

The Effect of Sleep Pattern on Reproductive Hormones in Females

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Annotation: Background: Sleep is the body's rest cycle. Sleep has stimulated by a complex set of mainly active hormones, which respond to signals from the body itself and its environment.

Methodology: This study was conducted on 50 women from the population with age of (18_25) years old, 25 women who suffer from a sleep disorder were considered as a case group and other 25 women with normal and regulated sleep were considered as control group. Samples were collected during the menstrual cycle, by using a gel tube

to measure the levels of the following hormones (FSH, LH, Progesterone, E2).

Results: The study showed a statistical significant increase in the level of progesterone) $p = 0.001$) and a decrease in the level of FSH ($p=0.02$), while the other parameters including study show that there isn't significant difference between two groups.

Conclusion: Sleep disturbance may have a significant impact on a woman's health.

Keywords: Sleep disorder, Female reproductive hormones, Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Progesterone, Estradiol (E2), Menstrual cycle, Hormonal imbalance, Sleep deprivation.

1-Introduction

It is indisputable that sleep is important. A third of a person's life is spent sleeping. Physical, mental, and cognitive health all depend on getting enough sleep. Adults in the United States, however, report sleeping fewer than the required seven hours per night. Numerous long-term conditions, including diabetes, arthritis, myocardial infarction, coronary artery disease, asthma, and stroke, are linked to inadequate sleep [1]. In older women, sleep disturbances are more common and sleep patterns may vary. Other hormonal, physiological, and even psychological elements may also play a role in these alterations, as may the development of underlying medical problems. According to several reports, women are more prone to suffer from sleeplessness in the years leading up to and following menopause. As many as 60% of women have insomnia during the menopausal transition. Sleep disturbances have a negative impact on one's health and quality of life. In addition to having greater rates of cardiovascular diseases, those who have sleep disruptions also have higher levels of worry and sadness. There are considerable differences in the types of complaints between the sexes. Insomnia, melancholy, anxiety, headaches, irritability, and exhaustion are more common complaints among women than men. Women's sleep is significantly influenced by hormones.

It was shown that in premenopausal women, reproductive hormones had a protective impact on sleep apnoea. Another time when sleep apnoea and restless legs syndrome are more common is during pregnancy. due to the influence of hormones. Women with obstructive sleep apnoea have a significant cardiovascular mortality rate [2]. In today's world, sleep deprivation is becoming a prevalent health issue, and several research are being conducted to examine its effects on the expanding global population. The partial or nearly complete lack of sleep that causes a number of detrimental health issues in an organism is known as sleep deprivation. There is evidence that our society is sleep deprived, with an average of 6.8 hours of sleep each day compared to 9 hours a century before. Approximately 30% of adults today sleep for less than 6 hours every night. Common sleep disorders include obstructive sleep apnoea syndrome, behaviourally caused insufficient sleep syndrome, and insomnia are linked to sleep deprivation. According to a prior study, human sleeping patterns today significantly differ from those of the preindustrial age, when people could sleep for extended periods of time. The pressure to meet fundamental socioeconomic needs imposed by daily schedules, social activities, studies, and routine job is the cause of the ongoing sleep deprivation seen in many classes of individuals. According to the National Sleep Foundation survey, roughly 39% of participants said they slept for fewer than seven hours on weeknights. Furthermore, studies reveal that self-reported sleep durations have drastically decreased by about two hours over the last few decades. Although there is much debate on the ideal amount of sleep an adult should get, it is widely accepted that 8 hours at night is ideal for overall health and wellness. A glycoprotein called follicle-stimulating hormone (FSH) is essential for mammalian development and reproduction. In order to prepare the reproductive tract for fertilisation, implantation, and pregnancy, FSH controls oocyte selection, folliculogenesis, and the production of sex steroid hormones in the ovary [3]. Spermatogenesis and testicular development in males are mediated by this gonadotropin [4]. The hormone acts on the surface of target cells in the male and female gonads, where hormone-induced signals linked to apoptosis and cell proliferation are triggered. It is secreted by the pituitary's gonadotrope cells after being pulsatile regulated by the hypothalamic gonadotropin-releasing hormone (GnRH) [5]. Along with follicle-stimulating hormone, the gonadotrophin cells in the adenohypophysis (anterior pituitary) release the glycoprotein hormone known as luteinizing hormone (LH). A neurological circuit that includes the gonads, pituitary gland, and hypothalamus includes luteinizing hormone. Gonadotropin-releasing hormone (GnRH) stimulates the production of LH in this route, whereas testosterone inhibits it in men and oestrogen in females. The roles of LH vary according on the gender of the individual. LH aids in the development of primordial germ cells in both sexes. In males, testosterone is produced by the Leydig cells in the testes in response to LH. LH causes the ovaries in women to produce steroid hormones. Furthermore, by

