Cortisol Awareness and its Impact on Sleep Patterns and Fatigue Among Nursing Students

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Abstract

Background: Cortisol, a key stress hormone, is closely linked to sleep patterns and fatigue. Among nursing students and nurses, high stress and poor sleep are common, leading to increased fatigue and reduced well-being. **The objective** of this study was to assess the cortisol awareness and its impact on sleep patterns and fatigue among nursing students. **The goal of this study was to** evaluate the cortisol awareness and its impact on sleep patterns and fatigue among nursing students. **Research Design:** In this study, a descriptive design was adopted. **Setting:** The research was carried out in the Zagazig University. **Sample:** The sample consisted of 360 nursing students. **Tools:** Data were collected using three primary instruments: 1. nursing students Interviewing Questionnaire, 2.Sleep Quality Scale, and 3. Fatigue Severity Scale. **Results:** Revealed thatmore than half of the studied sample(55%) aged was 18 year, and half of them(52.2%) were female. there was positive correlation between nursing students' sociodemographric and cortisol level, sleep problems and fatigue **Conclusion**: The study concluded that the awareness about cotisol among the studied students of Alryada University was high. Additionally, the majority of the study group had fatigue and sleep problems related to cortisol level. **Recommendations:** Further research studies and awareness programs should be carried out to improve knowledge about coryisol awareness and it's effect on sleep and fatigue.

Keywords: Cortisol, sleep patterns, fatigue, nursing students.

Introduction:

Cortisol is a hormone produced by the adrenal glands that affects metabolism and the regulation of the immune system. Imbalances in cortisol levels can lead to fatigue, depression, obesity, and immune dysfunction. Stress leads to adverse physical health through a biological response in the body as the result of hypercortisolemia and the inflammatory response **(Cockerham et al., 2018**).

Sleep is naturally-occuring states of decreased consciousness as well as reduced sensory and motor activity.Humans engage in sleep for an average of 7–8 h per 24-h period. Poor sleep behavior occurring over a limited time period induces changes in mood as well as diminishes alertness and cognitive performance. **(Bassett et al., 2015**).

Stress has been shown to be correlated with both inadequate quality and quantity of sleep. Inadequate sleep is faced by many university students on an everyday basis. Inadequate sleep quality can lead to increased levels of depression and anxiety. The impacts of increased levels of depression and anxiety exacerbate poor sleep. There are many studies that look at 6-week controlled interventions using active mindfulness and meditation practices, but college students are not commonly included in the study populations **(Weathers et al., 2020).**

The hypothalamic–pituitary–adrenal (HPA) axis is a central to physiological stress responses in directly stimulating the release of stress hormones, including cortisol. Both increased and decreased cortisol responses to psychological stress can be problematic. Specifically, blunted cortisol response to emotional stress have been found in various mental health conditions as well as linked with adverse health outcomes. Fatigue, defined as the subjective experience of persevering mental and physical exhaustion **(Stonciene et al ., 2022)**.

Learning is the relatively permanent change of behavior as a result of experience and tightly related to memory and cognition. Restoring sleep is associated both with improved learning performance and lower cortisol levels. Poor learning performance and increased cortisol levels were associated. The underlying concept claims that acute stress, understood as the occurrence of a transient stressor, triggers a

cascade of physiologically adaptive changes to cope with the stressor **(Brand et al., 2018).**

Academic responsibilities during college provide numerous challenges and lead to fatigue becoming an everyday occurrence for many students. A typical workplace may cause fatigue. With the increasingly intense competition for employment, many college students are under greater academic pressure to achieve outstanding performance at school. Particularly in East Asia **(Li et al., 2022).**

Nursing students are known to experience higher anxiety levels than other student populations. This anxiety is particularly heightened in clinical settings as opposed to classroom environments. cortisol offers a non-invasive method for measuring stress levels. When the body experiences stress, cortisol levels in the serum increase. Cortisol exhibits a diurnal circadian pattern, typically peaking around 30min after awakening and gradually decreasing throughout the day **(Loureiro et al., 2022).**

