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ORIGINAL ARTICLE

Melatonin and Male Fertility: A Narrative Review

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ABSTRAKT

Introduction. Melatonin has been a well-known substance to humanity since ancient times, but its properties became the subject of study in the past century. Although today melatonin supplementation is primarily associated with sleep regulation, there are evidence for its anti-inflammatory, antioxidant, and free radical-scavenging properties.
Aim. The aim of this narrative review is to analyze actual research on the effect of melatonin on male fertility.
Materials and methods. PubMed and Google Scholar were searched for studies and research paper related to antioxidant and anti-inflammatory properties of melatonin and its effect on fertility. After screening abstracts and full texts, data were extracted and the findings were synthesized in a narrative manner based on study design, population characteristics, the effects of melatonin on semen quality and reproductive function, and the reported outcomes.
Results. Most studies showed that melatonin may have beneficial effects on male fertility. It improved sperm parameters such as motility, viability, morphology, and DNA integrity. Positive effects were also observed in cases of oxidative stress caused by environmental toxins, cryopreservation, chemotherapy, and radiotherapy. There are many studies reported protective effects of melatonin on semen quality, but some of them suggest that long-term supplementation may negatively affect selected semen parameters in some individuals.
Conclusion. Melatonin seems to be a multifunctional molecule with antioxidant, anti-inflammatory, and reproductive regulatory properties, among others. It may support male fertility. Current evidence is still insufficient to determine the optimal dose and duration of treatment. Results may vary depending on species, individual variability, and biological context. Further research is needed to clarify its systemic effects and clinical utility in reproductive medicine.

KEYWORDS

melatonin, semen quality, oxidative stress, male fertility

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1. Introduction

Melatonin (N-acetyl-5-methoxytryptamine) has become a subject of research due to its effects on the immune system and its impact on mental health and sleep disorders. Along with the growing scientific research, awareness among consumers and healthcare professionals has increased. This situation likely led to a significant increase in the sales of melatonin dietary supplements in the United States in 2020 compared to 2017 [1]. Observing the increasing number of publications and the situation in the pharmaceutical market, the authors of this study wanted to investigate the effects of this drug on the male reproductive system.

This substance has been known to humanity since ancient times, although today it is primarily associated with sleep aids. In fact, its role is much broader than just sleep regulation – it has also been shown to have strong anti-inflammatory, antioxidant, and free radical-scavenging properties [2–4]. This raises the question: since oxidative stress is identified as a cause of infertility in approximately half of infertile men, could regular melatonin supplementation improve male fertility?

Melatonin is an indoleamine hormone that performs numerous physiological and biological functions in animals and plants [1–3]. This hormone does not originate solely from the pineal gland. Initially, it was believed that indoleamine was produced only in animals that possess a pineal gland. Later studies have proven that all living creatures, including bacteria, produce melatonin. Surgical removal of the melatonin does not result in the loss of indole from other organs. However, it disrupts the circadian rhythm. It has been observed that after removal of the pineal gland, melatonin concentrations actually increase in other subcellular organelles[4, 5].

It achieves its antioxidant effect in multiple ways: by directly detoxifying reactive oxygen and nitrogen species, and indirectly by stimulating antioxidant enzymes while simultaneously inhibiting the activity of prooxidant enzymes. This effect may slow the aging process and support the treatment of age-related diseases and serious illnesses [3]. Through its anti-radical mechanisms, melatonin also reduces the toxicity of harmful prescription drugs and methamphetamine [4]. Melatonin levels fluctuate throughout life, and it has been observed that decreased melatonin concentration in the pineal gland may become a biomarker of both mental disorders and aging [3]. Historically, melatonin was thought to control annual reproductive fluctuations in photoperiodic species through seasonal changes in the hormone signal. Humans reproduce continuously, but this does not change the fact that melatonin influences the reproductive system. Numerous studies in animals and humans demonstrate its multiple effects on reproductive function [4].

2. Research objective

The central objective of this study is to analyze existing research on the effects of melatonin on male fertility through a comprehensive literature review.

3. Need for a Review of Current Methods

Given the growing interest in melatonin, research on the effects of these drugs on the human body is continually expanding.

This paper focuses on the effects of this substance on the male reproductive system.

In this review, we examine whether melatonin can influence semen composition and, if so, whether this influence is positive or negative, and the protective effects of melatonin.

