




Instructions for Use

Histamine ELISA

Enzyme Immunoassay for the
Quantitative Determination of
**Histamine in Heparin Plasma, EDTA-Plasma, Urine,
Heparin Whole Blood (Total Histamine) and Stool
and in Cell Culture Media (RUO)**



REF EA213/96

 12 x 8


 2 – 8 °C

Table of Contents

| | | |
|----|---|----|
| 1 | Introduction and Principle of the Test..... | 3 |
| 2 | Precautions | 4 |
| 3 | Storage and Stability | 4 |
| 4 | Contents of the Kit | 5 |
| 5 | Specimen Collection and Storage..... | 7 |
| 6 | Preparation of Reagents and Samples..... | 9 |
| 7 | Test Procedure ELISA..... | 11 |
| 8 | Calculation of the Results..... | 12 |
| 9 | Assay Characteristics | 13 |
| 10 | Literature | 15 |
| | Pipetting Scheme - Sample Preparation | 16 |
| | Pipetting Scheme - ELISA..... | 16 |

Symbols



In Vitro Diagnostic
Medical Device



EC Declaration of conformity



Content



Expiry Date



Lot Number



Store at



Manufactured by



Sufficient for ... determinations



Catalogue Number



Consult Instructions for Use

Changes to declare

Version _9: The manufacturer and distributor information have been changed. Stool has been included as matrix. Extensive changes have been made and are highlighted in grey.

1 Introduction and Principle of the Test

Histamine (β -imidazole-ethylamine) a biogenic amine, is a product of the histidine metabolism. It is produced by decarboxylation of histidine.

Histamine is widely distributed in mammalian tissues. It is bound to heparin (as inactive form) and stored in the granules of basophilic leukocytes and mast cells and is actively released as required. These cells, if sensitized by IgE antibodies attached to their membranes, degranulate when exposed to the appropriate antigen.

It is involved in the defense against foreign substances and its pathological reactions lead to symptoms such as allergies and asthma. Histamine plays a major role in the initial phase of an anaphylactic reaction. The quantification of histamine in plasma after allergen administration is of clinical interest.

Histamine is part of the immune response to foreign pathogens and it increases the permeability of the capillaries to white blood cells and other proteins, in order to allow them to engage foreign invaders in the affected tissues. Responsible for the biological effects of histamine in tissue are the activation of different surface receptors, for instance H1, H2 and H3.

Histamine is involved in the regulating physiological function in the gut and acting as a neurotransmitter.

The Histamine ELISA Kit contains reagents for the quantitative determination of derivatized histamine in human EDTA- and heparin plasma, heparin whole blood (total histamine), stool, urine and for research purposes in cell culture samples. Derivatization takes place during sample preparation. In this process, histamine is quantitatively converted into N-acylhistamine by the acylating reagent.

The Histamine ELISA is a competitive enzyme immunoassay. Antigen bound to the solid phase and free antigen in solution compete for a defined number of antibody binding sites. When the system is in equilibrium, the unbound antigen-antibody complex is removed in a washing step and the correspondingly bound complex is detected using a peroxidase conjugate and determined via the conversion of tetramethylbenzidine (TMB). The TMB/POD reaction is stopped and the absorbance measured at 450 nm. The concentration of the antigen-antibody complex bound to the solid phase is inversely proportional to the concentration of the antigen in the sample.

2 Precautions

- For in vitro diagnostic use only. For professional use only.
- Before carrying out the test, the valid instructions for use, as included in this kit, should be read completely and the content understood.
- Material of human origin used in the preparation of this kit has been tested and found non-reactive for HBsAg, HCV or HIV I/II antibodies, but should non-the-less, be handled as potentially infectious.
- Material of animal origin used in the preparation of the kit have been obtained from certified healthy animals but these materials should be handled as potentially infectious.
- Individual components of different lots and test kits should not be interchanged. The expiry dates and storage conditions stated on the packaging and the labels of the individual components must be observed.
- When handling the reagents, controls and patient samples, the current laboratory safety guidelines and good laboratory practice should be observed.
- Wear protective clothing, disposable gloves, and safety goggles while performing the test.
- According to the CLP Regulation No. 1272/2008, the kit components do not have to be labelled as hazardous substances. Detailed safety information can be found in the safety data sheet.
- Avoid any actions that could result in ingestion, inhalation or injection of the reagents. Never pipette by mouth.
- Avoid contact with individual reagents.
- Dispose of waste according to state and local environmental protection regulations.
- Broken glass can cause injury. Be cautious with glass vials.
- The quality control guidelines in the medical laboratory regarding the inclusion of control samples and/or pooled samples should be observed.