Significance of the Study

Undergraduate nursing students experience high levels of stress with harmful repercussions for their health, curricular activities, and emotional state. High levels of stress and impairment in quality of life. In the nursing training environment, some conditions can be potentially more stressful, such as the student's initial contact with the university, curricular and extracurricular demands and assessments, the relationship with teachers, the conflicting interaction with colleagues and health professionals, the situations experienced in the internship fields inherent to care, which can generate reactions of rejection, anxiety, and emotional imbalance such as mourning and death **(Mendes et al., 2022).** As a result, the purpose of this study was to determine the cortisol awareness and its impact on sleep patterns and fatigue among nursing students.

Aim of the Study

This research aimed to appraise the cortisol awareness and its impact on sleep patterns and fatigue among nursing students. The goal was accomplished through the following objectives:

1. Examine nursing students ' awareness about cortisol.
2. Assess impact of cortisol on sleep patterns among nursing students.
3. Assess impact of cortisol on fatigue among nursing students.

Research questions:

1. What is the level of awareness among nursing students about cortisol?

2. What is the impact of cortisol on sleep patterns among nursing students?

3. What is the impact of cortisol on fatigue among nursing students?

Participants and Methods

Research Methodology:

This was a descriptive cross sectional study.

Setting

The study was conducted in the faculty of Nursing at Zagazig University, Egypt.

Sample size calculation and technique

The estimated sample size was at least 360 students, at confidence level 90% and precision rate at 0.05 by using **Steven equation (2012)**.
N= **Total population**
Z= **Z value "1.96"**
D= **Standard Error**
N= **Sample size**

Tools: Three instruments were utilized to gather data:

Instrument I – An interview questionnaire, designed by the researchers in Arabic. The questionnaire was divided into two sections:

Section 1 – Socio-demographic Information: This section collected data on nursing students' age, gender, place of residence, and marital status.

Section 2 – Nursing students ' Awareness: This section aimed to assess the nursing students ' understanding of the cortisol, covering definition, functions, effect of cortisol, factors affect on cortisol level, commonly symptoms associated with high levels of cortisol, relaxation techniques and

dietary strategies used to lower cortisol levels.

Nursing students ' Awareness Scoring System:

For the knowledge-related items, correct responses were pre-determined through a review of the literature. A correct answer was assigned a score of 1, while an incorrect answer received a score of 0. The overall knowledge score was considered satisfactory if the total score was ≥ 60%, and unsatisfactory if it was below 60%.

Instrument II- The Sleep Quality Scale **(Yi et al., 2006)** is a useful tool (II) to measure effect of cortisol on the sleep quality among nursing students. It is made up of 28 items.

Scoring System:

Using a four-point, Likert-type scale, respondents indicate how frequently they exhibit certain sleep behaviors (0 = "few," 1 = "sometimes," 2 = "often," and 3 = "almost always"). Scores on items belong to factors 2 and 5 (restoration after sleep and satisfaction with sleep) and are reversed before being tallied. Total scores can range from 0 to 84, with higher scores demoting more acute sleep problems.

Instrument III- Fatigue Severity Scale **(Krupp et al., 1989)** to measure effect of cortisol on fatigue among nursing students. It contains nine statements that rate the severity of your fatigue symptoms. Read each statement and circle a number from 1 to 7, based on how accurately it reflects student condition during the past week and the extent to which student agree or disagree that the statement applies to student. A low value (e.g., 1) indicates strong disagreement with the statement, whereas a high value (e.g., 7) indicates strong agreement.

Scoring System:

Students have completed the questionnaire, it is time to score Students' results and evaluate Students 'level of fatigue.

The fatigue Severity Scale key

A total score of less than 36 suggests that students may not be suffering from fatigue. A total score of 36 or more suggests that students may need further evaluation by a physician.

Content validity

A team of four professionals from the disciplines of medicine and medical-surgical nursing reviewed and evaluated the tools, and changes were made based on their recommendations.