participating in both ovulation and the implantation of an egg in the uterus, LH aids in controlling the duration and sequence of the female menstrual cycle [6]. The gonads, which are made up of the testes and ovaries, and the adrenal cortex both often generate progesterone, an endogenous steroid hormone. During the first 10 weeks of pregnancy, the ovarian corpus luteum also secretes progesterone, and later in the pregnancy, the placenta does the same. After week ten, progesterone production often shifts from the corpus luteum to the placenta. A byproduct of cholesterol, progesterone serves a variety of purposes in the human body, particularly in the reproductive system [7]. The primary female sex hormone is oestradiol (E2), an oestrogen steroid hormone that is also spelt oestradiol. It has a role in controlling the menstrual and reproductive cycles of women. Female secondary sexual traits including breast growth, hip enlargement, and a pattern of fat distribution exclusive to women are all caused by oestradiol. During adolescence, maturity, and pregnancy, it also plays a significant role in the growth and upkeep of female reproductive tissues, including the uterus, vagina, and mammary glands.[8] Numerous other tissues, including as the brain, liver, skin, fat, and bone, are also significantly impacted. Males also have significant responsibilities for oestradiol, although having far lower quantities than females. Oestradiol is present in most vertebrates and crustaceans, insects, fish, and other animal species in addition to humans and other mammals.[9][10] In addition to the ovaries' follicles, other tissues such as the testicles, adrenal glands, fat, liver, breasts, and brain also produce oestradiol. The body uses a sequence of processes and intermediates to convert cholesterol into oestradiol.[11] The primary process entails the synthesis of androstenedione, which aromatase subsequently transforms into oestrone and eventually into oestradiol. As an alternative, testosterone can be produced from androstenedione and subsequently transformed into oestradiol. Women's ovaries cease producing oestrogens during menopause, and their levels of oestradiol drop to extremely low levels. Apart from its function as a natural hormone, oestradiol is also utilised as a pharmaceutical. For example, it is used in feminising hormone treatment for transgender women and menopausal hormone therapy. One sex hormone that is essential to preserving your sexual and reproductive well-being is oestrogen. During your menstrual cycle and menopause, your oestrogen levels normally vary and decrease. Oestrogen is essential for the health of your reproductive system, together with progesterone. Oestrogen has a role in the development of secondary sex traits (breasts, hips, etc.), menstruation, pregnancy, and menopause. Other bodily systems are also significantly impacted by oestrogen. Because of this, all genders produce oestrogen, even though AFAB individuals produce the most of it [12, 13, 14, 15, 16]. Oestrogen comes in three main forms: After menopause, your body produces oestrone (E1), the main type of oestrogen. During your reproductive years, the main type of oestrogen in your body is oestradiol (E2). It is estrogen's strongest form. During pregnancy, the main type of oestrogen is oestriol (E3). Like other hormones, oestrogen functions as a chemical messenger. It instructs your body on when to initiate and terminate procedures that impact your sexual and reproductive well-being. Your body goes through significant alterations as a result of these processes. Lack of sleep and alterations in women's reproductive hormones: For women of all ages, sleep has a functional impact on reproductive viability. Sleep increases the pulsatile production of gonadotropin during puberty, but it has no effect on the other phases of the menstrual cycle and lowers the frequency of the LH pulse in women of reproductive age during the early follicular phase. Numerous research assessed how sleep affected sex hormone release. This study Aims to Evaluation the levels of reproductive hormones in women who suffer from sleep disorders. Study the effect of sleep patterns on these hormones (FSH, LH, progesterone, E2). Also Proving the difference between reproductive hormone levels during the menstrual cycle and during the Perimenopause.

