

Shift Work Pattern and Menstrual Characteristics among Nurses in Egypt

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Abstract: Background: Rotating shift work may interrupt the normal function of the biological clock, so considered to be one of the factors leading to alter endocrine regulation and increased risk of menstrual cycle abnormality. **Aim:** to assess the impact of shift work pattern on menstrual characteristics among nurses. **Methodology:** Research design used for the present study was a cross-sectional comparative design with three months of monitoring. The survey conducted in three hospitals in Benha city, Egypt which affiliated to the Ministry of health. After recognizing the inclusion and exclusion criteria, the study sample was 100 (100 out of 678) active female nurse staff who were in reproductive age below 40 years and had at least one year of work experience. A convenient type of sample was used to collect the data. The researchers designed an interviewing assessment sheet, and semi-structured menstrual self-assessment tool was adopted by the researcher to collect the data. **Results:** The present study showed that there were statistically significant differences in educational attainment, work duration and drinking tea habit among nurses in rotating shifts compared to day shift one. Heavy menstrual bleeding and severe dysmenorrhea were significantly higher among rotating shifts group nurses ($^{MC}P=0.034^*$ and $P=0.021^*$, respectively). Also, inter-menstrual bleeding and short cycle length were higher among nurses in rotating shifts group but not a significant difference. Also, Irregular menstrual cycle and very severe dysmenorrhea were significantly higher among nurses with more than 12-night shifts rotation at the last twelve months of work ($P=0.001^*$ and $^{MC}P=0.005^*$, respectively). For short menstrual and prolonged menstrual cycle, numbers of pads used, heavy menstrual bleeding, and inter-menstrual bleeding were higher among nurses with more than 12-night shifts rotation at the last 12 months of work but not reach the significant. Rotating shifts work has a negative impact on the menstrual cycle. Rotating shift has been associated with heavy menstrual bleeding, severe dysmenorrhea as well as intermenstrual bleeding and short cycle length. Also, Increased the numbers of night shifts more than 12-night shift rotation at last 12 months associated with severe dysmenorrhea and irregular menstrual cycle. So this finding can be used to guide preventive measures to eliminate or decrease the menstrual problems among rotating shift nurses. **Conclusion:** The results of this study which done to assess the impact of shift work pattern on menstrual characteristics among nurse staff in Egypt are comparable with those reported in other parts of the world. It can conclude from the results of this study that rotating shifts work associated with increased risk of menstrual disturbances. Nurses working in rotating shifts had a significant heavy menstrual bleeding and severe dysmenorrhea. [Mirfat, M. L. El-Kashif and Mageda, A. S. Arafat. **Shift Work Pattern and Menstrual Characteristics among Nurses in Egypt.** *Biomedicine and Nursing* 2016;2(4): 104-115]. ISSN 2379-8211 (print); ISSN 2379-8203 (online). <http://www.nbmedicine.org>. 15. doi:[10.7537/marsbnj020416.15](https://doi.org/10.7537/marsbnj020416.15).

Keywords: Nurse Staff, shift work pattern, menstrual cycle.

1. Introduction

Shift work is prevalent in modern society and includes several professions responsible for the health and safety of others ⁽¹⁾. A work schedule of nurses in hospital sector arranged as a result of the growing needs for best quality patients' care and the global phenomenon of health-systems financial constraints that require "maximum efficient work with minimum staffing. SO, extended work shifts of twelve hours, or longer, which began towards the end of the 80's, have now become omnipresent within nursing ⁽²⁾. Approximately 1/3 of the nursing population may employ as shift workers ⁽³⁾. Data on the general health condition of the nursing staff workers demonstrated alterations in the physical and psychological health of

nursing professionals due to shift work, whether they work day or night shifts. So, Shift work is related to both acute and chronic health problems ^(4,5). It reported that shift work could impair the circadian clock which is the integral regulatory part of the reproductive system. Circadian rhythms are endogenous biological rhythms with periods near 24 hours. The circadian rhythms of clock gene expression have observed at the tissue and cellular level in a majority of endocrine tissues including the hypothalamus, pituitary, adrenal gland, thyroid gland, adipocytes, pancreas, and gonads ^(6,7,8). Disruption of circadian rhythms in shift workers may affect follicular development and hormone secretion and disrupt the luteal phase, so altering the menstrual cycle ^(9,10). The menstrual cycle pattern is

considered as a crucial indicator of reproductive health and could use in the detection, diagnosis, and treatment of women's health problems. It mainly regulated by the hypothalamus-pituitary-ovary axis^(11, 12). Shift works have been associated with an increased risk of irregular menstrual cycles, increased bleeding, heightened menstrual pain and severe dysmenorrhea.

