

**Instructions for use**  
**Noradrenaline ELISA** **Fast Track**

**REF****BA E-6200R**

96

**RUO**

For research  
use only –  
Not for use  
in diagnostic  
procedures

## **1. Introduction**

### **1.1 Intended use and principle of the test**

Enzyme Immunoassay for the quantitative determination of noradrenaline (norepinephrine) in plasma and urine.

Noradrenaline (norepinephrine) is extracted by using a cis-diol-specific affinity gel, acylated and then converted enzymatically.

The competitive ELISA kit uses the microtiter plate format. The antigen is bound to the solid phase of the microtiter plate. The derivatized standards, controls and samples and the solid phase bound analytes compete for a fixed number of antibody binding sites. After the system is in equilibrium, free antigen and free antigen-antibody complexes are removed by washing. The antibody bound to the solid phase is detected by an anti-rabbit IgG-peroxidase conjugate using TMB as a substrate. The reaction is monitored at 450 nm.

Quantification of unknown samples is achieved by comparing their absorbance with a reference curve prepared with known standard concentrations.

### **1.2 Background**

In humans the catecholamines adrenaline (epinephrine), noradrenaline (norepinephrine) and dopamine are neurotransmitters of the sympathetic nervous system and are involved in many physiological processes. The sympathetic nervous system sets the body to a heightened state of alert, also called as the body's fight-or-flight response.

In the human body the catecholamines and their metabolites indicate the adaptation of the body to acute and chronic stress.

## **2. Procedural cautions, guidelines, warnings and limitations**

### **2.1 Procedural cautions, guidelines and warnings**

- (1) This kit is intended for professional use only. Users should have a thorough understanding of this protocol for the successful use of this kit. Only the test instruction provided with the kit is valid and has to be used to run the assay. Reliable performance will only be attained by strict and careful adherence to the instructions provided.
- (2) The principles of Good Laboratory Practice (GLP) have to be followed.
- (3) In order to reduce exposure to potentially harmful substances, wear lab coats, disposable protective gloves and protective glasses where necessary.
- (4) 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.
- (5) For dilution or reconstitution purposes, use deionized, distilled, or ultra-pure water.
- (6) The microplate contains snap-off strips. Unused wells must be stored at 2 °C to 8 °C in the sealed foil pouch with desiccant and used in the frame provided.
- (7) Duplicate determination of sample is highly recommended to be able to identify potential pipetting errors.
- (8) Once the test has been started, all steps should be completed without interruption. Make sure that the required reagents, materials and devices are prepared ready at the appropriate time.
- (9) Incubation times do influence the results. All wells should be handled in the same order and time intervals.
- (10) To avoid cross-contamination of reagents, use new disposable pipette tips for dispensing each reagent, sample, standard and control.
- (11) A standard curve must be established for each run.
- (12) The controls should be included in each run and fall within established confidence limits. The confidence limits are listed in the QC-Report provided with the kit.
- (13) Do not mix kit components with different lot numbers within a test and do not use reagents beyond expiry date as shown on the kit labels.
- (14) Avoid contact with Stop Solution containing 0.25 M H<sub>2</sub>SO<sub>4</sub>. It may cause skin irritation and burns. In case of contact with eyes or skin, rinse off immediately with water.
- (15) TMB substrate has an irritant effect on skin and mucosa. In case of possible contact, wash eyes with an abundant volume of water and skin with soap and abundant water. Wash contaminated objects before reusing them.
- (16) For information on hazardous substances included in the kit please refer to Safety Data Sheet (SDS). The Safety Data Sheet for this product is made available directly on the website of the manufacturer or upon request.
- (17) Kit reagents must be regarded as hazardous waste and disposed according to national regulations.

## 2.2 Limitations

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

### 2.2.1 Interfering substances

#### Plasma

Samples containing precipitates or fibrin strands or which are haemolytic or lipemic might cause inaccurate results.

#### 24-hour urine

Please note the sample preparation! If the percentage of the final concentration of acid is too high, this will lead to incorrect results for the urine samples.

### 2.2.2 Drug interferences

There are no known substances (drugs) which ingestion interferes with the measurement of noradrenaline level in the sample.

### 2.2.3 High-Dose-Hook effect

No hook effect was observed in this test.

## 3. Storage and stability

Store the unopened reagents at 2 - 8 °C until expiration date. Do not use components beyond the expiry date indicated on the kit labels. Once opened the reagents are stable for 1 month when stored at 2 - 8 °C. Once the resealable pouch has been opened, care should be taken to close it tightly with desiccant again.