3 Storage and Stability

The kit is shipped at ambient temperature. Upon arrival, store the kit at 2 – 8 °C to keep it stable until its expiry date. Once opened the kit is stable until its expiry date. The shelf life of the ready-to-use reagents is indicated on the respective bottle label. For stability of prepared reagents refer to 6.1. Reagents must equilibrate to room temperature before use and refrigerated immediately after use.

4 Contents of the Kit

MT-Strips STRIPS 12 strips
 8 wells each, break apart, precoated with
 N-acyl-histamine

Standards 1 – 6 CAL 1 - 6 6 vials
 each 4 ml, ready for use, Concentrations:

| Standard | 1 | 2 | 3 | 4 | 5 | 6 |
|----------|---|-----|-----|----|----|-----|
| ng/ml | 0 | 0.3 | 1 | 3 | 10 | 30 |
| nmol/l | 0 | 2.7 | 9.0 | 27 | 90 | 270 |

Control 1 & 2 CON 1 & 2 2 vials
 Each 4 ml, ready for use
 Range: see QC certificate

Acylation Reagent ACYL-REAG 3 vials
 3 ml lyoph.,
 dissolve content in SOLVENT

Acylation Buffer ACYL-BUFF 1 vial
 14 ml, ready for use, colour coded blue

Solvent SOLVENT 1 vial
 11 ml, ready for use, colour coded yellow

Antiserum AS 1 vial
 6 ml, ready for use, colour coded yellow,
 rabbit-anti-N-acyl-histamine

Enzyme Conjugate CONJ 1 vial
 13 ml, ready for use, anti-rabbit-IgG-
 peroxidase

Wash Buffer WASH 1 vial
 20 ml, 50 x concentrated

| | | |
|---|---------------------|----------|
| Substrate 13 ml, TMB solution, ready for use | SUB | 1 vial |
| Stop Solution 13 ml, ready for use, contains 0.3 M sulphuric acid | STOP | 1 vial |
| Acylation Plate For sample preparation (acylation) | ACYL-PLATE | 2 plates |
| Equalizing Reagent lyoph., dissolve contents with 6 ml Acylation Buffer | EQUA-REAG | 1 vial |
| Releasebuffer 21 ml, ready for use | RELEASE-BUFF | 2 vials |
| Adhesive Foil 21 ml, ready for use | FOIL | 2 pieces |

Additional materials and equipment required but not provided:

- Pipettes for 10, 50 and 100 μ l
- Multipipette
- Orbital shaker
- Vortex mixer and roll mixer
- Multichannel pipette or Microplate washing device
- Microplate photometer (450 nm)
- Distilled water
- Centrifuge
- Paper towels, pipette tips, timer
- Heating block or water bath and 1.5 ml reaction tubes (see 5.3)
- Stool collection tubes (s. 5.4)

5 Specimen Collection and Storage

Repeated freezing and thawing of samples should be avoided.

5.1 Plasma

EDTA- or heparin plasma can be used. However, as Histamine concentrations have been found to be lower in EDTA-plasma, it is recommended to use heparin plasma. Haemolytic, lipaemic and icteric samples should not be used.

The samples can be stored up to 6 hours at 2 – 8 °C. For a longer storage (up to 6 months) the samples must be frozen at -20 °C.

5.2 Urine

Spontaneous urine can be used for this test as well as collected urine. In the case of collected 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 determined in addition. Urine samples can be stored at -20 °C for at least 6 months.

Before use, mix urine and centrifuge.

5.3 Total Histamine

To determine total histamine, heparin whole blood must be used. Collect whole blood in a blood vial containing heparin as anticoagulant (e.g. LH-Monvette™) and mix carefully.

The samples can be stored up to 24 hours at 20 – 25 °C. Do not store at 2 - 8 °C, as this will lead to agglutination of leukocytes. Avoid exposure to direct sun light.

Equilibrate release buffer to room temperature. Determinations in duplicate are recommended.

1. Pipette **20 µl** of heparin whole blood into a reaction tube.
2. Add **500 µl** release buffer **RELEASE BUFF**, close tube and mix.
3. Incubate in heating block or water bath for 10 min at 90 °C.
4. Incubate in water bath (room temperature) for 10 min.

