DENGUE IgM MICROLISA
MAC-ELISA Test for the Detection of Dengue IgM Antibodies in Human Serum/Plasma

1. INTRODUCTION
The mosquito-borne dengue viruses (serotype 1-4) cause dengue fever, a severe flu-like illness. The disease is prevalent in third world tropical regions and spreading to sub-tropical developed countries - including the United States. WHO estimates that 50-80 million cases of dengue fever occur worldwide each year, including a potentially deadly form of the disease called dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS). Primary infection with dengue virus results in a self-limiting disease characterized by mild to high fever lasting 3 to 7 days, severe headache with pain behind the eyes, muscle and joint pain, rash and vomiting. Secondary infection is the more common form of the disease in many parts of Southeast Asia and South America. This form of the disease is more serious and can result in DHF and DSS. The major clinical symptoms can include high fever, haemorrhagic events, and circulatory failure, and the mortality rate can be as high as 40%. Early diagnosis of DSS is particularly important, as patients may die within 12 to 24 hours if appropriate treatment is not administered.

Primary dengue virus infection is characterized by elevations in specific IgM antibody levels 3 to 5 days after the onset of symptoms; this generally persists for 30 to 60 days. IgG levels also become elevated after 10 to 14 days and remain detectable for life. During secondary infection, IgM levels generally rise more slowly and reach lower levels than in primary infection, while IgG levels rise rapidly from 1 to 2 days after the onset of symptoms.

2. INTENDED USE
DENGUE IgM MICROLISA is designed for in vitro qualitative detection of Dengue IgM Antibodies in human serum or plasma and is used as a screening test for testing of collected blood samples suspected for DENGUE. The kit detects all four subtypes; DEN1, DEN2, DEN3 & DEN4 of Dengue virus.

3. PRINCIPLE
Dengue IgM Microlisa test is an enzyme immunoassay based on "MAC Capture ELISA". Anti-human IgM antibodies are coated onto microtiter wells. Specimens and controls are added to the microtiter wells and incubated.

Antibodies to Dengue if present in the specimen, will bind to the Anti-human IgM antibodies adsorbed onto the surface of the wells. The plate is then washed to remove unbound material. Horseradish peroxidase (HRP)- conjugated Dengue antigen (DEN 1-4) is added to each well. This dengue antigen conjugate will bind to dengue specific IgM antibodies which is complex with anti-human IgM antibodies. Finally substrate solution containing chromogen and hydrogen peroxide is added to the wells and incubated. A blue colour will develop in proportion to the amount of Dengue antigen conjugate will bind to dengue specific IgM antibodies which is complex with anti-human IgM antibodies in the wells. The colour reaction is stopped by a stop solution. The enzyme substrate reaction is read by EIA reader for absorbance at a wavelength of 450 nm. If the sample does not contain Dengue IgM antibodies then enzyme conjugate will not bind and the solution in the wells will be either colourless or only a faint background colour develops.

4. DESCRIPTION OF SYMBOLS USED
The following are graphical symbols used in or found on J. Mitra diagnostic products and packing. These symbols are the most common ones appearing on medical devices and their packing. They are explained in more detail in the British and European Standard EN ISO 15223-1:2016.

5. KIT PRESENTATION

- 48 Test Pack
- 96 Test Pack

6. KIT & ITS COMPONENTS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>DESCRIPTION</th>
<th>48 TESTS</th>
<th>96 TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwells</td>
<td>Breakaway microwells coated with anti-human IgM antibodies packed in a pouch with desiccant.</td>
<td>1 Plate (48 wells)</td>
<td>1 Plate (96 wells)</td>
</tr>
</tbody>
</table>

7. STORAGE AND STABILITY
Store the kit & its components at 2-8°C. Expiry date on the kit indicates the date beyond which the kit should not be used.

