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Recent Development for the Treatment of Hormonal Imbalance in Female

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Abstract: The present review focuses on the various hormonal imbalances frequently encountered in the females during various life stages and their treatment. Hormonal imbalances can occur when the levels of hormones in the bloodstream are either excessive or insufficient. These imbalances can have significant repercussions on various bodily functions due to the pivotal role hormones play in regulating physiological processes. Hormones are chemical messengers produced by glands within the endocrine system, and maintaining their optimal levels is crucial for overall health. While hormonal imbalances may occur at least once or twice in a person's life, they have become more commonplace in today's fast-paced modern lifestyle. These imbalances are frequently encountered during significant life stages such as puberty, menstruation, and pregnancy.

Keywords: Hormonal imbalance, Menstruation, Pregnancy, Hormones, Puberty

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Introduction

Hormones serve as the body's chemical messengers, transmitting vital information to cells via the bloodstream. They typically interact with specific receptors on target cells. These hormones are produced by the endocrine glands and travel throughout the body, reaching various tissues and organs through the circulatory system. Each hormone has a distinct purpose, conveying essential messages to specific regions of the body (Naveed *et al.*, 2015). For example, the pineal gland produces and releases the hormone

melatonin, which circulates in the cerebrospinal fluid and bloodstream around the brain, where receptors await. When melatonin levels rise, as they do during rest, menstruation, and pregnancy, the body receives signals for specific physiological responses. Nevertheless, some individuals contend with persistent and unpredictable hormonal challenges (Roop, 2018).

Hormones are the body's primary regulators, responsible for maintaining and harmonizing nearly every major system. They play a pivotal

role in managing mood, determining how the body responds to stress, and influencing the digestion and utilization of food (Treasure *et al.*, 2022). Moreover, hormones are essential for governing growth and development.

Hormonal Imbalance

When the body fails to produce hormones at the appropriate levels, it results in a condition known as hormonal imbalance. This imbalance can manifest in various ways, with some cases involving an excess of a specific hormone while others exhibit a deficiency. The specific hormone that is out of balance plays a pivotal role in shaping the symptoms and associated health risks (Gupta and Pushkala, 2018).

While certain common life events such as menopause or pregnancy can trigger hormonal imbalances, it is important to recognize that hormonal abnormalities can affect individuals of all genders and age groups. Hormone imbalances are not limited to a particular demographic; they can affect young people, adults, seniors, and even children. Due to the diverse functions of hormones in the body, there is no single method to identify a hormonal imbalance. The symptoms of such imbalances can vary widely and encompass a broad spectrum of conditions. This variability underscores the importance of regular testing, especially when unusual symptoms emerge (Gupta and Pushkala, 2018).

Hormone imbalance due to Stress and Sleep: Sleep and rest are essential components of a healthy, fulfilling, and joyful life. Sleep plays a vital role in the body's processes of repair and rejuvenation. Therefore, a lack of sleep can disrupt various metabolic functions. Over time and with age, these disturbances tend to become more pronounced. It is challenging to determine whether a lack of sleep causes hormone imbalances, if hormone imbalances cause sleep disturbances, or if insomnia is a result of this complex interplay. Notably, sleep-related issues are more frequently reported by women, who generally, throughout most life stages, tend to sleep more than men

(Dorsey *et al.*, 2021). In fact, women are twice as likely to suffer from insomnia compared to men.

The hormone estrogen has a direct link to sleep regulation (Morssinkhof *et al.*, 2020). Any fluctuations or decreases in estrogen levels due to physical stressors such as excessive exercise, low-fat or low-carbohydrate diets, undereating or fasting, and significant weight loss can lead to feelings of anxiety, restlessness, and disruptions in sleep (De *et al.*, 2022). Disturbed sleep patterns can also impact fertility by altering ovulation patterns. Leptin, a hormone derived from adipose tissue, is closely associated with both sleep and fertility (Roop, 2018; De *et al.*, 2022). It plays a role in suppressing appetite (Roop, 2018), but normal sleep is necessary to produce adequate levels of leptin. Reduced sleep duration can lead to decreased leptin production and increased levels of ghrelin (Beroukhim *et al.*, 2022). Ghrelin is a powerful appetite stimulant produced by specialized cells in the stomach and pancreas (Roop, 2018).

Leptin exerts its effects on the central nervous system by suppressing food intake and increasing energy expenditure. A deficiency in leptin can lead to increased appetite and obesity (Morsinkhof *et al.*, 2020; Dorsey *et al.*, 2021). Interestingly, elevated leptin concentrations have been linked to decreased appetite and a slowed basal metabolism, both associated with obesity. This may explain the adverse effects of high leptin levels on fertility (Beroukhin *et al.*, 2022), as significant hyperleptinemia in the bloodstream has been linked to female infertility (Roop, 2018). Leptin also indirectly regulates ovarian folliculogenesis by influencing the levels of LH (Luteinizing Hormone) and FSH (Follicle Stimulating Hormone). There is a moderate inverse relationship between leptin levels, the timing of LH surges, and ovulation. Therefore, disrupted sleep can affect leptin levels, subsequently impacting ovulation, leading to irregular menstrual cycles, and potentially reducing fertility or making conception more

challenging (Roop, 2018; Morssinkhof *et al.*, 2020).