5. Centrifuge for 10 min at 2,000 x g at room temperature.
6. Use 50 µl of supernatant for sample preparation (acylation) according to section 6.2.

5.4 Stool

Stool collection tubes are required for specimen collection and must be used according to the instructions for use included. Stool collection tubes must be ordered separately.

The extracted samples can be stored at room temperature for up to 2 days. For longer storage, the extracted samples must be frozen at ≤ -20 °C.

Before use in this assay, centrifuge the stool collection tubes for 5 minutes at 2,000 x g at room temperature.

50 µl of the supernatant are used for sample preparation (acylation), s. 6.2.

5.5 Cell Culture Media

Cell culture media such as DMEM and RPMI can be used in this assay. Other media must be validated by the user.

6 Preparation of Reagents and Samples

6.1 Preparation of Reagents

6.1.1 Equalizing Reagent

Dissolve the contents of EQUA-REAG by pipetting 6 ml of ACYL-BUFF into the vial. Mix shortly on a vortex mixer and leave on a roll mixer for at least 20 minutes until dissolved completely. Thereby, avoid excessive formation of foam. The reconstituted Equalizing Reagent should be stored at -20 °C and is stable until expiry date printed on vial label.

6.1.2 Wash Buffer

Dilute the contents of the 20 ml concentrated (50x) wash buffer WASH with dist. water to a total volume of 1000 ml.

The diluted wash buffer can be stored at 2 – 8 °C for a maximum period of 4 weeks. For longer storage freeze at -20 °C.

Should the kit be used in several runs, then prepare only the required amount of wash buffer for each run.

6.1.3 Acylation Reagent

Remove the required amount of vials of acylation reagent ACYL-REAG from the foil pouch, leave the remaining vials in the foil pouch together with the desiccant and close it carefully.

Dissolve the content of one bottle in 3 ml SOLVENT and shake for 5 minutes on a roll mixer or similar mixer. The Acylation Reagent must always be prepared immediately before performing the assay and is stable for approximately 3 hours. After use discard leftovers of the acylation reagent.

The second and third vial allows a second and third run of the test, respectively. If the whole kit is to be used in one run it is recommended to pool the dissolved contents of the two vials of Acylation Reagent.

All other reagents are ready for use.

6.2 Preparation of Samples (Acylation)

Equilibrate reagents and samples to room temperature. Determinations in duplicates are recommended. As wells of the reaction plate **ACYL-PLATE** can be used only once, it is recommended to mark the respective wells.

1. Pipette

50 µl standard 1 – 6 **CAL 1-6**

50 µl control 1 & 2 **CON 1 & 2**

50 µl of extracted heparin whole blood (diluted **1:26** in release buffer and heated, see 5.3)

50 µl extracted stool sample

50 µl cell culture media sample

10 µl urine sample

50 µl EDTA-plasma

50 µl heparin plasma

into the required amount of wells of the reaction plate **ACYL-PLATE**.

2. Pipette **50 µl of dist. water** into each well containing **urine**.

3. Pipette **50 µl dissolved Equalizing Reagent** **EQUA-REAG** into each well containing **standards, controls and heparin whole blood, stool, cell culture media or urine**.

Do not add Equalizing Reagent to wells with EDTA-plasma or heparin plasma. However, pipette **50 µl Acylation Buffer** **ACYL-BUFF** into each well containing **EDTA-plasma or heparin plasma**.

4. Shake for 10 seconds on a horizontal shaker.

5. Pipette **50 µl dissolved Acylation Reagent** **ACYL-REAG** into each well and proceed with the next step, immediately.

6. Incubate for **20 minutes** at room temperature on an orbital shaker at medium frequency.

7. Pipette **50 µl Antiserum** **AS** into each well.

8. Incubate for 30 minutes at room temperature on an orbital shaker at medium frequency.

Take 50 µl each for the ELISA.

7 Test Procedure ELISA

Allow reagents and samples to reach room temperature.

