



Instructions for Use

CAT ELISA


Enzyme Immunoassays


for the Quantitative Determination of


Adrenaline / Noradrenaline / Dopamine
in Plasma and Urine

RUO For research use only!

REF EA603/288

 3 x 96

 2 – 8 °C

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Symbols

 IVD	In Vitro Diagnostic Medical Device		EC Declaration of Conformity
 CONT	Content		Expiry Date
 LOT	Batch code		Temperature limitation
	Manufacturer		Sufficient for ... determinations
 REF	Catalogue number		Consult instructions for use

Hazard Pictograms



Danger



Warning

1. Introduction and Principle of the Test

Catecholamine is the name of a group of aromatic amines (noradrenaline, adrenaline, dopamine, and their derivatives) which act as hormones and neurotransmitter, respectively. Adrenaline and noradrenaline are formed from dopamine. They act on the cardiac musculature and the metabolism (adrenaline) as well as on the peripheral circulation (noradrenaline) and help the body to cope with acute and chronic stress.

An increased production of catecholamines can be found with tumours of the chromaffine system (pheochromocytoma, neuroblastoma, ganglioneuroma). An increased or decreased concentration of the catecholamines can also be found with hypertension, degenerative cardiac diseases, schizophrenia and manic-depressive psychosis. The measurement of dopamine and its derivatives is of special diagnostic value with children who are suspected to have a neuroblastoma.

The assay kit provides materials for the quantitative measurement of adrenaline, noradrenaline and dopamine in plasma and urine. Noradrenaline, adrenaline and dopamine are extracted using a cis-diol-specific affinity gel and acylated to N-acylnoradrenaline, N-acyladrenaline and N-acyl-dopamine and then converted enzymatically into N-acylnormetanephrine, N-acylmetanephrine and N-acyl-3-methoxytyramine.

The competitive CAT ELISA kit uses the microtitre plate format. Adrenaline, noradrenaline and dopamine, respectively, are bound to the solid phase of the microtiter plate. Acylated catecholamine from the sample and solid phase bound catecholamine compete for a fixed number of antiserum binding sites. When the system is in equilibrium, free antigen and free antigen-antiserum complexes are removed by washing. The antibody bound to the solid phase catecholamine is detected by anti-rabbit IgG / peroxidase. The substrate TMB / peroxidase reaction is monitored at 450 nm. The amount of antibody bound to the solid phase catecholamine is inversely proportional to the catecholamine concentration of the sample.

2. Precautions

- For in vitro diagnostic use only.
- Some reagents contain sodium azide as preservative. Avoid skin contact.
- Material of animal origin used in the preparation of the kit has been obtained from animals certified as healthy but these materials should be handled as potentially infectious.
- Some components of this kit are containing hazardous reagents. These components are marked with the adequate hazard label.

3. Storage and Stability

On arrival, store the kit at 2-8 °C. Once opened the kit is stable until its expiry date. For stability of prepared reagents refer to Preparation of Reagents.

Do not use components beyond the expiration date shown on the kit labels.

Do not mix various lots of any kit component within an individual assay.

4. Contents of the Kit

Reagents for Sample Preparation:

4.1	Extraction Plate 48 wells coated with boronate affinity gel	EX-PLATE	2 plates
4.2.	Extraction-Buffer 6 ml, ready for use colour coded purple	EX-BUFF	1 vial
4.3	HCl 21 ml, ready for use 0.025 M HCl colour coded yellow orange	HCL	1 vial

4.4 **Standards (1 - 7)** **CAL 1 - 7** 7 vials
 Each 4 ml, ready for use

Concentrations:

Standard	1	2	3	4	5	6	7
Adrenaline (ng/ml)	0	0.5	1.5	5	15	50	150
nmol/l	0	2.7	8.2	27.3	81.9	273	819
Noradrenaline (ng/ml)	0	1.5	5	15	50	150	500
nmol/l	0	8.9	29.6	88.9	296	887	2,955
Dopamine (ng/ml)	0	1.5	10	40	160	640	2,560
nmol/l	0	9.8	65.3	261	1,045	4,179	16,717

When determining urine samples only: Standard 2 can be omitted.