8. ADDITIONAL MATERIAL AND INSTRUMENTS REQUIRED
- Micropipettes and micropipette tips
- Elisa reader
- Distilled or deionized water
- Graduated Cylinders, for reagent dilution
- Sodium hypochlorite solution
- Paper towels or absorbent tissue

9. SPECIMEN COLLECTION & HANDLING
1. Human serum or plasma samples should be used for the test. While preparing serum samples, remove the serum from the clot as soon as possible to avoid haemolysis. Fresh serum/plasma samples are preferred.
2. Specimens should be free of microbial contamination and may be stored at 2-8°C for one week, or frozen at -20°C or lower. Avoid repeated freezing and thawing.
3. Do not use heat inactivated samples as their use may give false results. Haemolyzed and icteric hyperlipemic samples may give erroneous results.

10. SPECIMEN PROCESSING
(A) FROZEN SAMPLE
Dengue IgM MICROLISA test is best used with fresh samples that have not been frozen and thawed. However most frozen samples will perform well if the procedure suggested below is followed.

Allow the frozen sample to thaw in a vertical position in the rack. Do not shake the sample. This allows particles to settle to the bottom. If a centrifuge is available, the sample should be centrifuged. (5000 rpm for 5 min.)

(B) TRANSPORTATION
If the specimen is to be transported, it should be packed in compliance with the current Government regulations regarding transport of aetiological agents.

11. CAUTION
1. The use of Disposable Gloves and proper Biohazardous clothing is STRONGLY RECOMMENDED while running the test.
2. In case there is a cut or wound in hand, DO NOT PERFORM THE TEST.
3. Do not smoke, drink or eat in areas where specimens or kit reagents are being handled.
4. Tests are for in vitro diagnostic use only.
5. All the samples to be tested should be handled as though capable of transmitting infection.
6. Wash hands thoroughly with soap or any suitable detergent, after the use of the kit. In case of needle prick or other skin puncture or wounds, wash the hands with excess of water and soap.
7. Controls contain Sodium Azide as a preservative. If these material are to be disposed off through a sink or other common plumbing systems, flush with generous amounts of water to prevent accumulation of potentially explosive compounds.
8. All materials used in the assay and samples should be disposed off in the manner that will inactivate virus.

12. PRECAUTIONS FOR USE
Optimal assay performance requires strict adherence to the assay procedure described in the manual.
1. Do not use kit components beyond the expiration date, which is printed on the kit.
2. Avoid microbial contamination of reagents. The use of sterile disposable tips is recommended while removing aliquots from reagent bottles.
3. Stop solution contains sulfuric acid. If sulfuric acid comes in contact with the skin, wash thoroughly with water. In case of contact with eyes, flush with excess of water.
4. Take care while preparing working substrate solution as vials of TMB Substrate & TMB Diluent are of same size.
5. Prepare working substrate solution just 10 minutes prior to adding in the wells.
6. If blue colour or white particles appears in working substrate solution then do not use it. Take fresh containers and tips and prepare it again.
7. Use separate tips for TMB substrate and TMB diluent.
8. Do not allow microwells to dry once the assay has started.
9. Ensure that the microwell strips are levelled in the strip holder. Before reading, wipe the bottom of the microwell strips carefully with soft, absorbent tissue to remove any moisture.
10. If available, a microwell reader which contains a reference filter with settings at 620 or 630 nm should be used. Use of a reference filter minimises interference due to microwells that are opaque, scratched or irregular. However, if a reference filter is unavailable, the absorbance may be read at 450 nm without a reference filter.
11. Distilled or deionised water must be used for wash buffer preparation.
12. Bring all the reagents to room temperature (20-30ºC) before use.
13. PREPARATION OF REAGENTS
Prepare the following reagents before or during assay procedures. Reagents and samples should be at room temperature (20-30ºC) before beginning the assay and can remain at room temperature during testing. Return reagents to 2-8ºC after use. All containers used for preparation of reagents must be cleaned thoroughly and rinsed with distilled or deionized water. Warm the incubator to 37ºC.

i) Anti human IgM antibodies coated strips
Bring foil pack to room temperature (20-30ºC) before opening to prevent condensation on the microwell strips.

b) Unused well should be stored at 2-8ºC, with dessicant in an aluminium pouch with clamp & rod.

