



## THE INFLUENCE OF MELATONIN ON SEX HORMONES

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**Abstract:** Melatonin, a hormone synthesized by the pineal gland, is primarily known for its role in regulating circadian rhythms and sleep–wake cycles. However, emerging evidence indicates that melatonin also influences reproductive physiology by modulating the secretion of sex hormones. This article reviews the current scientific data concerning the effects of melatonin on estrogen, progesterone, and testosterone synthesis, as well as its physiological and clinical implications for reproductive health.

**Keywords:** Melatonin, Sex hormones, Estrogen, Testosterone, Circadian rhythm, Reproductive health

### Introduction

Melatonin (N-acetyl-5-methoxytryptamine) was first isolated by Lerner in 1958 and is secreted predominantly during the dark phase of the day. Beyond its chronobiological functions, melatonin exerts multiple regulatory effects on endocrine organs, including the hypothalamus, pituitary, gonads, and adrenal glands.

In both men and women, reproductive activity is tightly regulated by the hypothalamic–pituitary–gonadal (HPG) axis. Melatonin influences this axis by modulating the release of gonadotropin-releasing hormone (GnRH) and subsequently altering the secretion of luteinizing hormone (LH) and follicle-stimulating hormone (FSH).

### Materials and Methods

This review was based on data retrieved from PubMed, Scopus, and Web of Science databases using the keywords “melatonin,” “sex hormones,” and “reproductive physiology.” Only peer-reviewed articles published between 2000 and 2024 were included. Selected studies investigated both animal models and human subjects to ensure translational relevance.

### Results

#### 1. Melatonin and Female Reproductive Hormones

Melatonin exerts inhibitory control over GnRH release from the hypothalamus, leading to decreased FSH and LH secretion from the pituitary gland. Consequently, estrogen and progesterone synthesis in the ovaries is reduced.

Studies also demonstrate that melatonin may lengthen the menstrual cycle or delay ovulation by altering ovarian steroidogenesis. During menopause, melatonin levels decline markedly, potentially contributing to vasomotor instability, sleep disorders, and mood changes.

#### 2. Melatonin and Male Reproductive Hormones

In males, melatonin modulates testosterone secretion primarily through the hypothalamic–pituitary axis. Elevated melatonin concentrations suppress LH secretion, reducing testosterone production by Leydig cells.

Nonetheless, melatonin possesses strong antioxidant properties that protect spermatozoa from oxidative stress and apoptosis, thus improving overall sperm quality despite transient reductions in hormone levels.



#### Discussion

The interaction between melatonin and the reproductive endocrine system represents a complex, bidirectional relationship. On the one hand, melatonin regulates sex hormone secretion in accordance with photoperiodic and circadian signals. On the other hand, gonadal hormones can influence melatonin synthesis and metabolism.

Clinically, melatonin supplementation has shown promising results in improving oocyte quality in women with polycystic ovary syndrome (PCOS) and in protecting sperm DNA integrity in men exposed to oxidative stress. However, excessive melatonin intake or inappropriate timing of administration may disrupt normal reproductive hormone rhythms.

#### Conclusion

Melatonin plays a pivotal role not only in sleep regulation but also in maintaining reproductive hormone balance. By influencing the hypothalamic–pituitary–gonadal axis, melatonin can modulate estrogen, progesterone, and testosterone secretion.

The hormone's antioxidant and chronobiotic properties make it a potential therapeutic agent in managing reproductive disorders linked to oxidative stress and circadian disruption.

Further controlled clinical trials are necessary to establish safe and effective protocols for melatonin use in reproductive medicine.

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