When determining plasma samples only: Standard 7 can be omitted.

4.5 **Control 1 & 2** **CON 1 & 2** 2 vials
 Each 4 ml, ready for use, Concentrations: see q.c. certificate

4.6 **Acylation Reagent** **ACYL-REAG** 1 vial
 6 ml, ready for use, contains DMSO and DMF
 (please note that solvent reacts with many plastic materials including plastic trays; it does not react with normal pipette tips and with glass devices).



Danger, Warning

4.7 **Acylation Buffer** **ACYL-BUFF** 1 vial
 20 ml, ready for use, colour coded purple

4.8 **Enzyme** **ENZYME** 4 vials
 2 ml, lyophilized
 Catechol-O-methyltransferase

4.9 **Coenzyme** **COENZYME** 2 vials
 1 ml, ready for use
 S-adenosyl-L-methionine

4.10 **Enzyme Buffer** **ENZYME-BUFF** 1 vial
 2 ml, ready for use



Warning

Reagents for ELISA:

4.11	Adrenaline-Antiserum 6 ml, ready for use, rabbit colour coded blue	AS-AD	1 vial
4.12	Noradrenaline-Antiserum 6 ml, ready for use, rabbit colour coded yellow	AS-NAD	1 vial
4.13	Dopamine-Antiserum 6 ml, ready for use, rabbit colour coded green	AS-DA	1 vial
4.14	MT-Strips STRIPS-AD STRIPS-NAD STRIPS-DA 8 wells each, break apart, precoated with: derivatized adrenaline (12 strips), colour coded blue derivatized noradrenaline (12 strips), colour coded yellow derivatized dopamine (12 strips), colourless		3 x 12 strips
4.15	POD Conjugate 12 ml, ready for use, Anti-rabbit IgG-POD conjugate/ peroxidase	CONJ	3 vials
4.16	Wash Buffer 20 ml, concentrate Dilute content with dist. water to 1000 ml total volume	WASH	2 vials
4.17	Substrate 12 ml TMB solution, ready for use	SUB	3 vials
4.18	Stop Solution 12 ml, ready for use Contains 0.3 M sulphuric acid	STOP	3 vials
4.19	Adhesive Foil Ready for use	FOIL	10 pieces



Warning

Additional materials and equipment required but not provided:

- Pipettes for pipetting 20, 50, 300, 1000 μ l
- Repeating dispenser for 20, 50, 100, 150, 200, 250 μ l und 1 ml
- Horizontal shaker
- Microplate washing device
- Microplate photometer
- Distilled water

5. Sample Collection and Storage

Plasma

EDTA plasma samples are required for the assay. Physical and psychical stress usually causes a high increase of the catecholamine concentration. Therefore, it is recommended to let the patient rest for 20 to 30 minutes after the venipuncture and before collecting the blood sample.

Haemolytic and especially lipemic samples should not be used for the assay, because false low values will be obtained with such samples.

The plasma samples can be stored at 2 - 8 °C up to 6 hours. For a longer period (up to 1 week) the samples should be stored at -20 °C.

Urine

The total volume of urine excreted during a 24-hours period should be collected and mixed in a single bottle containing 10 - 15 ml of 6 M hydrochloric acid as preservative. Avoid exposure to direct sun light. Determine the total volume and take an aliquot for the measurement. For patients with suspected kidney disorders the creatinine concentration should be tested, too. Urine samples can be stored at -20 °C for at least 6 months.

6. Preparation of Reagents and Samples

6.1. Preparation of Reagents

Wash Buffer

Dilute the content of the bottle with distilled water to a total volume of 1000 ml.

Store the diluted wash buffer at 2 - 8 °C for a maximum period of 4 weeks or at -20 °C until the indicated expiry date.