Furthermore, women who work night shifts often experience disrupted menstrual cycles and difficulty maintaining regular sleep patterns due to irregular exposure to light and darkness. This irregularity can affect the production of the hormone melatonin in shift workers. Sleeplessness can lead to irritability and stress, often resulting in the prescription of antidepressants to alleviate stress. Prolonged stress can also lead to a decrease in progesterone levels. During the peri-menopausal phase, progesterone levels naturally decline, and stress can exacerbate this decline, particularly in women. Both age and stress contribute to reduced ovarian production of progesterone (Roop, 2018).

Hormone imbalance and precocious puberty: Puberty represents the transitional phase from childhood to adolescence, marking the onset of adult reproductive capability typically between the ages of 12 to 15 years (Calcaterra *et al.*, 2022). When this transition occurs unusually early, before the age of 8 to 9 years, it is referred to as precocious puberty. This early onset of puberty has been linked to heightened exposure to environmental estrogens, which have been documented to disrupt hormonal balance within the body (Roop, 2018; Calcaterra *et al.*, 2022).

Hormonal imbalance and memory: Excessive consumption of sugar and saturated fats, along with deficiencies in essential nutrients such as vitamin A, vitamin C, vitamin B₆, vitamin D₃, and zinc, can contribute to a decrease in progesterone levels (Ali *et al.*, 2018). This imbalance between progesterone and estrogen can lead to various health issues in women, including vaginal dryness, urinary infections, joint pain, and weight gain (Roop, 2018). These physical discomforts and imbalances can, in turn, contribute to sleep disturbances.

Furthermore, mild hypothyroidism has been linked to reduced progesterone production and sleep problems (Morssinkhof *et al.*, 2020).

Hypothyroidism can be induced by stress and exposure to various environmental chemicals. Prolonged and chronic stress can elevate cortisol and adrenaline levels from the adrenal glands, which are located on the kidneys. These elevated stress hormone levels can suppress the immune system and lead to sleeplessness in women (De *et al.*, 2022).

Hormone disturbance, weight gain and weight loss: Thyroid hormones play a crucial role in regulating the body's basal metabolic rate, which influences various physiological processes. Any deviation, whether a decrease (hypothyroidism) or an increase (hyperthyroidism) in their secretion, can lead to a range of physical changes.

Hypothyroidism is associated with symptoms such as weight gain, depression, hair loss, fatigue, constipation, dry skin, and intolerance to cold temperatures. Conversely, hyperthyroidism can lead to weight loss, heightened body temperature due to increased metabolism, elevated energy levels, and diarrhoea.

Imbalances in cortisol levels are also linked to changes in body weight, often related to estrogen dominance. Cortisol plays a pivotal role in regulating glucose and insulin levels, managing inflammation, facilitating bone matrix deposition, promoting muscle development, influencing mood and mental focus, enhancing stamina, affecting sex drive, and regulating sleep cycles.

Elevated stress levels can lead to fluctuations in cortisol levels, triggering disturbances in blood sugar and insulin regulation, food cravings, and the inhibition of thyroid function. Consequently, this can result in a decrease in metabolic activity and, subsequently, weight gain (Leeners *et al.*, 2017; Lund *et al.*, 2020).

Hormonal imbalance and insulin resistance (hyperinsulinemia): The pancreas produces insulin, a hormone responsible for regulating the metabolism of carbohydrates, proteins, and fats. After a meal, insulin promptly lowers blood glucose levels, a critical factor for maintaining optimal metabolism and overall health. Any

disruption in insulin production or utilization can give rise to various health issues (Unluhizarci *et al.*, 2021).

When the body loses its sensitivity to insulin signals, a condition known as insulin resistance develops. This condition results in elevated blood glucose levels and the accumulation of fat, which can contribute to obesity and the onset of type II diabetes. Insulin resistance also leads to increased levels of androgens, which may manifest as acne, infertility, facial hair growth, and hair loss on the scalp. Additionally, it can cause the development of dark skin patches on the neck or the appearance of skin tags. Insulin resistance is also associated with polycystic ovarian syndrome (PCOS) (Kim *et al.*, 2014; De *et al.*, 2021).

Hormone imbalance and polycystic ovarian syndrome (PCOS): Polycystic ovarian syndrome (PCOS) is an endocrine disorder commonly associated with menstrual irregularities, marked by chronic anovulation, hyperandrogenism, and infertility. Infertility and anovulation affect approximately 10% to 13% of women in their childbearing years. PCOS is also linked to various metabolic disorders (Roop, 2018). While some women with PCOS exhibit polycystic ovaries, others may have a single ovarian cyst.

The primary culprit behind PCOS is often insulin resistance, a condition that impairs the body's ability to process and absorb glucose. Ovaries are particularly sensitive to insulin, and when there is an imbalance in insulin levels, the ovaries respond by producing more ovarian hormones. This hormonal imbalance can disrupt various metabolic processes within the body. Consequently, PCOS may lead to symptoms such as acne, infertility, facial hair growth, hair loss on the scalp, and the development of dark skin patches on the neck or skin tags. Additional factors contributing to PCOS include elevated testosterone levels and potential mutations in Luteinizing Hormone and/or its receptor (Khmil *et al.*, 2020).

