



Cortisol ELISA Kit

Catalog Number KA1885

96 assays

Version: 11

Intended for research use only

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Introduction

Intended Use

Enzyme immunoassay for the quantitative measurement of active free cortisol in saliva. It is intended only for research use.

Background

Cortisol (hydrocortisone) is the major glucocorticoid produced in the adrenal cortex. Cortisol is a potent stress hormone and the secretion is regulated by the Hypothalamic-Pituitary-Adrenal-axis (HPA-axis).

The secretion of cortisol has a specific circadian rhythm with a curve presenting a sharp peak in the early morning and a gradually decrease over the day with a nadir in the evening (7). The position of this peak-value is strongly influenced by the average wake-up time during the past weeks. It is not dependent on the actual wake-up time of the specific day of sample collection (if different from the average wake-up time of the past week).

The loss of circadian rhythm with absence of a late-night cortisol nadir is a consistent abnormality in donors with Cushing's syndrome. This difference forms the basis for measurement of late-night salivary cortisol (4). Studies show that salivary cortisol concentration reflects the serum unbound cortisol concentration throughout the physiological concentration range (7, 8, 12). In serum, 90-95% of cortisol is bound to protein while in saliva cortisol appears mainly in its free, metabolic active form. The salivary cortisol concentration is independent of saliva flow rate as well as of the serous and mucous content (12). Spontaneous increases in cortisol concentration during the day may occur commonly due to stress or food intake. Changed patterns of Cortisol levels have been observed in connection with abnormal ACTH levels, clinical depression, psychological stress, and various physiological stressors as hypoglycemia, illness, fever, trauma, surgery, or pain.

Principle of the Assay

The Cortisol ELISA kit is a solid phase enzyme-linked immunosorbent assay (ELISA), based on the principle of competitive binding. The microtiter wells are coated with a polyclonal rabbit antibody directed against the cortisol molecule. The samples are dispensed in the coated wells and incubated with the enzyme conjugate (cortisol conjugated to horseradish peroxidase). During incubation endogenous cortisol of a sample competes with the enzyme conjugate for binding to the coated antibody. The unbound conjugate is removed by washing the wells.

Subsequently, the substrate solution is added and the color development is stopped after a defined time. The intensity of the color formed is inversely proportional to the concentration of cortisol in the sample. The absorbance is measured at 450 nm with a microtiter plate reader.

General Information

Materials Supplied

List of component

Component	Amount
Microtiterwells: 12x8 (break apart) strips; wells coated with an anti-cortisol antibody (polyclonal).	96 wells
Enzyme Conjugate: Ready to use. Cortisol conjugated to horseradish peroxidase.	7 mL
Substrate Solution: Ready to use. Tetramethylbenzidine (TMB).	22 mL
Stop Solution: Ready to use; contains 2 N acidic solution. Avoid contact with the stop solution. It may cause skin irritations and burns.  Hazards identification: H290 May be corrosive to metals. H314 Causes severe skin burns and eye damage. H335 May cause respiratory irritation.	7 mL
Wash Solution (10X concentrated)	50 mL
Control 1 (low): Ready to use; for control values and ranges please refer QC-Datasheet.	0.5 mL
Control 2 (high): Ready to use; for control values and ranges please refer QC-Datasheet.	0.5 mL

Standards -Ready to use

Component	Concentration (ng/mL)	Amount
Standard A (0)	0	2 mL
Standard B (1)	0.1	0.5 mL
Standard C (2)	0.4	0.5 mL
Standard D (3)	1.7	0.5 mL
Standard E (4)	7.0	0.5 mL
Standard F (5)	30	0.5 mL

* Conversion factor: 1 ng/mL = 2.76 nmol/L

Note: All reagents contain azide-free and mercury-free preservatives.

Storage Instruction

When stored at 2-8°C unopened reagents will be stable until expiration date. Do not use reagents beyond this date. Opened reagents must be stored at 2-8°C. After first opening the reagents are stable for 30 days if used and stored properly.

Microplate wells must be stored at 2-8°C. Take care that the foil bag is sealed tightly.