## 4. Materials

### 4.1 Content of the kit

**BA D-0090** FOILS **Adhesive Foil** - Ready to use

Content: Adhesive Foils in a resealable pouch

Volume: 1 x 4 foils

**BA E-0030** WASH-CONC 50x **Wash Buffer Concentrate** - Concentrated 50x

Content: Buffer with a non-ionic detergent and physiological pH

Volume: 1 x 20 ml/vial, light purple cap

**BA E-0040** CONJUGATE **Enzyme Conjugate** - Ready to use

Content: Goat anti-rabbit immunoglobulins, conjugated with peroxidase

Volume: 1 x 12 ml/vial, red cap

**BA E-0055** SUBSTRATE **Substrate** - Ready to use

Content: Chromogenic substrate containing tetramethylbenzidine, substrate buffer and hydrogen peroxide

Volume: 1 x 12 ml/vial, black cap

**BA E-0080** STOP-SOLN **Stop Solution** - Ready to use

Content: 0.25 M sulfuric acid

Volume: 1 x 12 ml/vial, light grey cap

Hazards

identification:



H290 May be corrosive to metals.

**BA E-0231** NAD NMN **Noradrenaline Microtiter Strips**- Ready to use

Content: 1 x 96 well (12x8) antigen precoated microwell plate in a resealable yellow pouch with desiccant

**BA E-6210** NAD-AS **Noradrenaline Antiserum** - Ready to use

Content: Rabbit anti-noradrenaline antibody, yellow coloured

Volume: 1 x 6 ml/vial, yellow cap

**BA R-0050** **ADJUST-BUFF** **Adjustment Buffer** - Ready to use

Content: TRIS buffer  
 Volume: 1 x 4 ml/vial, green cap

**Standards** and **Controls** - Ready to use

Cat. no.	Component	Colour/ Cap	Concentration ng/ml	Concentration nmol/l	Volume/ Vial
			NAD	NAD	
<b>BA E-6601</b>	<b>STANDARD</b> A	white	0	0	4 ml
<b>BA E-6602</b>	<b>STANDARD</b> B	light yellow	5	30	4 ml
<b>BA E-6603</b>	<b>STANDARD</b> C	orange	20	118	4 ml
<b>BA E-6604</b>	<b>STANDARD</b> D	dark blue	75	443	4 ml
<b>BA E-6605</b>	<b>STANDARD</b> E	light grey	250	1 478	4 ml
<b>BA E-6606</b>	<b>STANDARD</b> F	black	1 000	5 910	4 ml
<b>BA E-6651</b>	<b>CONTROL</b> 1	light green	Refer to QC report for expected value and acceptable range!		4 ml
<b>BA E-6652</b>	<b>CONTROL</b> 2	dark red			4 ml

Conversion: Noradrenaline (ng/ml) x 5.91 = Noradrenaline (nmol/l)  
 Content: Acidic buffer with non-mercury stabilizer, spiked with defined quantity of noradrenaline

**BA R-6611** **ACYL-BUFF** **Acylation Buffer** - Ready to use

Content: Buffer with light alkaline pH for the acylation  
 Volume: 1 x 20 ml/vial, white cap

**BA R-6612** **ACYL-REAG** **Acylation Reagent** - Ready to use

Content: Acylation reagent in DMF and DMSO  
 Volume: 1 x 3 ml/vial, light red cap

Hazards identification: 

H360D May damage the unborn child.  
 H226 Flammable liquid and vapour.  
 H312 + H332 Harmful in contact with skin or if inhaled.  
 H319 Causes serious eye irritation.

**BA R-6613** **ASSAY-BUFF** **Assay Buffer** - Ready to use

Content: 1M hydrochloric acid and a non-mercury preservative  
 Volume: 1 x 6 ml/vial, light grey cap

**BA R-6614** **COENZYME** **Coenzyme** - Ready to use

Content: S-adenosyl-L-methionine  
 Volume: 1 x 4 ml/vial, purple cap

**BA R-6615** **ENZYME** **Enzyme** - Lyophilized

Content: Catechol-O-methyltransferase  
 Volume: 2 vials, pink cap

**BA R-6617** **EXTRACT-BUFF** **Extraction Buffer** - Ready to use

Content: Buffer containing carbonate  
 Volume: 1 x 6 ml/vial, brown cap

**BA R-6618** **EXTRACT-PLATE** 48 **Extraction Plate** - Ready to use

Content: 2 x 48 well plates coated with boronate affinity gel in a resealable pouch

