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Review Article

Hormone Imbalance A Cause for Concern in Women

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ABSTRACT

The body's endocrine glands secrete hormones, which are complex chemical messengers that are essential to many metabolic processes as well as a person's ability to procreate. Excessive or insufficient hormone imbalances can have serious effects on the entire body. Hormone levels usually fluctuate slightly as a result of aging. Adopting a variety of ways to increase cattle, dairy, poultry, and agricultural productivity has become essential due to the growing world population. Environmental deterioration has been exacerbated by the extensive use of pesticides, insecticides, herbicides, rodenticides, and a variety of other chemical agents due to this necessity. The general well-being of people is negatively impacted. The body's endocrine glands secrete hormones, which are complex chemical messengers that are essential to many metabolic processes as well as a person's ability to procreate. Excessive or insufficient hormone imbalances can have serious effects on the entire body. Hormone levels usually fluctuate slightly as a result of aging. Adopting a variety of ways to increase cattle, dairy, poultry, and agricultural productivity has become essential due to the growing world population. Environmental deterioration has been exacerbated by the extensive use of pesticides, insecticides, herbicides, rodenticides, and a variety of other chemical agents due to this necessity. The general well-being of people is negatively impacted by such, The Another significant concern is the prevalence of unemployment and the severe fight for livelihoods, which has created humans increasingly irritable and prone to stress, prompting modifc.

INTRODUCTION

Definition:

The Hormonal imbalance in women refers to a disruption in the normal production, secretion, or control of one or more hormones that are required

for reproductive, metabolic, and general physiological health. It happens when hormones including estrogen, progesterone, androgens, thyroid hormones, insulin, or cortisol are either oversecreted (hyper-secretion) or undersecreted (hyposecretion). Menstrual cycle irregularities,

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infertility, weight swings, mood disorders, metabolic disorders, and an elevated risk of chronic conditions are all signs of this imbalance.

Key Hormonal Imbalances Affecting Women Concerning Cancer:

Estrogen, Progesterone, Testosterone, Follicle-Stimulating Hormone (FSH), Luteinizing Hormone (LH), Prolactin, Thyroid hormones, Cortisol, Insulin.

Common Symptoms:

1. Menstrual Irregularities Irregular or missed periods (amenorrhea) Heavy or prolonged bleeding (menorrhagia) Painful periods (dysmenorrhea)
2. Reproductive and Sexual Changes Infertility or difficulty conceiving Low libido or sexual dysfunction Vaginal dryness (especially during menopause)
3. Skin and Hair Changes Acne or oily skin Hair loss or thinning (scalp) excessive facial/body hair (hirsutism)
4. Metabolic Symptoms Unexplained weight gain or difficulty losing weight Fatigue or low energy Insulin resistance or increased appetite
5. Mood and Cognitive Symptoms Mood swings, irritability, anxiety, or depression Sleep disturbances or insomnia Poor concentration or memory problem. (brain fog)
6. Other physical changes hot flashes and night sweats (in menopause) breast tenderness or changes in breast tissue changes in skin texture or pigmentation

Health Significance:

1. **Reproductive Health:** Hormonal imbalance is a major cause of infertility, polycystic ovary syndrome (PCOS), and menstrual disorders. It

can lead to complications such as miscarriage or irregular ovulation.

2. **Metabolic and Cardiovascular Risks:** Imbalances, particularly in estrogen and insulin, increase risks of obesity, diabetes, and heart disease. PCOS and menopause are associated with long-term metabolic syndrome.
3. **Bone Health:** Low estrogen levels (especially during menopause) accelerate bone loss, increasing the risk of osteoporosis and fractures.
4. **Mental and Emotional Well-being:** Hormonal fluctuations influence neurotransmitters, contributing to depression, anxiety, and sleep disturbances.

Overall Quality of life

1. Major Hormonal Control System — The HPO Axis :

Introduction: - The Hypothalamic–Pituitary–Ovarian (HPO) Axis is the key hormonal regulatory system that controls the menstrual cycle, ovulation, and fertility in women. It works like a communication network between the brain and the ovaries, ensuring that reproductive functions proceed in a normal cycle.

Step 1 — Hypothalamus : The hypothalamus is a region in the brain that works as the main controller of the endocrine system. It secretes a hormone known as GnRH Gonadotropin Releasing Hormone in pulses, which means that it is delivered in brief bursts as opposed to continually. These pulses are important because the following organ, the pituitary, reacts to the frequency and amplitude of GnRH pulses.