Hormone disturbance and digestive problems:

Numerous reports suggest that variations in estrogen and progesterone levels can contribute to an increase in gastrointestinal symptoms, both painful and non-painful, during the menstrual cycle and the perimenopausal (early menopause) transition. This phenomenon is observed in women with or without Irritable Bowel Syndrome (IBS). Imbalances in these hormones have been linked to a range of symptoms, including headaches, bloating, weight gain, mild to severe cramps, backaches, cravings for salty or sweet foods, temperature sensitivity, and allergic reactions (Roop, 2018; Unluhizarci *et al.*, 2021).

Hormonal imbalance and depression: Estrogen plays a crucial role in maintaining adequate levels of serotonin, a neurotransmitter known for its ability to prevent symptoms such as bloating, mood swings, irritability, headaches, and depression (Roop, 2018). When estrogen levels decrease, it can lead to a reduction in serotonin concentration, potentially resulting in feelings of depression, anxiety, and sleep disturbances (Naveed *et al.*, 2015). Estrogen administration has been reported to enhance serotonin availability by reducing serotonin breakdown and influencing the mRNA and protein levels of various serotonin markers. These effects can directly impact mood disorders in women, including conditions such as premenstrual disorders, depression during pregnancy, postpartum depression, and mood changes during the menopausal transition (Trifu *et al.*, 2020).

In response to specific physiological and pathological stimuli, progesterone, as well as synthetic progestational agents, modulate the synthesis and release of various neurotransmitters and neuropeptides (Roop, 2018). Progesterone affects GABA (gamma-aminobutyric acid) receptors in the brain, promoting a calming effect on the body. This can help alleviate mood swings, irritability, and depression. Thus, any disruption in the balance between estrogen and progesterone may have an

impact on mood and potentially lead to depression.

Elevated cortisol levels can also contribute to insomnia, depression, anxiety, and difficulty in managing stress. Additionally, a decrease in thyroid hormone levels can lead to a reduced metabolic rate and potentially contribute to feelings of depression (Noble, 2005).

Hormone imbalance and hairs on the body (hirsutism): Hirsutism is a condition characterized by the presence of terminal coarse hairs in females, typically in a distribution pattern resembling that of males. It is estimated to affect approximately 5-10% of women globally. The underlying causes of hirsutism can be attributed to either an increased production of androgens (male hormones) or heightened sensitivity of the hair follicles to androgens circulating in the body. These factors may be linked to metabolic disorders or exposure to environmental pollutants (Mara *et al.*, 2016).

Hormone imbalance and allergy: Numerous reports have suggested that allergies, autoimmune diseases, and hypothyroidism are more prevalent among women, often attributed to hormonal imbalances. These conditions can be associated with severe symptoms, which may carry significant implications, including the risk of pregnancy loss and the imposition of substantial psychological and physical burdens (Shah, 2012).

Hormone imbalance, hysterectomy and osteoporosis: Environmental changes and alterations in dietary habits have given rise to reproductive and reproductive tract-related issues. Xenoestrogens present in the diet can contribute to estrogen dominance within the body, which has been identified as a major factor in the development of hypothyroidism, fibroids, endometriosis, and breast cancer. Consequently, surgical procedures like hysterectomy (removal of the uterus) or ovariectomy (removal of the ovaries), or both, can result in a sudden decrease in estrogen, progesterone, and testosterone levels. This decline can lead to reduced bone density,

potentially causing osteoporosis, as well as muscle loss, heart palpitations, increased stress, and feelings of depression (Roop, 2018; Cheng *et al.*, 2022).

Treatment for a hormonal imbalance

Hormonal abnormalities can be treated in various ways, and the specific treatment approach depends on the hormone that is out of balance and the underlying cause of the imbalance. The duration of treatment may also vary depending on whether the hormonal imbalance is related to a life event, such as menopause, or if it stems from a genetic condition (Gupta, 2022).

One common treatment for hormonal imbalances is hormone therapy. For instance, women experiencing uncomfortable menopausal symptoms may opt for estrogen therapy. Men with low testosterone levels or teenagers experiencing delayed puberty often choose testosterone therapy. Individuals with hypothyroidism may benefit from taking thyroid hormones. These hormone replacement therapies can be administered orally, topically, or intravenously. It is crucial to consult a healthcare provider who can determine the appropriate dosage based on test results and hormone levels, ensuring the precise amount of added hormones needed to restore balance (Davis *et al.*, 2012).

The hormones used in these treatments can come in various forms. Bioidentical hormones, for example, are synthesized in a laboratory and have the same chemical structure as the hormones naturally produced by the body. These hormones, such as synthetic forms of estrogen derived from soy or yams, can closely match the body's hormones, despite being created in a lab (Charkoudian *et al.*, 2014).

Pharmaceutical companies offer bioidentical hormones in various formulations with different proportions, like tri-estrogen (containing 10% estrone, 10% estradiol, and 80% estriol) or bi-estrogen (combining estriol and estradiol in varying percentages) (Janicki and Schupf, 2010).

On the other hand, natural hormones are not synthesized in a laboratory but are naturally occurring substances derived from animals or plants. While some individuals prefer the idea of natural hormones, it is important to understand that natural hormones may not provide the same precise match as bioidentical hormones (Moran *et al.*, 2011).

Lifestyle modification: Lifestyle modifications can play a significant role in managing hormonal imbalances and promoting overall hormonal health. Consume a well-balanced diet rich in whole foods, including fruits, vegetables, lean proteins, whole grains, and healthy fats. Incorporate high-fiber foods to support digestive health, as gut health can influence hormonal balance. Reduce the intake of sugary and processed foods, as excessive sugar consumption can affect insulin levels and lead to hormonal imbalances. Include sources of healthy fats like avocados, nuts, and fatty fish, which are important for hormone production.