Moreover, that, shift work has a negative impact on the regular cycle length, and that the change in cycle length does not return to the original length after a prolonged shift working over two years^(11,13). Dysmenorrhea is one of the most prevalent problems associated with menstruation that imposes enormous health and economic costs of a country. Besides its influence on women's physical status and quality of life, it reduces the performance of their work. The total cost of lost work days due to dysmenorrhea has estimated at 2 billion dollars^(14,15).

Significant of the study

Nurses are more than any other profession, at risk from exposure to many health disorders and disturbed mental and social well-being, resulting in a reduction of job performances which can affect both the quality of care and patients' safety because of the nature of their work and work schedules. It was hypothesizing that shifts in the circadian rhythms, either through sleep disturbances or altered melatonin production, may has a role in regulating the reproductive hormones that control the menstrual cycle^(16,17, 6, 18, 19, 20). Although, most of the nurses exposed to shift work are of reproductive age in Egypt, and Shift work, especially night shift work, may present risks to women of childbearing age because this is thought to link to the disruption of the menstrual cycle. The scientific literature regarding shift work pattern and menstrual characteristics among nurses in Egypt are relatively limited. Therefore, this study was conducted to assess the impact of shift work pattern on menstrual characteristics among nurses' staff.

The Aim of the Study

This study aimed to assess the impact of shift work pattern on menstrual characteristics among nurses' staff in Egypt.

Research question: -

Is there a correlation between shift work pattern and the disturbance of the menstrual cycle?

2. Subject and methods:

Design, setting, and subjects:

The research design used for the present study was a cross-sectional comparative design with three months of monitoring. Thsurveydy conducted in three hospitals in Benha city, Egypt which affiliated to the Ministry of health. These hospitals were Benha Teaching Hospital, Fever General Hospital (AL-

Homyate) and Health Insurance Hospital. The total staff nurses in three hospitals were 678 female nurse staff. After recognizing the inclusion and exclusion criteria, the study sample was 100 active female nurse staff that were in reproductive age below 40 years and had at least one year of work experience. The sample divided as the follows 24 from Benha teaching hospital, 63 from general fever hospital, and 13 from health insurance hospital.

Exclusion criteria were as follows

Female nurses > 40 years of age, pregnant or breastfeeding nurses, using a contraceptive, undergoing fertility treatment. Also, nurses who reported a diagnosis of menstrual dysfunction (e.g., polycystic ovary syndrome, endometriosis, hyperprolactinemia, thyroid disorders, and Sherman's syndrome) and nursing undergoing a hysterectomy and ovariectomy. Also, nurses were on sick leave or diabetic are excluded.

Tools for data collection:

The following tools were used to collect the data from the study:

Tool (1) The interviewing assessment sheet

It designed by the researcher consisted of four parts: -

Part I

It was concerned with the criteria for exclusion and confirms those who should exclude.

Part II

It was concerned with socio-demographic information for female staff nurses such as; age, educational attainment, weight, height, BMI (Kg/m²), marital status, number of children, and...etc.

Part III

Was concerned with shift work status. It consisted of closed-ended questions related to types of shift work, work experience years (duration of work), numbers of the night shift at the last 12 months of work, smoking habit, tea and coffee consumption, use of other central nervous system simulators, and use of hypnotics.

Part IV

Was concerned with menstrual history such as; the age of menarche, duration, interval, and regularity of menstrual cycle.

Tool (2): Semi-structured menstrual self-assessment tool and menstrual diary

Was obtained from standard textbooks and scientific journals, and adapted for applicability in the community by the researchers. It means that questions for all participants were the same, but interviewees had to answer questions in own words, there were no ready-made answers. It provides more in-depth information as well as the ability to monitor non-verbal information. It was concerned with the assessment of menstrual cycle characteristics over a

period of three calendar months (including cycle duration, menstruation duration, and amount of bleeding, interval, regularity, and dysmenorrhea). The female nurses' staff reordered the days of the month they were menstruating, duration of menstruation, the degree of pain using a Likert scale, from 0 (no pain) to 4 (very intense pain). Numbers of daily sanitary pads used during the period of duration of menstruation, the degree of absorption of these pads, and inter-menstrual bleeding recorded.

The variables were defined as follows

Weight:

Weight was measured in a kilogram, without footwear using a regularly standardized beam balance. Checks on the scale were made routinely before recording the weight of each nurse.

Height

Height was also taken barefooted in centimeter using standard measuring tape fixed vertically. It was recorded to the nearest 1 cm to avoid possible error.

Body Mass Index (BMI)

It is determined using the mathematical calculation of weight in kilograms divided by the square of the height in meter (kg/m²). According to nutritional status, BMI classified as overweight (over nourished), normal and undernourished as BMI more > 25, 18.5-24.99 and < 18.5 kg/ height in m² respectively ^(21, 22).

Measures definition:

Shift work definition

Two types of shifts used in this study: Day shift (including permanent morning shifts and afternoon) and permanent rotating shifts (alternating between morning, afternoon and night shifts).