Materials Required but Not Supplied

- ✓ Microcentrifuge
- ✓ A calibrated microtiter plate calibrated reader (450 ± 10 nm)
- ✓ Microplate mixer operating at about 600 – 900 rpm, optionally
- ✓ Vortex mixer
- ✓ Calibrated variable precision micropipettes (50 μ L, 100 μ L, 200 μ L).
- ✓ Absorbent paper.
- ✓ Distilled or deionized water
- ✓ Timer
- ✓ Semi logarithmic graph paper or software for data reduction

Precautions for Use

- ✓ Warnings and Precautions
1. This kit is for research use only.
 2. Before starting the assay, read the instructions completely and carefully. Use the valid version of the package insert provided with the kit. Be sure that everything is understood.
 3. The microplate contains snap-off strips. Unused wells must be stored at 2-8°C in the sealed foil pouch and used in the frame provided.
 4. Pipetting of samples and reagents must be done as quickly as possible and in the same sequence for each step.
 5. Use reservoirs only for single reagents. This especially applies to the substrate reservoirs. Using a reservoir for dispensing a substrate solution that had previously been used for the conjugate solution turn solution colored. Do not pour reagents back into vials as reagent contamination may occur.
 6. Mix the contents of the microplate wells thoroughly to ensure good test results. Do not reuse microwells.
 7. Do not let wells dry during assay; add reagents immediately after completing the rinsing steps.
 8. Allow the reagents to reach room temperature (18-25°C) before starting the test. Temperature will affect the absorbance readings of the assay.
 9. Never pipet by mouth and avoid contact of reagents and specimens with skin and mucous membranes.
 10. Do not smoke, eat, drink, or apply cosmetics in areas where specimens or kit reagents are handled.
 11. Wear disposable latex gloves when handling specimens and reagents. Microbial contamination of reagents or specimens may give false results.
 12. Handling should be done in accordance with the procedures defined by an appropriate national biohazard safety guideline or regulation.
 13. Do not use reagents beyond expiry date as shown on the kit labels.
 14. All indicated volumes have to be performed according to the protocol. Optimal test results are only obtained when using calibrated pipettes and microtiter plate readers.

15. Do not mix or exchange components from kits with different lot numbers. It is advised not to exchange wells of different plates even of the same lot. The kits may have been shipped or stored under different conditions and the binding characteristic of the plates may differ slightly.
16. Avoid contact with Stop Solution. It may cause skin irritation and burns.
17. Chemicals and prepared or used reagents have to be treated as hazardous waste according to the national biohazard safety guideline or regulation.
18. For information please refer to Material Safety Data Sheets. Safety Data Sheets for this product are available upon request directly from manufacturer.

✓ Limitations of Procedure

Reliable and reproducible results will be obtained when the assay procedure is performed with a complete understanding of the package insert instruction and with adherence to GLP (Good Laboratory Practice).

Any improper handling of samples or modification of this test might influence the results.

- High-Dose-Hook effect

A High-Dose-Hook Effect is not known for competitive assays.

- Drug interferences

Any medication (cream, oil, pill etc) containing Cortisol of course will significantly influence the measurement of this analyte in saliva. The same is true for any medication containing Prednisolone.

✓ Disposal of the kits

The disposal of the kit must be made according to the national regulations. Special information for this product is given in the Material Safety Data Sheet.

✓ Damaged test kits

In case of any severe damage of the test kit or components, the manufacturer has to be informed written, latest one week after receiving the kit. Severely damaged single components should not be used for a test run. They have to be stored until a final solution has been found. After this, they should be disposed according to the official regulations.

Assay Protocol

Reagent Preparation

Allow the reagents and the required number of wells to reach room temperature (18-25°C) before starting the test.

✓ Wash Solution

Add deionized water to the 10X concentrated Wash Solution.

Dilute 50 mL of concentrated Wash Solution with 450 mL deionized water to a final volume of 500 mL.

The diluted Wash Solution is stable for 12 weeks at room temperature (18-25°C).

