Monobind Inc.
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AccuBind
ELISA Microwells

AccuBind® 17α-OH Progesterone ELISA
Product Code: 5225-300

Intended Use: The Quantitative Determination of 17-OH Progesterone Concentration in Human Serum or Plasma by a Microplate Enzyme Immunoassay

SUMMARY AND EXPLANATION OF THE TEST

Plasma/Serum concentrations of 17α-hydroxyprogesterone (17α-OHP) are valuable in the initial diagnosis of congenital adrenal hyperplasia (CAH) [1, 2]. This common inborn error of metabolism is usually characterized by deficiency in the C21-hydroxylase enzyme system, and necessitates steroid replacement therapy. Adequacy of treatment has been monitored by determining circulating 17α-OHP concentrations[3, 4].

The incidence is roughly estimated to be 1 in 15,000 newborns and can reach as high as 1 in 1480 in native Alaskans. Early diagnosis is valuable to detect CAH in newborns afflicted with the disease, not clinically recognizable but which will lead to life threatening adrenal crisis in the neonatal period and to determine the cause of infants with ambiguous genitalia. Delayed diagnosis may also lead to further virilization in female children, acceleration of skeletal maturation and premature development of secondary sex characteristics in male children. Prompt treatment can save the life of infants and allow afflicted children to attain normal growth.

17P is a steroid produced in the adrenal cortex and the gonads. It is the immediate precursor to 11-desoxycortisol (CpS) which is converted to cortisol. Because CpS is produced by 21-hydroxylation of 17P, measurement of 17P is an indirect indicator of 21-hydroxylase activity. CAH occurs where there is a deficiency of this enzyme. The result is a decrease in the conversion of 17P to CpS which blocks the normal synthesis of cortisol. Due to the feed back mechanism, a decrease in cortisol causes an increase in ACTH secretion resulting in adrenal hyperplasia. As 17P is not being converted, increased concentrations of this steroid will be found.

17P concentration increases during pregnancy in the maternal and fetal blood. After birth, values decline rapidly to reach normal adult values in 2 to 7 days. Thus it is advisable not to collect samples before the 3rd day of life. Premature and sick term infants exhibit 2 to 3 fold 17P values with no CAH disorder. It is suggested that a different cut off be adopted to pre-term and sick infants.

In this method, a sample containing 17-OH progesterone is dispensed into a microplate well. An enzyme labeled 17OH progesterone derivative and biotinylated anti-17OH-progesterone are than added. After a suitable incubation, the antibody fraction is separated from unbound enzyme reagent.

The employment of several serum references of known 17-OH Progesterone concentration permits construction of a graph of activity and concentration. From comparison to the dose response curve, an unknown specimen's activity can be correlated with 17-OH Progesterone concentration.

PRINCIPLE

Competitive Enzyme Immunoassay (TYPE 7):

The essential reagents required for a enzyme immunoassay include antibody, enzyme-antigen conjugate and native antigen. Upon mixing biotinylated antibody, enzyme-antigen conjugate and a serum containing the native antigen, a competition reaction results between the native antigen and the enzyme-antigen conjugate for a limited number of antibody binding sites. The interaction is illustrated by the followed equation:

$$^{Enz}Ag + Ag + Ab_{Btn} \underset{k_{-a}}{\overset{k_a}{\rightleftharpoons}} AgAb_{Btn} + {}^{Enz}AgAb_{Btn}$$

Ab_{Btn} = Biotinylated Antibody (Constant Quantity)

Ag = Native Antigen (Variable Quantity)

^{Enz}Ag = Enzyme-antigen Conjugate (Constant Quantity)

$AgAb_{Btn}$ = Antigen-Antibody Complex

$^{Enz}Ag\ Ab_{Btn}$ = Enzyme-antigen Conjugate -Antibody Complex

k_a = Rate Constant of Association

k_{-a} = Rate Constant of Disassociation

$K = k_a / k_{-a}$ = Equilibrium Constant

A simultaneous reaction between the biotin attached to the antibody and the streptavidin immobilized on the microwell occurs. This effects the separation of the antibody bound fraction after decantation or aspiration.