Outcome definition

Dysmenorrhea

Was defined as at least two days of low back pains or/ and abdominal discomforts during menstrual bleeding ⁽²³⁾. The degree of pain using a Likert scale, from 0 (no pain) to 4 (very intense pain).

Menstrual cycle length (interval)

Was defined as the days the menstrual cycle usually take from the first day of menstruation in one cycle to the first day of menstruation in the next cycle.

The onset of the menstrual cycle defined as the first of two consecutive days with the onset of bleeding, bleeding more than spotting on at least one day ⁽²⁴⁾.

Duration of menstruation

It was calculated as the number of days from the first day of menstrual bleeding to the end ⁽²⁵⁾.

Irregular cycle

Was defined as more than seven days for changes in the menstrual cycle duration ⁽²³⁾.

Inter-menstrual bleeding

Was defined as bleeding or spotting between cycles ⁽²⁶⁾

Administrative design / Ethical consideration

Collection of data done after obtaining the formal permission from the manager of each selected hospital after clarifying the purpose of the study and accepting the process of data collection. The researcher explained the aim of the study to each female nurses staff who was eligible to participate in the study sample. Then, verbal consents obtained after explanation of the process to the participants.

Pilot Study:

The study tool was pre-tested on a random sample of 20 female staff nurses obtained from the three hospitals to assess the reliability and applicability of the tool. The pilot study revealed that some items needed to be omitted, e.g., characteristics of menstruation and personal habits such as drinking tea, coffee, or other caffeinated beverage before starting work as a nurse because the majority of nurses did not remember that.

Tool development

The researcher constructed it after an extensive review of relevant literature.

Validity and Reliability

Tool reviewed by a jury of five experts in the field of Obstetrics and Gynecological nursing and nursing administration to its content validity. The reliability of the tool involves its consistency and stability. The use of correlation procedures usually determines the degree of reliability. A correlation coefficient is established between two sets of scores or between the ratings of two judges. The higher the correlation coefficient, the more reliable is the instrument. A correlation coefficient above .70 is considered satisfactory ⁽²⁷⁾.

Fieldwork and procedures

The fieldwork took place from September 2015 to February 2016. The researcher met the nurses for the first time to collect data related to the tool (1). The researcher introduced herself to the nurses and explained the purpose of the study to obtain their acceptance to be recruited in the study as well as to gain their cooperation. Then, the researcher started the interview, which lasted about 20 minutes. So then a tool (2) **Semi-structured menstrual self-assessment tool and the menstrual diary** was distributed to all nurses who were eligible for study which concerned with the assessment of menstrual cycle characteristics over a period of three calendar months will be filled by nurses. The follow up was done to collect the assessment sheets from nurses after finished whenever it was possible.

Data collection

The baseline questionnaire collected information about work schedules. Information on current usual work schedule (up the past year) obtained and included day shift (including permanent morning

shifts and/or afternoon) and permanent rotating shifts (alternating between morning, afternoon and night shifts)). For the study, "night" was defined as most hours worked falling between 8:00 p.m.– 08:00 a.m hours, a day between 8:00 a.m. – 2:00 p.m and afternoon between 2:00 p.m – 8:00 p.m. Also how many night shifts worked over the past year was collected. Moreover, the study sample personal habits during shift work. Data on menstrual cycle characteristics obtained in the follow-up questionnaire such as (regularity of the menstrual cycles, duration, menstrual cycle length, numbers of sanitary pad used, intermenstrual bleeding and dysmenorrhea).

Statistical analysis:

The data collected were tabulated & analyzed by SPSS (Statistical Package for the Social Science Software) statistical package version 20 on IBM compatible computer. Quantitative data presented as the mean & standard deviation ($X \pm SD$) and analyzed by applying student t-test for normally distributed variables. Qualitative data expressed as number and

percentage-value at 0.05 was used to determine significance regarding P-value > 0.05 to be statistically non-significant-value ≤ 0.05 to be statistically significant and P-value ≤ 0.001 to be highly statistically significant. The degree of dysmenorrheal pain using a Likert scale classified according to the following; 0 (no pain), 1(mild), 2(moderate), 3(sever) and 4 (very intense pain). After follow up over a period of three calendar months the mean of menstrual characteristics taken (table3).

3. Results

Out of 678 nurses, 100 nurses were legible for the study. The majority of nurses were in age group 25-<30years, and 36.0% of them had completed Nursing Institute while 38.0 had Faculty of Nursing or postgraduate studies.42.0 % of them had normal weight and 35.0 % were obese. Most of the nurses were married 87% with more than two children. More than one third of them years of experiences from 1-<5 and from 5-<10(39.0%, 35%, respectively) (Table 1).