2-Material and Method

2.1 Study design:

This study included only 50 volunteers, 25 who suffer from a sleep disorder and do not get enough hours of sleep, and 25 normal women, and samples were taken from them on the second,

third, or fourth day of the menstrual cycle. The ages of these women were 18-25 years and the anxiety measurement was:

- 1-Follicle-stimulating hormone (FSH)
- 2-Luteinizing hormone (LH)
- 3-Progesterone
- 4-Estradiol (E2)

2-2. Sample collection:

Collection of blood samples from target women 2 ml of venous blood samples to obtain blood serum by placing the blood in a sterile vacuum gel, clot activating tube to clot at 37 degrees Celsius. The tube was centrifuged at (1500 rpm) for 5 minutes. The serum was collected and frozen. It was used for hormonal assay , which includes measuring the level of reproductive hormones in women (FSH, LH, Progesteron, E2).

2-3. Statistical analysis:

Data are stated as means standard deviation (SD).The correlations use one way ANOVA .Non-parametric Kruskal-Wallis test distribution .

A value of $P < 0.05$ was considered statistically was also applied.

And p.significant > 0.05 non- significant.

3. Results and discussion

3.1-Result

Table 1: Pearson parametric correlation sex hormones with sleep measurement in linear regression models.

Parameters		Age	Hours of sleep	FSH (mlu/ml)	LH (mlu/ml)	Pro (ng/ml)
Hours of sleep	Pearson correlation	108				
	Sig(2-tailed)	606				
FSH (mlu/ml)	Pearson correlation	-484*	-243			
	Sig(2-tailed)	014	241			
LH (mlu/ml)	Pearson correlation	197	051	-384		
	Sig(2-tailed)	367	818	071		
Pro(ng/ml)	Pearson correlation	013	-118	046	-031	
	Sig(2-tailed)	951	574	827	888	
E2 (pg/ml)	Pearson correlation	158	-175	-153	-527**	022
	Sig(2-tailed)	460	412	475	010	917

*.correlation is significant at the 0.05 level (2-tailed)

**..Correlation is significant at the 0.01 level (2-tailed)

Table (2): differences of the hormone levels among the study groups. value was express as mean +_ SD

Parameters	Control group (n=25) Mean±SD	Case group (n=25)	P. value
		Mean±SD	
FSH(mlu/ml)	6.55 ±1.56	5.50 ± 1.74	0.02*
LH(mlu/ml)	7.52 ± 2.75	6.91 ± 2.79	0.45NS

Pro(ng/ml)	1.16 ± 0.46	3.47 ± 1.71	<0.001*
E2(pg/ml)	109.58 ± 55.86	96.32 ± 70.15	0.46NS

NS: not significance

*: significance

Figure (1):