The dependability of the tools

The reliability test was conducted using Cronbach's Alpha, and the instruments proved to be trustworthy, particularly the Sleep Quality Scale and fatigue severity Scale (r= 088).

Pilot study

A pilot sample of 10% (36) of nursing students was provided prior to the commencement of the main trial to assess the feasibility and usability of the study tool. Those who participated in the pilot study were excluded from the main investigation. Modifications were made to the study tools as needed in order for them to be used.

Field work

Once permission was granted to proceed with the study, the researchers started to prepare a schedule for collecting the data. The researchers started the collection of data through face to face interview with each student individually; thereafter the aim and approach of this research were explained to the students in order to get their informed consent. Assessment of demographic characteristics, knowledge, symptoms and functions of cortisol, also, sleep quality scale and fatigue severity Scale as self-reported by nursing students. The time to complete the self-administered questionnaires ranged from 35-40 minutes, and emphasizing the purpose of the study and reassuring that all data collected and results treated confidentially for the benefiting scientific research only. Work continued for four days per week: Sundays, Mondays, Tuesday, and Wednesdays from 10.00 a.m. to 1.00 noons. Data were collected through 6 months, starting from the beginning of November 2023 to the end of Apirl 2024.

Ethical Considerations:

An approval for conducting the study was obtained from the Research Ethics Committee of the Faculty of Nursing, Zagazig University. The Written approval of participation was taken after full explanation of the purpose of the study. Participants were notified that they could withdraw at any time without giving any reason.

III. Administrative Design:-

Official letter containing the aim of the study was issued to the director of the Faculty of Nursing, Zagazig University.

Statistical Design

Using Microsoft Excel software, data from the prior tools and outcome measures were coded, input, and evaluated. For analysis, the data was imported into the Statistical Package for the Social Sciences (SPSS) version 20.0. Numbers and percentages are used to express qualitative data. The Chi-square test was used to look for differences and connections between qualitative variables (X2). The t-test was used.

Results:

Table 1. Demonstrates that 55% of the studied sample aged was 18 year, and 52.2% of them were female. In addition, all of nursing students were single, and 72.5% of them were living in rural areas.

Table 2. Reveals that, 93.1% of the studied participants had awareness about primary regulator of cortisol secretion in the body, and 91.9% of them had awareness about the primary functions of cortisol in the body and factors can influence cortisol secretion in the body. In addition, 88.3% of the study sample had awareness about activities may help in reducing stress and cortisol levels and 87.2 of them had awareness about correct definition of cortisol.

Table 3. Clarifies that, 66.04 ± 25.87 of the studied nursing students had the sleep problems related to cortisol based on using sleep quality scale.

Table 4. Shows that, 37.92 ± 17.18 of the studied nursing students were suffered from fatigue related to cortisol based on using fatigue severity scale.

Table 5. Illustrates that 3.09 ± 1.23 of the studied nursing students had awareness about relation between impact of Cortisol, Sleep Patterns and Fatigue .

Table 6. Reveals that there is statistical significant difference between impact of Cortisol, Sleep Patterns and Fatigue.

Table 7. Illustrates that there is statistical significant difference between socio-demographic of nursing students sample, impact of Cortisol, Sleep Patterns and Fatigue.

Table (1): Socio-demographic of nursing students sample (n=360).

Socio-demographic of nursing students sample	No.	%
Age groups in years		
18-	198	55.0
19-	162	45.0
Mean ± SD	**18.45±0.50**	
Sex		
Male	172	47.8
Female	188	52.2
Marital status		
Single	360	100.0
Married	0	0.0
Residence		
Urban	99	27.5
Rural	261	72.5

Table (2): Awareness of nursing students about Cortisol (n=360).