$AgAb_{Btn} + {}^{Enz}AgAb_{Btn} + \underline{Streptavidin_{CW}} \Rightarrow \underline{immobilized\ complex}$

$\underline{Streptavidin_{CW}}$ = Streptavidin immobilized on well

Immobilized complex = sandwich complex bound to the solid surface

The enzyme activity in the antibody bound fraction is inversely proportional to the native antigen concentration. By utilizing several different serum references of known antigen concentration, a dose response curve can be generated from which the antigen concentration of an unknown can be ascertained.

REAGENTS MATERIALS PROVIDED:

A. 17α-OH Progesterone Calibrators – 1ml/vial - Icons A-F
Six (6) vials of serum reference for 17-OH Progesterone at concentrations of 0 (**A**), 0.1 (**B**), 0.5 (**C**), 1.0 (**D**), 2.5 (**E**), and 10 (F) ng/ml. Store at 2-8°C. A preservative has been added. The calibrators can be expressed in molar concentrations (nM/L) by multiplying by 3.03.

For example: 1ng/ml x 3.03 = 3.03 nM/L

B. 17α-OH Progesterone Enzyme Reagent – 1.0 ml/vial Ⓔ
One (1) vial of 17-OH Progesterone (Analog)-horseradish peroxides (HRP) conjugate in a protein stabilizing matrix with dye. Store at 2-8°C.

C. Steroid Conjugate Buffer – 7.0 ml/vial - Icon Ⓑ
One (1) vial of reagent contains buffer, red dye, preservative, and binding protein inhibitors. Store at 2-8°C.

D. 17α-OH Progesterone Biotin Reagent – 6.0 ml - Icon ∇
One (1) bottle of reagent contains anti-17α-OH Progesterone biotinylated purified rabbit IgG conjugate in buffer, blue dye and preservative. Store at 2-8°C.

E. Streptavidin Coated Plate – 96 wells –Icon ⇓
One 96-well microplate coated with 1.0 µg/ml streptavidin and packaged in an aluminum bag with a drying agent. Store at 2-8°C.

F. Wash Solution Concentrate – 20ml – Icon
One (1) vial contains a surfactant in buffered saline. A preservative has been added. Store at 2-30°C.

G. Substrate Solution --12ml/vial - Icon S[N]
One (1) bottle contains tetramethylbenzidine (TMB) and hydrogen peroxide (H_2O_2) in buffer. Store at 2-8°C.

H. Stop Solution -- 8ml/vial - Icon STOP
One (1) vial contains a strong acid (0.5M H_2SO_4). Store at 2-30°C.

I. Product Instructions

Note 1: Do not use reagents beyond the kit expiration date.

Note 2: Opened reagents are stable for sixty (60) days when stored at 2-8°C.

Note 3: Above reagents are for a single 96-well microplate.

Required But Not Provided:

1. Pipette capable of delivering 25 µl and 50 µl with a precision of better than 1.5%.
2. Dispenser(s) for repetitive deliveries of 0.100ml and 0.350ml volumes with a precision of better than 1.5%.
3. Adjustable volume (200-1000µl) dispenser(s) for conjugate.
4. Microplate washer or a squeeze bottle (optional).
5. Microplate Reader with 450nm and 620nm wavelength absorbance capability.
6 Absorbent Paper for blotting the microplate wells.
7 Plastic wrap or microplate cover for incubation steps.
8 Vacuum aspirator (optional) for wash steps.
9 Timer.
10 Quality control materials.

PRECAUTIONS

For In Vitro Diagnostic Use
Not for Internal or External Use in Humans or Animals

All products that contain human serum have been found to be non-reactive for Hepatitis B Surface Antigen, HIV 1&2 and HCV Antibodies by FDA required tests. Since no known test can offer complete assurance that infectious agents are absent, all human serum products should be handled as potentially hazardous and capable of transmitting disease. Good laboratory procedures for handling blood products can be found in the Center for Disease Control / National Institute of Health, "Biosafety in Microbiological and Biomedical Laboratories," 2nd Edition, 1988, HHS Publication No. (CDC) 88-8395.

