



**EXPANDED RANGE  
SALIVARY TESTOSTERONE ENZYME IMMUNOASSAY KIT**

Catalog No. 1-2312, (Single) 96-Well Kit;  
1-2312-5, (5-pack) 480 Wells

**Intended Use**

The Salimetrics™ expanded range (ER) testosterone kit is a competitive immunoassay specifically designed and validated for the quantitative *in vitro* diagnostic measurement of salivary testosterone. Salivary testosterone accurately reflects the amount of serum testosterone in the circulation. Salimetrics has not validated this kit for use with serum/plasma. Please read the complete kit insert before performing this assay. For further information about this kit, applications, or procedures in this insert, contact the technical service team at Salimetrics or your local sales representative.

**Introduction**

Testosterone is an anabolic steroid synthesized primarily by the Leydig cells in the testes in males, the ovaries in females, and adrenal glands in both sexes. It is synthesized from cholesterol, with androstenedione, androstenediol, dehydroepiandrosterone (DHEA), progesterone and pregnenolone acting as some of the intermediate substrates. Testosterone levels in males increase 10 to 20-fold during puberty, driving the physiological changes associated with male puberty. It also exerts a powerful, wide-ranging influence over emotional well-being, sexual function, muscle mass and strength, energy, cardiovascular health, bone integrity, and cognitive ability throughout a man's entire life. Ensuring androgen balance is a crucial factor for creating and sustaining optimal cardiovascular health, bone and muscle integrity, sexual function, and natural immune protection. Testosterone levels have predicted the occurrence of diabetes in patients with depleted levels, and restoring levels improved insulin resistance (1). AIDS patients have also benefited by testosterone replacement therapy (2).

In the blood only 1 to 15% of testosterone is in its unbound or biologically active form. The remaining testosterone is bound to serum proteins. Unbound testosterone enters the saliva via intracellular mechanisms, and in saliva the majority of testosterone is not protein-bound. Salivary testosterone levels are unaffected by salivary flow rate or salivary enzymes (3).

This kit is designed to measure testosterone levels in saliva. The standard is in a saliva-like matrix. In addition, a built-in pH indicator warns the user of acidic or basic samples.

**Test Principle**

A microtitre plate is coated with rabbit antibodies to testosterone. Testosterone in standards and unknowns competes with testosterone linked to horseradish peroxidase for the antibody binding sites. After incubation, unbound components are washed away. Bound testosterone peroxidase is measured by the reaction of the peroxidase enzyme on the substrate tetramethylbenzidine (TMB). This reaction produces a blue color. A yellow color is formed after stopping the reaction using 2-molar sulfuric acid. Optical density is read on a standard plate reader at 450 nm. The amount of testosterone peroxidase detected is inversely proportional to the amount of testosterone present (4).

**pH Indicator**

A pH indicator in the assay diluent alerts the user to samples with high or low pH values. Acidic samples will turn the diluent yellow. Alkaline samples will turn the diluent purple. Dark yellow or purple wells indicate that a pH value for that sample should be obtained using pH strips. Testosterone values from samples with a pH  $\leq 4.0$  or  $\geq 9.0$  may be artificially inflated or lowered (5).

**Precautions**

1. Failure to follow kit procedure and recommendations for saliva collection and sample handling may result in false values.
2. Liquid stop solution is a 2-molar solution of sulfuric acid. This solution is caustic; use with care.
3. This kit uses break-apart microtitre strips. Unused wells must be stored at 2 - 8°C in the sealed foil pouch with desiccant and used in the frame provided.
4. Do not mix components from different lots of kits.

5. When using a multichannel pipette, reagents should be added to duplicate wells at the same time. Follow the same sequence when adding additional reagents so that incubation time with reagents is the same for all wells.
6. See 'Material Safety Data' at the end of procedure.
7. We recommend that samples be screened for possible blood contamination (6,7) using a reliable screening tool such as the Salimetrics Blood Contamination EIA Kit (Cat No: 1-1302/1-1312). Do not use dipsticks, which result in false positive values due to salivary enzymes.
8. Routine calibration of pipettes is critical for the best possible assay performance.
9. Pipetting of samples and reagents must be done as quickly as possible (without interruption) across the plate.
10. When running multiple plates, or multiple sets of strips, a standard curve should be run with each individual plate and/or set of strips.
11. The temperature of the laboratory may affect assays. Salimetrics' kits have been validated at 68 - 74°F (20 - 23.3°C). Higher or lower temperatures will cause an increase or decrease in OD values, respectively. Salimetrics cannot guarantee test results outside of this temperature range.
12. The quantity of reagent provided with this kit is sufficient for three individual runs. The volume of diluent and conjugate used for assays using less than a full plate should be scaled down accordingly, keeping the same dilution ratio.
13. Avoid microbial contamination of opened reagents. Salimetrics recommends using opened reagents within one month.