Enzyme Mix

NOTE: The enzyme mix has to be prepared freshly prior to the assay (not longer than 10 - 15 minutes in advance). After use the reagent has to be discarded.

Reconstitute the content of one vial labelled **ENZYME** with 2 ml distilled water.

Add 0.3 ml **COENZYME** and 0.3 ml **ENZYME-BUFF** (total volume: 2.6 ml) and mix thoroughly.

The three additional bottles of **ENZYME** allow another three runs of the test. If the whole kit is to be used in one run it is recommended to pool the contents of at least three prepared enzyme mixes.

6.2. Preparation of Samples

Preparation of standards, controls and samples is the same for the Adrenaline, Noradrenaline and Dopamine ELISAs and is performed in one extraction plate.

Allow reagents and samples to reach room temperature.

Determinations in duplicates are recommended.

Each 20 μ l of Standards, Control 1 & 2 and urine samples are extracted.

Each 300 μ l of plasma samples are extracted.

1. Pipette each 20 μ l Standard 1 - 7, 20 μ l Control 1 & 2 and each 20 μ l Urine Sample into the respective wells of the extraction plate. Add 250 μ l of distilled water to these wells to correct for volume. Pipette each 300 μ l Plasma Sample into the respective wells (no volume correction required).
2. Pipette each 50 μ l Extraction Buffer into all wells.
3. Incubate 60 minutes at room temperature on an orbital shaker (400 - 600 r/min).
4. Decant the plate and remove residual liquid by tapping the inverted plate on a paper towel.
5. Pipette each 1 ml Wash Buffer into all wells and incubate for 5 minutes at room temperature on an orbital shaker (slow shaking).
6. Decant the plate and remove residual liquid by tapping the inverted plate on a paper towel.
7. Pipette each 150 μ l Acylation Buffer into all wells.
8. Pipette each 50 μ l Acylation Reagent into all wells and continue with step 9. immediately.
(please note that solvent reacts with many plastic materials including plastic trays; it does not react with normal pipette tips and with glass devices)
9. Incubate the plate for 20 minutes at room temperature on an orbital shaker (400 - 600 r/min).
10. Decant the plate and remove residual liquid by tapping the inverted plate on a paper towel.

11. Pipette each 1 ml Wash Buffer into all wells and incubate for 5 minutes at room temperature on an orbital shaker (slow shaking).
12. Decant the plate and remove residual liquid by tapping the inverted plate on a paper towel.
13. Repeat the wash steps 11. and 12.
14. Pipette each 200 μ l HCl (0.025 M) into all wells.
15. Incubate the plate with adhesive foil for 20 minutes at room temperature on an orbital shaker (400 - 600 r/min).

Caution: Do not decant the supernatant thereafter.

Take each 50 μ l of the supernatant for the adrenaline assay, 50 μ l for the noradrenaline assay and 50 μ l for the dopamine assay.

7. Test Procedure ELISA

Allow reagents to reach room temperature.

7.1. Adrenaline ELISA

1. Pipette each 20 μ l of freshly prepared Enzyme Mix into all wells (colour coded blue).
2. Pipette each 50 μ l prepared Standards, Controls and Patient Samples into the respective wells (colour coded blue).
3. Incubate the plate with adhesive foil for 30 minutes at room temperature (20 – 25 °C) on an orbital shaker (400 - 600 r/min).
4. Pipette each 50 μ l Adrenaline-Antiserum (colour coded blue) into all wells.
5. Cover the plate with adhesive foil, shake for 10 seconds and incubate for 12 – 20 hours (overnight) at 2-8 °C.
6. Discard or aspirate the contents of the wells and wash thoroughly with each 250 μ l Wash Buffer. Remove residual liquid by tapping the inverted plate on clean absorbent paper. Repeat the washing procedure 4 times.
7. Pipette each 100 μ l POD-Conjugate into all wells.
8. Incubate for 30 minutes at room temperature on an orbital shaker (400 - 600 r/min).
9. Washing: Repeat wash step 6.
10. Pipette each 100 μ l Substrate into all wells.
11. Shake for 10 seconds, cover with a box and incubate for 30 \pm 5 minutes at room temperature (20 – 25 °C) without shaking.
12. Pipette 100 μ l Stop Solution into all wells.
13. Read the optical density at 450 nm (reference wavelength between 570 and 650 nm) in a microplate photometer within 15 minutes.