Step 2 — Anterior Pituitary Gland The anterior pituitary, located just below the brain, receives the GnRH signal. In response, it secretes two key reproductive hormones:

1. FSH (Follicle-Stimulating Hormone)
2. LH (Luteinizing Hormones): These hormones enter the bloodstream and travel to the ovaries

Step 3 — Ovarian Response The ovaries have special cells with receptors for FSH and LH. FSH acts mainly on granulosa cells → promotes follicle growth and estrogen production. LH acts mainly on theca and luteal cells → triggers ovulation and progesterone production. Together, these ovarian hormones — estrogen and progesterone — prepare the uterus for potential pregnancy.

Step 4 — Feedback Regulation Estrogen and Progesterone produced by the ovaries travel back

to the hypothalamus and pituitary through the blood. They regulate their own production by feedback loops

Negative Feedback: When estrogen/progesterone levels are high, they suppress GnRH, FSH, and LH release → prevents overproduction.

Positive Feedback: Mid-cycle, a sudden rise in estrogen triggers an LH surge, which causes ovulation.

Function Summary:

- The HPO Axis ensures:
- Regular menstrual cycles Proper ovulation
- Balanced hormone secretion
- Fertility and reproductive health

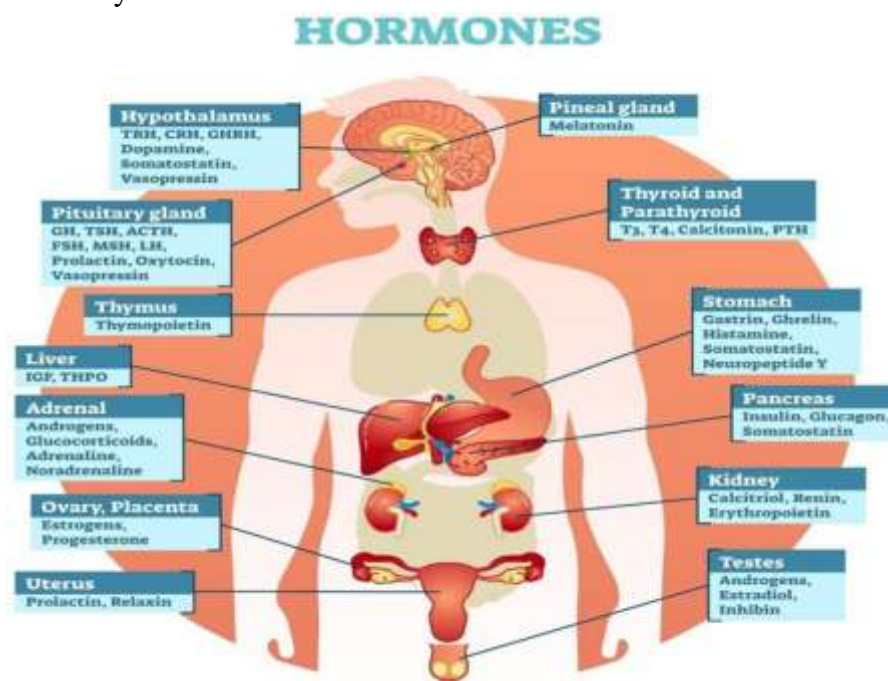


FIG NO .1.2

This image is a diagram of the human endocrine system, showing the major glands and the hormones they produce. The endocrine system releases hormones into the bloodstream to regulate

body functions such as growth, metabolism, stress response, reproduction, and sleep.

MECHANISM OF ACTION :

Hormonal Imbalance in Women –

Source	Role	Mechanism	Imphanme	Imbalance
ESTROGEN (Estradiol, Estrone, Estrinol)	Ovaries, placenta, adrenal gland	Regulates menstrual cycle, bones, heart, skin	Binds to ER α /ER β estrogen receptors	Weight gain, mood swings, fibroids
PROGESTERONE Corpus luteum (ovary)	Corpus luteum, placenta	Prepares uterus for pregnancy, stabilize lining	Binds to PR-A/PR-B receptors	Hot flashes, bone loss, irregular periods
FSH Anterior pituitary Stimulating Hormone	Anterior pituitary	Follicle growth, estrogen production	Binds to FSH GPCR, activate cAMP	Ovarian failure (FSH \uparrow menopause)
LH Anterior pituitary	Anterior pituitary	Triggers ovulation, corpus luteum	Binds to LH GPCR, activate protein kinase A	PCOS (with high FSH \rightarrow LH)
PROLACTIN Anterior pituitary	Anterior pituitary	Milk production, suppresses ovulation	JAK-STAT pathway, induces milk protein	Poor milk production, poor let-down
OXYTOCIN Posterior pituitary	Posterior pituitary	Labor contractions, milk let-down	Binds to GPCR, activates amant	Weak labor contractions, poor let down
ANDROGENS (Testosterone, DHEA)	Ovarian theca cells, adrenal glands	Libido, muscle tone, precursor for estrogen	Binds to androgen receptor, transcription	Acne, hirsutism, PCOS, infertility
THYROID HORMONES Thyroid gland	Thyroid gland	Regulates metabolism, menstrual cycle	Binds to thyroid receptor, controls p38 \rightarrow Akt	Low blood sugar, fatigue
INSULIN Pancreas (beta cells of islets of Langerhans)	Pancreas (beta cells of islets of Langerhans)	Regulates blood sugar, menstrual cycle	Weight loss, anxiety, irregular gain	Irregular cycles, anxiety, weight gain