4. Materials and methods

This study was performed as narrative review and did not involve original data collection. It was based on a targeted selection of scientific literature about influence of melatonin on male fertility; and due to the limited amount of literature on the effect of melatonin on men the effect of melatonin on animal fertility was examined.

4.1 Selection procedure

A literature search was conducted for publications using electronic databases, including PubMed. Additionally, supplementary tool, including Google Scholar was utilized to identify further relevant studies, supplemented by manual screening of references from relevant articles to identify further eligible studies. In April and May 2026 the following keywords were used in the literature search: „melatonin", „semen quality", „oxidative stress", „male fertility". Three independent authors conducted the search (AK, MCH, WJ). No specific time frame was applied, although preference was given to more recent studies when available.

Studies were included based on their relevance to the research question and their contribution to under-

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standing how melatonin affects fertility. This allowed for the comparison of findings from various study designs and populations, and also underscored the need for research on human subjects by drawing on evidence from animal studies.

5. Results

5.1 Melatonin in the Human World

5.1.1 Impact for Reproductive Men System

Due to its amphiphilic nature, it is one of the most effective antioxidants protecting sperm cells from damage. Its lipophilic nature allows it to easily penetrate cell membranes, allowing for direct action in the reproductive system [5]. A study by Luboshitzky and colleagues [6] analyzed the effects of long-term melatonin use on male fertility, hormonal balance, and semen quality. The authors attempted to answer the question of whether melatonin supplementation could affect spermatogenesis. The study concluded that melatonin may impair semen parameters. Eight men were studied for three months and received either a placebo or 3 mg of melatonin daily. Two of the eight men experienced decreased sperm concentration, motility, and estradiol (E2) levels while taking melatonin, and their testosterone-to-estradiol ratio also increased. In the remaining men, no deterioration was observed. Sperm count increased in some, but the authors considered this to be natural biological variability. Individual variability is a key observation; although all eight men had normal body weight, normal testicular volume, and normal serum hormone levels, results may vary. Melatonin likely disrupts the estrogen-testosterone balance locally in the testes by inhibiting aromatase. Aromatase is an enzyme that converts testosterone to estrogen, which alters the androgen-estrogen balance and disrupts sperm maturation. Estrogen is important for spermatogenesis and sperm maturation. It influences epididymal function and the regulation of fluid in the ejaculatory ducts. The presence of estrogen receptors in the testes is responsible for fertility, as evidenced by the fact that these mice are infertile. Men with estrogen deficiency had abnormal semen. Melatonin in the above study did not affect LH, FSH, or total testosterone levels, which may suggest that melatonin acts not primarily on the pituitary and hypothalamus but locally within the testes/epididymes and semen itself. Scientists describe three possible mechanisms of action on semen: direct inhibition of sperm motility, disruption of hormonal balance in the testes, and antioxidant activity. This presents a paradox: Melatonin reduces lipid peroxidation and may protect sperm from oxidative stress, potentially helping, but it may also disrupt the hormonal regulation of spermatogenesis. Therefore, the effect of melatonin is not clearly „good" or „bad". However, the study described above has certain drawbacks, such as the small study group (only eight participants), high biological variability of semen (semen parameters fluctuate throughout the day, under stress, etc.), and the lack of clear evidence of a mechanism (there is no evidence of aromatase inhibition). The researchers conclude that long-term use may affect the fertility of some men, but further research is needed. Additionally, it can be hypothesized that the effect of melatonin depends on the dose, timing of administration, duration of use, and individual biology. However, melatonin is not a hormonally „neutral" supplement. It is a biologically active hormone that influences circadian rhythms, affects the endocrine system, and potentially modulates reproduction [6]. In a study by Minich and colleagues [1], they noted that melatonin's free radical-scavenging effects improve the quality of sperm and eggs, supporting in vitro fertilization. Melatonin influences the functioning of the hypothalamic-pituitary-gonadal axis and acts as a powerful antioxidant and stimulates antioxidant mechanisms in the gonads, reducing oxidative damage to gametes—sperm and oocytes. Thanks to this, it improves the quality of reproductive cells and their ability to function properly. [1–4]

5.1.2 Antioxidant side of melatonin on humans

In a study by Iranian scientists [7], samples from 75 patients were used. After semen analysis, the material was frozen and, after thawing, the samples' antioxidant capacity was assessed and a melatonin test was performed. No significant correlation was observed between melatonin and antioxidants and semen parameters or nuclear maturity; however, a significant correlation was observed between melatonin and DNA fragmentation. The primary cause of DNA damage is free oxygen radicals, which are scavenged by melatonin. It detoxifies harmful substances, reducing molecular damage. Additionally, this compound exhibits antiapoptotic activity in seminal plasma and the membrane melatonin receptor M1, which is involved in regulating antiapoptotic activity. The authors of the paper wonder whether the effect of melatonin on sperm function may be dependent on both dose and the interaction between melatonin and its cell surface receptors. This may be due to the fact that the level

of melatonin in the semen as well as the number of surface receptors may be factors that lead to such different research results.