SPECIMEN COLLECTION AND PREPARATION

The specimens shall be blood; serum or heparanised plasma in type and taken with the usual precautions in the collection of venipuncture samples. For accurate comparison to establish normal values, a fasting morning serum sample should be obtained. The blood should be collected in a redtop (with or without gel additives) venipuncture tube or for plasma use evacuated tube(s) containing heparin. Allow the blood to clot for serum samples. Centrifuge the specimen to separate the serum or plasma from the cells.

Samples may be refrigerated at 2-8°C for a maximum period of five (5) days. If the specimen(s) cannot be assayed within this time, the sample(s) may be stored at temperatures of -20°C for up to 30 days. Avoid repetitive freezing and thawing. When assayed in duplicate, 0.050ml of the specimen is required.

REAGENT PREPARATION

1. **Working Enzyme Reagent -** Stable for 1 year.
Measure 0.7 ml of '17-OH Progesterone Enzyme Reagent' and add to the vial containing Steroid Conjugate Buffer. Store at 2-8°C.

2. **Wash Buffer**
Dilute contents of wash solution to 1000ml with distilled or deionized water in a suitable storage container. Diluted buffer can be stored at room temperature (20-27°C) for up to 60 days.

Note: Do not use the working substrate if it looks blue.

TEST PROCEDURE

Before proceeding with the assay, bring all reagents, serum references and controls to room temperature (20 - 27°C).

1. Format the microplates' wells for each serum reference, control and patient specimen to be assayed in duplicate. **Replace any unused microwell strips back into the aluminum bag, seal and store at 2-8°C.**
2. Pipette 0.025 ml (25 µL) of the appropriate serum reference, control or specimen into the assigned well.
3. Add 0.050 ml (50µl) of working 17α-OH Progesterone Enzyme Reagent to all wells.
4. Swirl the microplate gently for 20-30 seconds to mix.
5. Add 0.050 ml (50µl) of the 17α-OH Progesterone Biotin Reagent to all wells.
6. Swirl the microplate gently for 20-30 seconds to mix
7. Cover and incubate for 60minutes at room temperature.
8. Discard the contents of the microplate by decantation or aspiration. If decanting, blot the plate dry with absorbent paper.
9. Add 350µl of wash buffer (see Reagent Preparation Section), decant (tap and blot) or aspirate. Repeat two (2) additional times for a total of three (3) washes. **An automatic or manual plate washer can be used. Follow the manufacturer's instruction for proper usage. If a squeeze bottle is employed, fill each well by depressing the container (avoiding air bubbles) to dispense the wash. Decant the wash and repeat two (2) additional times.**
10. Add 0.100 ml (100µl) of substrate solution to all wells (see Reagent Preparation Section). **Always add reagents in the same order to minimize reaction time differences between wells.**
DO NOT SHAKE THE PLATE AFTER SUBSTRATE ADDITION
11. Incubate at room temperature for twenty (20) minutes.
13. Add 0.050ml (50µl) of stop solution to each well and gently mix for 15-20 seconds. **Always add reagents in the same order to minimize reaction time differences between wells.**
14. Read the absorbance in each well at 450nm (using a reference wavelength of 620-630nm. **The results should be read within thirty (30) minutes of adding the stop solution.**

Note: Dilute the samples suspected of concentrations higher than 20ng/ml 1:1 and 1:5 with 17-OH Progesterone '0' ng/ml calibrator or male patient serum pools with a known low value for 17-OH Progesterone.

QUALITY CONTROL

Each laboratory should assay controls at levels in the low, normal and high range for monitoring assay performance. These controls should be treated as unknowns and values determined in every test procedure performed. Quality control charts should be maintained to follow the performance of the supplied reagents. Pertinent statistical methods should be employed to ascertain trends. The individual laboratory should set acceptable assay performance limits. In addition, maximum absorbance should be consistent with past experience. Significant deviation from established performance can indicate unnoticed change in experimental conditions or degradation of kit reagents. Fresh reagents should be used to determine the reason for the variations.