Table (1): Socio-demographic characteristics of the studied nurses n=100

Socio-demographic characteristics	Studied nurses (n=100)	
	No.	%
Age (years)		
20-<25	29	29.0
25-<30	34	34.0
30-<35	10	10.0
35-<40	27	27.0
Mean \pm SD	29.3 \pm 5.8	
BMI (Kg/m²)		
Underweight (<18)	2	2.0
Normal (18-<25)	42	42.0
Overweight (25-<30)	35	35.0
Obese (30 \leq)	21	21.0
Mean \pm SD	26.5 \pm 6.3	
Educational level		
Nursing diploma	26	26.0
Nursing institute	36	36.0
Faculty of nursing or postgraduate studies	38	38.0
Marital status		
Single	7	7.0
Married	87	87.0
Widow	3	3.0
Divorced	3	3.0
Number of children		
None	12	12.0
1-2	49	49.0
3-4	36	36.0
5-6	3	3.0
Years of experience:-		
1-<5	39	39.0
5-<10	35	35.0
10-<15	13	13.0
15 \leq	13	13.0

More than half of the nurse (58.0%) had menarche between 13-<15, and 70% of them had

regular menstrual cycle. The mean duration of menses were 6.1 \pm 2.6 among nurses and more than half of

them (52.0%) had normal menstrual cycle length.98% of them suffer from dysmenorrhea, and 30% had inter-

menstrual bleeding table 2.

Table (2): Menstrual history among the studied nurses n= 100

Menstrual history	Studied nurses (n=100)	
	No.	%
Age of menarche (years)		
9-<11	10	10.0
11-<13	21	21.0
13-<15	58	58.0
15≤	11	11.0
Duration of menses (days)		
1-5	47	47.0
6-10	52	52.0
11-15	1	1.0
Mean±SD	6.1±2.6	
The pattern of the menstrual cycle:-		
Regular	70	70.0
Irregular	30	30.0
Menstrual cycle length (days):-		
Less than 15	11	11.0
15-<28	16	16.0
28-<30	52	52.0
30-<35	13	13.0
35≤	8	8.0
Number of pads used during menses:-		
Less than 5	10	10.0
5-<10	75	75.0
10-<15	15	15.0
Mean±SD	7.1±2.3	
Dysmenorrhea:-		
No	2	2.0
Yes	98	98.0
Mild	10	10.0
Moderate	33	33.0
Severe	22	22.0
Very severe	33	33.0
Suffer from inter-menstrual bleeding:-		
No	70	70.0
Yes	30	30.0

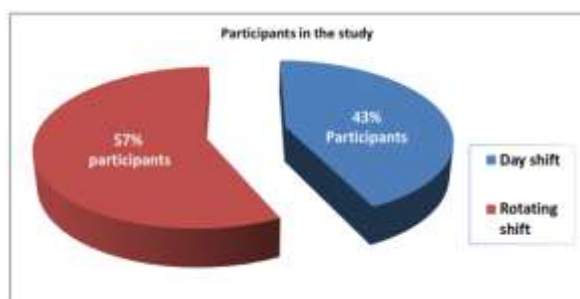


Figure 1: Distribution of the sample in relation types of shift work (n=100).

The final sample of participants after recognizing the inclusion and exclusion criteria were 100 active female nurse staff included 43 workers on a day and 57 workers on a rotating shift, (Figure 1).

As shown in the table (3), there was no significant difference between the two groups regarding the age, body mass index (BMI), marital status, and numbers of children. Regarding educational attainment, about half (50.9%) of nurses in rotating shift group having a bachelor or postgraduate degree while (39.5%) of nurses in the day group had the only nursing diploma ($X^2=11.360$, $P=0.003$.) As regards to nurses' years of experience, it was ranged from one year to fifteen years of experience. **Nurses reported** more work years' experience in day shift group in the present study (table 1), as less than half (47.4. %) of nurses in the rotating shifts group had 1-<5 years work duration compared only 27.9 % of day shift one. While, 23.3% & 18.6% of nurses in the day shift group had (10-<15 & 15≤, respectively) years' work duration compared only (5.2% & 8.8%, respectively) of the rotating shift one. Differences

observed were statistically significant ($X^2=10.797$, $P=0.013$).

Table (3): Biosocial characteristics among day shift and rotating shift groups (n=100):