	Awareness of nursing students about Cortisol	Incorrect answer		Correct answer	
		No.	%	No.	%
1	What is cortisol?	46	12.8	314	87.2
2	Where is cortisol primarily synthesized in the body?	29	8.1	331	91.9
3	What is one of the primary functions of cortisol in the body?	75	20.8	285	79.2
4	How does cortisol contribute to glucose metabolism?	251	69.7	109	30.3
5	What effect does cortisol have on protein metabolism?	318	88.3	42	11.7
6	How does cortisol affect lipid metabolism?	334	92.8	26	7.2
7	What is cortisol's role in the body's response to stress?	99	27.5	261	72.5
8	How does cortisol contribute to the body's anti-inflammatory response?	285	79.2	75	20.8
9	What role does cortisol play in stress-related adaptations?	243	67.5	117	32.5
10	How does cortisol influence the body's response to injury and trauma?	108	30.0	252	70.0
11	What is one of the effects of cortisol on the cardiovascular system?	77	21.4	283	78.6
12	How does cortisol influence the body's response to infection and illness?	98	27.2	262	72.8
13	What is the primary regulator of cortisol secretion in the body?	25	6.9	335	93.1
14	What triggers the release of adrenocorticotropic hormone (ACTH) from the pituitary gland?	311	86.4	49	13.6
15	How does the hypothalamus regulate cortisol secretion?	124	34.4	236	65.6
16	What role do glucocorticoid receptors play in cortisol regulation?	305	84.7	55	15.3
17	What other factors can influence cortisol secretion?	29	8.1	331	91.9
18	How does the circadian rhythm affect cortisol levels?	63	17.5	297	82.5
19	How do stress and emotional factors influence cortisol levels?	54	15.0	306	85.0
20	Which of the following tests is commonly used to measure cortisol levels in the body?	68	18.9	292	81.1
21	In a cortisol suppression test, what substance is typically administered to suppress cortisol production?	267	74.2	93	25.8
22	What is the primary sample type used for cortisol testing?	346	96.1	14	3.9
23	What is the approximate normal range for cortisol levels in the blood during the morning hours?	78	21.7	282	78.3
24	At what time of day are cortisol levels typically at their lowest in healthy individuals?	89	24.7	271	75.3
25	In which part of the day are cortisol levels typically highest in healthy individuals?	55	15.3	305	84.7
26	Which of the following conditions is characterized by chronically elevated levels of cortisol in the body?	73	20.3	287	79.7
27	Which of the following symptoms is commonly associated with high levels of cortisol?	94	26.1	266	73.9
28	In Cushing's syndrome, excess cortisol production can lead to the development of which of the following conditions?	94	26.1	266	73.9
29	Which of the following conditions is characterized by insufficient production of cortisol by the adrenal glands?	66	18.3	294	81.7
30	Which of the following is NOT a common symptom of Addison's disease?	86	23.9	274	76.1
31	In Addison's disease, low cortisol levels can lead to which of the following complications?	308	85.6	52	14.4
32	Which of the following lifestyle changes is known to help reduce cortisol levels in the body?	59	16.4	301	83.6
33	Which of the following relaxation techniques has been shown to lower cortisol levels?	52	14.4	308	85.6
34	What role does adequate sleep play in cortisol regulation?	65	18.1	295	81.9
35	Which of the following dietary strategies may help in reducing cortisol levels?	56	15.6	304	84.4
36	Which of the following activities may help in reducing stress and cortisol levels?	42	11.7	318	88.3
37	In addition to relaxation techniques, which of the following activities has been shown to lower cortisol levels?	60	16.7	300	83.3
		Mean		**±SD**	
	Total score	**24.42**		**6.39**	
	Mean percent score	**66.00**		**17.27**	

Table (3): Impact of cortisol on nursing students' Sleep Patterns (n=360).