Caution: Handle microwell strip with care. Do not touch the bottom exterior surface of the wells.

ii) Sample Preparation:
TUBE DILUTION: Mark the tubes carefully for the proper identification of the samples. Dilute the serum samples to be tested, with sample diluent 1:100 in separate tubes (1 ml. sample diluent + 10 µl serum samples). Use a separate tip for each sample and then discard as biohazardous waste.

iii) Preparation of Working Wash Buffer: 
- a) Check the buffer concentrate for the presence of salt crystals. If crystals are present in the solution, resolubilize by warming at 37ºC until all crystals dissolve.
- b) Prepare at least 25ml. (1ml. concentrated buffer with 24 ml. water) of buffer for each strip used. Mix well before use.
- c) Mix 20 ml. of 25X wash buffer concentrate with 480 ml. of distilled or deionized water. Wash buffer is stable for 2 months when stored at 2-8ºC.

iv) Preparation of Working Conjugate: 
Dilute conjugate concentrate 1:10 in conjugate diluent. Do not store working conjugate.
Prepare a fresh dilution for each assay in a clean glass vessel. Determine the quantity of working conjugate solution to be prepared from the table below. Mix solution thoroughly before use.

<table>
<thead>
<tr>
<th>No. of Strips</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Wells</td>
<td>8</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td>40</td>
<td>48</td>
<td>56</td>
<td>64</td>
<td>72</td>
<td>80</td>
<td>88</td>
<td>96</td>
</tr>
<tr>
<td>Enzyme Conjugate Concentrate (ml)</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Conjugate Diluent in (ml)</td>
<td>0.9</td>
<td>1.8</td>
<td>2.7</td>
<td>3.6</td>
<td>4.5</td>
<td>5.4</td>
<td>6.3</td>
<td>7.2</td>
<td>8.1</td>
<td>9.0</td>
<td>9.9</td>
<td>10.8</td>
</tr>
</tbody>
</table>

v) Preparation of working substrate solution:
Mix TMB substrate and TMB Diluent in 1:1 to prepare working substrate.
Do not store working substrate. Prepare a fresh dilution for each assay in a clean glass vessel. Determine the quantity of working substrate solution to be prepared from the table below. Mix solution thoroughly before use. Do not expose the substrate to strong light.

<table>
<thead>
<tr>
<th>No. of Strips</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Wells</td>
<td>8</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td>40</td>
<td>48</td>
<td>56</td>
<td>64</td>
<td>72</td>
<td>80</td>
<td>88</td>
<td>96</td>
</tr>
<tr>
<td>TMB Substrate (ml)</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>3.5</td>
<td>4.0</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>6.0</td>
</tr>
<tr>
<td>TMB Diluent (ml)</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>3.5</td>
<td>4.0</td>
<td>4.5</td>
<td>5.0</td>
<td>5.5</td>
<td>6.0</td>
</tr>
</tbody>
</table>