**BA R-6619** **HCL** **Hydrochloric Acid** - Ready to use

Content: 0.025 M Hydrochloric Acid, yellow coloured  
 Volume: 1 x 20 ml/vial, dark green cap

#### 4.2 Additional materials and equipment required but not provided in the kit

- Calibrated precision pipettes to dispense volumes between 10 – 700 µl; 1 ml
- Microtiter plate washing device (manual, semi-automated or automated)
- ELISA reader capable of reading absorbance at 450 nm and if possible 620 - 650 nm
- Microtiter plate shaker (shaking amplitude 3 mm; approx. 600 rpm)
- Absorbent material (paper towel)
- Water (deionized, distilled, or ultra-pure)
- Vortex mixer

#### 5. Sample collection and storage

##### **Plasma**

Whole blood should be collected into centrifuge tubes containing EDTA as anti-coagulant (Monovette™ or Vacuette™ for plasma) and centrifuged according to manufacturer's instructions immediately after collection. Haemolytic and lipemic samples should not be used for the assay.

Storage: up to 6 hours at 2 - 8 °C, for longer period (up to 6 month) at -20 °C.

Repeated freezing and thawing should be avoided.

##### **Urine**

Spontaneous urine or 24-hour urine, collected in a bottle containing 10 - 15 ml of 6 M HCl, can be used.

If 24-hour urine is used please record the total volume of the collected urine.


Storage: up to 48 hours at 2 - 8 °C, up to 24 hours at room temperature, for longer periods (up to 6 month) at -20 °C. Repeated freezing and thawing should be avoided.

Avoid exposure to direct sunlight.

#### 6. Test procedure

Allow all reagents to reach room temperature and mix thoroughly by gentle inversion before use. Duplicate determinations are recommended. It is recommended to number the strips of the microwell plate before usage to avoid any mix-up.

The binding of the antiserum and the enzyme conjugate and the activity of the enzyme are temperature dependent, and the absorbance may vary if a thermostat is not used. The higher the temperature, the higher the absorbance will be. Varying incubation times will have a similar influence on the absorbance. The optimal temperature during the Enzyme Immunoassay is between 20 – 25 °C.

 *In case of overflow, read the absorbance of the solution in the wells within 10 minutes, using a microplate reader set to 405 nm*

#### 6.1 Preparation of reagents


##### **Wash Buffer**

Dilute the 20 ml Wash Buffer Concentrate with water (deionized, distilled, or ultra-pure) to a final volume of 1000 ml.

Storage: 1 month at 2 - 8 °C

##### **Enzyme Solution**

Reconstitute the content of the vial labelled 'Enzyme' with 1 ml water (deionized, distilled, or ultra-pure) and mix thoroughly. Add 0.3 ml of Coenzyme followed by 0.7 ml of Adjustment Buffer. The total volume of the Enzyme Solution is 2.0 ml.

 *The Enzyme Solution has to be prepared freshly prior to the assay (not longer than 10 - 15 minutes in advance). Discard after use!*

##### **Noradrenaline Microtiter Strips**

In rare cases residues of the blocking and stabilizing reagent can be seen in the wells as small, white dots or lines. These residues do not influence the quality of the product.

## 6.2 Sample preparation, extraction and acylation

1.	Pipette <b>10 µl</b> of <b>standards, controls, urine samples</b> and <b>300 µl</b> of <b>plasma samples</b> into the respective wells of the <b>Extraction Plate</b> .		
2.	Add <b>250 µl</b> of <b>water</b> (deionized, distilled, or ultra-pure) to the wells with <b>standards, controls</b> and <b>urine samples</b> .		
3.	Pipette <b>50 µl</b> of <b>Assay Buffer</b> into all wells.		
4.	Pipette <b>50 µl</b> of <b>Extraction Buffer</b> into all wells.		
5.	Cover plate with <b>Adhesive Foil</b> and incubate <b>30 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).		
6.	Remove the foil. Empty plate and blot dry by tapping the inverted plate on absorbent material.		
7.	Pipette <b>1 ml</b> of <b>Wash Buffer</b> into all wells. Incubate the plate for <b>5 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm). Empty plate and blot dry by tapping the inverted plate on absorbent material.		
8.	Pipette another <b>1 ml</b> of <b>Wash Buffer</b> into all wells. Incubate the plate for <b>5 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm). Empty plate and blot dry by tapping the inverted plate on absorbent material.		
9.	Pipette <b>150 µl</b> of <b>Acylation Buffer</b> into all wells.		
10.	Pipette <b>25 µl</b> of <b>Acylation Reagent</b> into all wells.		
11.	Incubate <b>15 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).		
12.	Empty plate and blot dry by tapping the inverted plate on absorbent material.		
13.	Pipette <b>1 ml</b> of <b>Wash Buffer</b> into all wells. Incubate the plate for <b>10 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm). Empty plate and blot dry by tapping the inverted plate on absorbent material.		
14.	Pipette <b>150 µl</b> of <b>Hydrochloric Acid</b> into all wells.		
15.	Cover plate with <b>Adhesive Foil</b> . Incubate <b>10 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm). Remove the foil and discard.		
	⚠ <b>Do not decant the supernatant thereafter!</b>		
	The following volumes of the supernatant are needed for the subsequent ELISA:		
	<table border="1" style="margin-left: 40px;"> <tr> <td style="padding: 2px;"><b>Noradrenaline</b></td> <td style="padding: 2px;"><b>20 µl</b></td> </tr> </table>	<b>Noradrenaline</b>	<b>20 µl</b>
<b>Noradrenaline</b>	<b>20 µl</b>		