7.2. Noradrenaline ELISA

1. Pipette each 20 μ l of freshly prepared Enzyme Mix into all wells (colour coded yellow).
2. Pipette each 50 μ l prepared Standards, Controls and Patient Samples into the respective wells (colour coded yellow).
3. Incubate the plate with adhesive foil for 30 minutes at room temperature (20 – 25 °C) on an orbital shaker (400 - 600 r/min).
4. Pipette each 50 μ l Noradrenaline-Antiserum (colour coded yellow) into all wells.
5. Cover the plate with adhesive foil, shake for 10 seconds and incubate for 12 – 20 hours (overnight) at 2-8 °C.
6. Discard or aspirate the contents of the wells and wash thoroughly with each 250 μ l Wash Buffer. Remove residual liquid by tapping the inverted plate on clean absorbent paper. Repeat the washing procedure 4 times.
7. Pipette each 100 μ l POD-Conjugate into all wells.
8. Incubate for 30 minutes at room temperature on an orbital shaker (400 - 600 r/min).
9. Washing: Repeat wash step 6.
10. Pipette each 100 μ l Substrate into all wells.
11. Shake for 10 seconds, cover with a box and incubate for 30 \pm 5 minutes at room temperature (20 – 25 °C) without shaking.
12. Pipette 100 μ l Stop Solution into all wells.
13. Read the optical density at 450 nm (reference wavelength between 570 and 650 nm) in a microplate photometer within 15 minutes.

7.3. Dopamine ELISA

1. Pipette each 20 μ l of freshly prepared Enzyme Mix into all wells (colourless).
2. Pipette each 50 μ l prepared Standards, Controls and Patient Samples into the respective wells (colourless).
3. Incubate the plate with adhesive foil for 30 minutes at room temperature (20 – 25 °C) on an orbital shaker (400 - 600 r/min).
4. Pipette each 50 μ l Dopamine-Antiserum (colour coded green) into all wells.
5. Cover the plate with adhesive foil, shake for 10 seconds and incubate for 12 – 20 hours (overnight) at 2-8 °C.
6. Discard or aspirate the contents of the wells and wash thoroughly with each 250 μ l Wash Buffer. Remove residual liquid by tapping the inverted plate on clean absorbent paper. Repeat the washing procedure 4 times.
7. Pipette each 100 μ l POD-Conjugate into all wells.
8. Incubate for 30 minutes at room temperature on an orbital shaker (400 - 600 r/min).
9. Washing: Repeat wash step 6.
10. Pipette each 100 μ l Substrate into all wells.
11. Shake for 10 seconds, cover with a box and incubate for 30 ± 5 minutes at room temperature (20 – 25 °C) without shaking.
12. Pipette 100 μ l Stop Solution into all wells.
13. Read the optical density at 450 nm (reference wavelength between 570 and 650 nm) in a microplate photometer within 15 minutes.

8. Calculation of Results

On a semilogarithmic graph paper the concentration of the standards (x-axis, logarithmic) are plotted against their corresponding optical density (y-axis, linear). Alternatively, the optical density of each standard and sample can be related to the optical density of the zero standard, expressed as the ratio OD/OD_{max}, and then plotted on the y-axis.

A good fit is provided with 4 Parameter Logistic (alternatively Log-Logit or Cubic Spline).