A 2019 study by Amirjannaty and colleagues [8] used semen samples from 41 healthy men. Samples were collected from four groups: (1) a control group without cadmium and melatonin, (2) sperm incubated with cadmium, (3) sperm incubated with cadmium and melatonin, and (4) sperm induced with melatonin without cadmium.

The aim of this study was to evaluate the protective effect of melatonin on human sperm exposed to cadmium in the laboratory (in vitro). Cadmium can accumulate in the body and negatively impact the male reproductive system, causing decreased sperm motility, impaired viability, increased oxidative stress, DNA damage, and decreased sperm quality. Melatonin, as an antioxidant, anti-inflammatory, antiapoptotic, and potentially anticancer agent, is thought to prevent the negative effects of cadmium. Sperm motility and viability, DNA integrity, and DNA fragmentation levels were assessed. The cadmium-treated group experienced a significant decrease in sperm motility, decreased sperm viability, increased DNA fragmentation, and a general deterioration in semen quality parameters. The changes were statistically worse compared to the control group. In the melatonin-treated group, improvements in semen parameters were observed. Sperm motility and viability increased, DNA damage decreased, and cadmium-induced DNA fragmentation decreased. The group receiving melatonin with cadmium achieved significantly better results than the group receiving cadmium alone. Melatonin has a protective effect and may reduce oxidative stress and genetic damage. Therefore, it may have potential therapeutic applications in protecting the fertility of men exposed to environmental toxins.

In another study conducted by Minucci et al. [9] 15 in vitro human semen samples were examined. A control sample, a sample treated with cadmium (Cd), which was thought to induce oxidative stress, a melatonin (MLT) test, and co-administration of cadmium and melatonin were conducted. Semen of unknown quality or with abnormal parameters (according to WHO criteria) was excluded from the study. This confirmed that oxidative stress reduces sperm motility, DNA integrity, and increases apoptosis (cadmium study).

Melatonin, on the other hand, improved the localization and levels of cytoskeletal proteins important for motility. The sample co-administered with cadmium and melatonin demonstrated a partially neutralizing effect of MLT on Cd.

Another study conducted in Brazil examined the effects of melatonin and caffeine on the quality of human sperm undergoing cryopreservation, a process of freezing and thawing semen used in the treatment of infertility and fertility preservation. Sperm cryopreservation is an important tool in reproductive medicine, where it is used in patients with cancer, autoimmune diseases treated with immunosuppressants, prior to vasectomy, for sperm donation, prior to ART (assisted reproductive technology) procedures, and in individuals exposed to gonadotoxic substances. The greatest drawback of cryopreservation is the low survival rate of sperm after thawing. Between 25% and 75% of sperm undergo structural damage, lose biological function, and/or do not survive mechanical and osmotic stress.[10]

The freezing and thawing process additionally causes cell membrane damage, decreased sperm motility, mitochondrial dysfunction, and increased oxidative stress and DNA damage. All of this can reduce the effectiveness of ART, increase the risk of miscarriage, and increase developmental defects in future offspring [10].

The study authors wanted to determine whether melatonin and caffeine, an antioxidant, would improve semen quality after cryopreservation. However, let's focus on melatonin [10].

The study used 30 normozoospermic samples collected from men aged 22-45. Individuals with azoospermia, leukocytospermia, necrozoospermia, and other significant semen parameter abnormalities were excluded. The samples were divided into groups: (1) fresh samples before freezing, (2) a control group after thawing (CONT), and (3) melatonin (MEL). Cryopreservation significantly impaired semen parameters. Progressive sperm motility decreased from approximately 50% before freezing to approximately 7.5% after thawing. Overall motility decreased from 66% to 16%. Furthermore, clinical parameters such as VCL (curvilinear velocity, a parameter measuring the total distance (actual trajectory) traveled by sperm per unit of time), VSL (straight-line velocity of sperm – the distance traveled in a straight line by sperm per unit of time), VAP (average velocity of sperm along the trajectory), and others were significantly reduced. In mitochondria, a decrease in mitochondrial activity and an increase in the number of sperm with damage were observed.