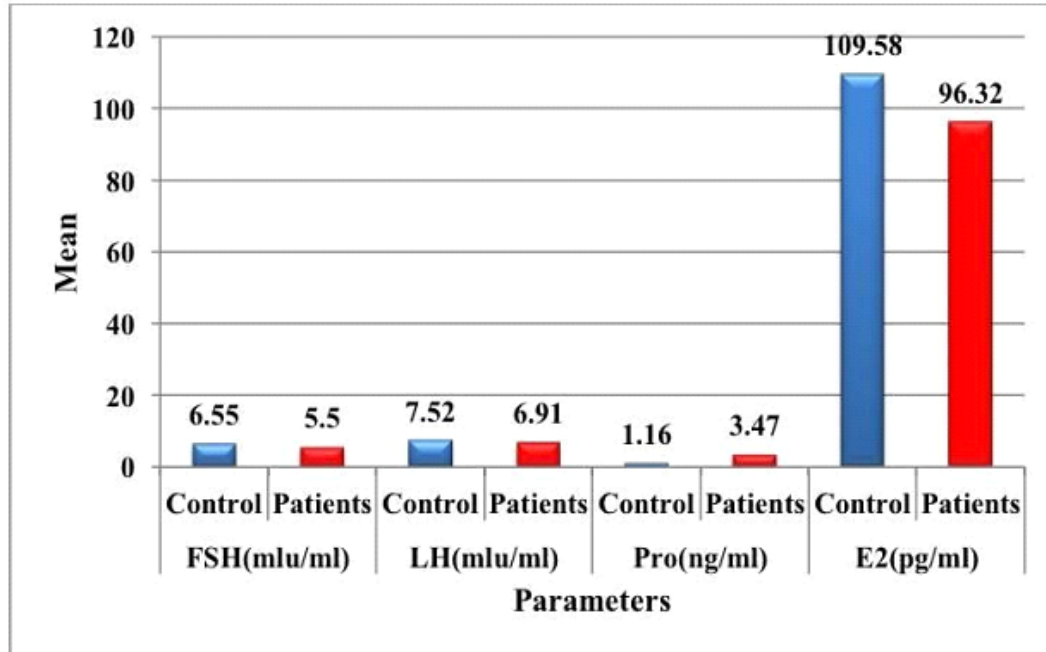
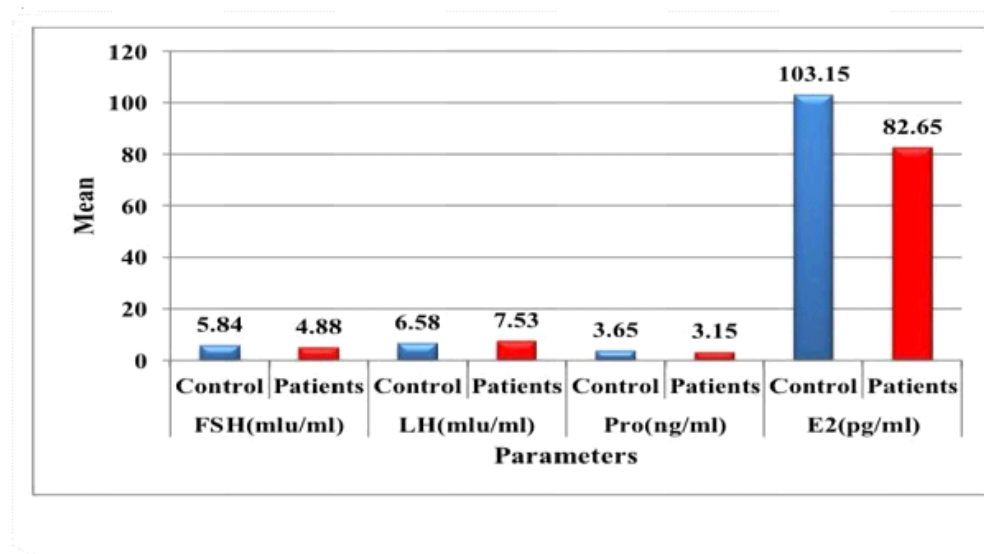


Table (3): differences of the hormone levels according to time of sleeping. value was express as mean +_ SD

Parameters	(2-5 hours)	(6-10 hours)	P. value
	(n=16)	(n=9)	
	Mean±SD	Mean±SD	
FSH(mlu/ml)	5.84 ± 1.91	4.88 ± 1.26	0.18NS
LH(mlu/ml)	6.58 ± 3.05	7.53 ± 2.26	0.45NS
Pro(ng/ml)	3.65 ± 1.94	3.15 ± 1.27	0.49NS
E2(pg/ml)	103.15 ± 71.76	82.65 ± 69.38	0.51NS

NS: not significance,

Figure (2):

3.2- Discussion

Sleep abnormalities have been linked to a number of health issues in both men and women, including anxiety disorders, depression, hypertension, glucose dysregulation, cardiovascular disease, and postpartum depression in women. Infertility in both men and women may result from sleep disruptions because they de-regulate the body's steroid hormone levels. According to result of our study shows that the levels of E2 and LH, there is not noticeable increase or decrease in patients in comparison to control group. Conversely, the result found a decrease significant difference of FSH ($P=0.02$) and increase significant difference of progesterone ($p=0.001$). The result of this study was not agreement with other study that reported there is positive correlation between sleep duration and FSH[17].