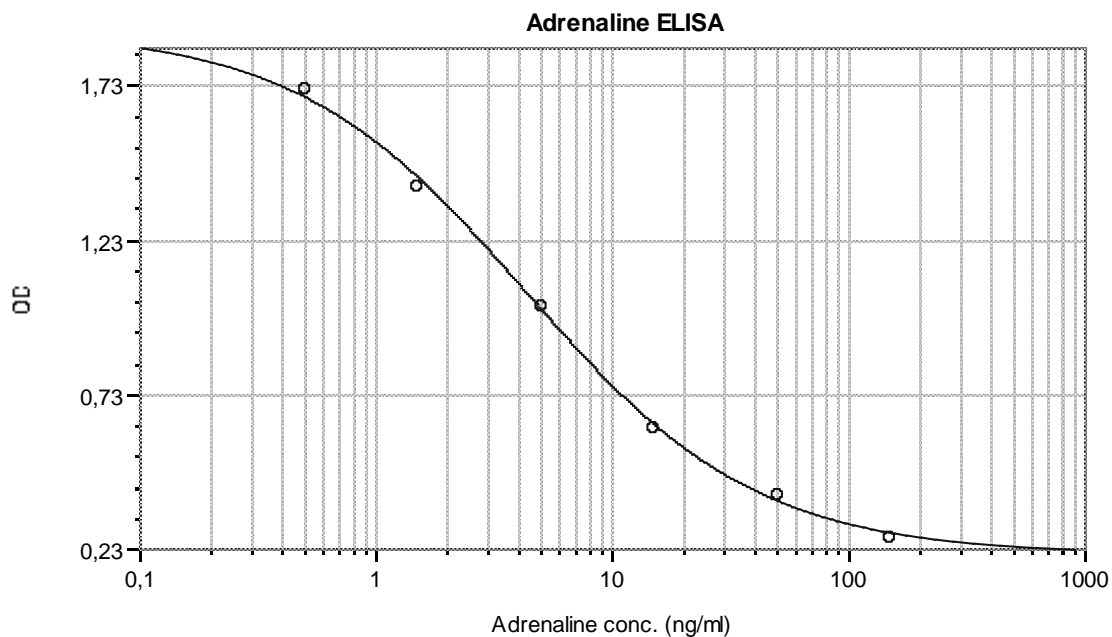
The concentration of the controls and urine samples can be read off the standard curve directly without any further conversion.

The read concentrations of adrenaline, noradrenaline and dopamine in **plasma samples** have to be **divided by 15** due to the use of 300 µl plasma sample in relation to 20 µl standard.

Typical Examples

Below are listed typical examples of standard curves with the Adrenaline ELISA, Noradrenaline ELISA and Dopamine ELISA:

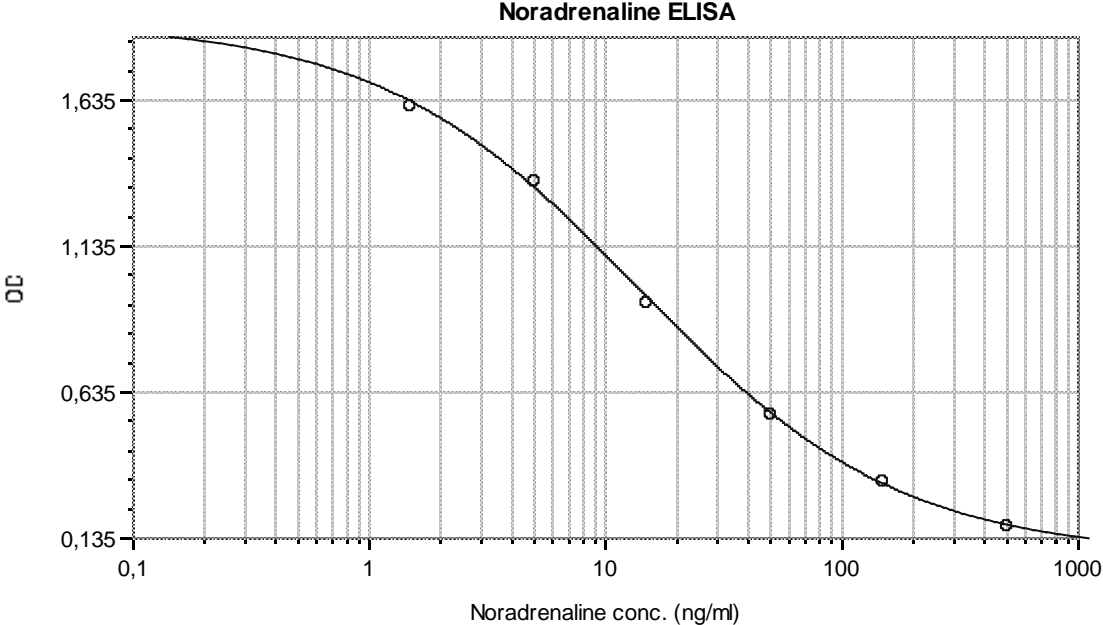
Adrenaline ELISA



$$y = \left(\frac{A - D}{1 + (x/C)^B} \right) + D$$

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>R²</u>
○ Std (Standards: Concentration vs MeanValue)	1,908	0,892	4,291	0,216	0,999

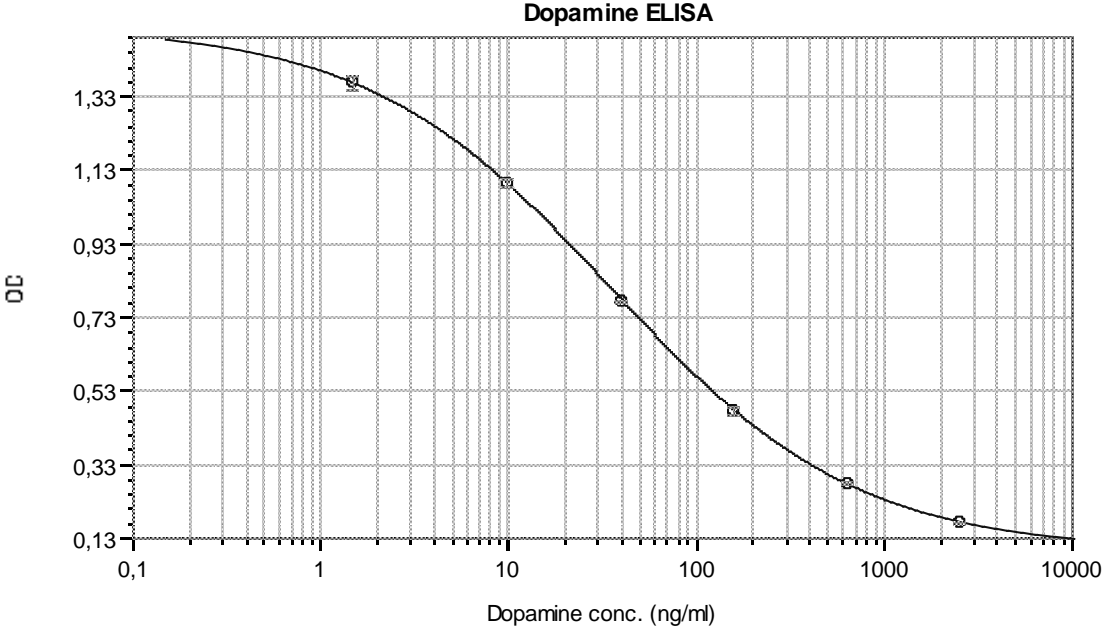
Noradrenaline ELISA



$y = ((A - D)/(1 + (x/C)^B)) + D$

	A	B	C	D	R ²
○ Std (Standards: Concentration vs MeanValue)	1,898	0,788	13,744	0,079	1

Dopamine ELISA



$y = ((A - D)/(1 + (x/C)^B)) + D$

	A	B	C	D	R ²
○ Std (Standards: Concentration vs MeanValue)	1,521	0,668	34,936	0,099	1

9. Assay Characteristics

9.1. Reference Ranges

The reference ranges given below should only be taken as a guideline. It is recommended that each laboratory should establish its own normal values.