## 6.3 Noradrenaline ELISA

1.	Pipette <b>25 µl</b> of the <b>Enzyme Solution</b> (refer to 6.1) into all wells of the <b>Noradrenaline Microtiter Strips</b> .
2.	Pipette <b>20 µl</b> of the extracted <b>standards, controls and samples</b> into the appropriate wells.
3.	Incubate for <b>30 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
4.	Pipette <b>50 µl</b> of the <b>Noradrenaline Antiserum</b> into all wells and cover plate with <b>Adhesive Foil</b> .
5.	Incubate for <b>2 h</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
6.	Remove the foil. Discard or aspirate the content of the wells. Wash the plate <b>3 x</b> by adding <b>300 µl</b> of <b>Wash Buffer</b> , <b>discarding</b> the content and <b>blotting dry each time</b> by tapping the inverted plate on absorbent material.
7.	Pipette <b>100 µl</b> of the <b>Enzyme Conjugate</b> into all wells.
8.	Incubate for <b>30 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
9.	Discard or aspirate the content of the wells. Wash the plate <b>3 x</b> by adding <b>300 µl</b> of <b>Wash Buffer</b> , <b>discarding</b> the content and <b>blotting dry each time</b> by tapping the inverted plate on absorbent material.
10.	Pipette <b>100 µl</b> of the <b>Substrate</b> into all wells and incubate for <b>25 ± 5 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm). ⚠ <b>Avoid exposure to direct sunlight!</b>
11.	Add <b>100 µl</b> of the <b>Stop Solution</b> to each well and shake the microtiter plate to ensure a homogeneous distribution of the solution.
12.	<b>Read</b> the absorbance of the solution in the wells within 10 minutes, using a microplate reader set to <b>450 nm</b> (if available a reference wavelength between 620 nm and 650 nm is recommended).

**7. Calculation of results**

<b>Measuring range</b>		<b>Noradrenaline</b>
	Urine	2.5 - 1000 ng/ml
	Plasma	93 - 33 333 pg/ml

The standard curve is obtained by plotting the absorbance readings (calculate the mean absorbance) of the standards (linear, y-axis) against the corresponding standard concentrations (logarithmic, x-axis). Use a non-linear regression for curve fitting (e.g. spline, 4- parameter, akima).

⚠ *This assay is a competitive assay. This means: the OD-values are decreasing with increasing concentrations of the analyte. OD-values found below the standard curve correspond to high concentrations of the analyte in the sample and have to be reported as being positive.*

**Urine samples and controls**

The concentrations of the **urine samples** and the **Controls 1 and 2** can be read directly from the standard curve.

Calculate the 24 h excretion for each urine sample:  $\mu\text{g}/24\text{h} = \mu\text{g}/\text{l} \times \text{l}/24\text{h}$

**Plasma samples**

The read concentrations of the **plasma samples** have to be **divided by 30**.

**Conversion**

Noradrenaline (ng/ml) x 5.91 = Noradrenaline (nmol/l)

**Expected reference values**

It is strongly recommended that each laboratory should determine its own normal and abnormal values.