However, the results show in table (2) appeared that (FSH, LH, Pro, E2) in the females who take adequate sleep (6-10 hrs.) as well as the females who suffered from sleep disorders and did not get sufficient sleep (2-5 hrs.), were show there is not statistical significant difference between two groups.

In other hand, the study results illustrate that the effect of waking up at night on the following hormones (FSH, LH, E2, and progesterone) was agreement with other study that explain the Sleep continuity disorder during the premenopausal period, including FSH, progesterone, and E2 were measured .However, on forty five women in the premenopausal period who suffered from waking up at night, the results noticed an increase in FSH level and decrease in E2 level independently of VMS

(vasomotor symptoms)

While there isn't effect on progesterone when waking up at night [18]. yet, the variation with this study due to the fact their study the measure was produced in the around menopause in comparison to our study which carried out those hormones during the first days of menstrual cycle. On the other hand, a research that followed the same route compared the Gonadotropin-releasing hormone agonist test with the hormonal sleep assay for detecting normal puberty in females [19].

In additionally, the results were showed 96% experienced a significant sleep –related LH rise (sleep VS wake).

The progesterone hormone gets the uterus ready for pregnancy every month. The ovary releases an egg and progesterone levels start to increase throughout a typical menstrual cycle. In order for a fertilised egg to attach (implant) within the uterus and develop into a baby, progesterone causes the lining of the uterus to thicken.

Your progesterone levels will drop if you are unable to conceive. The lining of the uterus will thin once again. Menstruation will start when the uterus starts to release extra blood and tissue. When you are not pregnant, a rise in progesterone levels might be caused by:

Ovarian cyst Ovarian cancer Congenital adrenal hyperplasia (CAH), a hereditary condition, or issues with the adrenal glands, such as adrenal cancer [20,21,22,23,24,25,26,27]. Regarding FSH, it aids in regulating the menstrual cycle in women who experience menstruation. It prepares the eggs for ovulation by promoting their development in the ovaries. When the ovary releases an egg, it travels to the fallopian tube to be fertilised by sperm. This process is known as ovulation.

Low levels of FSH in women and men are often a sign of a problem with the pituitary gland or hypothalamus.

In women, low FSH levels may also be associated with rapid weight loss, severe underweight, or intense exercise. [28,29,30,31,32,33,34,35,36,37,38].

Regarding LH, the hormone aids in regulating the menstrual cycle in women who experience menstruation. Additionally, it causes the ovary to release the egg. We refer to this as ovulation. Immediately prior to ovulation, LH levels increase dramatically. Adults with elevated LH

LH levels fluctuate throughout the month in women who menstruate. A proper ovulation is often indicated by a rise in LH two weeks following your menstruation. However, elevated LH levels throughout the month might indicate a malfunctioning ovary. If I were:

Age at childbearing: Elevated LH levels might indicate the presence of an ovarian dysfunction affecting the following:

Ovaries that never developed normally

Primary ovarian insufficiency (POI)

Polycystic ovary syndrome (PCOS)

Thyroid disease or adrenal gland disorders

Chromosomal disorder, such as Turner syndrome

At age 45 or older, rising LH levels may mean you're approaching menopause [39, 40, 41, 42, 43, 44]

4. Conclusion:

The current study showed that the level of progesterone increased significant in the case group compared to the control group, and level of FSH decreased and this changes is statistically significant.

We conclude from all these results that these parameters are negatively affected by the sleep disorders.

5. Recommendations:

1. To achieve more realistic results, a study must be conducted that takes into account the study participants so that their number is greater than the numbers included in this study.
2. Conducting studies with more than one group. This means a control group and other groups suffering from sleep disorders and not getting enough sleep, and the procedure must be during the menstrual cycle

3. Conduct future studies that must include all criteria related to the functions of female reproductive hormones.
4. Conduct more experimental and applied studies to understand and observe the effect of different sleep patterns on organ functions, including blood, vital and pathological indicators.
5. conduct further studies including important parameters as (melatonin, glucocorticoids, TSH, Prolactin).

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