

DEHYDROEPIANDROSTERONE (DHEA)

Cat. No.: CAN-DH-490

Version: 2.1

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INTENDED USE

For the direct quantitative determination of dehydroepiandrosterone (DHEA) in human serum by an enzyme immunoassay. For *in vitro* use only.

PRINCIPLE OF THE TEST

The principle of the following enzyme immunoassay test follows the typical competitive binding scenario. Competition occurs between an unlabeled antigen (present in standards, controls and patient samples) and an enzyme-labelled antigen (conjugate) for a limited number of antibody binding sites on the microwell plate. The washing and decanting procedures remove unbound materials. After the washing step, the enzyme substrate is added. The enzymatic reaction is terminated by addition of the stopping solution. The absorbance is measured on a microtiter plate reader. The intensity of the colour formed is inversely proportional to the concentration of DHEA in the sample. A set of standards is used to plot a standard curve from which the amount of DHEA in patient samples and controls can be directly read.

CLINICAL APPLICATIONS

Dehydroepiandrosterone (DHEA) is a C₁₉ steroid produced in the adrenal cortex and to a lesser extent in the gonads. DHEA serves as precursor in testosterone and estrogen synthesis. Due to the presence of a 17-oxo-group, DHEA has relatively weak androgenic activity, which has been estimated at ~10% that of testosterone. However in neonates, peripubertal children and in adult women, circulating DHEA levels may be several fold higher than testosterone concentrations, and rapid peripheral tissue conversion to more potent androgen (androstenedione and testosterone) and estrogen may occur. Moreover, DHEA has relatively low affinity for sex-hormone binding globulin. These factors may enhance the physiologic biopotency of DHEA.

The physiologic role of DHEA has not been conclusively defined. A variety of *in vivo* and *in vitro* effects have been demonstrated, including antitumoral effects by provoking prevention and/or regression in spontaneous or chemically induced skin and colon cancers in rodents. A few reports have suggested low production of DHEA(S) in women at risk of or having breast cancer. Therapeutic activity of DHEA has been reported for animals with diabetes of genetic origin, obesity and cardiovascular disease. There are also effects of DHEA in immune function, lipid metabolism, cholesterol, the nervous system, aging and in protection against virus development.

Serum DHEA levels are relatively high in the fetus and neonates, low during childhood, and increase during puberty until the third decade of life. No consistent change in serum DHEA levels occur during the menstrual cycle or pregnancy. DHEA has a rapid metabolic clearance rate as compared to its sulfated conjugate, DHEA-S. Because of this, serum DHEA levels are 100-1000 fold lower than DHEA-S levels. In addition serum DHEA levels show significant diurnal variation which is dependent on adrenocorticotrophic hormone (ACTH). Measurement of serum DHEA is a useful marker of adrenal androgen synthesis. Abnormally low levels may occur in hypoadrenalism, and elevated levels may occur in several conditions including virilizing adrenal adenoma and carcinoma, 21-hydroxylase and 3 β -hydroxysteroid dehydrogenase deficiencies and in some case of female hirsutism.

PROCEDURAL CAUTIONS AND WARNINGS

1. Users should have a thorough understanding of this protocol for the successful use of this kit. Reliable performance will only be attained by strict and careful adherence to the instructions provided.
2. Control materials or serum pools should be included in every run at a high and low level for assessing the reliability of results.
3. When the use of water is specified for dilution or reconstitution, use deionized or distilled water.
4. In order to reduce exposure to potentially harmful substances, gloves should be worn when handling kit reagents and human specimens.
5. All kit reagents and specimens should be brought to room temperature and mixed gently but thoroughly before use. Avoid repeated freezing and thawing of reagents and specimens.
6. A calibrator curve must be established for every run.
7. The controls should be included in every run and fall within established confidence limits.
8. Improper procedural techniques, imprecise pipetting, incomplete washing as well as improper reagent storage may be indicated when assay values for the controls do not reflect established ranges.
9. When reading the microplate, the presence of bubbles in the microwells will affect the optical densities (ODs). Carefully remove any bubbles before performing the reading step.
10. The substrate solution (TMB) is sensitive to light and should remain colourless if properly stored. Instability or contamination may be indicated by the development of a blue colour, in which case it should not be used.
11. When dispensing the substrate and stopping solution, do not use pipettes in which these liquids will come into contact with any metal parts.
12. To prevent contamination of reagents, use a new disposable pipette tip for dispensing each reagent, sample, standard and control.
13. Do not mix various lot numbers of kit components within a test and do not use any component beyond the expiration date printed on the label.
14. Kit reagents must be regarded as hazardous waste and disposed of according to national regulations.