Biosocial characteristics	Studied nurses (n=100)				Significance
	Day shift (n=43)		Rotating shift (n=57)		
	No.	%	No.	%	
Age (years):-					
20-<25	13	30.2	16	28.1	
25-<30	9	20.9	25	43.8	
30-<35	6	14.0	4	7.0	
35-<40	15	34.9	12	21.1	t=1.376
Mean±SD	30.2±6.2		28.6±5.4		P=0.172
BMI (Kg/m²):-					
Underweight (<18)	2	4.7	0	0.0	
Normal (18-<25)	19	44.2	23	40.4	
Overweight (25-<30)	13	30.2	22	38.5	
Obese (30≤)	9	20.9	12	21.1	t=0.348
Mean±SD	26.7±8.2		26.3±4.4		P=0.728
Educational attainment:-					
Nursing diploma	17	39.5	9	15.8	$X^2=11.360$
Nursing Institute	17	39.5	19	33.3	P=0.003*
Bachelor degree or postgraduate studies	9	21.0	29	50.9	
Marital status:-					
Single	2	4.7	5	8.8	$X^2=0.730$
Married	38	88.3	49	86.0	^{MC} P=0.694
Widow/divorced	3	7.0	3	5.2	
Number of children:-					
None	6	14.0	6	10.5	$X^2=0.750$
1-2	19	44.1	30	52.6	P=0.686
3 or more	18	41.9	21	36.9	
Years of experience:-					
1-<5	12	27.9	27	47.4	
5-<10	13	30.2	22	38.6	$X^2=10.797$
10-<15	10	23.3	3	5.2	P=0.013*
15≤	8	18.6	5	8.8	

t: Student t-test X^2 : Chi-Square test ^{MC}P: Monte Carlo corrected P-value *significant at $P\leq 0.05$

Concerning personal habits among the studied group, Table 4 demonstrated that more than three quarters (80.7%) of nurses in rotating shift group drank tea, compared more than one have (55.8%) of nurses in day shift one. The difference observed was statistically significant. Regarding smoking habits, drink coffee, use of other (CNS) central nervous system stimulants and hypnotics were higher among rotating shift group but not at the significant level (^{FE}P=1.0).

As indicated in table (5), there was no significant difference between the two groups regarding the duration of menses, pattern and length of menstrual cycle, and numbers of pads used during menses. For saturation of pads at the heaviest day, more than two thirds (70.2%) of rotating shifts group had full padsaturation, compared more than one half (58.1) of

day shift group ($X^2=7.066$, ^{MC}P=0.034). Also, about less than one third (31.6) of rotating shift group suffered from severe dysmenorrhea, compared only (9.3%) of day shift one with statistical differences ($X^2=9.720$, $P=0.021$). There was no statistical difference between the two groups regarding intermenstrual bleeding ($X^2=0.157$, $P=0.692$).

Table (6) portrays the menstrual characteristics and numbers of night shifts during the last 12 months of work for rotating shift group. It can observe that out of 57 nurses of rotating shifts group, 35 nurses had < 12-night shifts at the last 12 months of work and 22 nurses had ≥12-night shifts at the last 12 months of work. There was no a significant difference concerning the duration of menses between to the two groups (t=1.119, $P=0.268$). Irregular menstrual cycle pattern was significantly higher among the group had

≥ 12 -night shifts at the last 12 months of work (54.5%), compared only (14.3%) of other groups ($X^2=10.462$, $P=0.001$). As for menstrual cycle length, the shorter menstrual cycle Less than 15 days and longer menstrual cycle $35 \leq$ days were higher among the group had ≥ 12 -night shifts at the last 12 months of work but not reach a significant level. Also, the numbers of pads used during menses and full pad saturation at the heaviest day of the period were higher among the group had ≥ 12 -night shifts at the last 12

months of work but not a significant level. Regarding dysmenorrhea, severe dysmenorrhea was significantly higher among the group had ≥ 12 -night shifts at the last 12 months of work (63.7%), compared only (17.1%) of another group ($X^2=12.830$, $^{MC}P=0.005$). Exactly one half (50%) of nurses had ≥ 12 -night shifts at the last 12 months of work had intermenstrual bleeding, compared only (20%) of another group with no significant differences.

Table (4): Distribution of day shift and rotating shift group in relation to their habits (n= 100):

Personal habits	Studied nurses (n=100)				Significance
	Day shift (n=43)		Rotating shift (n=57)		
	No.	%	No.	%	
Smoking habit					
Non-smoker	43	100.0	56	98.2	$^{FE}P=1.0$
Smoker	0	0.0	1	1.8	
Drink tea					
No	19	44.2	11	19.3	$X^2=7.229$ $P=0.007^*$
Yes	24	55.8	46	80.7	
Drink coffee					
No	18	41.9	16	28.1	$X^2=2.077$ $P=0.150$
Yes	25	58.1	41	71.9	
Use other CNS stimulants					
No	34	79.1	43	75.4	$X^2=0.182$ $P=0.669$
Yes	9	20.9	14	24.6	
Use of hypnotics					
No	41	95.3	54	94.7	$^{FE}P=1.0$
Yes	2	4.7	3	5.3	

X^2 : Chi-Square test ^{FE}P : Fisher's Exact test *Significant at $P \leq 0.05$

Table (5): Distribution of day shift and rotating shift groups in relation to their menstrual characteristics after three months follow up (n=100).

