Tetanus toxoid IgG ELISA Kit

Catalog Number KA3314
96 assays
Version: 02

Intended for research use only
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Introduction

Intended Use

Tetanus toxoid IgG ELISA Kit is intended for the in-vitro measurement of specific IgG antibodies against tetanus toxoid (T.Tox.) present in serum, in order to determine protective status. Sufficient materials are supplied to allow a maximum of 39 samples to be tested in duplicate or 87 in single, with a seven point calibration curve and two controls. The seven point calibration curve can be reduced to five points if measurement below 0.09 IU/ml is not required.

Background

Anti-tetanus toxoid antibodies are raised in response to vaccination with tetanus toxoid protein. A patient’s response to the immunisation may be assessed, subsequently, by the serological determination of their anti-tetanus toxoid antibody levels using this quantitative enzyme immunoassay technique. Patients with recurrent infections should be investigated for immunodeficiency due to thymic abnormalities, and the consequent inability to respond to specific bacterial antigens (1).

Principle of the Assay

Microwells are pre-coated with tetanus toxoid antigen. The calibrators, controls and diluted patient samples are added to the wells and antibodies recognising the tetanus toxoid antigen bind during the first incubation. After washing the wells to remove all unbound proteins, purified peroxidase labelled rabbit anti-human IgG (γ chain specific) conjugate is added. The conjugate binds to the captured human antibody and the excess unbound conjugate is removed by a further wash step. The bound conjugate is visualised with 3,3',5,5' tetramethylbenzidine (TMB) substrate which gives a blue reaction product, the intensity of which is proportional to the concentration of antibody in the sample. Phosphoric acid is added to each well to stop the reaction. This produces a yellow end point colour, which is read at 450nm.
General Information

Materials Supplied

List of component

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<thead>
<tr>
<th>Component</th>
<th>Amount</th>
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<tr>
<td>T. Tox. IgG Coated Wells: Well strips coated with tetanus toxoid derived from the toxin of Clostridium tetani and packaged in a re-sealable foil bag containing two desiccant pouches.</td>
<td>96 (12×8) wells</td>
</tr>
<tr>
<td>Sample Diluent: Coloured yellow, ready to use for sample dilution.</td>
<td>2x50mL</td>
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<tr>
<td>Wash Buffer: 20-fold concentrated buffer for washing the wells.</td>
<td>1x50mL</td>
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<tr>
<td>T. Tox. IgG Calibrators: Diluted human serum, with the following concentrations of anti-tetanus toxoid antibody: 7, 2.33, 0.78, 0.26, 0.09, 0.03, 0.01 IU/ml, ready to use.</td>
<td>7x1.2mL</td>
</tr>
<tr>
<td>T. Tox. IgG High Control: Diluted human serum, ready to use.</td>
<td>1.2mL</td>
</tr>
<tr>
<td>T. Tox. IgG Low Control: Diluted human serum, ready to use.</td>
<td>1.2mL</td>
</tr>
<tr>
<td>T.Tox IgG Conjugate: Coloured red, purified peroxidase labelled antibody to human IgG, ready to use.</td>
<td>12mL</td>
</tr>
<tr>
<td>TMB Substrate: TMB substrate, ready to use.</td>
<td>14mL</td>
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<tr>
<td>Stop Solution: 3M phosphoric acid, ready to use.</td>
<td>14mL</td>
</tr>
</tbody>
</table>

Storage Instruction

✓ The kit should be stored at 2-8°C and should not be frozen. Inappropriate storage temperatures will affect the results.
✓ Wash buffer diluted into a clean container can be stored at room temperature for a maximum of 4 weeks.
✓ The expiry date of the kit is shown on the outer label.