LIMITATIONS

1. All the reagents within the kit are calibrated for the direct determination of DHEA in human serum. The kit is not calibrated for the determination of DHEA in saliva, plasma or other specimens of human or animal origin.
2. Do not use grossly hemolyzed, grossly lipemic, icteric or improperly stored serum.
3. Any samples or control sera containing azide or thimerosal are not compatible with this kit, as they may lead to false results.
4. Only calibrator A may be used to dilute any high serum samples. The use of any other reagent may lead to false results.
5. The results obtained with this kit should never be used as the sole basis for a clinical diagnosis. For example, the occurrence of heterophilic antibodies in patients regularly exposed to animals or animal products has the potential of causing interferences in immunological tests. Consequently, the clinical diagnosis should include all aspects of a patient's background including the frequency of exposure to animals/products if false results are suspected.

SAFETY CAUTIONS AND WARNINGS

POTENTIAL BIOHAZARDOUS MATERIAL

Human serum that may be used in the preparation of the standards and controls has been tested and found to be non-reactive for Hepatitis B surface antigen and has also been tested for the presence of antibodies to HCV and Human Immunodeficiency Virus (HIV) and found to be

negative. However no test method can offer complete assurance that HIV, HCV and Hepatitis B virus or any infectious agents are absent. The reagents should be considered a potential biohazard and handled with the same precautions as applied to any blood specimen.

CHEMICAL HAZARDS

Avoid contact with reagents containing TMB, hydrogen peroxide and sulfuric acid. If contacted with any of these reagents, wash with plenty of water. TMB is a suspected carcinogen.

SPECIMEN COLLECTION AND STORAGE

Approximately 0.2 mL of serum is required per duplicate determination. Collect 4-5 mL of blood into an appropriately labelled tube and allow it to clot. Centrifuge and carefully remove the serum layer. Store at 4°C for up to 24 hours or at -10°C or lower if the analyses are to be done at a later date. Consider all human specimens as possible biohazardous materials and take appropriate precautions when handling.

SPECIMEN PRETREATMENT

This assay is a direct system; no specimen pretreatment is necessary.

REAGENTS AND EQUIPMENT NEEDED BUT NOT PROVIDED

1. Precision pipettes to dispense 50, 100, 150 and 300 µL
2. Disposable pipette tips
3. Distilled or deionized water
4. Plate shaker
5. Microwell plate reader with a filter set at 450nm and an upper OD limit of 3.0 or greater* (see assay procedure step 10).

REAGENTS PROVIDED

1. Rabbit Anti-DHEA Antibody Coated Microwell Plate-Break Apart Wells - Ready To Use.

Contents: One 96 well (12x8) polyclonal antibody-coated microwell plate in a resealable pouch with desiccant.

Storage: Refrigerate at 2-8°C

Stability: 12 months or as indicated on label.

2. Dehydroepiandrosterone-Horseradish Peroxidase (HRP) Conjugate Concentrate - Requires Preparation.

Contents: DHEA-HRP conjugate in a protein-based buffer with a non-mercury preservative.

Volume: 0.3 mL/vial

Storage: Refrigerate at 2-8°C

Stability: 12 months or as indicated on label.

Preparation: Dilute 1:100 in assay buffer before use (eg. 20 µl of HRP in 2 mL of assay buffer). If the whole plate is to be used dilute 0.2 mL of HRP in 20 mL of assay buffer. Discard any that is left over.

3. Dehydroepiandrosterone Calibrators - Ready To Use.

Contents: Six vials containing DHEA in a protein-based buffer with a non-mercury preservative. Prepared by spiking buffer with a defined quantity of DHEA.

*Listed below are approximate concentrations, please refer to vial labels for exact concentrations.

Calibrator	Concentration	Volume/Vial
Calibrator A	0 ng/mL	2.0 mL
Calibrator B	0.2 ng/mL	0.6 mL
Calibrator C	0.5 ng/mL	0.6 mL
Calibrator D	4 ng/mL	0.6 mL
Calibrator E	10 ng/mL	0.6 mL
Calibrator F	40 ng/mL	0.6 mL

Storage: Refrigerate at 2-8°C

Stability: 12 months in unopened vials or as indicated on label. Once opened, the standards should be used within 14 days or aliquoted and stored frozen. Avoid multiple freezing and thawing cycles.