CALCULATION OF RESULTS

A dose response curve is used to ascertain the concentration of 17-OH Progesterone in unknown specimens.

1. Record the absorbance obtained from the printout of the microplate reader as outlined in Example 1.
2. Plot the absorbance for each duplicate serum reference versus the corresponding 17-OH Progesterone concentration in ng/ml on linear graph paper (do not

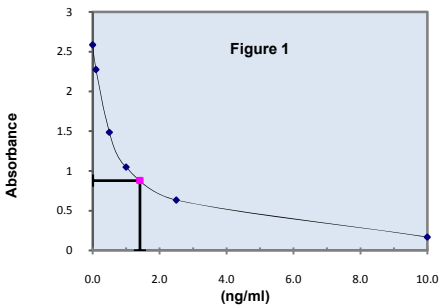
average the duplicates of the serum references before plotting).

3. Connect the points with a best-fit curve.
4. To determine the concentration of 17-OH Progesterone for an unknown, locate the average absorbance of the duplicates for each unknown on the vertical axis of the graph, find the intersecting point on the curve, and read the concentration (in ng/ml) from the horizontal axis of the graph (the duplicates of the unknown may be averaged as indicated). In the following example, the average absorbance (0.880) intersects the dose response curve at (1.41ng/ml) 17-OH Progesterone concentration (See Figure 1).

EXAMPLE 1

Sample I.D.	Well Number	Abs (A)	Mean Abs (B)	Value (ng/ml)
Cal A	A1	2.586	2.586	0
	B1	2.586		
Cal B	C1	2.276	2.275	0.1
	D1	2.274		
Cal C	E1	1.509	1.486	0.5
	F1	1.463		
Cal D	G1	1.069	1.049	1.0
	H1	1.030		
Cal E	A2	0.642	0.634	2.5
	B2	0.626		
Cal F	C2	0.172	0.169	10
	D2	0.166		
Pat# 1	A3	0.876	0.880	**1.41**
	B3	0.884		

*The above data and table below is for example only. Do not use it for calculating your results.



Q.C. PARAMETERS

In order for the assay results to be considered valid the following criteria should be met:

1. The absorbance (OD) of calibrator 0 ng/ml should be ≥ 1.3.
2. Four out of six quality control pools should be within the established ranges.

RISK ANALYSIS

A. Assay Performance

1. It is important that the time of reaction in each well is held constant for reproducible results.
2. Pipetting of samples should not extend beyond ten (10) minutes to avoid assay drift.
3. If more than one (1) plate is used, it is recommended to repeat the dose response curve.
4. Addition of the substrate solution initiates a kinetic reaction, which is terminated by the addition of the stop solution. Therefore, the addition of the substrate and the stopping solution should be added in the same sequence to eliminate any time-deviation during reaction.
5. Plate readers measure vertically. Do not touch the bottom of the wells.
6. Failure to remove adhering solution adequately in the aspiration or decantation wash step(s) may result in poor replication and spurious results.
7. Use components from the same lot. No intermixing of reagents from different batches.
8. Accurate and precise pipetting, as well as following the exact time and temperature requirements prescribed are essential. Any deviation from this may yield inaccurate results.
9. It is important to calibrate all the equipment e.g. Pipettes, Readers, Washers and/or the automated instruments used for using this device.
10. Risk Analysis- as required by CE Mark IVD Directive 98/79/EC - for this and other devices, made by Monobind, can be requested via email from Monobind@monobind.com.

B. Interpretation

1. If computer controlled data reduction is used to interpret the results of the test, it is imperative that the predicted values for the calibrators fall within 10% of the assigned concentrations.

EXPECTED RANGES OF VALUES

In agreement with established reference intervals for a "normal" adult population and females during gestation the expected ranges for the 17α-OH Progesterone AccuBind™ ELISA Test System are detailed in Table 1.