Exercise: Engaging in regular physical activity can help regulate hormones, improve insulin sensitivity, and support overall health. Aim for a mix of aerobic exercise, strength training, and flexibility exercises.

Stress management: Chronic stress can disrupt hormonal balance. Practice stress-reduction techniques such as meditation, deep breathing, yoga, or mindfulness to manage stress effectively.

Adequate Sleep: Ensure you get enough quality sleep as sleep plays a crucial role in hormone regulation. Aim for 7-9 h of uninterrupted sleep each night.

Maintain a Healthy Weight: Achieving and maintaining a healthy weight can help regulate hormones, particularly insulin and sex hormones.

Limit Alcohol and Caffeine: Excessive alcohol and caffeine intake can disrupt hormonal balance. Limit consumption and opt for healthier alternatives like herbal tea or water.

Hydration: Stay well-hydrated by drinking enough water throughout the day. Proper hydration

supports various bodily functions, including hormonal regulation.

Avoid Toxins: Minimize exposure to environmental toxins and endocrine-disrupting chemicals found in some plastics, pesticides, and personal care products.

Nutritional Supplements: Consult with a healthcare provider to determine if specific nutritional supplements or vitamins, such as vitamin D, omega-3 fatty acids, or herbal supplements, may help support hormonal balance.

Regular Medical Check-ups: Visit your healthcare provider regularly for check-ups and screenings, especially if you suspect a hormonal imbalance. They can help diagnose and manage any hormonal issues.

Hormone-specific Approaches: For conditions like polycystic ovarian syndrome (PCOS), managing insulin resistance through diet and exercise can be particularly beneficial. Discuss hormone-specific lifestyle modifications with a healthcare provider (Moran *et al.*, 2011; Lim *et al.*, 2019).

Hormone Replacement Therapy: Hormone replacement therapy (HRT) is a medical treatment commonly used to address hormonal imbalances, particularly in conditions such as menopause, low testosterone in men, and certain thyroid disorders. It involves the administration of hormones to restore hormonal balance in the body. An overview of hormone replacement therapy is given in Table 1 (Harper-Harrison and Shanahan, 2018).

(i) Menopausal Hormone Replacement Therapy (HRT): Estrogen is often prescribed to alleviate symptoms of menopause, such as hot flashes, vaginal dryness, and mood swings. For women with a uterus, combined therapy includes both estrogen and progestin to reduce the risk of endometrial cancer associated with estrogen use. Medications like raloxifene may be prescribed to manage menopausal symptoms and support bone health without the use of traditional HRT (Chlebowski and Anderson, 2014).

Table 1: Summarizing the information about hormone replacement therapy (HRT)

Aspects	Description
Definition	Hormone replacement therapy (HRT) refers to the use of medications containing female hormones to replace the ones the body no longer makes after menopause.
Purpose	HRT is primarily used to alleviate the symptoms of menopause, such as hot flashes, night sweats, and vaginal dryness. It can also help prevent bone loss and reduce the risk of fractures.
Types of HRT	Combination HRT: Contains both estrogen and progesterone. Estrogen-only HRT: Typically used for women who have had a hysterectomy. Low-dose vaginal products: Includes creams, rings, and tablets for vaginal dryness.
Benefits	Reduces the frequency and intensity of hot flashes. Helps manage vaginal dryness and discomfort during intercourse. Reduces the risk of osteoporosis and fractures.
Risks	May increase the risk of stroke and blood clots. Can elevate the risk of certain cancers, including breast cancer. Long-term use may lead to an increased risk of heart disease and dementia.
Considerations	HRT should be used at the lowest effective dose for the shortest possible duration. It's essential to discuss the potential risks and benefits with a healthcare provider before starting HRT. Regular check-ups and follow-ups are necessary to monitor any potential side effects.

(ii) *Testosterone Replacement Therapy (TRT)*: TRT is used to address low testosterone levels in men, a condition known as hypogonadism. It can help improve energy, libido, muscle mass, and mood (Tsametis and Isidori, 2018).

(iii) *Thyroid Hormone Replacement Therapy*: Thyroid hormone replacement is used to treat hypothyroidism, a condition where the thyroid gland does not produce enough thyroid hormones (T3 and T4). Levothyroxine is a common medication prescribed for this purpose (Wiersinga, 2002).

(iv) *Bioidentical Hormone Replacement Therapy (BHRT)*: BHRT involves using hormones that are chemically identical to those naturally produced by the body. These hormones are often customized based on an individual's hormone levels and symptoms (Files *et al.*, 2011).

(v) *Adrenal Hormone Replacement*: In some cases, such as adrenal insufficiency, hormone replacement therapy may involve the administration of adrenal hormones like cortisol (Pazderska and Pearce, 2017).

(vi) *Guided by Hormone Testing*: Hormone replacement therapy is typically guided by

hormone level testing to determine the appropriate dosage and ensure optimal balance. It is important to note that hormone replacement therapy is not suitable for everyone, and its use should be carefully considered and discussed with a healthcare provider. The decision to pursue HRT should take into account an individual's medical history, current health status, and the potential risks and benefits associated with treatment.