Materials Required but Not Supplied

✓ Automatic microplate plate washer: This is recommended, however, plate washing can be performed manually.
✓ Plate reader: Capable of measuring optical densities at 450nm referenced on air.
✓ Distilled or deionised water: This should be of the highest quality available.
✓ Calibrated micropipettes: For dispensing 1000, 100 & 10µL.
✓ Multichannel pipette: Recommended for dispensing 100µL volumes of conjugate, substrate and stop solution.
✓ Glass/plastic tubes: For sample dilution.
Precautions for Use

✓ Important note:
  • All donors of human serum supplied in this kit have been serum tested and found negative for hepatitis B surface antigen (HBsAg) and antibodies to human immunodeficiency virus (HIV1 and HIV2) and hepatitis C virus. The assays used were either approved by the FDA (USA) or cleared for in vitro diagnostic use in the EU (Directive 98/79/EC, Annex II); however these tests cannot guarantee the absence of infective agents. Proper handling and disposal methods should be established as for all potentially infective material, including (but not limited to) users wearing suitable protective equipment and clothing at all times. Only personnel fully trained in such methods should be permitted to perform these procedures.
  • This product contains sodium azide and ProClin 300 and must be handled with caution; suitable gloves and other protective clothing should be worn at all times when handling this product. Do not ingest or allow contact with the skin (particularly broken skin or open wounds) or mucous membranes. If contact does occur wash with a large volume of water and seek urgent medical advice. Explosive metal azides may be formed on prolonged contact of sodium azide with lead and copper plumbing; on disposal of reagent, flush with a large volume of water to prevent azide build up.

The buffers and serum supplied in this kit contain various enzyme inhibitors as listed below.

<table>
<thead>
<tr>
<th>INHIBITOR</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Azide</td>
<td>0.099%</td>
</tr>
<tr>
<td>Proclin 300</td>
<td>0.02% - 0.045%</td>
</tr>
<tr>
<td>Bromonitrodioxane</td>
<td>0.002%</td>
</tr>
<tr>
<td>Methylisothiazone</td>
<td>0.002%</td>
</tr>
</tbody>
</table>

 ✓ The stop solution contains 3M phosphoric acid, which is an irritant. Avoid contact with skin or eyes.
 ✓ Reagent spills should be cleaned up appropriately, observing local and environmental regulations.

✓ Caution
  • This product should only be used by appropriately trained personnel. Strict adherence to the protocol is recommended. Any deviation may affect assay performance, and the results obtained. Pay attention to specific ‘Notes’ and warnings throughout these Instructions for Use.
  • Reagents from different batch numbers of kits are NOT interchangeable. If large numbers of tests are performed care should be taken to ensure that all reagents are from the SAME batch. All strips used must be taken from the same foil pouch. Substitution of any component may lead to incorrect results.
  • To avoid reagent contamination, especially of the conjugate and calibrators, only use new or clean plastic / glassware. NEVER return unused reagents to the bottles.
  • Do not leave reagent bottles uncapped; any resulting evaporation or contamination will lead to inconsistent results.
  • TMB substrate must not be exposed to light or water.
- Microbially contaminated, haemolysed or lipaemic serum and specimens containing particulate matter should not be used.
- Inaccurate sample dilution cannot be checked, as kit controls are ready to use. The use of calibrated pipettes and appropriate internal QC samples is recommended. The use of calibrated pipettes and appropriate internal QC samples is recommended.
- When using automated assay systems, sample diluters and other automated equipment, follow the manufacturer’s instructions carefully. Particular attention should be given to the setup of the equipment and installation and connection to external services. All settings for automatic washers and readers must be followed carefully and equipment must be maintained and serviced according to the manufacturer’s instructions.

✓ Limitations
- Pre-and post-vaccination samples should be run simultaneously.
- This kit may be used to aid diagnosis of immunodeficiency. Results must be confirmed by clinical findings and other serological tests.
- The results obtained from this assay are not diagnostic proof of lack of protection / protection against tetanus or the presence or absence of immunodeficiency.
Assay Protocol

Reagent Preparation

✓ Bring the kit to room temperature
  • The kit is designed for room temperature operation (20-24°C).
  • Remove the kit from storage and stand at room temperature for approximately 60 minutes. Wells must not be removed from the foil bag until they have reached room temperature.
  • Note: The kits may be maintained at room temperature for up to 1 week.