**Storage**

All components of this kit are stable at 2 - 8°C until the kit's expiration date.

**Reagents and Reagent Preparation**

1. **Anti-Testosterone Coated Plate:** A ready-to-use, 96-well microtitre plate pre-coated with rabbit anti-testosterone antibodies in a resealable foil pouch.
2. **Testosterone Standard:** 0.5 mL of testosterone, in a saliva-like matrix with a non-mercury preservative, at a concentration of 600 pg/mL.
3. **Testosterone Controls:** Two controls representing high and low levels of testosterone in a saliva-like matrix with a non-mercury preservative. Each vial contains 0.5 mL.
4. **Wash Buffer:** 100 mL of a 10X phosphate buffered solution containing detergents and a non-mercury preservative. Dilute only the amount needed for current day's use. Discard any leftover reagent. Dilute the wash buffer concentrate 10-fold with room temperature deionized water (100 mL of 10X wash buffer to 900 mL of deionized H<sub>2</sub>O). (**Note:** If precipitate has formed in the concentrated wash buffer, it may be heated to 60°C for 15 minutes. *Cool to room temperature before use in assay.*)
5. **Testosterone Assay Diluent:** 60 mL of a phosphate buffered solution containing a pH indicator and a non-mercury preservative.
6. **Enzyme Conjugate:** 40-50  $\mu$ L of a solution of testosterone labeled with horseradish peroxidase. Dilute prior to use with assay diluent.
7. **Tetramethylbenzidine (TMB):** 25 mL of a non-toxic, ready-to-use solution.
8. **Stop Solution:** 12.5 mL of a solution of sulfuric acid.
9. **Non-specific Binding Wells (NSB):** These wells do not contain anti-testosterone antibody. In order to support multiple use, a strip of NSB wells is included. They are located in the foil pouch. Wells may be broken off and inserted as blanks (optional) where needed.

**Materials Needed But Not Supplied**

- Precision pipette to deliver 18  $\mu$ L, 25  $\mu$ L, and 150  $\mu$ L
- Precision multichannel pipette to deliver 50  $\mu$ L, 150  $\mu$ L, and 200  $\mu$ L
- Vortex
- Plate rotator with 0.08-0.17 inch orbit (assay sensitivity may be affected if a rotator is not used)
- Plate reader with a 450 nm filter
- Computer software for data reduction
- Deionized water
- Reagent reservoirs
- One 20 mL disposable tube
- Five small disposable tubes
- Pipette tips
- 25 mL serological pipette

**Specimen Collection**

Due to the episodic secretion pattern of steroid hormones, we can expect reproducible and reliable results only in cases of multiple sampling. Therefore, we recommend taking a minimum of 3 samples within at least a 2-hour period and pooling the samples before testing (8,9).

Collecting whole saliva samples from adults and children over 6 may be done by using the Salimetrics Oral Swab (SOS), P/N 5001.02, or by unstimulated passive drool. Collection protocols are available on request. **Do not use Salivettes,**

**Sorbettes, cotton, or polyester materials to collect samples.** False readings will result (10,11). Do not add sodium azide to saliva samples as a preservative. Samples visibly contaminated with blood should be recollected. Avoid sample collection within 60 minutes after eating a major meal or within 12 hours after consuming alcohol. Acidic or high sugar foods can compromise assay performance by lowering sample pH and influencing bacterial growth. To minimize these factors, rinse mouth thoroughly with water 10 minutes before sample is collected. Record the time and date of specimen collection. After collection it is important to keep samples cold, in order to avoid bacterial growth in the specimen. Refrigerate sample within 30 minutes, and freeze at or below -20°C within 4 hours of collection. (Samples may be stored at -20°C or lower for long term storage.)

