group I and Age, BMI, Working years, CWP, No of night shifts, No of shift hours and total QOL score.

Variables	Cortisol		Prolactin		Melatonin	
	r	p	r	p	r	p
Age	0.16	>0.05	0.01	>0.05	0.19	>0.05
BMI	0.07	>0.05	0.15	>0.05	0.01	>0.05
No of working years	0.34	< 0.05	0.58	<0.001**	-0.28	< 0.05*
CWP	0.65	<0.001**	0.75	<0.001**	-0.50	<0.001**
No of night shifts /week	0.41	< 0.05*	0.36	<0.001**	-0.32	< 0.05*
No of shift hours	0.31	< 0.05*	0.35	< 0.05*	-0.39	<0.001**
Total quality of life	0.08	>0.05	0.47-	<0.001**	0.54	< 0.05*
Cortisol	---	---	0.37	< 0.05*	-0.30	< 0.05*
Prolactin	0.37	< 0.05*	--	---	-0.35	< 0.05*
Melatonin	-0.30	< 0.05*	-0.35	< 0.05*	---	---

r: Spearman correlation coefficient.

Non significant (P>0.05) *: Significant (P< 0.05)

**: Highly significant (P<0.01)

BMI: Body Mass Index CWP: Cumulative working period

Table (3) showed that there was positive significant correlation between both cortisol and prolactin level and No. of working years, Cumulative working period, No. of night shifts and hours of the shifts. Also there were positive correlation between prolactin and cortisol, and negative correlation between prolactin and TQL score. Also there were negative correlation between melatonin level and No. of working years, CWP, No. of night shifts, hours of the shifts, prolactin, cortisol and positive significant correlation between melatonin and TQL score.

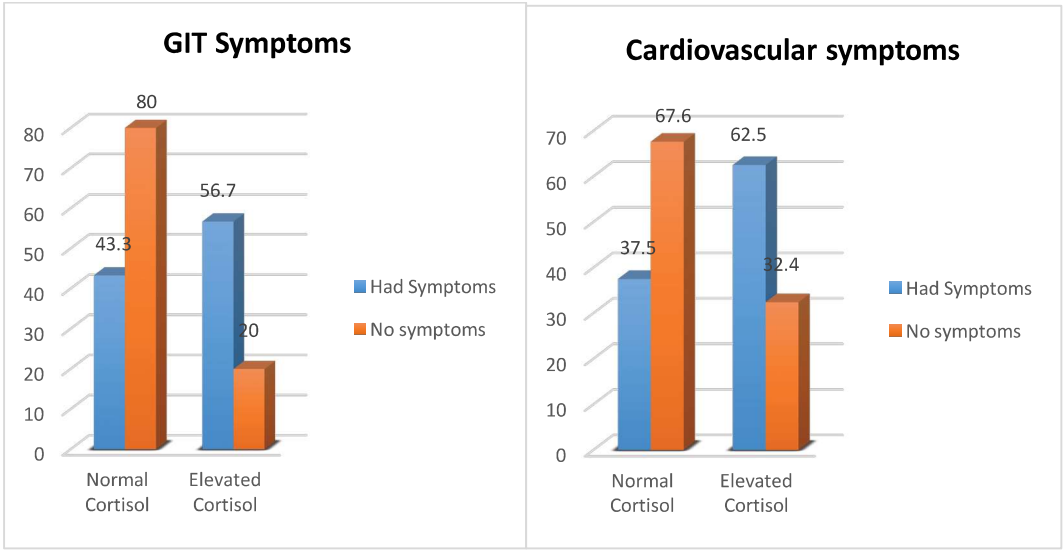

Figure (2): Relation between Cortisol level and GIT and Cardiovascular symptoms in Group I.

Figure (2) shows that there was statistical significance difference between physicians who had GIT and Cardiovascular symptoms and those who had no symptoms as regards cortisol level with marked increase cortisol level among those had GIT and Cardiovascular symptoms (p=0.01* and 0.04* respectively). No relation was found between melatonin and prolactin abnormalities and GIT and cardiovascular symptoms.

Discussion

Shift work has increasingly become an integral part of a wide range of occupations especially among first responders (e.g., police, firefighters, and emergency services) where there is an obvious need for a 24-hours service. So, a component of the work organization that may affect the balance between efficiency and wellbeing is shift work (Dall'Ora et al., 2016).

Unfortunately, shift work may affect the health of shift workers negatively. Furthermore, the risk of accidents and errors has been shown to be higher when working unusual hours compared with day work. This affects the individual, the work place and also the community as a whole (Flo et al., 2014).

Our work included rotating shift working physicians (Group I) mainly are resident physicians, while, day time only working physicians (Group II) mainly from academic medicine departments.

Choosing a career in academic medicine is greatly influenced by the environment of training of physicians, the teaching staff in faculty where physician learn, mentors, role models and family. An interest in teaching is a primary reason women choose a career in academic medicine. Many women physicians entering academic medicine chose this after or during fellowship, which is when they became more aware of academic medicine as a possible career. For many women, choosing academic medicine was not necessarily an active, planned decision; rather it was serendipitous or circumstantial (Borges et al., 2012). So in our study, there was highly statistical significance difference between both groups as regard sex with marked increase in female No. among Group II (96.0%) compared to Group I (66.0%) (Table 1).