✓ Kit components
  • Gently mix each kit component before use.

✓ Wash buffer dilution
  • Add 50mL of the wash buffer concentrate to 950 mL of distilled water (1 in 20 dilution) into a clean container and mix. Smaller volumes can be diluted as appropriate. Note: Diluted wash buffer can be stored at room temperature for up to 4 weeks, therefore only dilute the appropriate amount.

✓ Strip and frame handling
  • Place the required number of wells in the strip holder. Position from well A1, filling columns from left to right across the plate. When handling the plate, squeeze the long edges of the frame to prevent the wells falling out. Note: Return unused wells to the foil bag immediately with the two desiccant pouches and re-seal tightly to minimise exposure to moisture. Take care not to puncture or tear the foil bag, see below. WARNING: Exposure of wells to moisture or contamination by dust or other particulate matter will result in antigen degradation, leading to poor assay precision and potentially false results.

Sample Preparation

✓ Blood samples should be collected by venepuncture allowed to clot naturally and the serum separated.
✓ The serum may be stored at 2-8°C for up to 48 hours prior to assay, or for prolonged storage kept undiluted at -20°C or below.
✓ Repeated thawing and freezing should be avoided.
✓ Serum samples should not be heat-inactivated, as this may give false positive results.
✓ Sample dilution
  • Dilute 10µL of each sample with 1000µL of sample diluent (1:100) and mix well. Note: Diluted sample must be used within 8 hours.
**Assay Procedure**

Maintain the same dispensing sequence throughout the assay.

1. **Sample addition:** Dispense 100µL of each calibrator, control and diluted (1:100) sample into the appropriate wells of the plate provided. **Note:** *Samples should be added as quickly as possible to the plate to minimise assay drift, and the timer started after the addition of the last sample. Incubate at room temperature for 30 minutes.*

2. **Washing:** The washing procedure is critical and requires special attention. An improperly washed plate will give inaccurate results, with poor precision and high backgrounds. After incubation remove the plate and wash wells 3 times with 250-350 µL wash buffer per well. Wash the plate either by using an automatic plate washer or manually as indicated below. After the final automated wash, invert the plate and tap the wells dry on absorbent paper.

   **Plates can be washed manually as follows:**
   a. Flick out the contents of the plate into a sink.
   b. Tap the wells dry on absorbent paper.
   c. Fill each well with 250-350 µL of wash buffer using a multichannel pipette.
   d. Gently shake the plate on a flat surface.
   e. Repeat a-d twice.
   f. Repeat a and b.

3. **Conjugate addition:** Dispense 100 µL of conjugate into each well, blot the top of the wells with a tissue to remove any splashes. **Note:** *To avoid contamination, NEVER return excess conjugate to the reagent bottle. Incubate at room temperature for 30 minutes.*

4. **Washing:** Repeat step 2.

5. **Substrate (TMB) addition:** Dispense 100 µL of TMB substrate into each well, blot the top of the wells with a tissue to remove any splashes. **Note:** *To avoid contamination never return excess TMB to the reagent bottle. Incubate at room temperature in the dark for 30 minutes.*

6. **Stopping:** Dispense 100 µL of stop solution into each well. This causes a change in colour from blue to yellow.

7. **Optical density measurement:** Read the optical density (OD) of each well at 450 nm on a microplate reader, within 30 minutes of stopping the reaction.
Data Analysis

Calculation of Results

✓ Quality control
In order for an assay to be valid, all the following criteria must be met:
• Calibrators and controls must be included in each run.
• The value obtained for each control should be in the range specified on the QC Certificate.
• The curve shape should be similar to the calibration curve, shown on the QC Certificate.
If the above criteria are not met, the assay is invalid and the test should be repeated.

✓ Calculate mean optical densities (For assays run in duplicate only)
For each calibrator, control and sample calculate the mean OD of the duplicate readings. The percentage
coefficient of variation (%C.V.) for each duplicate OD should be less than 15%.