1. Transfer **50 µl** each of **acylated Standards 1 to 6, Controls 1 & 2** and **Samples** from the Acylation Plate into the respective wells of the coated microtiter strips **STRIPS**. Leave strips, which are not needed, in the bag with the desiccant and close it thoroughly.
2. Cover strips with adhesive foil **FOIL**.
Incubate for 60 minutes at room temperature (20 – 25 °C) on an orbital shaker at medium frequency.
3. Discard or aspirate the contents of the wells, pipette **300 µl diluted Wash Buffer** **WASH** into each well and again discard or aspirate the contents of the wells. Remove residual liquid by tapping the inverted plate on clean absorbent paper.
Repeat the washing procedure 4 times.
Alternatively, a washing device may be used.
4. Pipette **100 µl Enzyme Conjugate** **CONJ** into each well.
5. Incubate for 20 minutes at room temperature on an orbital shaker at medium frequency.
6. Washing: Repeat step 3.
7. Pipette **100 µl Substrate** **SUB** into each well.
8. Shake for 10 seconds on an orbital shaker.
Incubate for 20 ± 5 minutes at room temperature (20 – 25 °C) on the table without shaking. Cover with a large box.
9. Pipette **100 µl Stop Solution** **STOP** into each well.
Shake for 10 seconds on an orbital shaker.
10. Read the optical density at 450 nm (reference wavelength between 570 nm and 650 nm) in a microplate photometer within 15 minutes.

8 Calculation of the Results

On a semi logarithmic graph paper the concentration of the standards (x-axis, logarithmic) are plotted against their corresponding optical density (y-axis, linear). When using analysing software, it is recommended to use the Four Parameter Logistic (4PL) Regression (alternatively: cubic-spline or logit-log).

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. When using analysing software, it is recommended to use the Four Parameter Logistic (4PL) Regression (alternatively: cubic-spline).

The concentration of the controls and EDTA-plasma, heparin plasma and cell culture media samples in ng/ml can be read directly from the standard curve.

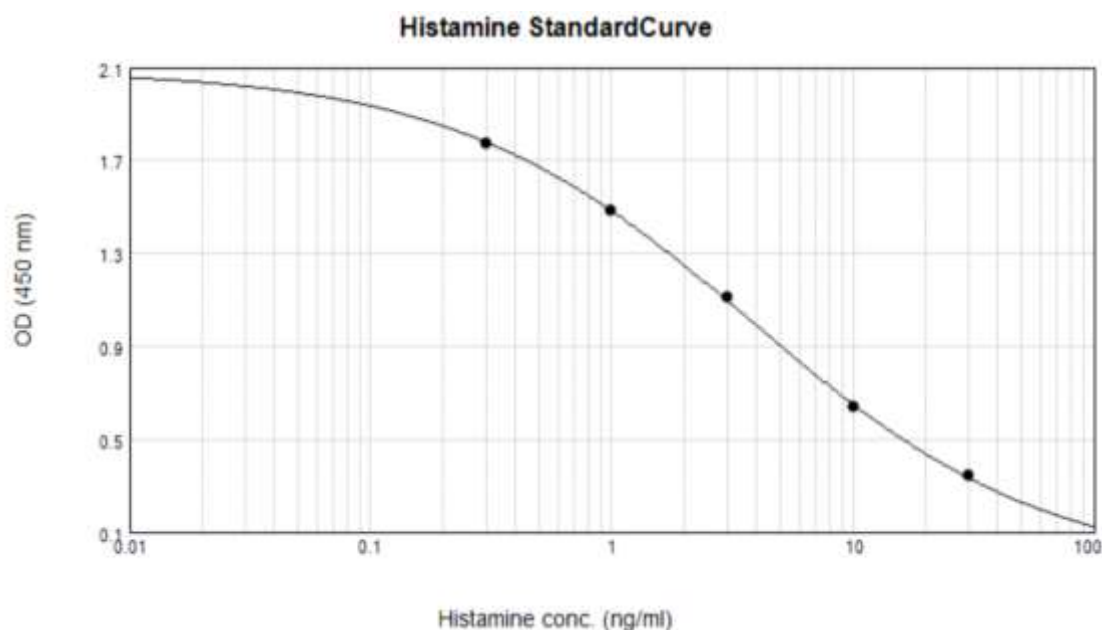
The read concentration of urine samples in ng/ml must be multiplied by a factor of 5.

The read concentration of the heparin whole blood samples in ng/ml must be multiplied by a factor of 26.

The read concentration of the stool samples must be multiplied by a factor of 150, which accounts for the amount stool used in the assay. The result is expressed as ng/g.

Conversion: Histamine: 1 ng/ml corresponds to 9.0 nmol/l

Typical standard curve:



Quality Control: The results are only valid, when the kit controls are within the range indicated on the QC certificate. Otherwise, the test must be repeated.