HRT may carry certain risks and side effects, including an increased risk of blood clots, stroke, heart disease, and breast cancer in some cases. Therefore, it is crucial to have a thorough discussion with a healthcare provider, including the potential benefits and risks, before starting hormone replacement therapy. Additionally, regular monitoring and follow-up appointments are typically recommended during HRT to adjust treatment as needed (Bielohuby *et al.*, 2012).

Medication:

The choice of medication for the treatment of hormonal imbalances depends on the specific hormone(s) involved and the underlying condition. Figure 1 depicts some common medications used to address hormonal imbalances.

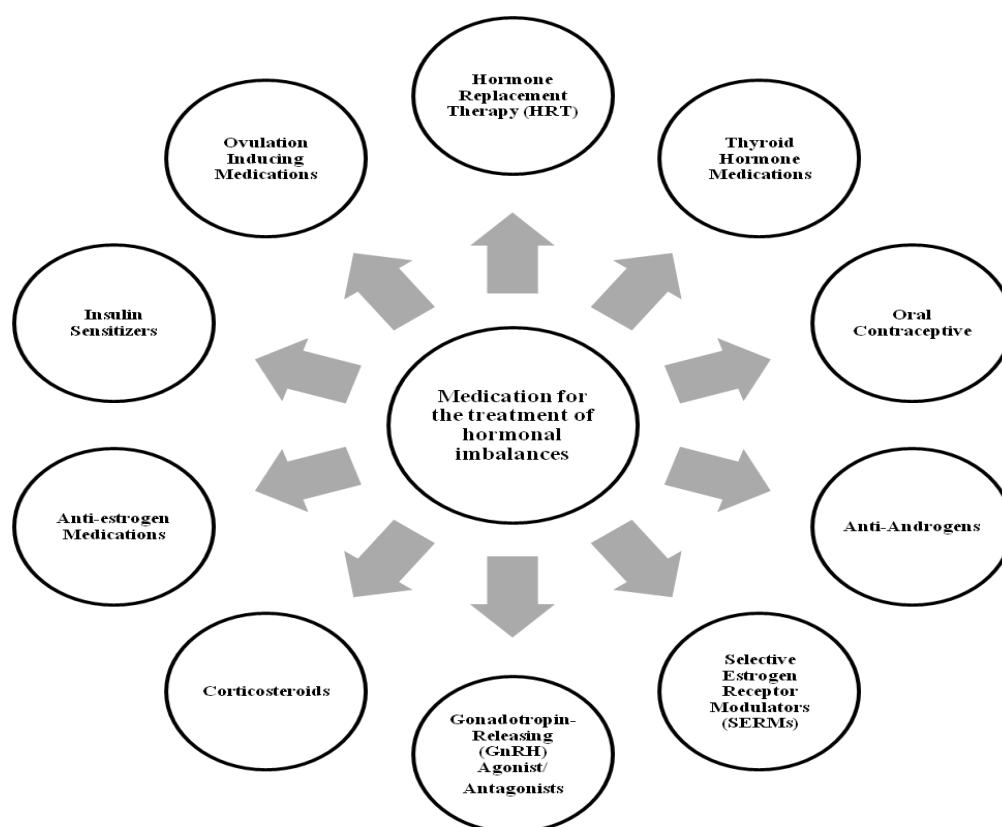


Fig. 1: Medications for the treatment of hormonal imbalances.

(i) **Hormone Replacement Therapy (HRT)**: Used to alleviate symptoms of menopause, estrogen therapy may come in various forms, including pills, patches, creams, and vaginal rings. Often prescribed in combination with estrogen therapy for women with a uterus to reduce the risk of endometrial cancer. Prescribed for men with low testosterone levels to address symptoms like low energy, reduced libido, and muscle loss.

(ii) **Thyroid Hormone Medications**: Levothyroxine, this synthetic form of thyroid hormone (T4) is used to treat hypothyroidism (underactive thyroid) and is typically taken orally.

(iii) **Oral Contraceptives**: Birth control pills contain synthetic hormones, including estrogen and progestin. They are used not only for contraception but also to regulate menstrual cycles and manage conditions like polycystic ovarian syndrome (PCOS).

(iv) **Anti-Androgens**: Used to reduce androgen (male hormone) levels and manage conditions like

hirsutism (excessive hair growth) and acne in women. Often used in combination with estrogen in certain birth control pills to treat symptoms related to excess androgens.

(v) **Selective Estrogen Receptor Modulators (SERMs)**: A SERM used in the treatment of osteoporosis and to reduce the risk of breast cancer in postmenopausal women (Naveed *et al.*, 2015).

(vi) **Gonadotropin-Releasing Hormone (GnRH) Agonists/Antagonists**: Leuprolide and Goserelin are used to suppress the production of sex hormones (estrogen and testosterone) and are commonly used in the treatment of conditions like endometriosis and certain types of prostate cancer (Wu *et al.*, 2021).

(vii) **Corticosteroids**: Prednisone and Hydrocortisone are prescribed to address hormonal imbalances related to the adrenal glands, such as Addison's disease and adrenal insufficiency.