Menstrual characteristics	Studied nurses (n=100)				Significance
	Day shift (n=43)		Rotating shift (n=57)		
	No.	%	No.	%	
Duration of menses (days):-					
1-5	20	46.5	27	47.4	$t=0.01$ $P=0.1$
6-10	23	53.5	29	50.9	
11-15	0	0.0	1	1.8	
Mean \pm SD	5.7 \pm 2.5		5.7 \pm 2.7		
The pattern of the menstrual cycle:-					
Regular	30	69.8	40	70.2	$X^2=0.002$ $P=1.0$
Irregular	13	30.2	17	29.8	
Menstrual Cycle length (days):-					
Less than 15	8	18.6	3	5.4	$X^2=6.439$ $^{MC}P=0.170$
15-<28	6	14.0	10	17.5	
28-<30	18	41.9	34	59.6	
30-<35	7	16.3	6	10.5	
$35 \leq$	4	9.2	4	7.0	
Number of pads used during menses					
Less than 5	10	23.3	15	26.3	$t=0.912$ $P=0.364$
5-<10	32	74.4	36	63.2	
10-<15	1	2.3	6	10.5	
Mean \pm SD	6.9 \pm 1.9		7.3 \pm 2.6		
Saturation of pad at the heaviest day					

Full pad	25	58.1	40	70.2	X ² =7.066 MC P=0.034*
Half Pad	11	25.6	16	28.0	
A quarter of a pad or less	7	16.3	1	1.8	
Dysmenorrhea:-					
No/mild	7	16.3	5	8.8	X ² =9.720 P=0.021*
Moderate	19	44.2	14	24.6	
Severe	4	9.3	18	31.6	
Very intense pain	13	30.2	20	35.0	
Suffer from inter-menstrual bleeding:-					
No	31	72.1	39	68.4	X ² =0.157 P=0.692
Yes	12	27.9	18	31.6	

X²: Chi-Square test MC P: Monte Carlo corrected P-value *significant at P≤0.05 t: Student t-test

Table (6): Distribution of rotating shift group in relation to numbers of night shift during the last 12 months of work and menstrual characteristics (n= 57):

Menstrual history	Number of night shifts among rotating shift group at the last 12 months (n=57)				Significance
	Number of night shifts <12 in last 12 months (n=35)		Number of night Shifts ≥12 in last 12 months (n=22)		
	No.	%	No.	%	
Duration of menses (days):					t=1.119 P=0.268
1-5	15	42.9	12	54.5	
6-10	19	54.2	10	45.5	
11-15	1	2.9	0	0.0	
Mean±SD	6.0±2.7		5.2±2.5		
The pattern of the menstrual cycle:					X ² =10.462 P=0.001*
Regular	30	85.7	10	45.5	
Irregular	5	14.3	12	54.5	
Menstrual Cycle length (days):-					X ² =7.078 MC P=0.119
Less than 15	1	2.9	2	9.1	
15-<28	4	11.4	6	27.3	
28-<30	22	62.9	12	54.5	
30-<35	6	17.1	0	0.0	
35≤	2	5.7	2	9.1	
Number of pads used during menses					t=0.617 P=0.539
Less than 5	7	20.0	8	36.4	
5-<10	27	77.1	9	40.9	
10-<15	1	2.9	5	22.7	
Mean±SD	7.5±2.2		7.0±3.2		
Saturation of pad at the heaviest day					X ² =2.569 MC P=0.288
Full pad	22	62.9	18	81.8	
Half Pad	12	34.2	4	18.2	
A quarter of a pad or less	1	2.9	0	0.0	
Dysmenorrhea:					X ² =12.830 MC P=0.005*
None/mild	4	11.4	1	4.5	
Moderate	11	31.5	3	13.6	
Severe	14	40.0	4	18.2	
Very intense pain	6	17.1	14	63.7	
Inter-menstrual bleeding:-					X ² = 5.627 P= 0.18
No	28	80.0	11	50.0	
Yes	7	20.0	11	50.0	

X²: Chi-Square test MC P: Monte Carlo corrected P-value *significant at P≤0.05 t: Student t-test

4. Discussion

Menstrual symptoms caused by a combination of biological factors such as hormonal disorders and

lifestyle, psychological and social factors such as working environment⁽²⁸⁾. Shift work may interrupt the normal function of the biological clock and is considered to be one of the factors contributing to the changes in the menstrual cycle⁽¹¹⁾. In analyzing the literature, there are limited studies done in finding the significant relevance of the impact of shift work pattern and menstrual characteristics among nurses in Egypt. So, the study aimed to address this concern.