9 Assay Characteristics

9.1 Normal Range

| Matrix | Reference Range |
|---------------------|-----------------|
| EDTA Plasma | < 1 ng/ml |
| Heparin Plasma | < 4.5 ng/ml |
| Heparin whole blood | 10 - 100 ng/ml |
| Urine | < 45 µg/day |
| Stool | < 600 ng/g |

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

9.2 Sensitivity

| Matrix | Lower Detection Limit | Calculation |
|-----------------------------|-----------------------|---------------------------|
| EDTA Plasma, Heparin Plasma | 0.09 ng/ml | OD _{Cal1} - 2xSD |
| Heparin whole blood | 2.3 ng/ml | OD _{Cal1} - 2xSD |
| Urine | 0.45 ng/ml | OD _{Cal1} - 2xSD |
| Stool | 13.4 ng/ml | OD _{Cal1} - 2xSD |
| Cell Culture Media | 0.09 ng/ml | OD _{Cal1} - 2xSD |

9.3 Specificity (Cross Reactivity)

| Substance | Cross Reactivity (%) |
|---------------------------------|----------------------|
| Histamine | 100 |
| 1-methyl histamine | < 0.05 |
| 3-methyl histamine | 0.1 |
| 1-methyl-4-imidazol-acetic acid | < 0.0002 |
| Imidazol-4-acetic acid | < 0.0005 |
| L-histidine | < 0.0002 |

9.4 Recovery after spiking

| Matrix | Range (ng/ml) | Mean (%) | Range (%) |
|---------------------|---------------|----------|-----------|
| EDTA Plasma | 0.78 – 12.6 | 98 | 96 - 102 |
| Heparin Plasma | 1.8 – 13.0 | 105 | 94 - 111 |
| Heparin whole blood | 57 – 157 | 104 | 99 - 111 |
| Urine | 14 – 109 | 101 | 93 - 107 |
| Stool | 206 – 1773 | 103 | 92 - 109 |

9.5 Linearity

| Matrix | Range(ng/ml) | Highest Dilution | Mean (%) | Range (%) |
|----------------|--------------|--------------------------|----------|-----------|
| EDTA-Plasma | 3.1 – 14.2 | 1 : 5 Equalizing Reagent | 107 | 102 - 110 |
| Heparin Plasma | 3.2 – 16.0 | 1 : 5 Equalizing Reagent | 96 | 89 - 101 |
| H. whole blood | 27 – 389 | 1 : 15 dist. water | 100 | 96 - 103 |
| Urine | 6.8 - 78 | 1 : 10 dist. water | 94 | 87 - 102 |
| Stool | 210 – 2052 | 1 : 10 dist. water | 97 | 88 - 102 |

9.6 Reproducibility

| Matrix | Range (ng/ml) | Intra-Assay-cv (%) |
|----------------|---------------|--------------------|
| EDTA-Plasma | 1.7 – 9.1 | 10.5 – 7.0 % |
| Heparin Plasma | 1.6 – 9.9 | 11.1 – 5.5 % |
| H. whole blood | 54 – 158 | 9.8 – 8.4 % |
| Urine | 13 – 64 | 8.9 – 9.4 % |
| Stool | 179 – 1096 | 10.6 – 8.7 % |

9.7 Comparison of methods

| Matrix | Method | Correlation |
|----------------|---------|--|
| EDTA-Plasma | LC/MS | $Y = 0.87 \times \text{LC/MS} - 0.06$; $R = 0.979$; $N = 13$ |
| Heparin Plasma | LC/MS | $Y = 1.01 \times \text{LC/MS} + 0.089$; $R = 0.973$; $N = 28$ |
| H. whole blood | Elisa A | $Y = 1.11 \times \text{ELISA A} - 4.71$; $R = 0.994$; $N = 21$ |
| Urine | LC/MS | $Y = 1.05 \times \text{LC/MS} + 3.2$; $R = 0.964$; $N = 32$ |
| Stool | Elisa A | $Y = 0.87 \times \text{ELISA A} + 63$; $R = 0.961$; $N = 51$ |

9.8 Calibration

The calibration is carried out by weighing the pure substance. The correctness of the method was determined by comparing the methods (9.7).

9.9 Limitation of Method

The result of the Histamine-Elisa is to be seen in connection with other diagnostic procedures and the anamnesis and the resulting questions.

Samples measured above the highest standard must be diluted with the appropriate medium (see 9.5) and determined again. The values of diluted samples must be multiplied by the appropriate dilution factor.

