



4000 Hormonal Health - Serum

Methodology: Chemiluminescent, RIA

Serum Sex Hormones			
Progesterone		Estrogens	
Progesterone	0.31	Reference Range 1.21-19.47 ng/mL	
Androgens			
DHEA-S	436	18-391 mcg/dL	
Testosterone, Total	0.56	<0.10-0.75 ng/mL	
Free Androgen Index	3.52	0.43-8.48	
		Binding Proteins	
		Sex Hormone Binding Globulin	55.1 18.2-135.5 nmol/L

Reference ranges are based on the menstrual status as selected by your provider on the requisition, or are age, sex specific.

Additional reference range info for other menstrual phases or sex

	Premenopause Luteal	Unsupplemented Menopause	Unsupplemented Male	Patient Result
Estrone Sulfate (ng/mL)	0.75 - 4.28	0.23 - 1.40	Not Established	3.24
Estrone (pg/mL)	43 - 250	18 - 63	46 - 143	116
Estradiol (pg/mL)	37 - 246	<15 - 25	<15 - 32	70
Estriol (pg/mL)	<=80	<=80	<=80	<80
Progesterone (ng/mL)	1.21 - 19.47	<=0.78	<=2.06	0.31
Testosterone (ng/mL)	<0.10 - 0.75	<0.10 - 0.75	1.75 - 7.81	0.56

The testosterone reference range is based on the manufacturer's range determined from women ages 21-73. Other reference ranges were determined with luteal serum samples from premenopause women. These ranges serve as clinical guidelines. However, each individual is unique and evaluation of hormone status should be within the context of the patient's clinical picture.

Steroidogenic Pathway





Additional Tests

Hormone		Reference Range
Luteinizing Hormone *	 8.8	1.0-11.4 mIU/mL
Follicle Stimulating Hormone *	 6.9	1.7-7.7 mIU/mL
Prolactin (serum)	 12.06	3.34-26.72 ng/mL
Androstenedione (serum)*	 118	73-184 ng/dL

* Please see commentary section for relevant testing location and reference range details.

Analyte	Premenopause Luteal	Unsupplemented Menopause	Patient Results
Luteinizing Hormone (mIU/mL)	1.0 - 11.4	7.7 - 58.5	8.8
FSH (mIU/mL)	1.7 - 7.7	25.8 - 134.8	6.9
Prolactin (ng/mL)	3.34 - 26.72	2.74 - 19.64	12.06
Androstenedione (ng/dL)	73 - 184	20 - 75	118



Commentary

Please note that the reference ranges for Prolactin, Sex Hormone Binding Globulin (SHBG), Progesterone, Testosterone, and DHEA-S have been updated.

The Prolactin and Androstenedione reference ranges were determined with serum samples from adult women.

Reference ranges for Follicle Stimulating Hormone and Luteinizing Hormone are provided by LabCorp.

Testing for Luteinizing Hormone and Follicle Stimulating Hormone performed by LabCorp - Regional Lab and Center for Esoteric Testing (CET), 1447 York Court, Burlington, NC 27215. The reference ranges shown are Premenopausal luteal.

Androstenedione testing is performed by Quest Diagnostics, Nichols Institute 33608 Ortega Highway, San Juan Capistrano, CA 92675.

Luteinizing Hormone Testing Methodology: Electrochemiluminescence immunoassay (ECLIA)

Follicle Stimulating Hormone Testing Methodology: Electrochemiluminescence immunoassay (ECLIA)

Prolactin Testing Methodology: Chemiluminescent

Androstenedione Testing Methodology: Chromatography/Mass Spectrometry

Reference ranges are for patients ≥ 18 years of age.

The performance characteristics have been verified for assays performed by Genova Diagnostics, Inc. Those assays have been cleared by the U.S. Food and Drug Administration.

Commentary is provided to the practitioner for educational purposes, and should not be interpreted as diagnostic or as treatment recommendations. Diagnosis and treatment decisions are the practitioner's responsibility.

Progesterone

Progesterone is an ovarian hormone produced by the corpus luteum and to some degree the adrenal glands as well. Progesterone participates in cyclic breast changes and preparation of the endometrium for implantation of the fertilized egg.

Low levels of progesterone may indicate an anovulatory cycle or luteal phase defect, in which the corpus luteum production of progesterone is impaired. Possible causes include psychological or physical stress, strenuous exercise, inflammatory conditions, hyperprolactinemia, or peri-menopause. Adrenal insufficiency might also contribute to low luteal progesterone, as can medications such as ampicillin and oral contraceptives.

Low progesterone may relate to PMS, infertility, spontaneous abortion, benign breast disease, or dysfunctional uterine bleeding. Although the secretion of progesterone inhibits the proliferation of the endometrium by estrogen, endometrial hyperplasia is less common in premenopausal women than in postmenopausal women.

Commentary

Binding Proteins

Sex hormone-binding globulin (SHBG) is within the reference range. SHBG serves as a protein carrier for steroid hormones, with a binding affinity in the order of dihydrotestosterone > testosterone > estradiol. The biologic effects of these steroid hormones (especially testosterone) are largely determined by the unbound portion. Thus, SHBG exerts a major regulatory effect on circulating levels of these steroids.

