12 Panel Hormone Testing Patient Guide

At some point in your health and fertility journey, a provider may order lab tests to assess your overall reproductive functioning.

The following labs are commonly ordered at various points during your cycle to assess your overall health and interplay between body systems. Hormones control many aspects of your reproductive health. The information below is provided as an educational guide and not intended to diagnose underlying reproductive issues.

Androstenedione

Androgens are a group of hormones that play a role in male traits and reproductive activity. Present in both males and females, the principle androgens are testosterone and androstenedione.

Hyperandrogenism or hyperandrogenemia are medical conditions characterized by excessive levels of circulating androgens. Individuals with hyperandrogenism may experience symptoms such as hirsutism, seborrhea, acne, androgenetic alopecia, and virilization in women.

Testing androstenedione helps identify androgen excess in women. An initial workup in adults might also include testosterone measurements as well. Depending on results, this may be supplemented with measurements of sex hormone-binding globulin and other androgenic steroids. Testing can be helpful in the diagnosis of PCOS, congenital adrenal hyperplasia and diagnosis of premature puberty. Girls with early adrenarche may be at increased risk of polycystic ovarian syndrome.

- *Hyperandrogenism is a medical condition characterized by high levels of male hormones in females.*
- *Premature adrenarche is when puberty changes begin early, before age 8 for girls and age 9 for boys.*
- *Virilization is a condition in which a female develops characteristics associated with male hormones (androgens).*
- *Huritism refers to a condition of excessive hair growth on unexpected areas of the body, such as on the face, chest, and back*
- *Hypogonadism refers to a failure of the gonads, testes in men and ovaries in women, to function properly.*

Testosterone

Testosterone is the major androgenic hormone. It is responsible for the development of the male external genitalia and secondary sexual characteristics. In females, its main role is as an estrogen precursor. In both genders, it also exerts muscle/tissue building effects and influences behavior.

Most circulating testosterone is bound to sex hormone-binding globulin (SHBG), which, in men, also is called testosterone-binding globulin. During childhood, excessive production of testosterone induces premature puberty in boys and masculinization in girls.

In adult women, excess testosterone production results in varying degrees of virilization, including hirsutism, acne, irregular menstruation, or infertility. Mild-to-moderate testosterone elevations are usually asymptomatic in males but can cause distressing symptoms in females. Decreased testosterone in females causes subtle symptoms. These may include some decline in libido and nonspecific mood changes.

DHEA-S

Dehydroepiandrosterone-sulfate, or DHEAS, is a hormone precursor made in the adrenal glands from cholesterol. Your body uses DHEA-S to make different steroid sex

hormones, including estradiol and testosterone. After age 20-30, DHEA-S levels decline steadily. Optimal levels of DHEA-S are associated with increased energy, better bone and muscle health, a healthier immune system, and good sexual function.

Elevated DHEA/DHEAS levels can cause signs or symptoms of hyperandrogenism in women. Men are usually asymptomatic but can occasionally experience mild estrogen excess. Most mild-to-moderate elevations in DHEAS levels are not harmful. However, pronounced elevations of DHEA/DHEAS may be indicative of androgen-producing adrenal tumors.

Studies on the supplementation of DHEA-S have not produced recommendations or guidelines to date. When DHEAS therapy is used, it is important that blood levels are monitored by a provider to avoid over-treatment since hyperandrogenic effects can occur. These are particularly likely to occur in women after menopause if DHEA/DHEAS levels approach or exceed high doses.

Sex Hormone Binding Globulin (SHGB)

Sex Hormone Binding Globulin (SHBG) is a protein produced primarily in the liver. This protein transports sex hormones, including testosterone, throughout the body. Bioavailability of testosterone is influenced by the level of SHBG. With optimal levels of SHBG, you will have a normal sex drive, strong bones, and a healthy heart.

Measuring SHBG levels is useful for diagnosis and follow-up of women in the evaluation of infertility, disorders of puberty, thyrotoxicosis, and in the monitoring of sex-steroid and anti-androgen therapies.