	Adrenaline	Noradrenaline	Dopamine
Urine	< 20 µg/day	< 90 µg/day	< 600 µg/day
Plasma	< 100 pg/ml	< 600 pg/ml	< 100 pg/ml

9.2. Sensitivity

The lower limit of detection was determined by taking the 2fold standard deviation of the absorbance of the Zero Reference and reading the corresponding value from the standard curve.

	Adrenaline	Noradenaline	Dopamine
Urine	0.08 ng/ml	0.67 ng/ml	0.43 ng/ml
Plasma	5 pg/ml	45 pg/ml	29 pg/ml

9.3. Specificity (Cross Reactivity)

Structural related components were tested for possible interference with the antisera against adrenaline, noradrenaline and dopamine used in the ELISA method.

Components	Cross Reactivity (%) Adrenaline-Ab	Cross Reactivity (%) Noradrenaline-Ab	Cross Reactivity (%) Dopamine-Ab
Adrenaline	100	< 0.01	< 0.02
Noradrenaline	0.053	100	0.45
Dopamine	< 0.01	0.37	100
Metanephrine	< 0.01	< 0.01	< 0.01
Normetanephrine	< 0.001	< 0.01	< 0.01
3-Methoxytyramine	< 0.001	< 0.01	< 0.01
L-Dopa	< 0.001	< 0.01	< 0.01
Tyramine	< 0.001	< 0.01	< 0.01
Tyrosine	< 0.001	< 0.001	< 0.002
Homovanillic acid	< 0.0001	< 0.001	< 0.001
Vanillic mandelic acid	< 0.0001	< 0.001	< 0.001

9.4. Recovery

Increasing amounts of adrenaline, noradrenaline and dopamine were added to an urine and to a plasma sample. Each spiked sample was assayed. The analytical recovery was estimated at different concentrations by using the theoretically expected and the actually measured values.

Concentrations in ng/ml

Adrenaline

Matrix	Range (ng/ml)	Mean (%)	Recovery (%)
Urine	2.1 – 30.3	102	100 - 105
EDTA-Plasma	0.02 – 1.39	101	94 – 103

Noradrenaline

Matrix	Range (ng/ml)	Mean (%)	Recovery (%)
Urine	32.4 – 113.2	93	89 - 98
EDTA-Plasma	0.20 – 4.91	104	91 – 109

Dopamine

Matrix	Range (ng/ml)	Mean (%)	Recovery (%)
Urine	136 – 479	92	90 - 96
EDTA-Plasma	0.01 – 17.1	101	91 – 110

9.5. Linearity

The linearity of the ELISA method was investigated using different dilutions of an urine and a plasma sample.

Concentrations in ng/ml

Adrenaline

Matrix	Range (ng/ml)	Max. dilution	Mean (%)	Recovery (%)
Urine	4.4 – 59.7	1:15 (dist. water)	108	100 - 112
EDTA-Plasma	0.11 – 1.52	1:15 (dist. water)	107	104 - 111

Noradrenaline

Matrix	Range (ng/ml)	Max. dilution	Mean (%)	Recovery (%)
Urine	9.9 – 132.3	1:15 (dist. water)	105	98 - 112
EDTA-Plasma	0.33 – 4.87	1:15 (dist. water)	103	100 - 108

Dopamine

Matrix	Range (ng/ml)	Max. dilution	Mean (%)	Recovery (%)
Urine	48 – 750	1:15 (dist. water)	98	95 - 101
EDTA-Plasma	0.45 – 5.86	1:15 (dist. water)	107	97 - 115

9.6. Reproducibility

Adrenaline

Matrix	Range (ng/ml)	Intra-Assay-CV	Range (ng/ml)	Inter-Assay-CV
Urine	3.1 – 15.2	7.6 – 7.3 %	2.6 – 16.6	6.7 – 9.6 %
EDTA-Plasma	0.12 – 1.19	9.6 – 9.5 %		