Androgens

Dehydroepiandrosterone sulfate (DHEA-S) is above the reference range. DHEA-S circulates in a higher concentration than any other steroid, is derived from the adrenal gland in response to ACTH, and is the storage form for DHEA. This hormone serves as a precursor to other androgens, which may in turn be enzymatically converted to estrogens via aromatase activity in various tissues, particularly adipose, skin, and bone. DHEA-S also plays an important role in thyroid function, immune regulation, maintenance of libido and lean body mass, insulin sensitivity, and balancing the body's stress response.

Elevated DHEA-S may occur with DHEA or pregnenolone supplementation, adrenal stimulation (e.g. hyperplasia or Cushing's disease, in which cortisol is also significantly elevated), defects in DHEA-S metabolism, or polycystic ovary syndrome.

Testosterone is within the reference range. Testosterone is derived from both adrenal and ovarian activity. In peripheral tissues, particularly adipose, testosterone is converted into estradiol via the aromatase enzyme. Normal levels provide protection against osteoporosis, and help maintain libido and lean muscle mass. Testosterone has very strong binding with SHBG; therefore, the higher the SHBG, the lower the amount of bioavailable testosterone. This relationship is reflected in the Free Androgen Index.

The **Free Androgen Index** is described in the literature and provides a calculated indicator of unbound (bioavailable) testosterone. While not representing ALL of the androgenic effects present, the FAI is a reasonable means to determine the effects of androgens in women. This value is calculated by multiplying the testosterone value by a unit conversion factor, dividing by the SHBG value, and multiplying by 100. The FAI may be particularly significant in relation to PCOS, hirsutism, acne, and breast cancer.

Estrogens

Estrone sulfate (E1-S) is within the reference range. Estrone sulfate is the most abundant circulating estrogen in non-pregnant women. Because E1-S is unable to bind to the estrogen receptor, it is biologically inactive, but serves as an important reservoir for active estrogens. E1-S is converted to estrone (E1) within estrogen target tissues such as ovary, placenta, skin, brain, endometrium, bone, and blood. Estrone can then be converted to the more potent estradiol, or be re-sulfated to inactive E1-S. In pre-menopause, E1-S levels generally parallel those of E1.

Normal levels of E1S suggest normal sulfation activity and an adequate reserve of estrogens. Together, E1-S, estrone, and estradiol provide an approximation of total estrogenicity in the body.

Estrone (E1) is within the reference range. Estrone is the second most potent estrogen after estradiol, and is derived from estradiol (reversible reaction) or from adrenal androstenedione via aromatization in peripheral tissues such as adipose. Estrone is bound primarily to albumin rather than SHBG, and may be processed via either the 2- or 16alpha-hydroxylation pathways to form 2-hydroxyestrone or 16alpha-hydroxyestrone, respectively.

Normal levels of estrone imply adequate conversion from estradiol and from aromatase activity. Secondary metabolism should be checked in the "Estrogen Metabolism" section of the report.

Commentary

Estradiol (E2) is within the reference range. Estradiol is the most potent estrogen and is the major estrogen secreted by the ovaries in a premenopausal woman. Estradiol may also arise from estrone (reversible reaction) or from testosterone via aromatization in peripheral tissues such as adipose.

Estrogens stimulate growth and development of tissues related to female reproduction such as the breasts, vagina and uterus. They also promote vasodilatation and vascular smooth muscle tone, collagen production, brain activity, and inhibit bone resorption. E2 levels are cycle-dependent and while variable from person to person, tend to be quite consistent for one individual over time; thus single measurements are typically reflective of long-term patterns.

Estriol (E3) is within the reference range. The least potent of the estrogens, E3 levels are traditionally used clinically to gauge the viability of pregnancies. In the context of this profile, estriol is least likely to be associated with high-estrogen problems (PMS, breast cancer, etc), and is generally viewed as a "protective" estrogen. Estriol originates from conversion of estrone via 16alpha-hydroxyestrone; thus E3 represents a terminal point along estrogen metabolism. Normal levels imply relative balance in enzyme conversion among its sources.



Vitamin D

Methodology: Chemiluminescent

	Inside Range	Reference Range:
25-Hydroxyvitamin D ♦	39	30-100 ng/mL

Deficiency:	<20 ng/mL
Insufficiency:	20-29 ng/mL
Sufficient:	30-100 ng/mL
Recommended:	50-80 ng/mL
Excessive:	>100 ng/mL

There is no consensus in the literature regarding optimal levels of 25-Hydroxyvitamin D. Higher levels of 25-Hydroxyvitamin D may be concerning in patients with renal failure. Levels below 30 ng/mL are considered insufficient by most medical associations.

Holick MF, et al. *J Clin Endocrinol Metab.* 2011;96(7):1911-1930.
Vitamin D Council: <https://www.vitamindcouncil.org/>

Commentary

The performance characteristics of all assays have been verified by Genova Diagnostics, Inc. Unless otherwise noted with ♦, the assay has not been cleared by the U.S. Food and Drug Administration.

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Sufficient levels:

Vitamin D is a hormone produced in the skin during exposure to sunlight or consumed in the diet, and converted to its active form, calcitriol, in the liver and kidneys. Vitamin D helps regulate serum calcium and phosphorus levels by increasing intestinal absorption of calcium and stimulating tubular reabsorption of calcium. Vitamin D also affects numerous other functions in the body.

Recommended levels are protective against osteoporosis as well as infection, autoimmune disease, hypertension, arteriosclerosis, diabetes and insulin resistance, musculoskeletal pain, epilepsy, and migraine.