SHBG has profound effects on the balance between bioavailable androgens and estrogens. Decreased SHBG concentrations in women may be associated with androgenization. SHBG is also regulated by insulin, and a low SHBG concentration often indicates insulin resistance and, consequently, may be a predictor of type 2 diabetes.

Many conditions of mild-to-moderate androgen excess in women, particularly polycystic ovarian syndrome, are associated with low sex hormone-binding globulin (SHBG) concentrations. A defect in SHBG production could lead to excess bioavailable androgens, in turn causing insulin resistance that decreases SHBG concentrations further. In polycystic ovarian syndrome and related conditions, there is often significant insulin resistance, which is associated with low SHBG levels. Consequently, bioavailable or free testosterone levels may be more significantly elevated.

Thyroid Hormones: TSH, FT4, T3

The production of thyroid hormones is controlled by thyroid stimulating hormone (TSH), which is made in the pituitary gland near the brain. The pituitary is always measuring the amount of thyroid hormone and adjusts the amount of TSH in order to “talk” to the thyroid.

The major thyroid hormone made by the thyroid gland is thyroxine, called T4. The thyroid makes a smaller amount of triiodothyronine (T3), but most of the body’s T3 comes from conversion of T4 to T3 outside of the thyroid.

If there is less T4, TSH will go up to tell the thyroid gland to produce more, and vice versa. By listening to each other, TSH and T4 keep each other balanced in a fairly narrow range.

Thyroid labs are useful in the diagnosis of primary (thyroid) versus secondary (pituitary) and tertiary (hypothalamus) hypothyroidism. In primary hypothyroidism, TSH levels are significantly elevated, while in secondary and tertiary hypothyroidism, TSH levels are low or normal.

Elevations in FT4 cause hyperthyroidism, while decreases cause hypothyroidism. Elevated values suggest hyperthyroidism and decreased values suggest hypothyroidism. Labs showing decrease of TSH if T3 or T4 is high suggest hyperthyroidism, and increased TSH if T3 or T4 is low suggests hypothyroidism.

Follicle Stimulating Hormone (FSH)
Luteinizing Hormone (LH)

FSH levels are used as a an adjunct in the evaluation of menstrual irregularities, evaluating patients with suspected hypogonadism, predicting ovulation, diagnosing pituitary disorders and evaluating infertility.

FSH levels may be normal normal or decreased in Polycystic ovary disease in females FSH and LH are both decreased in failure of the pituitary or hypothalamus.

In both males and females, LH is essential for reproduction. In females, the menstrual cycle is divided by a midcycle surge of both LH and FSH into a follicular phase and a luteal phase. This "LH surge" triggers ovulation thereby not only releasing the egg, but also initiating the conversion of the residual follicle into a corpus luteum that, in turn, produces progesterone to prepare the endometrium for a possible implantation. LH is

necessary to maintain luteal function for the first 2 weeks. In case of pregnancy, luteal function will be further maintained by the action of hCG (a hormone very similar to LH) from the newly established pregnancy.

FSH and LH are generally elevated in:
- Primary ovarian failure
- Complete testicular feminization syndrome
- Precocious puberty (either idiopathic or secondary to a central nervous system lesion)
- Menopause
- Primary ovarian hypodysfunction in females
- Polycystic ovary disease in females

Prolactin

Prolactin is the principal hormone that controls the initiation and maintenance of lactation. In normal individuals, prolactin concentrations increase in response to physiologic stimuli such as sleep, stress, exercise, sexual intercourse, and hypoglycemia, and concentrations are also elevated during pregnancy, lactation, postpartum, and in a newborn infant.

Hyperprolactinemia is the most common hypothalamic-pituitary disorder encountered in clinical endocrinology. Pathologic causes of hyperprolactinemia include prolactin-secreting pituitary adenoma (prolactinoma, which is more frequent in females than males and accounts for approximately 40% of all pituitary tumors), functional and organic disease of the hypothalamus, primary hypothyroidism, compression of the pituitary stalk, chest wall lesions, renal insufficiency, polycystic ovarian disease, and ectopic tumors.

