



**IMMUNOASSAYS AND SERVICES**  
BIOGENIC AMINES & NEUROSCIENCE | ENDOCRINOLOGY | FOOD SAFETY

LABOR DIAGNOSTIKA NORD GmbH & Co.KG | Am Eichenhain 1 | 48531 Nordhorn | Germany | Tel. +49 5921 8197-0 | Fax +49 5921 8197-222 | info@ldn.de | www.ldn.de

---

**Instructions for use**  
**Noradrenaline Research ELISA™**

**REF**

**BA E-5200**



**RUO**

For Research use only-  
Not for use in diagnostic  
procedures

---

## Noradrenaline Research ELISA

### 1. Intended use and principle of the test

Enzyme Immunoassay for the quantitative determination of noradrenaline (norepinephrine). Flexible test system for various biological sample types and volumes.

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 analyte 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 standard curve prepared with known standard concentrations.

### 2. 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 latex 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.
- (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 Material Safety Data Sheet (MSDS). The Material 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.

### 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-0032** 96 **Microtiter Plate** - Ready to use  
 Content: 1 x 96 wells, empty in a resealable pouch
- 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/black 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
- BA E-0231** 96 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, yellow coloured
- BA E-5210** 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
- BA R-4617** TE-BUFF **TE Buffer** - Ready to use  
 Content: TRIS-EDTA buffer  
 Volume: 1 x 4 ml/vial, brown cap

**Standards and Controls** - Ready to use

Cat. no.	Component	Colour/ Cap	Concentration	Concentration	Volume/ Vial
			ng/ml	nmol/l	
			NAD	NAD	
<b>BA R-5601</b>	<span style="border: 1px solid black; padding: 0 2px;">STANDARD</span> <span style="border: 1px solid black; padding: 0 2px;">A</span>	white	0	0	4 ml
<b>BA R-5602</b>	<span style="border: 1px solid black; padding: 0 2px;">STANDARD</span> <span style="border: 1px solid black; padding: 0 2px;">B</span>	light yellow	0.2	1.2	4 ml
<b>BA R-5603</b>	<span style="border: 1px solid black; padding: 0 2px;">STANDARD</span> <span style="border: 1px solid black; padding: 0 2px;">C</span>	orange	0.6	3.5	4 ml
<b>BA R-5604</b>	<span style="border: 1px solid black; padding: 0 2px;">STANDARD</span> <span style="border: 1px solid black; padding: 0 2px;">D</span>	dark blue	2	12	4 ml
<b>BA R-5605</b>	<span style="border: 1px solid black; padding: 0 2px;">STANDARD</span> <span style="border: 1px solid black; padding: 0 2px;">E</span>	light grey	8	47	4 ml
<b>BA R-5606</b>	<span style="border: 1px solid black; padding: 0 2px;">STANDARD</span> <span style="border: 1px solid black; padding: 0 2px;">F</span>	black	32	189	4 ml
<b>BA R-5651</b>	<span style="border: 1px solid black; padding: 0 2px;">CONTROL</span> <span style="border: 1px solid black; padding: 0 2px;">1</span>	light green	Refer to QC-Report for expected value and acceptable range!		4 ml
<b>BA R-5652</b>	<span style="border: 1px solid black; padding: 0 2px;">CONTROL</span> <span style="border: 1px solid black; padding: 0 2px;">2</span>	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:



H225 Highly flammable liquid and vapour.

H360 May damage fertility or the unborn child.

H319 Causes serious eye irritation.

**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: 4 vials, pink 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 1 – 750 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
- Shaker (shaking amplitude 3 mm; approx. 600 rpm)
- Temperature controlled incubator (37 °C) or similar heating device
- Absorbent material (paper towel)
- Water (deionized, distilled, or ultra-pure)
- Vortex mixer

#### 5. Sample collection and storage

Storage: up to 6 hours at 2 – 8 °C; for longer periods (up to 6 months) at -20 °C or -80 °C.

*Advice for the preservation of the biological sample:* to prevent catecholamine degradation, add EDTA (final concentration 1 mM) and sodium metabisulfite (final concentration 4 mM) to the sample.

#### 6. Test procedure

Allow reagents and samples to reach room temperature and mix thoroughly by gentle inversion before use. Duplicate determinations are recommended.

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!*

## 6.2 Sample preparation

The Noradrenaline Research ELISA is a flexible test system for various biological sample types and volumes. It is not possible to give a general advice how to prepare the samples. However, the following basics should help the researcher to fit the protocol to his specific needs.