Sample Preparation

Samples containing sodium azide must not be used in the assay. The saliva samples should be completely colorless. Even the slightest red color shows blood contamination. Such blood contamination will result in falsely elevated concentration values. In case of visible blood contamination the donor should discard the sample, rinse the collection device with water, also rinse the mouth with (preferably) cold water, wait for 10 minutes and take a new sample. Chewing anything during the sampling period must be avoided. Any pressure on the teeth may result in falsely elevated measurement due to an elevated content of gingival liquid in the saliva sample.

✓ Specimen Collection

For the correct collection of saliva we are recommending to only use appropriate devices made from ultra-pure polypropylene (PP). Do not use any PE devices or Salivettes for sampling; in most cases this will result in significant interferences. Glass tubes can be used as well, but in this case special attention is necessary for excluding any interference caused by the stopper.

As the Cortisol secretion in saliva as well in serum shows an obvious secretion pattern throughout the day, it is important to care for a proper sample timing of the sampling. The morning peak normally appears during the first two hours after the average wake-up time. Therefore we recommend taking 5 separate samples within a period of two hours (multiple sampling) directly after the usual wake-up time (e.g. 1 min, 30 min, 60 min, 90 min and 120 min). It is important to know that the timing of the morning peak is not related to the absolute time or day light. It is just related to the wake-up habits of the donor. If possible the volume of each single sample should be a minimum of 0.5 mL (better 1 mL).

As food might contain significant amounts of steroid hormones samples preferably should be taken while fasting. Do not collect samples within 60 minutes after eating a major meal, 12 hours after consuming alcohol or 60 minutes after brushing teeth. Rinse mouth with water 10 minutes prior to specimen collection.

Furthermore please avoid any strenuous physical exercises and intense stress situations.

The collection for the evening sample has to be done during the late evening (at best between 10 and 12 PM). Also in this case we recommend collecting 5 samples in intervals of at least 30 minutes. If only 5

sampling devices are available for the collection of a day profile, sampling also can be done as follows. 30 min, 60 min, and 90 minutes after the usual wake-up time for the morning value, followed by 2 samples in the late evening collected during the last hour prior to regular bed time.

✓ **Specimen Storage and Preparation**

In general saliva samples are stable at ambient temperature for several days. Therefore mailing of such samples by ordinary mail without cooling will not create a problem. Whenever possible, samples preferable should be kept at a temperature of -20°C . We recommend avoiding multiple freeze-thaw cycles.

Each sample has to be frozen, thawed, and centrifuged at least once in order to separate the mucins. Upon arrival of the samples in the lab the samples have to be stored frozen at least overnight. In the next morning the frozen samples are thawed and brought to room temperature and mixed carefully. Then the samples have to be centrifuged for 5 to 10 minutes. Now the clear colorless supernatant is easy to pipette. If the sample should show even a slight reddish tinge it should be discarded. Otherwise the concentration value most probably will be falsely elevated. Due to the episodic variations of the cortisol secretion we highly recommend the strategy of multiple sampling. If such a set of multiple samples has to be tested the lab (after at least one freezing, thawing, and centrifugation cycle) has to mix the aliquots of the five single samples in a separate sampling device and perform the testing from this mixture. If the shape of the morning peak has to be determined all five morning samples have to be tested separately.

✓ **Specimen Dilution**

If in an initial assay, a specimen is found to contain more cortisol than the highest standard, the specimens can be diluted with Standard A and re-assayed as described in Assay Procedure.

For the calculation of the concentrations this dilution factor has to be taken into account.

Assay Procedure

✓ **General remarks**

- All reagents and specimens must be allowed to come to room temperature ($18-25^{\circ}\text{C}$) before use. All reagents must be mixed without foaming.
- Once the test has been started, all steps should be completed without interruption.
- Use new disposal plastic pipette tips for each standard, control or sample in order to avoid cross contamination.
- Absorbance is a function of the incubation time and temperature. Before starting the assay, it is recommended that all reagents are ready, caps removed, all needed wells secured in holder, etc. This will ensure equal elapsed time for each pipetting step without interruption.
- As a general rule the enzymatic reaction is linearly proportional to time and temperature.
- Respect the incubation times as stated in this instructions for use.
- Duplicate determination of standards, controls and samples is recommended in order to identify potential pipetting errors.

