MAYO CLINIC LABORATORIES

Test Definition: FFTST

Testosterone, Free and Weakly Bound, With Total Testosterone, LC/MS-MS

Overview

Useful For

Free and weakly bound testosterone (FWBT), also referred to as bioavailable testosterone, is thought to reflect an individual's biologically active, circulating testosterone. FWBT includes free testosterone and testosterone that is bound to albumin. FWBT does not include sex hormone-binding globulin-bound testosterone. The SHBG-bound fraction is biologically inactive because of the high binding affinity of SHBG for testosterone. The rapid dissociation of "weakly bound" testosterone from albumin results in the availability of essentially all albumin-bound testosterone for steroid-receptor interaction.(1)

Method Name

Ammonium sulfate precipitation; liquid chromatography/tandem mass spectrometry (LC/MS-MS)

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Collection Container/Tube:
Preferred: Red top
Acceptable: Serum gel
Submission Container/tube: Plastic vial
Specimen Volume: 2 mL
Collection Instructions:
1. Within one hour of collection, centrifuge and aliquot 2 mL serum into a plastic vial.
2. Ship refrigerated.

Specimen Minimum Volume

1.4 mL (does not allow for repeat testing)

Reject Due To

Gross hemolysis	OK
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Ambient	7 days	

Clinical & Interpretive

Clinical Information

Free and weakly bound (bioavailable) testosterone measurement involves the selective precipitation of sex hormone binding globulin (SHBG) with ammonium sulfate. Tritiated testosterone is added to serum, which is then allowed to come to equilibrium at physiologic temperature. Testosterone bound to SHBG is then selectively precipitated with 50% ammonium sulfate, leaving free and albumin-bound testosterone in solution. The percentage of tritiated label not bound to SHBG is multiplied by the total testosterone to produce the bioavailable testosterone.

Elevated levels of free and weakly bound testosterone (FWBT) are observed in female hirsutism.(2) The measurement of free and weakly bound testosterone in women, when used in conjunction with the assay of the DHEA-S and SHBG, can be used to establish etiology of hirsutism. In males, decreased serum concentrations are associated with hypogonadism. FWBT levels tend to increase during pregnancy but have been found to remain below the upper limit of the reference interval.(3) Total testosterone levels in women decrease by approximately 30% after menopause.(4) Administration of exogenous estrogens has the physiologic effect of increasing SHBG concentrations and suppressing the production of androgens by the ovary.(4) This results in a net decrease in FWBT. Decreased FWBT levels have been associated with diminished libido and loss of bone density.(4,5) FWBT levels in males fall with age at a rate that exceeds that of total testosterone and parallels the drop in DHEA sulfate.(6) This decrease is thought to be caused by diminished testicular production and not due to hypothalamic/pituitary insufficiency.(7) Decreased FWBT was not, however, found to correlate with diminished potency.(8) Since SHBG has been found to increase with age, the FWBT level may be a more reliable indicator of testosterone production than total testosterone.

Reference Values

Males:

Age:	Range (ng/dL):
Premature Infants (26 to 28 weeks) Day 4	59.0-125.0
Premature (31-35 weeks) Day 4	37.0-198.0
Newborns	75.0-400.0
Prepubertal (1 to 10 years)	<2.5-10.0

1 to 7 Months

Levels decrease rapidly the first week to 20.0-50.0 ng/dL, then increase to 60.0-400.0 ng/dL (mean=190.0) between 20-60 days. Levels then decline to prepubertal range of <2.5-10.0 by seven months.

Females:

Age:	Range (ng/dL):

Premature Infants (26 to 28 weeks) Day 4	5.0-16.0
Premature (31-35 weeks) Day 4	5.0-22.0
Newborns	20.0-64.0
Prepubertal (1 to 9 years)	<2.5-10.0

1 to 7 Months

Levels decrease during the first month to <10.0 ng/dL and remain there until puberty.

Puberty:

Tanner Stage (Males)	Age (Years)	Range (ng/dL)	Mean (ng/dL)
1	<9.8	<2.5-10.0	4.9
2	9.8-14.5	18.0-150.0	42.0
3	10.7-15.4	100.0-320.0	190.0
4	11.8-16.2	200.0-620.0	372.0
5	12.8-17.3	350.0-970.0	546.0

Tanner Stage (Females)	Age (Years)	Range (ng/dL)	Mean (ng/dL)
1	<9.2	<2.5-10.0	4.9
2	9.2-13.7	7.0-28.0	18.0
3	10.0-14.4	15.0-35.0	25.0
4	10.7-15.6	13.0-32.0	22.0
5	11.8-18.6	20.0-38.0	28.0

Adults:

> or =18 Years	Range (ng/dL)
Males	350.0-1030.0
Females	
Premenopausal	10.0-55.0
Postmenopausal	7.0-40.0

Testosterone % Free+Weakly Bound:

Female: 3.0-18.0%

Male: 9.0-46.0%

Testosterone, F+W Bound:

Female: 0.0-9.5 ng/dL

Male: 40.0-250.0 ng/dL

Clinical Reference

1. Pardridge WM. Transport of protein-bound hormones into tissues in vivo. Endocr Rev. 1981;2(1):103-123

2. Cumming DC, Wall SR. Non-sex hormone-binding globulin-bound testosterone as a marker for hyperandrogenism. J Clin Endocrinol Metab. 1985;61(5):873-876

3. Kerlan V, Nahoul K, Le Martelot MT, Bercovici JP. Longitudinal study of maternal plasma bioavailable testosterone and

androstanediol glucuronide levels during pregnancy. Clin Endocrinol (Oxf). 1994;40(2):263-267
4. Davis SR, Burger HG. Use of androgens in postmenopausal women. Curr Opin Obstet Gynecol. 1997;9(3):177-180
5. Jassal SK, Barrett-Connor E, Edelstein SL. Low bioavailable testosterone levels predict future height loss in postmenopausal women. J Bone Miner Res. 1995;10(4):650-654
6. Morley JE, Kaiser F, Raum WJ, et al. Potentially predictive and manipulable blood serum correlates of aging in the healthy human male: Progressive decreases in bioavailable testosterone, dehydroepiandrosterone sulfate, and the ratio of insulin-like growth factor 1 to growth hormone. Proc Natl Acad Sci USA. 1997;94(14):7537-7542
7. Nahoul K, Roger M. Age-related decline of plasma bioavailable testosterone in adult men. J Steroid Biochem. 1990;35(2):293-299
8. Korenman SG, Morley JE, Mooradian AD, et al. Secondary hypogonadism in older men: Its relation to impotence. J Clin Endocrinol Metab. 1990;71(4):963-969

Performance

PDF Report
No

Day(s) Performed
Daily

Report Available
6 to 10 days

Performing Laboratory Location
LabCorp Burlington

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test was developed, and its performance characteristics determined by LabCorp. It has not been cleared or approved by the Food and Drug Administration.

CPT Code Information
84410

LOINC® Information

MAYO CLINIC LABORATORIES

Test Definition: FFTST

Testosterone, Free and Weakly Bound, With Total Testosterone, LC/MS-MS

Test ID	Test Order Name	Order LOINC® Value
FFTST	Testosterone,F/WklyBd+T LC/MS	Not Provided

Result ID	Test Result Name	Result LOINC® Value
Z6079	Testosterone, Total, LC/MS	2986-8
Z6080	Testost. % Free+Weakly Bound	6891-6
Z6081	Testost. F+W Bound	2990-0