4. Controls - Ready To Use.

Contents: Two vials containing DHEA in a protein-based buffer with a non-mercury preservative. Prepared by spiking serum with defined quantities of DHEA. Refer to vial labels for the acceptable range.

Volume: 0.6 mL/vial

Storage: Refrigerate at 2-8°C

Stability: 12 months in unopened vial or as indicated on label. Once opened, the controls should be used within 14 days or aliquoted and stored frozen. Avoid multiple freezing and thawing cycles.

5. Wash Buffer Concentrate - Requires Preparation.

Contents: One bottle containing buffer with a non-ionic detergent and a non-mercury preservative.

Volume: 50 mL/bottle

Storage: Refrigerate at 2-8°C

Stability: 12 months or as indicated on label.

Preparation: Dilute 1:10 in distilled or deionized water before use. If the whole plate is to be used dilute 50 mL of the wash buffer concentrate in 450 mL of water.

6. Assay Buffer - Ready To Use.

Contents: One bottle containing a protein-based buffer with a non-mercury preservative.

Volume: 25 mL/bottle

Storage: Refrigerate at 2-8°C
Stability: 12 months or as indicated on label.

7. TMB Substrate - Ready To Use.

Contents: One bottle containing tetramethylbenzidine and hydrogen peroxide in a non-DMF or DMSO containing buffer.

Volume: 16 mL/bottle

Storage: Refrigerate at 2-8°C

Stability: 12 months or as indicated on label.

8. Stopping Solution - Ready To Use.

Contents: One vial containing 1M sulfuric acid.

Volume: 6 mL/bottle

Storage: Refrigerate at 2-8°C

Stability: 12 months or as indicated on label.

ASSAY PROCEDURE

Specimen Pretreatment: **None.**

All reagents must reach room temperature before use. Calibrators, controls and specimen samples should be assayed in duplicate. Once the procedure has been started, all steps should be completed without interruption.

1. Prepare working solutions of the DHEA-HRP conjugate and wash buffer.
2. Remove the required number of microwell strips. Reseal the bag and return any unused strips to the refrigerator.
3. Pipette 50 µL of each calibrator, control and specimen sample into correspondingly labelled wells in duplicate.
4. Pipette 150 µL of the conjugate working solution into each well (We recommend using a multichannel pipette).
5. Incubate on a plate shaker (approximately 200 rpm) for 1 hour at room temperature.
6. Wash the wells 3 times with 300 µL of diluted wash buffer per well and tap the plate firmly against absorbent paper to ensure that it is dry (The use of a washer is recommended).
7. Pipette 150 µL of TMB substrate into each well at timed intervals.
8. Incubate on a plate shaker for 10-15 minutes at room temperature (or until calibrator A attains dark blue colour for desired OD).
9. Pipette 50 µL of stopping solution into each well at the same timed intervals as in step 7.
10. Read the plate on a microwell plate reader at 450nm within 20 minutes after addition of the stopping solution.

* If the OD exceeds the upper limit of detection or if a 450nm filter is unavailable, a 415nm filter may be substituted. The optical densities will be lower, however, this will not affect the results of patient/control samples.

CALCULATIONS

1. Calculate the mean optical density of each calibrator duplicate.

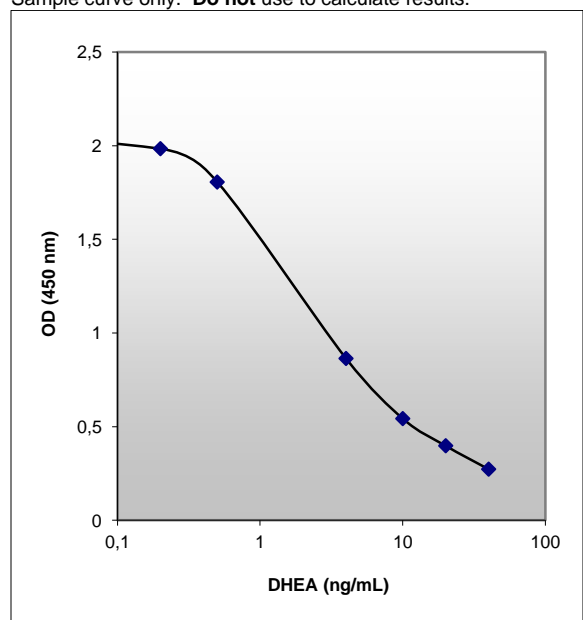
2. Draw a calibrator curve on semi-log paper with the mean optical densities on the Y-axis and the calibrator concentrations on the X-axis. If immunoassay software is being used, a 4-parameter or 5-parameter curve is recommended.
3. Calculate the mean optical density of each unknown duplicate.
4. Read the values of the unknowns directly off the calibrator curve.
5. If a sample reads more than 40 ng/mL then dilute it with calibrator A at a dilution of no more than 1:8. The result obtained should be multiplied by the dilution factor.