- Avoid excess of acid: excess of acid might exceed the buffer capacity of the extraction buffer. A pH > 7.0 during the extraction is mandatory.
- Prevent noradrenaline degradation by adding preservatives to the sample (see *Sample collection and storage*).
- Avoid chaotropic chemicals like perchloric acid. The high salt content might reduce the recovery of noradrenaline. If your samples already contain high amounts of perchloric acid, neutralize the sample prior to the extraction step.
- Tissue samples can be homogenised in 0.01 N HCl in the presence of EDTA and sodium metabisulfite. Under these conditions noradrenaline is positively charged which reduces binding to proteins and optimizes solubility.
- Avoid samples that contain substances with a cis-diol structure. These will reduce the recovery of the noradrenaline.
- It is advisable to perform a "Proof of Principle" to determine the recovery of noradrenaline in your samples. Prepare a stock solution of noradrenaline. Add small amounts (to change the native sample matrix as less as possible) of the stock solutions to the sample matrix and check the recovery.
- The used sample volume determines the sensitivity of this test. Determine the sample volume needed to determine the noradrenaline in your sample by testing different amounts of sample volume.

*If you need any support in establishing a protocol for your specific purposes, do not hesitate to contact the manufacturer directly!*

## 6.3 Extraction and acylation

The Noradrenaline Research ELISA offers a flexible test system for various biological sample types and volumes. Step 1 of the extraction procedure depends on the sample volume:

- in case you have sample volumes between 1 – 100 µl follow **1.1**
- in case you have sample volumes between 100 – 500 µl follow **1.2**
- in case you have sample volumes between 500 – 750 µl follow **1.3**

 ***Within a run it is only possible to measure samples with the same volume!***

1.	1.1 Sample volume 1 – 100 µl	1.2 Sample volume 100 – 500 µl	1.3 Sample volume 500 – 750 µl
	Pipette into the respective wells of the Extraction Plate: <b>10 µl standards, 10 µl controls and 1 – 100 µl sample.</b> Fill up each well with water (deionized, distilled, or ultra-pure) to a <b>final volume</b> of 100 µl [e.g. 10 µl standard plus 90 µl water (deionized, distilled, or ultra-pure)].	Pipette into the respective wells of the Extraction Plate: <b>10 µl standards, 10 µl controls and 100 – 500 µl sample.</b> Fill up each well with water (deionized, distilled, or ultra-pure) to a <b>final volume</b> of 500 µl [e.g. 10 µl standard plus 490 µl water (deionized, distilled, or ultra-pure)].	Pipette into the respective wells of the Extraction Plate: <b>10 µl standards, 10 µl controls and 500 – 750 µl sample.</b> Fill up each well with water (deionized, distilled, or ultra-pure) to a <b>final volume</b> of 750 µl [e.g. 10 µl standard plus 740 µl water (deionized, distilled, or ultra-pure)].
2.	Pipette <b>25 µl</b> of <b>TE Buffer</b> into all wells		
3.	Cover the plate with <b>Adhesive Foil</b> . Shake <b>60 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).		
4.	Remove the foil and empty the plate. Blot dry by tapping the inverted plate on absorbent material.		

5.	Pipette <b>1 ml</b> of <b>Wash Buffer</b> into all wells.
6.	Shake <b>5 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
7.	Blot dry by tapping the inverted plate on absorbent material.
8.	<b>Wash one more time</b> as described (step 5, 6 and 7)!
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.	Shake <b>20 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
12.	Empty the 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.
14.	Shake <b>5 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
15.	Blot dry by tapping the inverted plate on absorbent material.
16.	<b>Wash one more time</b> as described (step 13, 14, 15).
17.	Pipette <b>100 µl</b> of <b>Hydrochloric Acid</b> into all wells.
18.	Cover plate with <b>Adhesive Foil</b> . Shake <b>10 min</b> at <b>RT</b> (20-25°C) on a <b>shaker</b> (approx. 600 rpm).
	<b>Do not decant the supernatant thereafter!</b>
	<b>90 µl of the supernatant is needed for the subsequent enzymatic conversion</b>

#### 6.4 Enzymatic Conversion

1.	Pipette <b>90 µl</b> of the <b>extracted standards, controls</b> and <b>samples</b> into the respective wells of the <b>Microtiter Plate</b> .		
2.	Add <b>25 µl</b> of <b>Enzyme Solution</b> (refer to 6.1) to all wells.		
3.	Cover plate with <b>Adhesive Foil</b> . Shake <b>1 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm) to mix.		
4.	Incubate for <b>2 h</b> at <b>37°C</b> . The following volumes of the supernatants are needed for the subsequent ELISA:		
	<table border="1" style="margin-left: 40px;"> <tr><td><b>Noradrenaline</b></td><td><b>100 µl</b></td></tr> </table>	<b>Noradrenaline</b>	<b>100 µl</b>
<b>Noradrenaline</b>	<b>100 µl</b>		