That state of "Femaleness" may give an explanation for the statistical significance difference between both groups as regarding their income. As females, who contributed the main part in academic group, usually share in supplementing the family income (Poduval and Poduval, 2009), while males, who contributed the most part in Group I, are the responsible for family income (Table 1). And that may explain the cause why 8% of Group I

are working in other hospital trying to raise their income (Table 1).

Residency is a stressful, overwhelming period during which residents work long hours to increase their knowledge base and experience (Mansour and Al-Haidar, 2008). This agreed with our study that there was highly statistical significance increase in CWP among Group I (Median=12000 hours) (Table 1).

In our study, more than half of them (62%) had less than 4 night shifts per week and 74% of them had 24 hours shift (Table 1). These findings agreed with Bolster and co- workers (2015) who found that the desire to continue caring for a patient frequently leads doctors to work for longer than is permitted. They also found that there is also a belief that long hours do, or can, improve training. The ability to follow a patient from admission through the next 30 or 40 hours may be valued more than observing several patients for shorter periods.

In the current study, Quality of life (QOL) was evaluated using The Quality of Life Profile Questionnaire (Raphael et al., 1995) showed that there was highly statistical significance poorer quality of life among Group I (OR=3.86, 95% CI 1.54 – 9.77), mainly in domains of Community belonging (OR=8.14, 95% CI 3.05 – 22.25), Social belonging (OR=6.64, 95% CI 2.55 – 17.66), Leisure becoming (OR=6.16, 95% CI 2.21-17.68), Spiritual being (OR=3.78, 95% CI 1.53 – 9.47), and Psychological being (OR=3.27, 95% CI 1.27 – 8.59) .

Sonati and co- workers (2016) study demonstrated that perceptions of quality of life among shift workers were found to be more negative, mainly in terms of physical aspects and social relations.

The same results were evident in Guerra et al. (2016) study, where, despite the scores of global quality of life being within the average, evening shift professionals had lower scores in social role functioning when compared to the other groups. They explained that by lacking of time for social and leisure activities found among these professionals.

There is growing evidence that links shift work to numerous adverse health outcomes including risk factors for cardiovascular disease, metabolic syndrome, diabetes, specific types

of cancer, fatigue, on-duty injury and autoimmune hypothyroidism. Therefore, shift work, particularly night or rotating shift, has long been considered a significant occupational exposure. So, Shift work and related health problems are important topics in the health-care sector due to their possible negative impact on the workers' health and safety (Anbazhagan et al., 2016).

Gastrointestinal disorders are more common among shift workers than in day workers (Knutsson, 2003). In the current study, GIT troubles were significantly higher among Group I (OR 2.76; 95 % CI 1.1–6.51). Hyperacidity and GERD (Gastro-esophageal reflux disease) were significantly higher among Group I (OR 3.62; 95 % CI 1.44–9.23) (Table 2). This in accordance with a recent study in South Korea among shipyard workers (Chung et al., 2016), who revealed that night-shift work is a risk factor for GERD (OR 1.41; 95 % CI 1.03–1.94), and avoidance of night-shift work should be considered a primary prevention strategy for GERD.

As regarding IBS (Irritable Bowel Syndrome), the results of the current study reveal that it was significantly higher among Group I (OR = 4.24, 95 % CI 1.28 – 14.8) (Table 2). This is almost in line with that revealed in previous studies done by Koh et al. (2014)

In Contrary to a recent Saudian study (Ibrahim et al., 2016) which found that nurses who were working on day shifts had higher IBS compared with those working in alternating shifts (OR= 2.79; 95 % CI 1.32–5.90) and explained that by poor sleep quality at home.

In our study, CVD was significantly higher among Group I (OR = 2.89, 95% CI 1.07 – 8.84). Hypercholesterolemia (OR = 4.57, 95% CI 1.83 – 33.2), and Tachycardia (OR = 2.85, 95% CI 1.09 – 9.36) were significantly higher among Group I (Table 2).

These results are in accordance with Ellingsen et al. (2007), who reported an increased risk of coronary heart disease among shift workers (RR = 1.65, 95% CI 1.38–1.97) and also Haupt et al. (2008), who reported an increased risk of myocardial infarction among shift workers versus non-shift workers (OR = 1.53, 95% CI 1.06–2.22). Two studies focused on ischemic brain

stroke: Hermansson et al., (2007) did not find an increased risk of ischemic stroke among shift workers (RR = 1.0, 95% CI 0.6–1.8), while in the Nurses' Health Study, there was a small increased risk of ischemic stroke among nurses who reported working rotating night shifts for 15 or more years (OR = 1.04, 95% CI 1.01–1.07) (Brown et al., 2009).

In contrast to these reports, a more recent systematic review of the relationship between shift work and IHD (Ischaemic heart diseases) concluded that the published findings on shift work and IHD were inconclusive and did not support a causal association (Frost et al., 2009).