After freezing, the R level increased [10]. However, the study is a kind of introduction and requires further analysis.

5.2 Melatonin in the Animal Kingdom

Melatonin has an important role in sleep regulation in diurnal species, including humans [11]. The substance

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has pleiotropic effects. Scientists describe antioxidant, free radical-scavenging, anti-inflammatory, and antiapoptotic effects [12–14].

Its antioxidant effect is observed in all body systems, including the reproductive system. In men, it is responsible for regulating GnRH and LH, testosterone production, and testicular maturation. These effects protect against environmental toxins. Animal studies demonstrate melatonin's positive role in reproductive performance [14]. Unfortunately, the mechanisms by which melatonin improves sperm quality have not yet been fully explained [15].

5.2.1 Melatonin in Animal Reproduction

Veterinary medicine gives us the opportunity to observe trials of administering melatonin to various animal species in order to observe the effects of melatonin on animals, including the reproductive system.

A meta-analysis conducted by Budiyanto and colleagues in 2024, which analyzed 30 studies on small ruminants, confirmed the positive effect of melatonin administration on reproductive performance in minor ruminant species. Melatonin delivery increased sperm concentration, normal morphology, viability, acrosome integrity, and DNA integrity. Additionally, melatonin administration increased testosterone and improved estradiol-17β levels. The researchers suggest that melatonin modulates testicular blood flow, resulting in increased energy production by mitochondria and increased sperm motility [12].

The research of Afzal and colleagues [2] demonstrates the heterogeneous effects of melatonin and its positive impact on the reproductive system. It demonstrates that it improves animal performance not only by regulating circadian rhythms but also through antioxidant, immunomodulatory, and metabolic effects. This latter effect improves both immunity and fertility. The substance influences the hypothalamic-pituitary--gonadal axis, increasing hormone secretion and synchronizing estrous cycles. Reproductive physiology requires melatonin for the proper production of reproductive hormones, such as gonadotropin-releasing hormone, luteinizing hormone, and progesterone [2].

Active transport of melatonin causes cellular processes related to spermatogenesis and steroidogenesis, intensifying them [12].

Additionally, melatonin appears to be a promising regulator of the reproductive microbiome in farm animals, thus influencing fertility and reproductive performance. In males, it improves semen quality, including sperm motility, supporting artificial insemination programs. Overall, melatonin helps animals adapt to environmental stressors and increases their productive performance [2].

Reza Divar and colleagues [16] investigated the effects of melatonin supplementation with refrigerants and freezers. Since frozen sperm storage is the most popular reproductive technology in the dog breeding industry, scientists are looking for a way to address harmful semen changes. Melatonin, which has antioxidant properties, was used to reduce free radicals [16].

The study proved that in vitro melatonin supplementation on frozen dog sperm improved sperm motility, sperm viability, and acrosome integrity, as also shown in the meta-analysis by Budiyanto and colleagues [12,16].

Unfortunately, the positive effect on sperm fertility requires confirmation in in vitro or in vivo fertility studies [16].

Another study from 2022 examined the effect of melatonin administration on testicular vascular perfusion with respect to steroid hormones and semen characteristics in dogs [14]. Twelve normospermic German Shepherds were included in the study, with six males receiving a subcutaneous dose of melatonin. Both groups underwent follow-up examinations on days 15, 0, 15, 30, and 60. The melatonin group demonstrated increased semen volume, concentration, percentage of motility, and total sperm count. Additionally, peak testicular artery velocity also increased on day 60 compared to day 0, as did testosterone, estradiol 17B, and nitric oxide levels. This confirms that a single injection of melatonin can improve testicular vascular perfusion by improving semen quality, steroidogenesis, and hormonal profile. GnRH and testosterone are stimulated by interstitial cells through the presence of specific melatonin receptors in spermatogonial cells in the testes. Melatonin is responsible for the production of estrogen from androgens. The study showed a significant increase in estrogen production, which in turn led to vasodilation of the testicular arteries—a vasodilatory effect of estradiol [14].