As shown in this study, there were no statistical differences between two groups regarding body mass index (BMI). This result is in line with the results of **Moen et al., 2014**⁽²⁹⁾ & **Attarchi et al., 2013**⁽²³⁾ who found that there was no a significant difference between the groups' shifts regarding body mass index. Also, **Wan and Chung, 2012**⁽²⁰⁾ & **Varli and Bilici, 2016**⁽³⁰⁾ reported that all nurses for both groups had normal body mass index in their studies. Other studies result found that nurses who worked night shifts or rotating night shifts were more likely to be overweight or obese **Lawson et al., 2015**⁽¹⁶⁾; **Griep et al., 2014**⁽³¹⁾ and **Zhao et al., 2011**⁽³²⁾. Also, **Wang et al., 2016**⁽¹¹⁾ reported that Nurses in the shift group had a higher BMI than those in the non-shift group ($P = 0.003$). In the same context, **Schernhammer et al., 2013**⁽¹⁸⁾ addressed that women with longer histories of rotating night-shift work were more likely to had a higher mean body mass index. On the contrary, **Albert-Sabatter et al., 2016**⁽³³⁾ reported that there was a higher percentage of obese and underweight women among those on the day shift.

Also, the present study have shown that there was a significant difference in educational attainment, with about half (50.9%) of nurses in rotating shift group having a bachelor or postgraduate degree while (39.5%) of nurses in the day group had an only nursing diploma. Wang et al. support **these results., 2016**⁽¹¹⁾ who presented that 79 % of nurses in the shift group having a bachelor degree while about half of nurses in the non-shift group had only completed junior college ($P < 0.001$). Also, **Ferri et al., 2016**⁽³⁴⁾ reported that rotating shift workers more frequently had a degree in nursing, compared with day shift nurses (83% vs. 75%, $P=0.003$). On the same context **Buja et al., 2013**⁽³⁵⁾ have demonstrated that the higher percentage of nurses with degrees in the rotating shift group was probably related to both their younger age and university nursing courses only recently available. In contrast to these findings, **Wan and Chung, 2012**⁽²⁰⁾ reported that education did not significantly differ among nurses in both groups.

The professional experience recognized by years of work, more work years' experience was being reported by nurses in day shift group in the present study, as Years of experience were higher among day shift group, compared to rotating one. However, this

expected because day shift nurses were older and had a lower education level than nurses in the rotating group. These results are congruent with those of **Ferri et al., 2016**⁽³⁴⁾ who found that statistically significantly differed between the two groups of nurses regarding years of work: 14.1 years on average in rotating shift nurses compared to 22.5 in day shift nurses (unpaired t-test, $P < 0.001$). In this respect **Burdalak et al., 2012**⁽³⁶⁾ and **Buja et al., 2013**⁽³⁵⁾ have reported that it is quite common in health care settings worldwide to allocate younger and less experienced nurses in rotating shift work. Also, **Walsh, 2013**⁽³⁷⁾ mentioned that night shifts are often entry-level positions for the new nurse. On the contrary, **Attarchi et al., 2013**⁽²³⁾; **Moen et al., 2014**⁽²⁹⁾; **Wang et al., 2016**⁽¹¹⁾ and **Naghashpour et al., 2013**⁽³⁸⁾ found no a significant difference between the groups regarding years worked as a nurse.

Drinking tea and coffee were being reported by a significant proportion of nurses in rotating shift group, this attributed to night shift rotation. In this respect **Pallesen et al., 2010**⁽³⁹⁾ mentioned that caffeine consumption could be used to counteract sleepiness and improve performance when working a night shift. These results are congruent with the **Lawson et al., 2015**⁽¹⁶⁾ and **Su et al., 2008**⁽⁴⁰⁾. But not in line with **Moen et al., 2014**⁽²⁹⁾ and **Attarchi et al., 2013**⁽²³⁾.

The present study results revealed that there was no significant difference between the two groups regarding duration of menses, pattern and length of menstrual cycle, and numbers of pads used during menses. These results are in agreement with **Albert-Sabatter et al., 2016**⁽³³⁾ who showed that there were no differences in menstruation alteration in nurse staff who work a rotating shift compared to those working a day shift. Also, **Lawson et al., 2011**⁽¹³⁾ suggested a weak link between rotating shift work and irregular menstrual cycle. Moreover, that, **Moen, et al., 2015**⁽²⁹⁾ found that no association between night work and irregular menstruation or cycle length variation. On the same context **Su et al., 2008**⁽⁴⁰⁾ reported that shift work did not appear to be a significant predictor of prolonged menstrual bleeding as there were no significant differences in the mean menstrual cycle length and number of menstrual bleeding days between the two groups. Wang et al. contradict **these results., 2016**⁽¹¹⁾; **Lawson et al., 2015**⁽¹⁶⁾ & **Wan and Chung, 2012**⁽²⁰⁾ who found higher prevalence of cycle irregularity, very short cycles, and long cycles among rotating shifts nurses with nights. Also, **Attarchi et al., 2013**⁽²³⁾ reported that the average length of menstrual cycle, the average of bleeding time and the number of tampons used in shift workers are significantly higher than that of day workers ($p < 0.05$). Also, short-term menstrual cycle, long-term menstrual

cycle, irregular menstruation are significantly higher than that of day workers ($p < 0.05$).