	Impact of cortisol on nursing students' Sleep Patterns	Mean	±SD
1	I have difficulty falling asleep	2.87	0.76
2	I fall into a deep sleep	2.62	0.87
3	I wake up while sleeping	2.65	0.86
4	I have difficulty getting back to sleep once I wake up in the middle of the night	2.66	0.95
5	I wake up easily because of noise	2.10	1.03
6	I toss and turn	2.08	0.99
7	I never go back to sleep after waking during sleep	2.58	0.96
8	I feel refreshed after sleep	2.30	1.04
9	I feel unlikely to sleep after sleep	2.32	1.06
10	Poor sleep gives me headaches	1.94	0.99
11	Poor sleep makes me irritated	2.26	1.01
12	I would like to sleep more after waking up	2.49	1.06
13	My sleep hours are enough	2.32	0.90
14	Poor sleep makes me lose my appetite	2.49	1.01
15	Poor sleep makes it hard for me to think	2.21	0.94
16	I feel strong, healthy and full of energy after sleep	1.98	0.96
17	Poor sleep makes me lose interest in my work/school/training	2.39	1.05
18	My fatigue level is relieved after sleep	1.93	0.83
19	Poor sleep makes me make mistakes with my work/school/training	2.55	1.05
20	I am satisfied with my sleep	2.40	0.91
21	Poor sleep makes me forget things easily	2.37	1.02
22	Poor sleep makes it hard to concentrate on my work/training/school	2.29	1.00
23	Sleepiness interferes with my daily life	2.43	1.01
24	Poor sleep makes me lose desire in all things	2.42	1.00
25	I have difficulty getting out of bed	2.74	1.02
26	Poor sleep makes me tired at school/work/training	2.26	0.95
27	I have a clear head after sleep	2.01	0.95
28	Poor sleep makes my life painful	2.41	0.96
	Total score	**66.04**	**25.87**
	Mean percent score	**45.29**	**30.80**

Table (4): Impact of cortisol on nursing students' Fatigue (n=360).

	Impact of cortisol on nursing students' Fatigue	Mean	±SD
1	During the past week, I have found that: My motivation is lower when I am fatigued.	4.73	2.11
2	During the past week, I have found that: Exercise brings on my fatigue.	3.03	1.98
3	During the past week, I have found that: I am easily fatigued.	3.61	2.15
4	During the past week, I have found that: Fatigue interferes with my physical functioning.	4.55	2.00
5	During the past week, I have found that: Fatigue causes frequent problems for me.	4.34	2.07
6	During the past week, I have found that: My fatigue prevents sustained physical functioning.	4.52	1.98
7	During the past week, I have found that: Fatigue interferes with carrying out certain duties and responsibilities.	4.60	2.01
8	During the past week, I have found that: Fatigue is among my three most disabling symptoms.	4.23	2.09
9	During the past week, I have found that: Fatigue interferes with my work, family, or social life.	4.29	2.11
	Total score	**37.92**	**18.17**
	Mean percent score	**53.55**	**33.64**

Table (5): Awareness of nursing students about relation between impact of Cortisol, Sleep Patterns and Fatigue (n=360).

	Awareness of nursing students about relation between impact of Cortisol, Sleep Patterns and Fatigue	Incorrect answer		Correct answer	
		No.	%	No.	%
1	Which of the following best describes the relationship between cortisol levels and fatigue among nursing students?	103	28.6	257	71.4
2	How does cortisol influence the sleep patterns of nursing students?	239	66.4	121	33.6
3	Which of the following scenarios is most likely to result in elevated cortisol levels and disrupted sleep patterns among nursing students?	221	61.4	139	38.6
4	How do cortisol levels typically fluctuate throughout a 24-hour period, influencing sleep-wake cycles?	66	18.3	294	81.7
5	How can nursing students mitigate the negative effects of cortisol on fatigue and sleep patterns?	60	16.7	300	83.3
		Mean		**±SD**	
	Total score	**3.09**		**1.23**	
	Mean percent score	**61.72**		**24.67**	

Table (6): Correlation between the studied variables (n =360).

		Awareness of nursing students about Cortisol	Sleep Patterns	Fatigue	Awareness relation between impact of Cortisol, Sleep Patterns and Fatigue
Awareness of nursing students about Cortisol	**r**				
	p				
Sleep Patterns	**r**	0.257*			
	p	<0.001*			
Fatigue	**r**	0.362*	0.986*		
	p	<0.001*	<0.001*		
Awareness relation between impact of Cortisol, Sleep Patterns and Fatigue	**r**	0.782*	0.263*	0.385*	
	p	<0.001*	<0.001*	<0.001*	

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

Table (7): Relation between Socio-demographic of nursing students and the study variables (n=360).