5.2.2 The Protective Role of Melatonin in Animals

One of the serious complications of chemotherapy and radiotherapy is testicular dysfunction caused by oxidative stress. Animal studies have observed a protective effect of melatonin on the male reproductive system during anticancer treatment. This may provide a perspective for melatonin supplementation in patients treated with these methods.[13]

Dehdari Ebrahimi et al.[13] reviewed the literature regarding the protective effects of melatonin on ro-

dent testicular tissue in the context of anticancer stressors. A meta-analysis of studies examining the effects of exogenous melatonin on rodent testicles during anticancer therapy was conducted. Melatonin therapy was shown to improve sperm quality and quantity – count, motility, viability, normal morphology, spermatogonial count, and increased serum reproductive hormone levels. Characteristics related to body weight were also examined – total body weight, epididymis, and testicles.

These results are consistent with different meta-analyses by this author, demonstrating a beneficial effect of melatonin on testicular damage induced by metabolic disorders, physical factors and chemical toxicants in animal models.[17–19]

In this meta-analysis scientists have discovered that this treatment may exert effect by damaging DNA and induction apoptosis, lipid peroxidation, increased oxidative stress, inflammation, hormonal imbalance, and mitochondrial damage, which result in abnormal sperm characteristics. Anti-inflammatory and anti-apoptotic effects of melatonin could protect DNA against the destructive effects of Reactive oxygen species (ROS) induced by chemotherapy and radiotherapy. It can improve sperm morphology, motility, count, and viability. Additionally, it affects testosterone levels, by reducing Leydig cell apoptosis, protecting against the decline in testosterone levels caused by the harmful effects of diabetes – suggesting the potential of melatonin to regulate the expression of androgen receptor genes. Unfortunately, there is conflicting evidence that melatonin has no effect on testosterone levels in animals with physical testicular damage and in healthy men. In addition to the effects above, melatonin influences the elimination of endoplasmic reticulum stress. It affects improves blood-testis barrier impairment, and therefore, spermatogenesis abnormalities following anticancer treatment. These meta-analyses have limitations, including the fact that the data were derived from animal studies, and it is unclear whether such effects can be translated to humans. Furthermore, a significant number of animal studies examining the effects of melatonin therapy on male infertility have used rodent models, making it difficult to generalize conclusions to other animals.[13] These studies provide future prospects for melatonin treatment in men reproductive system after radiotherapy and chemotherapy by attenuating inflammatory cytokines in the testicles[20,21].

Amer's and colleagues[22] study examines the positive effect of melatonin administration in rats with reproductive system damage. This study was initiated because the anticonvulsant drug depakine has a negative effect on the male reproductive system, including testicular damage and infertility. The results suggest that melatonin prevents the adverse effects of depakine on spermatogenesis by increasing sperm count, motility, and survival, and improving their morphology. This results in reduced oxidative damage in the testes. Rats treated with melatonin and depakine had significantly reduced levels of cytokines and chemokines, indicating melatonin's anti-inflammatory effects. According to the researchers, melatonin has the potential to be an effective pharmaceutical adjuvant that could be used in clinical practice to prevent testicular damage caused by oxidative inflammation and apoptosis induced by drugs, including anticonvulsants[22].

6. Discussion

Melatonin performs many functions in the body, as demonstrated by both animal and human studies. The results of the presented studies demonstrate that the hormone melatonin has multifaceted biological effects, including antioxidant, anti-inflammatory, and antiapoptotic effects.[2,3] This is a suitable compound that can effectively reduce the negative impact of oxidative stress, environmental, and pharmacological factors on the male reproductive system, as indicated by the studies and meta-analyses cited in this paper.

Sleep plays a crucial role in human life. In their study, Liu and colleagues highlight the importance of sleep for male reproductive function. They found that the incidence of sleep disorders has increased in the industrialized world, which in turn reduces semen quality. They observed that individuals with less sleep had lower sperm counts and lower sperm viability.[15] This demonstrates that sleep deprivation can reduce male sperm quality.[15,23,24] Unfortunately, the mechanisms underlying the relationship between sleep and male reproductive function in humans are unclear. Du and colleagues[23] have not observed a relationship between sleep quality and reproductive hormones. They suggested that this may be due to the circadian system, which influences the production of mature sperm. These cycles are controlled by endogenous melatonin; disruptions to the cycle can disrupt melatonin and cortisol production.[23] It is worth asking whether external melatonin supplementation could improve reproductive physiology in shift workers or those with dysregulated circadian rhythms.