Noradrenaline

Matrix	Range (ng/ml)	Intra-Assay-CV	Range (ng/ml)	Inter-Assay-CV
Urine	21.8 – 76.4	8.7 – 9.2 %	23.1 – 83.9	11.1 – 8.7 %
EDTA-Plasma	0.76 – 4.85	8.4 – 9.7 %		

Dopamine

9.7 Method Comparison

Matrix	Range (ng/ml)	Intra-Assay-CV	Range (ng/ml)	Inter-Assay-CV
Urine	111 – 426	9.3 – 10.1 %	108 – 400	10.1 – 10.7 %
EDTA-Plasma	0.66 – 5.10	13.0 – 8.2 %		

9.7 Method Comparison

Adrenaline

Matrix	Method	Correlation
Urine	HPLC	$Y = 0.94 \times \text{HPLC} - 0.21$; $R = 0.987$; $N = 32$

Noradrenaline

Matrix	Method	Correlation
Urine	HPLC	$Y = 0.90 \times \text{HPLC} + 6.3$; $R = 0.983$; $N = 32$

Dopamine

Matrix	Method	Correlation
Urine	HPLC	$Y = 0.90 \times \text{HPLC} + 24$; $R = 0.982$; $N = 32$

Pipetting Scheme Sample Preparation (Adrenaline, Noradrenaline, Dopamine)

		Standards	Controls	Urine	Plasma
Standard 1 - 7	µl	20			
Control 1&2	µl		20		
Patient Urine	µl			20	
Patient Plasma	µl				300
Dist. Water	µl	250	250	250	
Extraction Buffer	µl	50	50	50	50

Incubate 60 minutes at RT (shake: 400 - 600 r/min)

Decant plate and remove residual liquid

Wash Buffer	ml	1	1	1	1
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Incubate 5 minutes at RT (slow shaking)

Decant plate and remove residual liquid

Acylation Buffer	µl	150	150	150	150
Acyl. Reagent	µl	50	50	50	50

Immediately shake 20 minutes at RT (shake: 400 - 600 r/min)

Decant plate and remove residual liquid

Wash Buffer	ml	1	1	1	1
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Incubate 5 minutes at RT (slow shaking)

Decant plate and remove residual liquid

Wash Buffer	ml	1	1	1	1
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Incubate 5 minutes at RT (slow shaking)

Decant plate and remove residual liquid

HCl	µl	200	200	200	200
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Incubate 20 minutes with adhesive foil at RT (shake: 400 - 600 r/min)

Caution: Do not decant the supernatant thereafter

For the ELISA take each

50 µl for Adrenaline
50 µl for Noradrenaline
50 µl for Dopamine

Pipetting Scheme - ELISA

		Standards	Controls	Samples
Adrenaline (blue):				
Enzyme Mix (Fresh)	μl	20	20	20
Standard 1 - 7	μl	50		
Controls 1&2	μl		50	
Samples	μl			50
Cover with adhesive foil; shake 30 min at room temperature				
Adrenaline Antiserum	μl	50	50	50

Noradrenaline (yellow)				
Enzyme Mix (Fresh)	μl	20	20	20
Standard 1 - 7	μl	50		
Controls 1&2	μl		50	
Samples	μl			50
Cover with adhesive foil; shake 30 min at room temperature				
Noradrenaline Antiserum	μl	50	50	50

Dopamine (colourless)				
Enzyme Mix (Fresh)	μl	20	20	20
Standard 1 - 7	μl	50		
Controls 1&2	μl		50	
Samples	μl			50
Cover with adhesive foil; shake 30 min at room temperature				
Dopamine Antiserum (green)	μl	50	50	50

Cover the plates with adhesive foil and shake for 10 seconds
 Incubate for 12 – 20 hours (overnight) at 2-8 °C
 4 x washing

POD-Conjugate	μl	100	100	100
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Incubate for 30 minutes at room temperature on an orbital shaker

4 x washing

Substrate	μl	100	100	100
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Shake for 10 seconds

Incubate 30 ± 5 minutes at room temperature, covered with a box, without shaking

Stop Solution	μl	100	100	100
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Reading of absorbance at 450 nm