Freezing saliva samples will precipitate the mucins. On day of assay, thaw completely, vortex, and centrifuge at 1500 x g (@3000 rpm) for 15 minutes. It is important to avoid additional freeze-thaw cycles. However, if samples have been refrozen, centrifuge again prior to assaying. Samples should be at room temperature before adding to assay plate. Pipette clear sample into appropriate wells. Particulate matter may interfere with antibody binding, leading to falsely elevated results.

**Procedure**

Bring all reagents to room temperature. **Note:** It is important to keep the zip-lock pouch with the plate strips closed until warmed to room temperature as humidity may have an effect on the coated wells. Mix all reagents before use.

**Step 1:** Determine your plate layout (see below).

	1	2	3	4	5	6	7	8	9	10	11	12
A	600 Std	600 Std	C-H	C-H								
B	240 Std	240 Std	C-L	C-L								
C	96 Std	96 Std	Unk-1	Unk-1								
D	38.4 Std	38.4 Std	Unk-2	Unk-2								
E	15.4 Std	15.4 Std	Unk-3	Unk-3								
F	6.1 Std	6.1 Std	Unk-4	Unk-4								
G	Zero	Zero	Unk-5	Unk-5								
H	NSB	NSB	Unk-6	Unk-6								

**Step 2:** Keep the desired number of strips in the strip holder and place the remaining strips back in the foil pouch. If you choose to place non-specific binding wells in H-1, 2, remove strips 1 and 2 from the strip holder. Break off the bottom wells in each strip. Place the strips back into the strip holder leaving H-1, 2 blank. Break off 2 NSB wells from the strip of NSBs included in the foil pouch. Place in H-1, 2. Alternatively, NSBs may be placed wherever you choose on the plate. Reseal the zip-lock foil pouch with unused wells and desiccant. Store at 2 - 8°C.

**Cautions:** 1. Extra NSB wells should not be used for determination of standards, controls, or unknowns.  
2. Do not insert wells from one plate into a different plate.

**Step 3:**

- Label five microcentrifuge tubes or other small tubes 2 through 6.
- Pipette 90 µL of testosterone assay diluent in tubes 2 through 6. Serially dilute the standard 2.5X by adding 60 µL of the 600 pg/mL standard (tube 1) to tube 2. Mix well. After changing pipette tips, remove 60 µL from tube 2 to tube 3. Mix well. Continue for tubes 4, 5, and 6. The final concentrations of standards for tubes 1 through 6, respectively, are 600 pg/mL, 240 pg/mL, 96 pg/mL, 38.4 pg/mL, 15.4 pg/mL, and 6.1 pg/mL. Standard concentrations in pmol/L are 2080.5, 832.2, 332.9, 133.2, 53.3 and 21.3, respectively.
- Pipette 18 mL of testosterone assay diluent into the disposable tube. (Scale down proportionally if not using the entire plate.) Set aside for Step 5.

**Step 4:**

- Pipette 25 µL of standards, controls, and unknowns into appropriate wells. Standards, controls, and unknowns should be assayed in duplicate.
- Pipette 25 µL of testosterone assay diluent into 2 wells to serve as the zero.
- Pipette 25 µL of testosterone assay diluent into each NSB well.

**Step 5:** Dilute the enzyme conjugate 1:1000 by adding 18 µL of the conjugate to the 18 mL of testosterone assay diluent prepared in Step 3. (Scale down proportionately if not using the entire plate.) Immediately mix the diluted conjugate solution and add 150 µL to each well using a multichannel pipette.

**Step 6:** Mix plate on a plate rotator for 5 minutes at 500 rpm (or tap to mix) and incubate at room temperature for an additional 55 minutes.

**Step 7:** Wash the plate 4 times with 1X wash buffer. A plate washer is recommended. However, washing may be done by gently squirting wash buffer into each well with a squirt bottle, or by pipetting 300 µL of wash buffer into each well and then flipping the liquid into a sink. After each wash, the plate should be thoroughly blotted on paper towels before turning upright. If using a plate washer, blotting is still recommended after the final wash.

**Step 8:** Add 200 µL of TMB solution to each well with a multichannel pipette.

**Step 9:** Mix on a plate rotator for 5 minutes at 500 rpm (or tap to mix) and incubate the plate in the dark at room temperature for an additional 25 minutes.