✓ Plot calibration curve
The calibration curve can be plotted either automatically or manually as follows by plotting the anti-tetanus
toxoid antibody concentration on the log scale against the OD on the linear scale for each calibrator:
✓ Automatic-use appropriately validated software, and the curve fit that best fits the data.
✓ Manual-using log/linear graph paper, draw a smooth curve through the points (not a straight line or point
to point).

✓ Treatment of anomalous points
If any one point does not lie on the curve, it can be removed provided that the overall expected curve shape is
maintained (this is normally done automatically when using curve fitting software). If the absence of this point
means that the curve has a shape dissimilar to that of the sample calibration curve, or more than one point
appears to be anomalous, then the assay should be
repeated.

✓ Calculation of the control value
Read the level of the anti-tetanus toxoid antibody in the controls directly from the calibration curve.

✓ Calculation of antibody levels in diluted samples
Read the level of the anti-tetanus toxoid antibody in the diluted samples directly from the calibration curve.

Note: The calibrator values have been adjusted by a factor of 100 to account for a 1:100 sample dilution. No
further correction is required.
Assay calibration
The assay is calibrated against the NIBSC tetanus antitoxin reference preparation, 76/589, which is supplied by National Institute for Biological Standards and Control.

Protective Levels
The level of protective antibody in the normal population has been cited in the literature as between 0.01 and 0.15 IU/mL\(^2,3,4\). The largest study conducted in the United States\(2\), involved a sample population of 10,618 individuals, ranging from age 6 upwards. Overall 69.7% had protective levels of >0.15 IU/mL, the rate decreased from 87.7% in 6-11 year olds to 27.8% in those 70 years of age and older. The results from two smaller studies\(3,4\), indicate protective levels of 0.01 IU/mL. Due to the wide ranges quoted above, it is recommended that each laboratory determine its own normal protective range.

Typical Values
Anti-tetanus toxoid IgG antibody levels were measured in serum from 100 normal adult blood donors (of unknown vaccination and immune status). The results displayed below, are provided for illustration only, and should not be used to calculate a normal range Normal ranges have been established using The Binding Site T.Tox kit (MK010). See reference 5.
Performance Characteristics

✓ Precision
The intra- and inter-assay precision was measured using three samples within the range of the calibration curve. The concentration and % C.V. for each sample are given below:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Intra-assay Precision</th>
<th>% C.V.</th>
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</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>4.05</td>
<td>2.31</td>
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<tr>
<td>Sample 2</td>
<td>1.21</td>
<td>2.65</td>
</tr>
<tr>
<td>Sample 3</td>
<td>0.51</td>
<td>5.06</td>
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<table>
<thead>
<tr>
<th>Sample</th>
<th>Inter-assay Precision</th>
<th>% C.V.</th>
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<tbody>
<tr>
<td>Sample 1</td>
<td>3.77</td>
<td>8.81</td>
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<tr>
<td>Sample 2</td>
<td>0.98</td>
<td>7.99</td>
</tr>
<tr>
<td>Sample 3</td>
<td>0.47</td>
<td>5.63</td>
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✓ Analytical Sensitivity
Sensitivity was determined as the mean concentration + 2 SD given by 16 determinations of the sample diluent. This equates to 0.0093 IU/mL.

✓ Measuring Range
The measuring range of the assay is 0.01-7 IU/mL.

✓ Interfering Substances
A range of interfering substance has been spiked into serum samples containing tetanus antibody, which have then been subsequently assayed.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration</th>
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<tbody>
<tr>
<td>Bilirubin F (Free)</td>
<td>183mg/mL</td>
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<tr>
<td>Bilirubin C (Conjugate)</td>
<td>190mg/mL</td>
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<tr>
<td>Haemolysed Haemoglobin</td>
<td>4900mg/mL</td>
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<tr>
<td>Chyle</td>
<td>19300 Units</td>
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<tr>
<td>Rheumatoid Factor</td>
<td>500 IU/mL</td>
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No interference was observed with free or conjugated bilirubin, haemoglobin, lipid or rheumatoid factor.
Resources

References

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