- ✓ Each run must include a standard curve.
- 1. Secure the desired number of coated strips in the frame holder.
- 2. Dispense 50 μL of each Standard, Control and Samples in duplicates with new disposable tips into appropriate wells.
- 3. Dispense 50 μL Enzyme Conjugate into each well.
Thoroughly mix for 10 seconds. It is important to have a complete mixing in this step.
- 4. Incubate for 60 minutes at room temperature (18-25°C). Shaking on a horizontal shaker during incubation is not necessary, but it improves the sensitivity of the test.
- 5. Briskly empty the contents of the wells by aspiration or by decanting.
Rinse the wells 4 times with diluted Wash Solution (300 μL per well). Strike the wells sharply on absorbent paper to remove residual droplets.
Important note: The sensitivity and precision of this assay is markedly influenced by the correct performance of the washing procedure!
- 6. Add 200 μL of Substrate Solution to each well.
- 7. Incubate for 30 minutes in the dark at room temperature (18-25°C).
- 8. Stop the enzymatic reaction by adding 50 μL of Stop Solution to each well.
- 9. Determine the absorbance of each well at 450 ± 10 nm within 15 minutes after adding the Stop Solution.

Data Analysis

Calculation of Results

1. Calculate the average absorbance values for each set of standards, controls and samples.
 2. The obtained OD of the standards (y-axis, linear) are plotted against their concentration (x-axis, logarithmic) either on semi-logarithmic paper or using an automated method.
 3. Using the mean absorbance value for each sample determine the corresponding concentration from the standard curve.
 4. Automated method: The results in this protocol have been calculated automatically using a 4 PL (4 Parameter Logistics) curve fit. 4 Parameter Logistics is the preferred calculation method. Other data reduction functions may give slightly different results.
 5. The concentration of the samples can be read directly from this standard curve. Samples with concentrations higher than that of the highest standard have to be further diluted. For the calculation of the concentrations this dilution factor has to be taken into account.
- ✓ Example of typical calibration curve

The following data is for demonstration only and cannot be used in place of data generations at the time of assay.

Standard	Optical Units (450 nm)
Standard A 0.0 ng/mL	3.099
Standard B 0.1 ng/mL	2.647
Standard C 0.4 ng/mL	1.932
Standard D 1.7 ng/mL	0.856
Standard E 7.0 ng/mL	0.357
Standard F 30 ng/mL	0.172

- ✓ Expected Normal Values

In order to determine the normal range of Cortisol free in Saliva samples from adult male and female apparently healthy subjects, were collected and analyzed using the Cortisol ELISA Kit.

The following range was calculated from this study.

Time of day	5-95% percentile (ng/mL)	n
Morning	1.6 - 9.2	234
Midday	0.9 - 6.9	427
Afternoon	0.6 - 3.6	129
Evening	0.4 - 3.9	419
Midnight	< 1.2	26

Since cortisol levels show diurnal cycles, we recommend to always collecting a series of samples in the morning and another one in the evening. The difference between morning and evening is the important parameter. Furthermore, we recommend that each laboratory determines its own range for the population tested.

✓ Quality Control

Good laboratory practice requires that controls be run with each standard curve. A statistically significant number of controls should be assayed to establish mean values and acceptable ranges to assure proper performance.

It is recommended to use control samples according to state and federal regulations. The use of control samples is advised to assure the day to day validity of results. Use controls at both normal and abnormal levels.

The controls and the corresponding results of the QC-Laboratory are stated in the QC certificate included in the kit. The values and ranges stated on the QC sheet always refer to the current kit lot and should be used for direct comparison of the results.

It is also recommended to make use of national or international Quality Assessment programs in order to ensure the accuracy of the results.