Summary:

Category	Key Function
HPO Axis Brain–Ovary communication controlling the cycle Estrogen & Progesterone	Maintain uterus, bones, skin, pregnancy FSH & LH
Prolactin & Oxytocin	Milk production and childbirth
Thyroid, Insulin, Cortisol	Indirectly influence reproductive health, maintain for implantation

Pathophysiology of hormonal imbalance for concern woman:

A. Hypothalamic–Pituitary–Gonadal (HPG) Axis Dysfunction: GnRH (gonadotropin-releasing hormone) is released by the

hypothalamus, which stimulates the pituitary gland to release FSH and LH and acts on the ovaries to create progesterone and estrogen. Disruption at any level (hypothalamus, pituitary, or ovary) can produce hormonal imbalance. For instance, stress, eating disorders, or intense physical activity decrease GnRH \rightarrow FSH/LH \rightarrow estrogen and progesterone \rightarrow irregular menstruation or amenorrhea.

A. B. Ovarian Dysfunction: Ovaries may fail to respond properly to FSH/LH stimulation. Polycystic Ovary Syndrome (PCOS): Increased LH and insulin \rightarrow \uparrow androgen (testosterone) production \rightarrow \downarrow follicular maturation \rightarrow anovulation. Leads to irregular cycles, infertility, acne, hirsutism. Premature Ovarian Insufficiency (POI): Decreased estrogen due to loss of ovarian



follicles before age 40 → ↑ FSH/LH (lack of feedback inhibition)

C. Adrenal Gland Imbalance: Cortisol and androgens produced by the adrenal glands affect reproductive hormones. Chronic stress → ↑ cortisol → suppresses GnRH and LH → menstrual irregularities. Congenital Adrenal Hyperplasia (CAH): excess adrenal androgens → masculinization and menstrual disturbance.

D. Thyroid Hormone Imbalance: Thyroid hormones interact with sex hormones: Hypothyroidism: ↑ TRH → ↑ prolactin → inhibits GnRH → anovulation and amenorrhea.

Hyperthyroidism: ↑ SHBG (sex hormone-binding globulin) → altered estrogen and testosterone levels → menstrual changes.

Clinical Manifestations in hormonal imbalance for concern woman:

1. Infertility or anovulation
2. Weight changes (gain or loss)
3. Hirsutism or acne
4. Hair loss or thinning
5. Mood swings, anxiety, depression

Common Conditions Involving Hormonal Imbalance:

Condition	Key Hormonal Changes	Main Effects
PCOS	↑ LH, ↑ androgens, ↓ FSH	Anovulation, infertility, hirsutism
Hypothyroidism	↓ T3/T4, ↑ TRH, ↑ prolactin	Irregular menses, fatigue
Hyperparathyroidism	↑ Prolactin	Amenorrhea, galactorrhea
Premature Ovarian Insufficiencies	↓ Estrogen, ↑ FSH/LH	Early menopause symptom
Cushing's Syndrome	↑ Cortisol	Menstrual irregularity, weight gain
Menopause osteoporosis	↓ Estrogen, ↓ Progesterone	Hot flashes

The primary systems involved are:

- Hypothalamic–pituitary–ovarian (HPO)
- Adrenal glands
- Thyroid gland
- Pancreas (insulin regulation)

The hypothalamus secretes gonadotropin releasing hormone (GnRH) in pulses.

GnRH stimulates the anterior pituitary to release FSH (follicle-stimulating hormone) and LH (luteinizing hormone). FSH and LH act on the ovaries. Hormonal imbalance in women (PCOS, menopausal transition, thyroid disorders, metabolic/endocrine cross-talk), plus a one-paragraph summary of each paper's mechanistic.