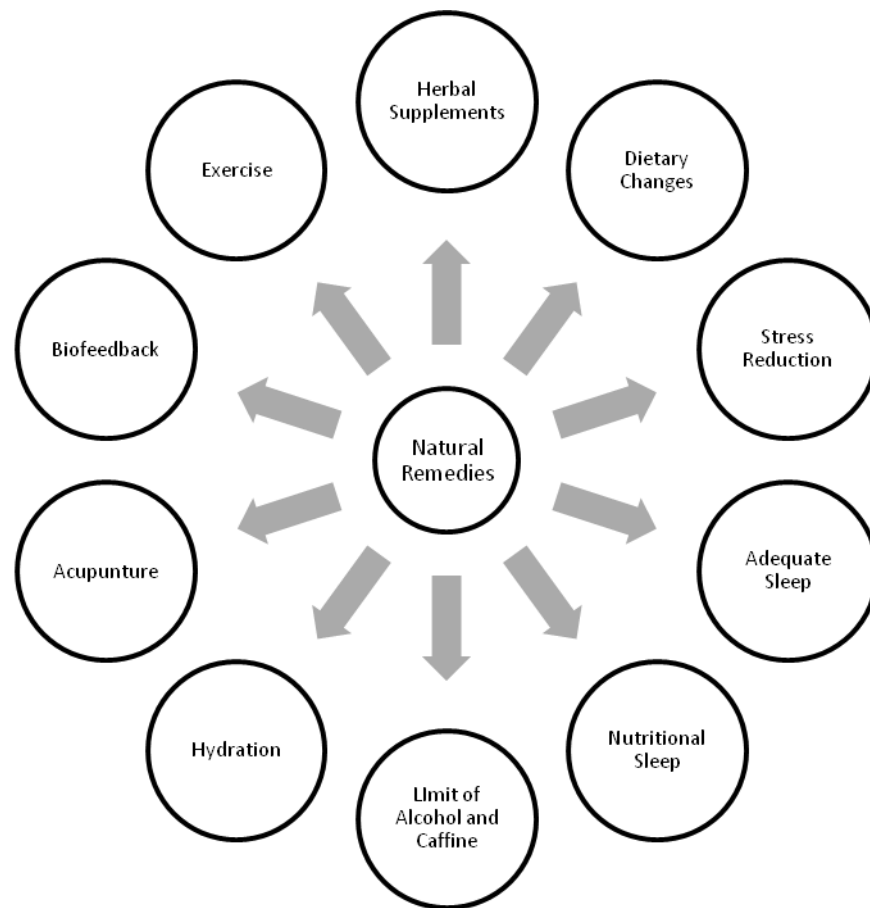


Fig. 2: Natural Remedies for the treatment of hormonal imbalance.

(viii) **Anti-estrogen Medications:** Tamoxifen and Aromatase Inhibitors are used in the treatment of hormone receptor-positive breast cancer to block the effects of estrogen on cancer cells.

(ix) **Insulin Sensitizers:** Metformin is often used to manage insulin resistance associated with conditions like polycystic ovarian syndrome (PCOS) and type 2 diabetes.

(x) **Ovulation Inducing Medications:** Clomiphene Citrate and Letrozole are prescribed to induce ovulation in women with infertility issues related to hormonal imbalances.

It is essential to remember that these medications should only be used under the guidance and prescription of a healthcare provider. Treatment plans should be tailored to individual needs and monitored closely to ensure effectiveness and safety. Additionally, potential

side effects and interactions with other medications should be discussed with a healthcare professional (Wu *et al.*, 2021).

Natural Remedies

Natural remedies and lifestyle changes can complement conventional treatments for hormonal imbalances. While they may not replace medical interventions when necessary, they can help support hormone balance and overall well-being. Figure 2 illustrates some natural remedies and practices that may help.

(i) **Dietary Changes:** Consume a diet rich in whole foods, including fruits, vegetables, whole grains, lean proteins, and healthy fats. A balanced diet provides essential nutrients for hormone production and regulation. Some foods contain natural compounds called phytoestrogens (e.g., soy, flaxseeds) that can mimic the effects of

estrogen in the body and may help alleviate menopausal symptoms in women.

(ii) *Herbal Supplements*: Black Cohosh is used to relieve menopausal symptoms, such as hot flashes and mood swings. Red Clover contains phytoestrogens and is used to manage menopausal symptoms. Chasteberry (Vitex) may help regulate menstrual cycles and alleviate symptoms of premenstrual syndrome (PMS).

(iii) *Exercise*: Regular physical activity can help improve insulin sensitivity, reduce stress, and promote overall hormone balance. Aim for a combination of aerobic, strength, and flexibility exercises.

(iv) *Stress Reduction*: Practice stress-reduction techniques such as meditation, deep breathing, yoga, tai chi, or mindfulness to lower cortisol levels and improve hormonal balance.

(v) *Adequate Sleep*: Prioritize quality sleep to support hormone regulation and overall health. Aim for 7-9 h of restful sleep each night.

(vi) *Nutritional Supplements*: Certain supplements, such as omega-3 fatty acids, vitamin D, and magnesium, may help support hormonal balance and overall health. Consult a healthcare provider before starting any supplements.

(vii) *Limit Alcohol and Caffeine*: Reduce or eliminate alcohol and caffeine consumption, as they can disrupt hormonal balance and sleep patterns.

(viii) *Hydration*: Stay well-hydrated by drinking plenty of water throughout the day, as dehydration can affect hormone function.

(ix) *Acupuncture*: Acupuncture may help regulate hormonal imbalances, alleviate symptoms, and improve overall well-being.