Numerous studies demonstrate improved semen quality, including increased sperm concentration, motility, and viability, improved acrosome integrity and sperm DNA, and a reduced percentage of abnor-

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mal sperm.[2,4,5,12] Budiyanto and colleagues[12] noted the hormone's modulating effect on testicular blood flow, which positively impacts sperm. Scientists agree that this substance is necessary for the proper functioning of the reproductive system, influencing reproductive hormones and supporting the cellular processes responsible for spermatogenesis and steroidogenesis, enhancing them.[2,12] It influences the activity of the hypothalamic-pituitary-gonadal axis, regulating the secretion of reproductive hormones such as GnRH, LH, and testosterone. Amirjannati and colleagues[8], studying the semen of healthy men, also observed the antioxidant, anti-inflammatory, and antiapoptotic effects of melatonin. They noted that this substance may have potential therapeutic applications in the treatment of infertility. Additionally, the work of Minucci and colleagues[9] demonstrated improved localization and levels of cytoskeletal proteins important for motility. This shows that melatonin is a promising substance in the treatment of infertility caused by excess heavy metals in the environment, especially in large cities.

In recent years, sperm cryopreservation has become a rapidly developing technique due to improved production and the preservation of endangered species. Unfortunately, this technique can cause significant damage to sperm. The biggest drawback of cryopreservation is the low survival rate of sperm after thawing, which causes structural damage, loss of biological function, or failure to survive mechanical and osmotic stress.[10] This necessitates the addition of cryoprotectants. Research results on semen cryopreservation indicate that melatonin supplementation may reduce damage occurring during the freezing and thawing process [25]. Divar and colleagues[16] work demonstrates this by demonstrating the positive in vitro effects of melatonin on canine sperm after freezing. This represents the future of this supplement for sperm preservation, especially as genetic material storage and in vitro fertilization are becoming increasingly popular. International literature reports optimal concentrations of 1 and 2 mM in various animal species. In humans, improved sperm parameters were obtained at a melatonin concentration of 3 mM, with reduced free radical levels [25]. Human studies show that the mechanism is melatonin's strong antioxidant effects and support for mitochondrial respiration. However, the authors emphasize the need for further research on this topic. [10] Melatonin's protective potential is evident in reproductive system damage induced by chemotherapy and radiotherapy.[13] A similar effect is also observed with the administration of other toxic substances and metabolic disorders. Animal models have demonstrated cell protective effects by limiting DNA damage, increasing oxidative stress, and reducing inflammatory processes and cellular apoptosis. These results suggest the potential use of melatonin as a supportive treatment for fertility disorders associated with gonadal damage.[13,17–19]

Despite promising results, it should be emphasized that most of the available data comes from experimental studies conducted on animal models. This limits the possibility of direct extrapolation of the obtained results to humans. Further research is needed to investigate the molecular mechanisms of melatonin's action and to determine optimal therapeutic doses and methods of administration of this hormone. Current knowledge indicates that melatonin may be a substance that supports the protection and improvement of the male reproductive system, especially under conditions of increased oxidative and environmental stress. It is worth noting that emerging research on the female reproductive system describes melatonin's effect on the entire reproductive process in women, from protecting oocyte quality through embryo implantation and fetal development. It protects against various diseases such as preeclampsia, endometriosis, polycystic ovary syndrome, and aging.[4,26] Reiter and colleagues[4] describe a positive effect on the physiology of all ovarian cell components by stimulating antioxidant enzymes and scavenging free radicals. The presence of melatonin receptors in the placenta, which regulate villous trophoblast apoptosis, has also been observed. Pharmacological melatonin or its analogues may find applications in placental therapy.[27,28] Additionally, scientists observed that melatonin administration during in vitro fertilization and embryo transfer improved implantation and pregnancy rates. [28]

Furthermore, melatonin receptors have also been found in uterine smooth muscle, which may provide a new target for treating childbirth.[27]

Other areas of the human body are known to use melatonin. There is emerging evidence that, in both controlled and uncontrolled studies, there is a strong association between melatonin and headache relief. There are studies confirming the effective effects of this substance on migraines, but in this regard, the authors write about the need for more research on melatonin therapy for migraines[29].

7. Conclusion

In summary, based on the presented studies, melatonin is an anti-inflammatory, anticancer, antioxidant,

free radical scavenger, and regulator of reproductive hormone release. It is generally beneficial for reproduction. Unfortunately, there are no adequate studies establishing appropriate therapeutic doses and duration of administration of this substance. Furthermore, research should be expanded to include local and systemic effects, as the potential for interplay between melatonin's effects on various organs may arise. When assessing the target effects of melatonin, it is important to consider species differences in tissue response to its levels—rhythmic and arrhythmic. High genetic variability, gender differences, and developmental stage may influence reproductive tissue response to this substance.

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