Employ appropriate statistical methods for analysing control values and trends. If the results of the assay do not fit to the established acceptable ranges of control materials sample results should be considered invalid.

In this case, please check the following technical areas: Pipetting and timing devices; microtiter plate reader, expiration dates of reagents, storage and incubation conditions, aspiration and washing methods. After checking the above mentioned items without finding any error contact your distributor or the manufacturer directly.

Performance Characteristics

✓ Analytical Sensitivity

The analytical sensitivity of the Cortisol ELISA Kit was calculated by subtracting 2 standard deviations from the mean of twenty (20) replicate analyses of Standard A. The analytical sensitivity of the assay is 0.019 ng/mL.

✓ Assay dynamic range

The range of the assay is between 0.1 - 30 ng/mL.

✓ Reproducibility

1. Intra-Assay

The intra-assay variation was determined by replicate measurements of three saliva samples within one run using the Cortisol ELISA Kit. The intra-assay variation is shown below:

	Sample 1	Sample 2	Sample 3
Mean (ng/mL)	0.64	2.01	4.87
SD (ng/mL)	0.05	0.08	0.21
CV (%)	7.1	4.1	4.3
n=	20	20	20

2. Inter-Assay

The inter-assay variation was determined by duplicate measurements of three saliva samples in ten different runs using the Cortisol ELISA Kit. The inter-assay variation is shown below:

	Sample 1	Sample 2	Sample 3
Mean (ng/mL)	0.65	2.05	5.31
SD (ng/mL)	0.03	0.15	0.48
CV (%)	4.2	7.5	9.1
n=	10	10	10

✓ Specificity (Cross Reactivity)

The following materials have been evaluated for cross reactivity.

Steroids	% Cross reactivity
Testosterone	< 0.1
Corticosterone	6.2
Cortisone	0.8
11-Deoxycorticosterone	2.6
11-Deoxycortisol	50
Dexamethasone	< 0.1
Estriol	< 0.1
Estrone	< 0.1
Prednisolone	100
Prednisone	0.9
Progesterone	< 0.1
17-Hydroxyprogesterone	1.3
Danazole	< 0.1
Pregnenolone	< 0.1
Estradiol	< 0.1
Androstenedione	< 0.1

✓ Recovery

Recovery of the Cortisol ELISA Kit was determined by adding increasing amounts of the analyte to three different saliva samples containing different amounts of endogenous analyte. Each sample (non-spiked and spiked) was assayed and analyte concentrations of the samples were calculated from the standard curve. The percentage recoveries were determined by comparing expected and measured values of the samples.

Saliva	Spiking	Measured Concentration (ng/mL)	Expected Concentration (ng/mL)	Recovery %
1	native	0.53	-	-
	3 ng/mL	3.35	3.53	95%
	5 ng/mL	6.57	5.53	119%
	7 ng/mL	8.31	7.53	110%
2	native	0.54	-	-
	3 ng/mL	3.52	3.54	99%
	5 ng/mL	7.02	5.54	126%
	7 ng/mL	8.61	7.54	114%
3	native	0.82	-	-
	3 ng/mL	3.51	3.82	92%
	5 ng/mL	6.32	5.82	108%
	7 ng/mL	9.15	7.82	117%

✓ Linearity

Three saliva samples containing different amounts of analyte were serially diluted with Standard A and assayed with the Cortisol ELISA Kit. The percentage recovery was calculated by comparing the expected and measured values for cortisol.

Saliva	Dilution	Measured Concentration (ng/mL)	Expected Concentration (ng/ml)	Linearity %
1	native	4.13	-	-
	1 in 2	2.04	2.07	99%
	1 in 4	1.07	1.03	104%
	1 in 8	0.60	0.52	115%
2	native	4.13	-	-
	1 in 2	2.26	2.07	109%
	1 in 4	1.24	1.03	120%
	1 in 8	0.66	0.52	127%
3	native	4.48	-	-
	1 in 2	2.32	2.24	104%
	1 in 4	1.33	1.12	119%
	1 in 8	0.65	0.56	116%

Resources

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Plate Layout

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