(x) *Biofeedback*: Biofeedback techniques can help individuals gain control over certain physiological functions, potentially reducing stress and its impact on hormones.

(xi) *Mindful Eating*: Practice mindful eating to

foster a healthy relationship with food and reduce emotional eating, which can impact hormones.

(xii) *Avoid Endocrine-Disrupting Chemicals*: Minimize exposure to environmental toxins, such as BPA, phthalates, and pesticides, which can disrupt hormone function.

(xiii) *Consult a Naturopathic or Integrative Healthcare Provider*: Consider consulting a healthcare provider with expertise in natural and integrative medicine for personalized guidance and treatment options.

Remember that the effectiveness of natural remedies may vary from person to person, and it is essential to consult with a healthcare provider before making significant changes to your diet or starting any new supplements or herbal treatments, especially if you have underlying health conditions or are taking medications. Your healthcare provider can help you create a tailored plan for managing hormonal imbalances (Arentz *et al.*, 2014; Gottfried, 2020; Balkrishna *et al.*, 2023).

Surgery:

Surgery is not a primary treatment for hormonal imbalances in most cases. Hormonal imbalances are typically managed through medical interventions, lifestyle modifications, and hormone replacement therapy (HRT) when necessary. Surgery may be considered in specific situations where it directly addresses the underlying cause of the hormonal imbalance. Figure 3 depicts some instances where surgery may be used.

(i) *Hysterectomy*: In some cases, a hysterectomy (removal of the uterus) may be recommended to address certain gynecological conditions that cause hormonal imbalances, such as uterine fibroids, endometriosis, or certain types of cancer. However, this procedure is only performed when conservative treatments have failed or when there is a compelling medical reason.

(ii) *Oophorectomy*: An oophorectomy involves the

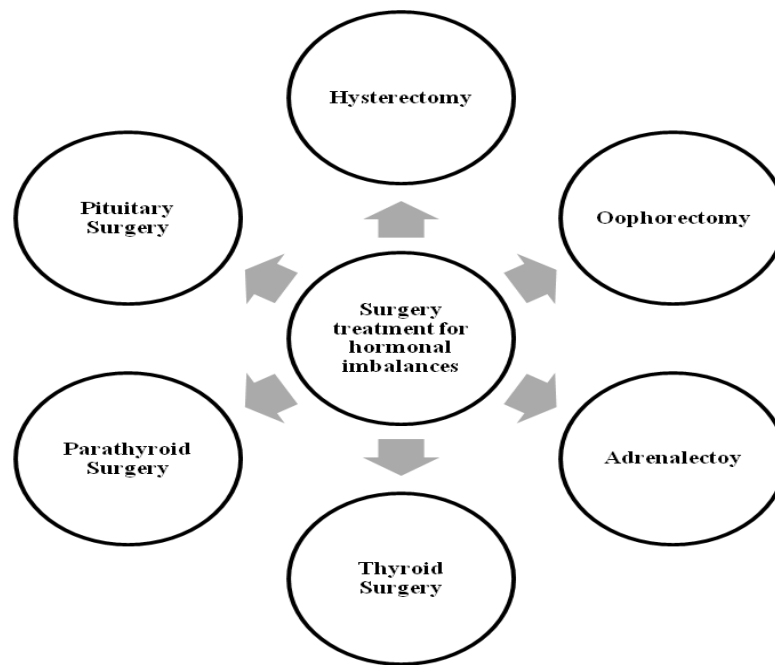


Fig. 3: Surgery treatment for hormonal imbalances.

removal of one or both ovaries. It may be performed to treat conditions like ovarian cysts, ovarian cancer, or polycystic ovarian syndrome (PCOS) when other treatments are ineffective or when cancer is present.

(iii) **Adrenalectomy:** In cases of adrenal gland disorders, such as Cushing's syndrome or adrenal tumors, surgical removal of the adrenal glands (adrenalectomy) may be necessary to restore hormonal balance (Cameron and Braunstein, 2004).

(iv) **Thyroid Surgery:** Thyroid surgery (thyroidectomy) may be recommended for individuals with thyroid disorders, such as thyroid nodules or thyroid cancer. Depending on the extent of surgery, patients may need thyroid hormone replacement therapy afterward.

(v) **Parathyroid Surgery:** In cases of hyperparathyroidism, surgery to remove one or more overactive parathyroid glands may be required to regulate calcium and parathyroid hormone levels (Toneto *et al.*, 2016).

(vi) **Pituitary Surgery:** In some rare cases, surgery may be needed to remove tumors or growths on

the pituitary gland that are causing hormonal imbalances. This procedure is known as transsphenoidal pituitary surgery.

It is essential to note that surgery is usually considered a last resort when other conservative treatments have failed or when there is a severe medical need. Surgical interventions carry risks and potential complications, so they are typically reserved for cases where the benefits outweigh the risks.

Before undergoing any surgery for hormonal imbalance, individuals should have a comprehensive evaluation by a healthcare provider who specializes in the condition, and the decision should be made collaboratively between the patient and their medical team. In many cases, hormonal imbalances can be effectively managed with less invasive treatments, lifestyle modifications, or hormone replacement therapy.