9.10 Interferences

Hemolytic, lipemic and icteric specimens should not be used. Do not use non-acidified urine collection.

10 Literature

- Nettis, E.; Colanardi, A.; Ferrannini, A. (2005):
Antihistamines as Important Tools for Regulating Inflammation
Curr. Med. Chem. – Anti-Inflammatory & Anti-Allergy Agents, 4, 81-89
- Matsumoto, J.; Matsuda, H. (2002):
Mast-cell-dependent histamine release after praziquantel treatment of Schistosoma japonicum infection: implications for chemotherapy-related adverse effects
Parasitol Res 88: 888–893
- Belic, A.; Grabnar, I.; Karba, R.; et al. (1999):
Interdependence of histamine and methylhistamine kinetics: modelling and simulation approach
Computers in Biology and Medicine 29, 361-375
- Martens-Lobenhoffer, J.; Neumann, H. (1999):
Determination of 1-methylhistamine and 1-methylimidazoleacetic acid in human urine as a tool for the diagnosis of mastocytosis
Journal of Chromatography B, 721, 135–140
- Prell, G.; Green, J.; Elkashef, A. (1996):
The relationship between urine excretion and biogenic amines and their metabolites in cerebrospinal fluid of schizophrenic patients
Schizophrenia Research 19, 171-176
- Eberlein-König, B.; Ullmann, S.; Thomas, P.; et al. (1995):
Tryptase and histamine release due to a sting challenge in bee venom allergic patients treated successfully or unsuccessfully with hyposensitization
Clinical and Experimental Allergy, Volume 25, pages 704-712
- Koller, D.; Rosenkranz, A.; Pirker, C.; et al. (1992):
Assessment of histamine release from basophils in whole blood by benzylpenicilloyl poly-L-lysine in penicillin-sensitized patients
Allergy: 47: 459-462.
- Marquardt, D.; Wasserman, S. (1982):
Mast Cells in Allergic Diseases and Mastocytosis
West J Med; 137:195-212
- Butchers, P.; Vardey, C.; Skidmore, I.; et al. (1980):
Histamine-Containing Cells from Bronchial Lavage of Macaque Monkeys. Time Course and Inhibition of Anaphylactic Histamine Release
Int. Archs Allergy appl. Immun. 62: 205-212

Pipetting Scheme - Sample Preparation

| | Stand. | Controls | EDTA- & Heparin Plasma | Stool | Urine | H. whole blood | Cell Culture Medium |
|-----------------------------|--------|----------|------------------------|-------|-------|----------------|---------------------|
| ACYL-PLATE: | | | | | | | |
| CAL 1 - 6 | 50 | | | | | | |
| CON 1 & 2 | | 50 | | | | | |
| EDTA- & Heparin Plasma | | | 50 | | | | |
| Stool | | | | 50 | | | |
| Urine | | | | | 10 | | |
| H. whole blood (dil. 1:26*) | | | | | | 50 | |
| Cell Culture Medium | | | | | | | 50 |
| Dist. Water | | | | | 50 | | |
| EQUA-REAG | 50 | 50 | | 50 | 50 | 50 | 50 |
| ACYL-BUFF | | | 50 | | | | |

* see section 5

Shake for 10 seconds

| | | | | | | | |
|-----------|----|----|----|----|----|----|----|
| ACYL-REAG | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
|-----------|----|----|----|----|----|----|----|

Immediately, shake for 20 minutes at room temperature

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| AS | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
|----|----|----|----|----|----|----|----|

Shake for 30 minutes at room temperature

Pipetting Scheme - ELISA

| | Acyl. Standards | Acyl. Controls | Acyl. Sample |
|------------------------------------|-----------------|----------------|--------------|
| STRIPS: | | | |
| Transfer from ACYL-PLATE to STRIPS | 50 | 50 | 50 |

Cover with FOIL

Shake for 1 hour at room temperature

4 x washing

| | | | |
|------|-----|-----|-----|
| CONJ | 100 | 100 | 100 |
|------|-----|-----|-----|

Shake for 20 minutes at room temperature

4 x washing

| | | | |
|-----|-----|-----|-----|
| SUB | 100 | 100 | 100 |
|-----|-----|-----|-----|

Shake for 10 seconds

Incubate for 20 ± 5 minutes at room temperature, covered with large box, no shaking

| | | | |
|------|-----|-----|-----|
| STOP | 100 | 100 | 100 |
|------|-----|-----|-----|

Shake for 10 seconds and determine absorbance at 450 nm