

Androstenedione and Dehydroepiandrosterone in Serum by LC-MS/MS

Test Highlights

- High sensitivity/specificity for androstenedione and dehydroepiandrosterone.
- Analytical sensitivity of 0.01 ng/mL for androstenedione and 0.05 ng/mL for dehydroepiandrosterone.
- Small sample volume (0.25 mL of serum or plasma).
- Reference intervals for children, men, and post-menopausal women.

Clinical Background

- DHEA sulfate (DHEA-S) is produced in the adrenal glands. DHEA is produced in both the adrenal glands and the gonads.
- Androstenedione and testosterone are predominantly produced in ovarian follicles in women and testicles in men. They are also produced in smaller amounts in the adrenal glands. In hypogonadal men and postmenopausal women androgens produced in the adrenal glands are a major source of androgens in circulation. Androgen concentrations vary through the menstrual cycle, with highest concentration just before ovulation and the lowest concentration at the early follicular stage of a cycle.
- In both genders androgen testing can be used for the diagnosis of precocious or delayed puberty, as well as hypothalamic and pituitary function. In females it can be used to diagnose androgen-related abnormalities in primary and secondary amenorrhea and in assessment of menopausal status. Increased concentrations of DHEA and androstenedione may be associated with increased concentrations of circulating androgens (testosterone and dihydrotestosterone).
- Excretion of DHEA and androstenedione by fetus increases throughout embryonic development and reaches peak values before birth. After birth, concentrations fall rapidly to pre-pubertal levels. With the onset of adrenarche, concentrations of DHEA and androstenedione gradually increase, reaching adult levels by age 16–18. Early adrenarche is not associated with early puberty and is generally regarded as a benign condition not requiring intervention. However, girls with early adrenarche may be at increased risk of polycystic ovarian syndrome (PCOS) as adults, and some boys may develop early penile enlargement.
- Elevated concentrations of DHEA and androstenedione can result in symptoms of hyperandrogenism in women. Men are usually asymptomatic, but through peripheral conversion of androgens to estrogens they can occasionally experience mild symptoms of estrogen excess, such as gynecomastia.

Indications for Ordering

- Precocious puberty
- Hypoandrogenism
- Evaluation of ovarian and testicular function
- Monitoring of androgen replacement therapy
- Anti-androgen therapy

- Amenorrhea
- Menopause
- Fertility treatment
- Gynecomastia
- Assessment of the status of enzymes involved in biosynthesis of sex steroids

Additional Ordering Notes

- Androstenedione by LC-MS/MS (ARUP test #2001638) will replace radioimmunoassay Androstenedione, Serum (ARUP test #0070020).
- Dehydroepiandrosterone by LC-MS/MS (ARUP test #2001640) will replace immunoassay Dehydroepiandrosterone, Serum (ARUP test #0070199).

Interpretation

- Elevated concentrations of DHEA and androstenedione indicate increased adrenal or gonadal androgen production. Mild elevations in adults are usually idiopathic, or related to conditions such as PCOS in women or use of DHEA and androstenedione as supplements in men and women.
- Concentrations of androstenedione above 5 ng/mL could be caused by the presence of an androgen-secreting adrenal or gonadal tumor. Such tumors usually also result in overproduction of testosterone. Ratios of testosterone to androstenedione greater than 1.5 are an indication of neoplastic androgen production.
- Girls younger than 8 years old and boys younger than 9 years old presenting with early development of pubic hair may be suffering from either premature adrenarche or premature puberty, or both. Measurement of DHEA, DHEA-S, androstenedione, total and bioavailable testosterone, estradiol, SHBG, and LH/FSH can be used for establishing the diagnosis.
- In premature adrenarche, only DHEA-S and, to a lesser degree, androstenedione will be elevated above the pre-pubertal levels. In premature puberty gonadal sex-steroids and gonadotropins will be elevated above upper-normal values, and SHBG levels will be low.
- Differential diagnosis of CAH always requires the measurement of pregnenolone, 17 hydroxypregnenolone, 17 hydroxyporgesterone, 11 deoxycortisol, DHEA, androstenedione, and testosterone.

- Any condition that can result in partial or complete adrenal or gonadal failure may result in low androstenedione concentrations.
- Androstenedione and DHEA supplements can result in elevations of concentrations of DHEA and androstenedione.

Methodology

Androgens are extracted from the sample, derivatized, and analyzed by liquid chromatography tandem mass spectrometry (LC-MS/MS). The high specificity of tandem mass spectrometry is enhanced by the measurement of two product ions of each androgen and the internal standard. This assures specificity of the analysis for every sample and eliminates potential interferences.

References

1. Haymond S, Granowsky AM. Reproductive related disease. In *Tietz textbook of clinical chemistry and molecular diagnostics*, 4th ed. Ashwood ER, Burtis CA, Bruns DE, eds. 2005, New York: Saunders;2097–152.
2. Ibanez L, et al. Premature adrenarche—normal variant or forerunner of adult disease? *Endocrine Rev* 2001;40:1–16
3. Kushnir MM, et al. Performance characteristics of a novel tandem mass spectrometry assay for serum testosterone. *Clinical Chemistry* 2006;52:120–8.

Test Information

2001638
2001640

Androstenedione
Dehydroepiandrosterone, Serum or Plasma

For specific collection, transport, and testing information, refer to the ARUP Web site at www.aruplab.com.

For information on test selection, ordering, and interpretation, refer to ARUP Consult® at www.arupconsult.com.