**Step 10:** Add 50 µL of stop solution with a multichannel pipette.

**Step 11:** Mix on a plate rotator for 3 minutes at 500 rpm (or tap to mix). Be sure all wells have turned yellow. If green color remains, continue mixing until green color turns to yellow. **Caution:** Do not mix at speeds over 600 rpm. Wipe off bottom of plate with a water-moistened, lint-free cloth and wipe dry. Read in a plate reader at 450 nm. Read plate within 10 minutes of adding stop solution. (Correction at 490 to 630 is desirable.)

**Calculations**

- Compute the average optical density (OD) for all duplicate wells.
- Subtract the average OD for the NSB wells (if used) from the average OD of the zero, standards, controls, and unknowns (B).
- Calculate the percent bound (B/Bo) for each standard, control, and unknown by dividing the average OD (B) by the average OD for the zero (Bo).
- Determine the concentrations of the controls and unknowns by interpolation using software capable of logistics. We recommend using a 4-parameter sigmoid minus curve fit.

**Quality Control**

The Salimetrics' high and low salivary testosterone controls should be run with each assay. The control ranges established at Salimetrics are to be used as a guide. Each laboratory should establish its own range. Variations between laboratories may be caused by differences in techniques and instrumentation.

**Limitations**

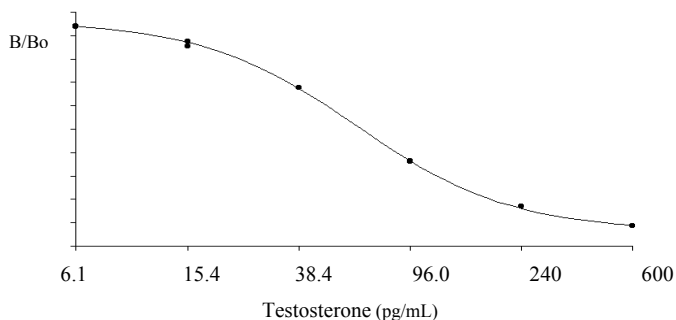
- Samples with testosterone values greater than 600 pg/mL should be diluted with assay diluent and rerun for accurate results. To obtain the final testosterone concentration, multiply the concentration of the diluted sample by the dilution factor.
- A pH value should be obtained on samples that appear yellow or purple after assay diluent is added and the plate is mixed. Samples with pH values ≥ 9.0 or ≤ 4.0 should be recollected.
- See "Specimen Collection" recommendations to insure proper collection of saliva specimens and to avoid interfering substances.
- Samples collected with sodium azide are unsuitable for this assay.
- Any quantitative results indicating abnormal testosterone levels should be followed by additional testing and evaluation.

**Typical Results**

The following results are shown for illustration only and should not be used to calculate results from another assay.

Well	Sample	Average OD	B	B/Bo	Testosterone (pg/mL)
A1, A2	S1	0.225	0.203	0.088	600
B1, B2	S2	0.417	0.395	0.170	240
C1, C2	S3	0.863	0.841	0.362	96
D1, D2	S4	1.593	1.571	0.677	38.4
E1, E2	S5	2.026	2.004	0.864	15.4
F1, F2	S6	2.201	2.179	0.939	6.1
G1, G2	Bo	2.342	2.320	NA	NA
H1, H2	NSB	0.022	NA	NA	NA

**Example: ER Testosterone 4-Parameter Sigmoid Minus Curve Fit**



## Material Safety Data\*

### Hazardous Ingredients

Liquid stop solution is a 2-molar solution of sulfuric acid. This solution is caustic; use with care. We recommend the procedures listed below for all kit reagents. Specific kit component MSDS sheets are available from Salimetrics upon request.

### Handling

Follow good laboratory procedures when handling kit reagents. Laboratory coats, gloves, and safety goggles are recommended. Wipe up spills using standard absorbent materials while wearing protective clothing. Follow local regulations for disposal.

### Emergency Exposure Measures

In case of contact, immediately wash skin or flush eyes with water for 15 minutes. Remove contaminated clothing. If inhaled, remove individual to fresh air. If individual experiences difficulty breathing, give oxygen and call a physician.

\*The above information is believed to be accurate but is not all-inclusive. This information should only be used as a guide. Salimetrics shall not be liable for accidents or damage resulting from contact with reagents.

## Performance Characteristics

### A. Recovery:

Saliva samples containing different levels of an endogenous testosterone were spiked with known quantities of testosterone and assayed.