Overall for CVD, the systematic and critical reviews provide suggestive but not conclusive evidence for a significant association with shift work, including night and rotating shift work (Wang et al., 2011).

It is evident from our work that Cortisol had a highly significant ($p<0.01$) elevated levels among Group I (15.65 ± 5.8) compared to Group II (11.56 ± 4.8), with a highly significant elevated levels (OR= 4.45, 95% CI 1.53 – 13.34) than Group II (Tables 2). These findings were in accordance with other studies which showed elevation in cortisol level among shift workers. (Axelsson et al., 2003 and Radwa, 2010).

The initial increase in the cortisol response marks the development of a chronic stress response, the subsequent reversal to baseline levels might be indicative of a process of recovery, possibly the development of shift work tolerance (Lammers-van der Holst and Kerkhof, 2015). This may give an explanation for the contrary between our results and that found by Bracci et al., (2016) study among nurses. As Group I in our study were starting their carrier and lacking shift work tolerance (mean years of work = 2.91 ± 1.66). While in Bracci et al., (2016) study, the studied group was senior nurses (Mean years of work = 13.6 ± 3.4). So, they found that cortisol levels were also significantly different in the 24 h period of both groups (ANOVA repeated measures, $p < 0.05$) with maximum values at 6:00 AM. Significant differences were found between shift-working (SW) and daytime (DT) nurses in cortisol levels (ANOVA repeated measures, $p < 0.05$);

cortisol levels were significantly lower in SW nurses than those of DT nurses at 6:00 AM and 8:00 AM.

As regard prolactin, there were a highly significant ($p<0.01$) elevated levels among Group I (20.5 ± 11.39) compared to Group II (14.74 ±10.31) with a highly significant elevated levels (OR=2.47, 95% CI 1.86 – 7.23) than Group II (Tables 2).

In a study done Touitou et al., 1990 who collected blood samples every 2 h overnight shift in four oil refinery operators (aged 25–34 years) ,they detected low prolactin concentration among night shift workers . Also the same evidence has been stated in a recent study among nurses and midwives (Bukowska et al., 2015).

In our study, Group I had a highly significant ($p<0.01$) decreased levels of melatonin (103.66 ± 82.13) compared to Group II (254.21 ± 146.4), and there was a highly significant lower levels among Group I (OR=10.09, 95% CI 3.68 – 28.47) (Tables 2). This is in accordance with the recent study done by Song et al. (2016) where, the mean serum concentration of melatonin was significantly lower among the nighttime medical group (1.87 pg/mL) than the daytime group (4.04 pg/mL, $p < 0.001$) when samples were collected simultaneously.

Also, previous studies (Mirick et al., 2013) provide the same evidence that night time work disrupts the normal circadian rhythm and consequently reduces melatonin levels. And it has been reported that increasing exposure to light, especially to nighttime workers, decreases secretion of melatonin on the basis of the LAN hypothesis.

Our study shows that there was statistical significance higher prevalence of GIT and cardiovascular symptoms among physicians with elevated cortisol levels ($p=0.01$) (Figure 2).

As regarding cardiovascular symptoms, there is increasing evidence that cortisol contributes to cardiovascular troubles. The cardiovascular consequences of cortisol excess are protean and include, inter alia, elevation of blood pressure, truncal obesity, hyperinsulinemia, hyperglycemia, insulin resistance, and dyslipidemia (Whitworth et al., 2005).

Our work shows positive significant correlation between work load (No. of working years, Cumulative working period, No. of night shifts and hours of the shifts) and both prolactin and cortisol level and negative correlation between work load and melatonin (Table 3). This is in accordance with the study done by Radwan (2010) who both confirmed that the more the years of shift work and work load , the lower the melatonin and the higher prolactin and cortisol serum levels.

It is evident from our study that there was a negative correlation between prolactin and total QOL score (Table 3). These findings are consistent with a study done in Turkey on pre-menopausal women who revealed that hyper-prolactinemia was associated with bad Quality of life (Yavuz, 2003).

Negative correlation is detected between melatonin and total QOL score (Table 3). This is in accordance with recent study found that elevated melatonin level was associated with improving quality of life (Innominato et al, 2016).

Conclusion

It can be concluded from this study that rotating shift working resident physicians are not satisfied with their income and female physicians prefer academic medical field than clinical field fearing of shift work and high work load.

Also rotating shift working resident physicians characterize with long working hours, many night shifts, high work load and working in more than one place to cover their financial needs.

Rotating shift working resident physicians are at great risk for cardiovascular symptoms, GIT symptoms, bad quality of life and disturbances in normal level of cortisol, prolactin and melatonin comparing to day only working physicians.

The bad QOL risk increase with high BMI, female sex, not enough income, high work load and disturbed prolactin and melatonin level. And finally the risk of GIT and Cardiovascular symptom increase with elevated cortisol level.

The cortisol, prolactin and melatonin level correlate with each other and with the working load.

Conflict of interest

Authors have declared that no conflict of interest exists.

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