Lifestyle changes for specific hormonal issues

Lifestyle changes can play a significant role in managing specific hormonal issues and addressing hormonal imbalances. Figure 4 depicts some

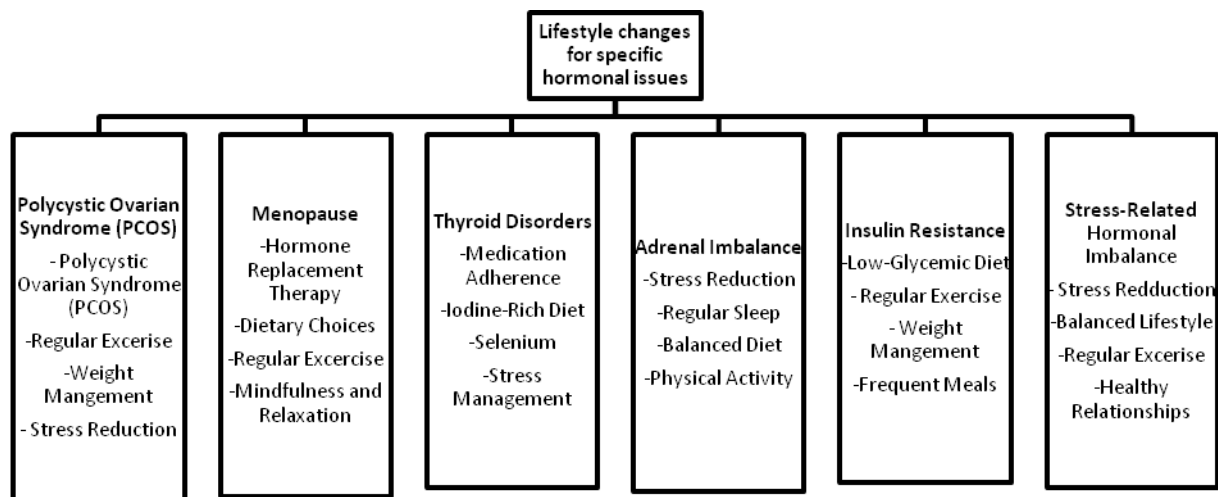


Fig. 4: Lifestyle changes for specific hormonal issues.

Table 2: Past, present and future development in the treatment of hormonal imbalance in female (Rouse, 1998; Boothby *et al.*, 2004; Akturk *et al.*, 2018)

Aspect	Past Development	Present Development	Future Development
Hormone Replacement Therapy (HRT)	HRT was introduced as the primary treatment for menopausal symptoms and associated health risks.	HRT formulations have evolved to include various delivery methods such as patches, gels, and low-dose vaginal products to minimize risks.	Future developments focus on personalized HRT to optimize efficacy while reducing potential adverse effects. Newer delivery systems and tailored hormonal combinations are being explored.
Alternative Therapies	Herbal remedies and dietary changes were commonly used as alternatives to HRT, although their efficacy was not extensively supported by scientific evidence.	Integrative approaches combining traditional and complementary therapies, lifestyle modifications, and nutritional supplements are gaining popularity.	Research is focusing on novel non-hormonal therapies, including targeted medications and interventions that aim to regulate hormone production and balance without the use of traditional HRT.
Awareness and Education	Limited awareness and understanding of hormonal imbalances led to delayed diagnoses and suboptimal treatment strategies.	Increased awareness and education have led to improved recognition of hormonal imbalances, facilitating earlier interventions and holistic management approaches.	Strategies aim to further enhance awareness through community-based education programs, targeted campaigns, and accessible resources, promoting comprehensive understanding and proactive management of hormonal health

lifestyle modifications tailored to specific hormonal concerns.

Always consult with a healthcare provider before making significant lifestyle changes, especially if you have underlying health conditions or are taking medications. Your healthcare provider can provide personalized guidance and monitor your progress in managing hormonal imbalances through lifestyle modifications (Bhadra, 2020; Pataky *et al.*, 2021; Sorensen, 2002).

Past, Present and Future development for the treatment of hormonal imbalance in female:

Table 2 provides an overview of the historical, current, and potential future developments in the treatment of hormonal imbalances in females, highlighting the evolution of treatment approaches and the ongoing focus on personalized, integrative, and non-hormonal therapeutic options.

Conclusion

In conclusion, new developments in the management of female hormone imbalance have led to the development of therapeutic approaches that show promise for treating a variety of illnesses. Effective management of hormonal abnormalities is now possible with a wide range of treatments, ranging from conventional hormone replacement therapy to cutting-edge techniques including hormone-modulating medications and targeted therapies.

Because treatment programmes can now be customised to meet the requirements of individual patients based on variables including hormone levels, underlying illnesses, and treatment goals, these advancements highlight the significance of personalised medicine. Furthermore, dietary interventions, lifestyle changes, and alternative therapies might be used with conventional treatments to enhance patient results overall.

But even with these improvements, problems including adverse effects, long-term safety issues, and getting specialist treatment still exist. To

improve our understanding of the mechanisms behind hormonal imbalance and to provide more focused and efficient treatment options, further study is required.

There is hope for higher quality of life and better control of female health concerns which is due to the developing field of therapy for hormone imbalances. To ensure that women receive the complete and individualised treatment they require, it will be imperative that physicians, researchers, and patients continue to collaborate in order to drive future development.

Ethical Statement

This is a review article hence no Ethical Approval needed.

Author Contributions

Each author has contributed equally to the study's planning, writing, and editing. All authors have read and agreed to the published version of the manuscript.

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Conflict of Interest

The authors declare no conflicts of interest.

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