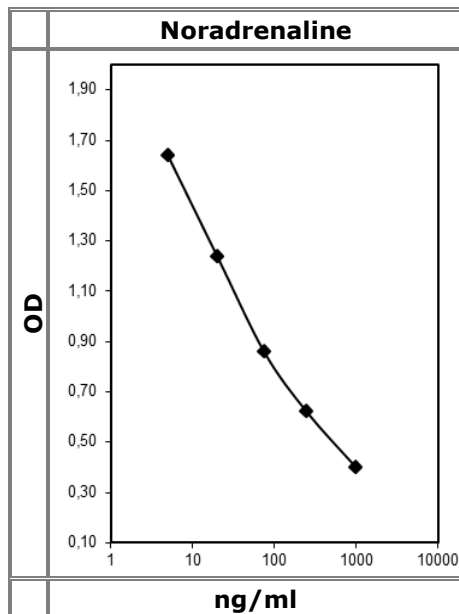
	<b>Noradrenaline</b>
24-hour urine	< 90 $\mu\text{g}/\text{day}$ (535 nmol/day)
Plasma	< 600 pg/ml

**7.1 Quality control**

The confidence limits of the kit controls are printed on the QC-Report.

**7.2 Typical standard curve**

⚠ *Example, do not use for calculation!*



**8. Assay characteristics**

<b>Analytical Sensitivity</b>			<b>Noradrenaline</b>
	<b>LOD</b>	Urine (ng/ml)	1.7
		Plasma (pg/ml)	36
	<b>LOQ</b>	Urine (ng/ml)	2.5
		Plasma (pg/ml)	93

<b>Analytical Specificity (Cross Reactivity)</b>	<b>Substance</b>	<b>Cross Reactivity (%)</b>	
		Noradrenaline	
	Derivatized Adrenaline	0.08	
	Derivatized Noradrenaline	100	
	Derivatized Dopamine	0.03	
	Metanephrine	< 0.01	
	Normetanephrine	0.16	
	3-Methoxytyramine	< 0.01	
	3-Methoxy-4-hydroxyphenylglycol	< 0.01	
	Tyramine	< 0.01	
Phenylalanine, Caffeinic acid, L-Dopa, Homovanillic acid, Tyrosine, 3-Methoxy-4-hydroxymandelic acid	< 0.01		

<b>Precision</b>							
<b>Intra-Assay Urine (n = 60)</b>				<b>Intra-Assay Plasma (n = 60)</b>			
	Sample	Range (ng/ml)	CV (%)		Sample	Range (pg/ml)	CV (%)
Noradrenaline	1	26.1 ± 3.6	13.8	Noradrenaline	1	510 ± 65	12.8
	2	97 ± 12.8	13.4		2	1358 ± 194	14.3
	3	267 ± 35	13.1		3	3363 ± 374	11.1
<b>Inter-Assay Urine (n = 33)</b>				<b>Inter-Assay Plasma (n = 18)</b>			
	Sample	Range (ng/ml)	CV (%)		Sample	Range (pg/ml)	CV (%)
Noradrenaline	1	19.5 ± 3.9	20.0	Noradrenaline	1	445 ± 40.9	9.2
	2	80.6 ± 10.6	13.2		2	1232 ± 134	10.9
	3	226 ± 39.5	17.4		3	3283 ± 302	9.2

<b>Linearity</b>			<b>Serial dilution up to</b>	<b>Range (%)</b>	<b>Mean (%)</b>
	Noradrenaline	Urine	1:512	100 - 127	112
	Plasma	1:512	102 - 125	112	











<b>Recovery</b>			<b>Mean (%)</b>	<b>Range (%)</b>	<b>Range</b>
	Noradrenaline	Urine	103	91 - 113	58.6 - 260 ng/ml
	Plasma	87	75 - 107	51 - 14 251 pg/ml	

## 9. References/Literature

- (1) Kim et al. Vitamin C prevents stress-induced damage on the heart caused by the death of cardiomyocytes, through the down-regulation of the excessive production of catecholamine, TNF- $\alpha$ , and ROS production in GULO(-/-) Vit C-Insufficient mice. *Free Radical Biology and Medicine*, 65:573-583 (2013)
- (2) Bada et al. Peripheral vasodilatation determines cardiac output in exercising humans: insight from atrial pacing. *The Journal of Physiology*, 590(8):2051-2060 (2012)
- (3) Parks et al. Employment and work schedule are related to telomere length in women. *Occupational & Environmental Medicine* 68(8):582-589 (2011)

 **For updated literature or any other information please contact your local supplier.**

### Symbols:

	Storage temperature		Manufacturer		Contains sufficient for <n> tests
	Expiry date		Batch code		
	Consult instructions for use		Content		
	Caution		Catalogue number		For research use only!