Also, the present study results highlighted that heavy amount of menstrual bleeding was observed in rotating shifts group as the full pads saturation at the heaviest day were significantly higher among rotating shift group than that of day workers ($^{MC}P=0.034$). These findings are in agreement with **Attarchi et al., 2013⁽²³⁾** and **Wang et al., 2016⁽¹¹⁾** that showed a heavy amount of flow among rotating shifts group. Another study has failed to find significant differences in **Albert-Sabateret al., 2016⁽³³⁾**. Also, severe dysmenorrhea was significantly higher among nurses in rotating shifts group as indicated in the present study results. In the study done by **Wang et al., 2016⁽¹¹⁾** was carried out on menstrual patterns before and after work (in the non-shift work) or starting work rotation (in the shift work), demonstrated that dysmenorrhea occurred more frequent after a shift working in the shift group ($p = 0.01$). This finding ties in with insights of **Attarchi et al., 2013⁽²³⁾**; **Lawson et al., 2011⁽¹³⁾** and **Yao et al., 2009⁽⁴¹⁾**. On the contrary, (**Albert-Sabateret al., 2016⁽³³⁾**; **Chung et al., 2005⁽⁴²⁾**) claim that rotating shift workers compared to day shift workers had a non-statistically significant of dysmenorrhea. Regarding intermenstrual bleeding, the present study revealed that nurses in rotating shifts group had a higher percentage of intermenstrual bleeding but not reach a significant. These results supported by **Wang et al., 2016⁽¹¹⁾** who presented nearly that (6.5%) of the non-shift group and (11.11%) of shift one were experienced bleeding during menstrual cycle with no significant differences, ($p = 0.124$). In this respect, **Attarchi et al., 2013⁽²³⁾** mentioned that intermenstrual bleeding in shift workers are significantly higher than that of day workers ($p < 0.05$).

The relationship between the numbers of night shifts at the last twelve months of work and menstrual characteristics investigated in the present study. Irregular menstrual cycle and very severe dysmenorrhea were significantly higher among nurses with ≥ 12 night shifts at the last twelve months. Also, short menstrual cycle, prolonged menstrual cycle, numbers of pads, full pads saturation at the heaviest day, and inter-menstrual bleeding were higher among nurses with ≥ 12 -night shifts at the last 12 months but not reach the significant. In this respect, **Lawson et al., 2011⁽¹³⁾** showed that the number of months spent working rotating night shift over the previous two years was modestly related to irregularity, as well as very short (< 21 days) or very long (≥ 40 days) cycle lengths. Moreover, **Lawson et al., 2015⁽¹⁶⁾** mentioned that prevalence of irregular cycles was higher among nurses who worked rotating shifts with nights (PR 1.27, 95% CI 1.10–1.47) compared to nurses working

days only, and the prevalence increased with the number of nights worked per month (P for trend < 0.0001). Also **Enea et al., 2011⁽⁴³⁾** reported that night time working hours may disturb the reproductive hormones that regulate the menstrual cycle, possibly through sleep disturbances or altered melatonin production. So, the effects of night work on menstrual function take > 12 months to diminish.

Conclusion

The results of this study which done to assess the impact of shiftwork pattern on menstrual characteristics among nurse staff in Egypt are comparable with those reported in other parts of the world. It can conclude from the results of this study that rotating shifts work associated with increased risk of menstrual disturbances. Nurses working in rotating shifts had a significant heavy menstrual bleeding and severe dysmenorrhea. Moreover, inter-menstrual bleeding and short cycle length more common among rotating shifts nurses. Nurses had increasing numbers of night shifts were significantly complain of dysmenorrhea and irregular menstrual cycle. Also, short menstrual and prolonged menstrual cycle, numbers of pads used, heavy menstrual bleeding, and inter-menstrual bleeding were higher among nurses with ≥ 12 -night shifts rotation at the last 12 months of work.

Recommendation:

Based on the findings of the present study, the following recommendations suggested:

Recommendations for identifying and addressing menstruation-related risks include the following:

- 1- New guidelines for the diagnosis and treatment of menstrual disorder among nurses should be designed and developed to be appropriate for nurses.
- 2- A new hospital strategies should be prepared to create safe and healthy environments for nurses and all healthcare workers as well as for the patient.
- 3- Adequate breaks must be allowed to nurses and other healthcare workers in all shifts.
- 4- Night shift work hours must decrease.

For further research

- 5- Bearing in mind the significance of this problem, it is necessary to conduct new research into the prevalence of and risk factors for menstrual disorders and the consequential effects among nurses in Egypt as well to tackle this issue which is insufficiently recognized.

Acknowledgments

The authors thank the nursing staff at Benha Teaching Hospital, Fever General Hospital (AL-Homyate) and Health Insurance Hospital, Benha,

Egypt, for their contribution to the collection of the data used in this study.

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