#### 6.5 Noradrenaline ELISA

1.	Pipette <b>100 µl</b> of <b>standards, controls</b> and <b>samples</b> from the <b>Enzyme Plate</b> (refer to 6.4) into the respective pre-coated <b>Noradrenaline Microtiter Strips</b> .
2.	Pipette <b>50 µl</b> of the respective <b>Noradrenaline Antiserum</b> into all wells.
3.	Cover the plate with <b>Adhesive Foil</b> . Shake <b>1 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
4.	Incubate for <b>15 – 20 h</b> (overnight) at <b>2 – 8 °C</b> .
5.	Remove the foil. Discard or aspirate the content of the wells. Wash the plate <b>4 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.
6.	Pipette <b>100 µl</b> of <b>Enzyme Conjugate</b> into all wells.
7.	Cover the plate with <b>Adhesive Foil</b> . Incubate <b>30 min</b> at <b>RT</b> (20 – 25 °C) on a <b>shaker</b> (approx. 600 rpm).
8.	Remove the foil. Discard or aspirate the content of the wells. Wash the plate <b>4 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.
9.	Pipette <b>100 µl</b> of <b>Substrate</b> into all wells.
10.	Incubate <b>20 - 30 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.	Pipette <b>100 µl</b> of <b>Stop Solution</b> into all wells.
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

The standard curve from which the concentrations in the samples can be read off, is obtained by plotting the absorbance readings (calculate the mean absorbance) measured for 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.*

**The concentrations of the samples taken from the standard curve have to be multiplied by a correction factor.**

$$\text{Correction factor} = \frac{10 \mu\text{l (volume of standards extracted)}}{\text{sample volume } (\mu\text{l}) \text{ extracted}}$$

### Example

750  $\mu\text{l}$  of the sample is extracted and the concentration taken from the standard curve is 0.15 ng/ml noradrenaline.

Correction factor =  $10/750 = 0.013$

Concentration of the sample =  $0.15 \text{ ng/ml} \times 0.013 = 0.002 \text{ ng/ml} = 2 \text{ pg/ml}$  noradrenaline

### Conversion

Noradrenaline (ng/ml)  $\times 5.91 =$  Noradrenaline (nmol/l)

## 7.1 Quality control

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

## 8. Assay characteristics

Analytical Specificity (Cross Reactivity)	Substance	Cross Reactivity (%)
	Derivatized Adrenaline	0.14
	Derivatized Noradrenaline	100
	Derivatized Dopamine	0.2
	Metanephrine	< 0.003
	Normetanephrine	0.48
	3-Methoxytyramine	< 0.003
	3-Methoxy-4-hydroxyphenylglycol	0.01
	Tyramine	< 0.003
	Phenylalanine, Caffeinic acid, L-Dopa, Homovanillic acid, Tyrosine, 3-Methoxy-4-hydroxymandelic acid	< 0.003

Sensitivity (Limit of Detection)	Noradrenaline
	0.1 ng/ml $\times$ C*

C\* = Correction factor (refer to 7.)

Analytical Sensitivity (750 $\mu\text{l}$ undiluted sample)	Noradrenaline
	1.3 pg/ml

Functional Sensitivity (750 $\mu\text{l}$ undiluted sample)	Noradrenaline
	2 pg/ml

Precision				
Intra-Assay Human EDTA-Plasma				
	Sample	Mean $\pm$ 3 SD (pg/ml)	SD (pg/ml)	CV (%)
Noradrenaline	high	1377.4 $\pm$ 483.6	161.2	11.7
	medium	502.6 $\pm$ 126.9	42.3	8.4
	low	32.7 $\pm$ 15.3	5.1	15.6
Intra-Assay Cell Culture Medium (RPMI)				
	Sample	Mean $\pm$ 3 SD (pg/ml)	SD (pg/ml)	CV (%)
	high	2027.8 $\pm$ 712.5	237.5	11.7

Noradrenaline	medium	716.5 ± 179.7	59.9	8.4
	low	46.0 ± 16.8	5.6	12.2

<b>Recovery Noradrenaline</b>	Mean (%)	Range (%)	SD (%)	CV (%)
Human EDTA-Plasma	116.5	104.8 – 125.6	8.0	6.9
Cell Culture Medium	96.7	70.6 – 124.7	17.1	17.7

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

**Symbols:**

	Storage temperature		Manufacturer		Contains sufficient for <n> tests
	Expiry date	<b>LOT</b>	Batch code	<b>IVD</b>	For in-vitro diagnostic use only!
	Consult instructions for use	<b>CONT</b>	Content	<b>CE</b>	CE labelled
	Caution	<b>REF</b>	Catalogue number	<b>RUO</b>	For research use only!