Polycystic Ovary Syndrome — comprehensive reviews (pathophysiology & mechanisms)

Mechanism summary: PCOS arises from a complicated combination of insulin resistance, adiposity-caused inflammation, and hypothalamic–pituitary–ovarian (HPO) axis dysfunction leading to increased ovarian Andro. This image illustrates a representation of the human endocrine system, depicting the major glands and the hormones, they make. The endocrine system sends hormones into the bloodstream to govern physiological activities such as growth, metabolism, stress response, reproduction, and sleep.

Hormonal changes during menopause — Mechanism summary:



Hormonal changes during menopause — Mechanism summary: Menopause is caused by ovarian follicular depletion, which lowers estradiol and inhibit levels; lack of negative feedback increases FSH and modifies autonomic regulation, systemic metabolism (lipids, endothelial function), and vasomotor, cardiovascular, and bone consequence.

Thyroid disorders and female reproductive health — mechanistic: Mechanism summary: Thyroid hormones modulate gonadotropin releasing hormone (GnRH) pulse patterns, SHBG, and ovarian steroid metabolism. Hypothyroidism and hyperthyroidism can cause menstrual irregularities, infertility, and altered pregnancy outcomes via direct effects on ovarian function and indirect metabolic/vascular actions Hypothyroidism and hyperthyroidism can cause menstrual abnormalities, infertility, and altered pregnancy outcomes by direct impacts on ovarian function and indirect metabolic/vascular action.

Metabolic hormones and female reproductive regulation: According to Athar F. et al., metabolic hormones are essential regulators of female Mechanism summary: Leptin, insulin, adipokines and gut hormones convey nutritional status to the hypothalamus and pituitary; perturbations (e.g., obesity, insulin resistance) perturb GnRH/LH pulses and ovarian receptivity, linking metabolic disease to reproductive hormonal imbalance. The majority of female hormonal imbalances are complex, involving peripheral gland dysfunction (ovary, thyroid, adrenal) + metabolic status (insulin, adipokines) + central (hypothalamic/pituitary) alterations. Reproductive hormone signaling is disrupted and androgen excess (PCOS) is amplified by insulin resistance and adipose-driven inflammation. Menopausal hormonal changes (estrogen/inhibit → FSH) are caused by ovarian follicle depletion and loss of

ovarian endocrine feedback. Peripheral steroid metabolism and central neuroendocrine rhythms are two ways that thyroid hormones impact reproduction.

Diagnosis involves a combination of clinical evaluation, lab tests, and sometimes imaging:

- 1. Medical History & Physical Exam:** Symptom review, menstrual history, lifestyle, and medications.
- 2. Laboratory Tests:** Blood hormone levels, including: Estrogen, progesterone, FSH, LHT testosterone, DHEA-S Thyroid hormones (TSH, T3, T4) Cortisol Insulin and glucose (for PCOS) Prolactin
- 3. Imaging Tests (if indicated)** Pelvic ultrasound: to check ovaries and uterus. RI/CT scan: for pituitary or adrenal gland disorders

Treatment of hormonal imbalance:

Treatment depends on the cause and specific hormones involved:

- 1. Lifestyle & Natural Approaches:** Balanced diet (low sugar, high fiber, rich in omega-3s) Regular exercise Stress management (yoga, meditation) Adequate sleep Maintaining a healthy weight
- 2. Medications:** Birth control pills: to regulate menstrual cycles Metformin: for insulin resistance/PCOS Thyroid hormone therapy: for hypothyroidism-androgens: to reduce male hormone effects Corticosteroids or hormone replacement therapy (HRT): if adrenal or menopausal imbalance
- 3. Hormone Replacement Therapy (HRT)** Used in menopause or severe



estrogen/progesterone deficiency Options:
pills, patches, creams, or pellets Requires
careful monitoring to avoid



Fig no 1.3] Hormone balancing food wheel

When to See a doctor:

- Evaluation if you experience
- Irregular periods for 3+ months 3] Severe mood or energy changes
- Unexplained hair loss or facial hairs
- Difficulty conceiving

CONCLUSION:

Hormonal imbalance in women is a complex illness with major implications for physical, mental, and reproductive health. It may show through menstrual irregularities, infertility, metabolic issues, mental disturbances, and long-term dangers such as osteoporosis and cardiovascular disease. Early detection and appropriate evaluation are critical for prompt intervention. Lifestyle adjustments, pharmaceutical therapy, and tailored care techniques can help restore hormonal balance and

improve quality of life. Continued research and patient-centered education remain necessary to raise awareness, maximize treatment.

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