Socio-demographic of nursing students sample	Awareness of nursing students about Cortisol		Sleep Patterns		Fatigue		Awareness impact Cortisol, Sleep Patterns and Fatigue	
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD
Age groups in years								
18-	23.28	6.86	46.14	14.38	23.77	10.51	2.62	0.61
19-	25.81	5.48	90.38	12.48	55.21	7.31	3.66	1.53
t(p)	**3.885* (<0.001*)**		**31.231* (<0.001*)**		**33.363* (<0.001*)**		**8.181* (<0.001*)**	
Sex								
Male	22.72	7.20	42.88	12.50	21.48	9.32	2.56	0.63
Female	25.97	5.10	87.23	14.03	52.95	8.85	3.57	1.44
t(p)	**4.908* (<0.001*)**		**31.549* (<0.001*)**		**32.852* (<0.001*)**		**8.504* (<0.001*)**	
Marital status								
Single	24.42	6.39	66.04	25.87	37.92	18.17	3.09	1.23
Married	-	-	-	-	-	-	-	-
t(p)	-		-		-		-	
Residence								
Urban	19.38	7.98	33.30	5.86	14.45	5.16	2.23	0.67
Rural	26.33	4.37	78.46	18.65	46.82	12.51	3.41	1.25
t(p)	**10.521* (<0.001*)**		**23.632* (<0.001*)**		**24.931* (<0.001*)**		**8.931* (<0.001*)**	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

Discussion:

Nursing students are known to experience higher anxiety levels than other student populations. This anxiety is particularly heightened in clinical settings as opposed to classroom environments. cortisol is widely recognised as the most extensively studied endocrinological biomarker for assessing stress exposure. The aim of the study was to assess the cortisol awareness and its impact on sleep patterns and fatigue among nursing students.

According to the age group of the nurses, the current study showed that more than half of the nursing students were 18 year, and female. This result was disagreement with **(Mendes et al., 2022)** found that majority of the studied sample were women (81.29%), 35 men (18.71%), with a mean age of 26.8 years (SD: 8.03).

The current study indicated that there was positive correlation between nursing students' cortisol level and sleep problems. This research finding was in agreement with **(Hackett et al. 2020)**, found that Sleep problems were positively associated with daily cortisol area under the curve adjusting for age, sex, marital status, education, household income, body mass index and smoking; suggesting that those with greater sleep problems had greater cortisol concentrations over the course of an ordinary day. Participants reporting greater sleep problems also had raised evening cortisol levels.

The current study indicated that there was positive correlation between nursing students' cortisol level and fatigue. This research finding was in agreement with **(Kabay et al. 2017)**, found that Sleep disorder and fatigue were more severe and correlated with Cortisol awakening response. Decreased Cortisol awakening response output, delayed and unsustainable cortisol levels may be associated with HPA axis dysfunction secondary to chronic stress.

The present study indicated that there was positive correlation between nursing students' sociodemographric and cortisol level, sleep problems and fatigue. This research finding was relevant with **(Spiga et al. 2022)**, reported that Lower social class was associated with a slower time to recover from exposure to stress in the morning, thereby increasing overall cortisol exposure. These findings provide some evidence for a mechanism that may contribute to the association between lower social class and a higher risk of adverse health outcomes.

Conclusion:

Based on the study results the following conclusion can be deduced: The study showed that the awareness about cotisol among the studied students of Zagazig University was high. Additionally, the majority of the study group had fatigue and sleep problems related to cortisol level and there is statistical significant difference between socio-demographic of nursing students sample, impact of Cortisol, Sleep Patterns and Fatigue.

Recommendations

In view of the recent study's findings, the following recommendations have been made:

- Replication of the study on a larger probability sample acquired from different geographical areas in Egypt.
- Further awareness programs should be carried out to improve awareness of nursing students about the cortisol and prevention methods of sleep problems and fatigue**.**

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