Hyperprolactinemia often results in loss of libido, galactorrhea, oligomenorrhea or amenorrhea, and infertility in premenopausal females, and loss of libido, impotence, infertility, and hypogonadism in males. Postmenopausal and premenopausal women, as well as men, can also suffer from decreased muscle mass and osteoporosis.

Progesterone

Measuring progesterone levels is useful for determining whether ovulation occurred in a menstrual cycle, assessment of infertility, evaluation of abnormal uterine bleeding, evaluation of placental health in high-risk pregnancy, determining the effectiveness of progesterone injections when administered to women to help support early pregnancy, and in the workup of some patients with adrenal disorders.

Sources of progesterone are the adrenal glands, corpus luteum, and placenta. After ovulation, there is a significant rise in serum levels as the corpus luteum begins to produce progesterone in increasing amounts. This causes changes in the uterus, preparing it for implantation of a fertilized egg. If implantation occurs, the trophoblast begins to secrete human chorionic gonadotropin, which maintains the corpus luteum and its secretion of progesterone. If there is no implantation, the corpus luteum degenerates and circulating progesterone levels decrease rapidly, reaching follicular phase levels about 4 days before the next menstrual period.

By the end of the first trimester, the placenta becomes the primary secretor of progesterone. Ovulation results in a midcycle surge of luteinizing hormone (LH) followed by an increase in progesterone secretion, peaking between day 21 and 23. If no fertilization and implantation has occurred by then, supplying the corpus luteum with human chorionic gonadotropin-driven growth stimulus, progesterone secretion falls, ultimately triggering menstruation.

Increased progesterone concentrations are occasionally seen with some ovarian cysts, molar pregnancies, rare forms of ovarian cancer, adrenal cancer, congenital adrenal hyperplasia, and testicular tumors. Increased progesterone may also be a result of overproduction by the adrenal glands.

Low concentrations of progesterone may be associated with toxemia in late pregnancy, decreased ovarian function, amenorrhea, ectopic pregnancy, and miscarriage.

Estrogen

Measuring estrogen is useful for the evaluation of hypogonadism and abnormal menstruation in females, assessing ovarian status (including follicle development, In conjunction with luteinizing hormone measurements), and monitoring of estrogen replacement therapy in premenopausal women.

Estrogens are involved in development and maintenance of the female characteristics, germ cell maturation, and pregnancy. They also are important for many other, nongender-specific processes, including growth, nervous system maturation, bone metabolism/remodeling, and endothelial responsiveness. The 2 major biologically active estrogens in nonpregnant humans are estrone (E1) and estradiol (E2). A third bioactive estrogen, estriol (E3), is the main pregnancy estrogen, but plays no significant role in nonpregnant women or men.

E2 levels in premenopausal women fluctuate during the menstrual cycle. They are lowest during the early follicular phase. E2 levels then rise gradually until 2 to 3 days before ovulation, at which stage they start to increase much more rapidly and peak just before the ovulation-inducing luteinizing hormone (LH)/follicle stimulating hormone (FSH) surge at 5 to 10 times the early follicular levels. This is followed by a modest decline during the ovulatory phase. E2 levels then increase again gradually until the midpoint of the luteal phase and, thereafter, decline early follicular levels.

Measurement of serum E2 forms an integral part of the assessment of reproductive function in females, including assessment of infertility, oligo-amenorrhea, and menopausal status.

Irregular or absent menstrual periods with normal or high E2 levels (and often high estrone: E1 levels) are indicative of possible polycystic ovarian syndrome, androgen producing tumors, or estrogen producing tumors. Further workup is required and usually includes measurement of total and bioavailable testosterone, androstenedione, dehydroepiandrosterone (sulfate), sex hormone-binding globulin, and possibly imaging.

Sources:

See the Mayo Clinic Laboratories website for clinical information on lab testing:
Mayo clinic Laboratories. (n.d.). Retrieved February 15, 2021, from https://www.mayocliniclabs.com/index.html

Thyroid information provided by:
American Thyroid Association. (2019). *Thyroid Function Tests FAQ* [Brochure]. Author.