Sample	Endogenous (pg/ml)	Added (pg/ml)	Expected (pg/ml)	Observed (pg/ml)	Recovery (%)
1	29.57	9.60	39.17	37.40	95.5
1	29.57	60.00	89.57	97.91	109.3
1	29.57	400.00	429.57	452.95	105.4
2	76.42	9.60	86.02	90.18	104.8
2	76.42	60.00	136.42	136.23	99.9
3	80.66	200.00	280.66	311.90	111.1

### B. Correlation with serum:

The correlation between saliva and total serum testosterone was determined by assaying 28 matched samples (15 adult males and 13 females). The saliva-serum correlation was  $r(26) = 0.96$ ,  $p < 0.001$ . The saliva-serum correlation was stronger for males,  $r = 0.91$ , than for females,  $r = 0.61$ . (12)

### C. Linearity of Dilution:

Four saliva samples were serially diluted with testosterone assay diluent and assayed.

Sample	Dilution Factor	Expected (pg/ml)	Observed (pg/ml)	Recovery (%)
1			71.81	
	1:2	35.91	38.08	106
	1:4	17.95	19.31	107.6
	1:8	8.98	9.69	109
2			404.67	
	1:2	202.34	196.99	97.4
	1:4	101.17	94.12	93
	1:8	50.58	47.19	93.3
3			135.56	
	1:2	67.78	62.34	92
	1:4	33.89	35.86	105.8
	1:8	16.95	18.33	108.1
4			553.88	
	1:2	276.94	296.94	107.2
	1:4	138.47	141.01	101.8
	1:8	69.24	72.59	104.8
	1:16	34.62	38.55	111.4

### D. Sensitivity:

The lower limit of sensitivity was determined by interpolating the mean optical density minus 2 SDs of 10 sets of duplicates at the 0 pg/ml level. The minimal concentration of testosterone that can be distinguished from 0 is  $< 1.0$  pg/ml.

## E. Specificity

The following compounds were tested at concentrations up to 1,000 ng/mL for cross-reactivity:

Compound	Spiked Concentration (ng/mL)	% Cross-reactivity
Aldosterone	1,000	ND
Androstenedione	10	1.157
Corticosterone	1,000	ND
Cortisol	1,000	ND
Cortisone	1,000	ND
11-Deoxycortisol	1,000	ND
21-Deoxycortisol	1,000	0.004
DHEA	1,000	ND
Dianabol	10	0.489
Dihydrotestosterone*	500	36.4
Epitestosterone	100	0.165
11-Hydroxytestosterone	10	1.90
19-Nortestosterone†	1,000	21.02
Estradiol	51	0.025
Estriol	1,000	0.012
Estrone	1,000	0.005
Progesterone	1,000	0.005
17 $\alpha$ -Hydroxyprogesterone	1,000	ND
Transferrin	1,000	ND

ND = None detected ( $< 0.004$ )

\* Literature states that salivary DHT levels expected in normal healthy adults, presenting no symptoms, is less than 10pg/ml, well below the levels used to test cross reactivity. (13)

† Literature states that 19-nortestosterone is absent in normal healthy males & females, and that levels for pregnant females peak in the third trimester at 12-60 pg/ml, well below the levels used to test cross reactivity. (14)

## F. Normal Ranges

Gender	N	Mean (pg/ml)	Median (pg/ml)	Range (5-95%)
Female	158	50.55	40.00	7.09-135.14
Male	87	165.50	136.18	59.05-335.12

Note: Early morning samples may be significantly higher.

## References

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**Seller's Limited Warranty**

“Seller warrants that all goods sold hereunder will be free from defects in material and workmanship. Upon prompt notice by Buyer of any claimed defect, which notice must be sent within thirty (30) days from date such defect is first discovered and within three months from the date of shipment, Seller shall, at its option, either repair or replace the product that is proved to Seller's satisfaction to be defective. All claims should be submitted in written form. This warranty does not cover any damage due to accident, misuse, negligence, or abnormal use. Liability, in all cases, will be limited to the purchased cost of the kit.

**It is expressly agreed that this limited warranty shall be in lieu of all warranties of fitness and in lieu of the warranty of merchantability. Seller shall not be liable for any incidental or consequential damages that arise out of the installation, use or operation of Seller's product or out of the breach of any express or implied warranties.”**

“European Authorized Representative”  
Salimetrics Europe Ltd, Unit 7 Acorn Business Centre,  
Oaks Drive, Newmarket, CB8 7SY, UK  
(T) +44 (0) 1638782619

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