TABLE I
Expected Values for the 17α-OH Progesterone Test System

	(ng/ml)	(nmol/L)
Prepubertal Child (1-10 yr)	0.2 – 0.8	0.64 – 2.54
Adult man	0.2 – 3.1	0.64 – 9.86
Adult woman		
Follicular phase	0.20-1.30	0.64 – 4.13
Luteal phase	1.00 – 4.51	3.18 – 14.34
Postmenopausal woman	0.2 – 0.9	0.64 – 2.86

It is important to keep in mind that establishment of a range of values which can be expected to be found by a given method for a population of "normal" persons is dependent upon a multiplicity of factors: the specificity of the method, the population tested and the precision of the method in the hands of the analyst. For these reasons each laboratory should depend upon the range of expected values established by the manufacturer only until an in-house range can be determined by the analysts using the method with a population indigenous to the area in which the laboratory is located.

PERFORMANCE CHARACTERISTICS

A. Precision

The within and between assay precision of the 17-OH Progesterone AccuBind™ Microplate EIA Test System were determined by analyses on three different levels of pool control sera. The number, mean values, standard deviation and coefficient of variation for each of these control sera are presented in Table 2 and Table 3.

TABLE 2
Within Assay Precision (Values in ng/ml)

Sample	N	X	σ	C.V.
Low	20	0.94	0.06	8.5%
Normal	20	3.25	0.22	6.7%
High	20	7.38	0.43	5.8%

TABLE 3
Between Assay Precision (Values in ng/ml)

Sample	N	X	σ	C.V.
Low	10	0.88	0.07	8.0%
Normal	10	3.12	0.24	7.7%
High	10	7.55	0.48	6.4%

*As measured in ten experiments in duplicate over a ten day period.

B. Accuracy

The 17-OH Progesterone AccuBind™ Microplate ELISA Test System was compared with a chemiluminescence immunoassay method. Biological specimens from low, normal and high 17-OH Progesterone level populations were used (The values ranged from < 0.15 ng/ml – 128 ng/ml). The total number of such specimens was 66. The least square regression equation and the correlation coefficient were computed for this method in comparison with the reference method. The data obtained is displayed in Table 4.

TABLE 4

Method	Mean (x)	Least Square Regression Analysis	Correlation Coefficient
This Method (Y)	3.49	Y= 0.2232+1.065(x)	0.957
Reference (X)	3.19		

Only slight amounts of bias between this method and the reference method are indicated by the closeness of the mean values. The least square regression equation and correlation coefficient indicates excellent method agreement.

C. Sensitivity

The 17-OH Progesterone AccuBind™ Microplate EIA Test System has a sensitivity of 0.03ng/ml. The sensitivity was ascertained by determining the variability of the 0 ng/ml serum calibrator and using the 2σ (95% certainty) statistic to calculate the minimum dose.

D. Specificity

The % cross reactivity of the 17OH-progesterone antibody to selected substances was evaluated by adding the interfering substance to a serum matrix at various concentrations. The cross-reactivity was calculated by deriving a ratio between dose of interfering substance to dose of 17-OH Progesterone needed to displace the same amount of labeled analog.

Substance	Cross Reactivity
17-OH Progesterone	100.000
Progesterone	0.375
Androstenedione	0.158
Cortisone	0.014
Corticosterone	0.347
Cortisol	0.005
Danazol	0.003
Dihydotestosterone	0.006
DHEA sulfate	0.002
Estradiol	0.004
Estrone	0.003
Estriol	0.002
Prednisone	0.023
Testosterone	0.015
RF	<0.001

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Size		96(A)	192(B)
Reagent (fill)	A)	1ml set	1ml set
	B)	1 (1ml)	2 (1ml)
	C)	1 (7ml)	2 (7ml)
	D)	1 (6ml)	2 (6ml)
	E)	1 plate	2 plates
	F)	1 (20ml)	1 (20ml)
	G)	1 (12ml)	2 (12ml)
	H)	1 (8ml)	2 (8ml)

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