TYPICAL TABULATED DATA

Calibrator	OD 1	OD 2	Mean OD	Value (ng/mL)
A	2.193	2.189	2.191	0
B	1.984	2.001	1.993	0.2
C	1.806	1.814	1.810	0.5
D	0.864	0.911	0.888	4
E	0.543	0.526	0.535	10
F	0.273	0.245	0.259	40
Unknown	0.398	0.368	0.383	20

TYPICAL CALIBRATOR CURVE

Sample curve only. **Do not** use to calculate results.



PERFORMANCE CHARACTERISTICS

SENSITIVITY

The lower detection limit is calculated from the standard curve by determining the resulting concentration of the mean OD of Calibrator A (based on 10 replicate analyses) minus 2 SD. Therefore, the sensitivity of the dbc DHEA ELISA kit is **0.082 ng/mL**.

SPECIFICITY (CROSS-REACTIVITY)

The following compounds were tested for cross-reactivity with the Direct DHEA ELISA kit with DHEA cross-reacting at 100%:

Steroid	%Cross-Reactivity
DHEA	100
Andrenosterone	0.282
Androstenedione	0.610
Androsterone	0.248
Cholesterol	0.152
Corticosterone	0.139
Cortisol	0.124
DHEAS	0.050
DHT	0.471
Epiandrosterone	4.555
Estradiol	0.196
Estrone	0.173
Progesterone	0.419
Progesterone, 17-OH	0.306

Testosterone	0.496
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INTRA-ASSAY PRECISION

Three samples were assayed ten times each on the same calibrator curve. The results (in ng/mL) are tabulated below:

Sample	Mean	SD	CV%
1	3.50	0.47	13.4
2	1.25	0.13	10.4
3	9.31	0.55	5.9

INTER-ASSAY PRECISION

Three samples were assayed 20 times, 2 runs a day on the same calibrator curve. The results (in ng/mL) are tabulated below:

Sample	Mean	SD	CV%
1	3.85	0.47	12.2
2	1.41	0.19	13.5
3	9.38	0.86	9.2

RECOVERY

Spiked samples were prepared by adding defined amounts of DHEA to three patient serum samples. The results (in ng/mL) are tabulated below:

Sample	Obs.Result	Exp.Result	Recovery%
1 Unspiked	5.4	-	-
+0.08	5.6	5.2	108
+0.2	6.7	6.2	108
+0.8	13.5	11.2	121
2 Unspiked	0.6	-	-
+0.08	1.3	1.2	108
+0.2	2.4	2.2	109
+0.8	7.5	7.7	97
3 Unspiked	11.3	-	-
+0.08	8.6	9.0	96
+0.2	9.9	10.8	91
+0.8	12.3	15.8	79

LINEARITY

Three patient serum samples were diluted with calibrator A. The results (in ng/mL) are tabulated below:

Sample	Obs.Result	Exp.Result	Recovery%
1	2.269	-	-
1:2	1.149	1.135	101
1:4	0.680	0.567	119
1:8	0.311	0.280	111
2	5.77	-	-
1:2	2.905	2.890	101
1:4	1.357	1.440	94
1:8	0.664	0.720	92
3	4.535	-	-
1:2	2.066	2.250	92
1:4	1.298	1.170	111
1:8	0.542	0.567	96

EXPECTED NORMAL VALUES

As for all clinical assays each laboratory should collect data and establish their own range of expected normal values.

Group	Range (ng/mL)
Females	1-12
Males	3-11

REFERENCES

1. Baulieu, E.M., Dehydroepiandrosterone (DHEA): A fountain of youth? .Journal of Clinical Endocrinology and Metabolism, 18: 3147, 1996.
2. Blethen S.L., et al., Dehydroepiandrosterone (DHEA) measurements in cord blood. Steroids, 45:187, 1985.