14. REAGENT PREPARATION

<table>
<thead>
<tr>
<th>Reagent</th>
<th>Preparation</th>
<th>Stability of opened/ diluted reagents (+2ºC to +8ºC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anti-human IgM coated Microwells</td>
<td>Ready to use</td>
<td>30 days</td>
</tr>
<tr>
<td>2. Sample Diluent</td>
<td>Ready to use</td>
<td></td>
</tr>
<tr>
<td>3a. Negative Control</td>
<td>Ready to use</td>
<td></td>
</tr>
<tr>
<td>3b. Positive Control</td>
<td>Ready to use</td>
<td></td>
</tr>
<tr>
<td>4. Calibrator</td>
<td>Ready to use</td>
<td></td>
</tr>
<tr>
<td>5. Washing Solution</td>
<td>Dilute 1:25 (1+24) with distilled water</td>
<td>2 months.</td>
</tr>
<tr>
<td>6. Conjugate Diluent</td>
<td>Ready to use for the dilution of Enzyme Conjugate</td>
<td></td>
</tr>
<tr>
<td>7. Enzyme Conjugate Concentrate (10X)</td>
<td>Diluent 1:10 in conjugate Diluent</td>
<td>4 hours</td>
</tr>
<tr>
<td>8. TMB Diluent</td>
<td>Ready to use for the dilution of TMB Substrate</td>
<td>Discard unused solution. A deep blue colour present in the substrate solution indicates that the solution has been contaminated and must be discarded.</td>
</tr>
<tr>
<td>9. TMB Substrate</td>
<td>Dilute 1:1 in TMB Diluent just before use</td>
<td></td>
</tr>
<tr>
<td>10. Stop Solution</td>
<td>Ready to use</td>
<td></td>
</tr>
</tbody>
</table>
15. PROCEDURAL NOTES:
1. Material should not be used after the expiry date shown on the labels. Components and test specimen should be at room temperature (20-30°C) before testing begins. Return the reagents to 2-8°C after use.
2. All reagents must be mixed well before use.
3. To avoid contamination, do not touch the top or bottom of strips or edge of wells.
4. All pipetting steps should be performed with utmost care and accuracy. Cross contamination between reagents and samples will invalidate results.
5. Prevent evaporation during sample incubation by covering the strips with sealer; remove sealer before washing.
6. Routine maintenance of wash system is strongly recommended to prevent carry over from highly reactive specimens to non reactive procedures.

16. TEST PROCEDURE
Once the assay has started, complete the procedure without interruption. All the reagents should be dispensed in the centre of the well and the tip of the pipette should not touch the wall of the microwell.

Fit the strip holder with the required number of Anti-human IgM coated strips. The sequence of the microwell.

1. Add 100 µl Negative Control in A-1 well.
2. Add 100 µl calibrator in B-1, C-1 & D-1 wells.
3. Add 100 µl Positive Control in E-1 well.
4. Add 100 µl of each sample diluted in sample diluent (1:100), in each well starting from F-1 well. (Refer TUBE DILUTION).
5. Apply cover seal.
6. Incubate at 37°C ± 1°C for 60 min. ± 1 min.
7. While the samples are incubating, prepare working Wash Solution and working Conjugate as specified in preparation of reagents.
8. Take out the plate from the incubator after the incubation time is over and, wash the wells 5 times with working Wash Solution.
9. Add 100 µl of working Conjugate Solution in each.
10. Apply cover seal.
11. Incubate at 37°C ± 1°C for 60 min ± 1 min.
12. Aspirate and wash as described in step no. 8.
13. Add 100 µl of working substrate solution in each well.
14. Incubate at room temperature (20-30°C) for 30 min. in dark.
15. Add 50 µl of stop solution.
16. Read absorbance at 450 nm. within 30 minutes in ELISA READER. (Bichromatic absorbance measurement with a reference wavelength 600-650 nm is recommended when available).

17. CALCULATION OF RESULTS
Impact Note: The calibration factor detail is batch specific and stamped on back page of Instruction manual.

a. Cut off value = mean O.D. of calibrator x calibration factor
b. Calculation of sample O.D. ratio : Calculate sample O.D. ratio as follows:

Sample O.D. ratio = \frac{Sample O.D.}{Cut off Value}
c. Calculation of Dengue IgM units : Calculate by multiplying the sample O.D. ratio by 10.

Dengue IgM units = sample O.D. ratio x 10.
e.g.: Mean O.D. of calibrator = 0.75
Calibration factor = 0.7
Cut off value = 0.75 x 0.7 = 0.525
e.g.: sample absorbance (O.D.) = 0.925
Cut off value = 0.525
Sample O.D. ratio = 0.925 / 0.525 = 1.761
Dengue IgM units = 1.761 x 10 = 17.61

18. INTERPRETATION OF RESULTS
a. If the Dengue IgM Units is < 9 then interpret the sample as Negative for Dengue IgM antibodies.
b. If the Dengue IgM Units is between 9 - 11 then interpret the sample as Equivocal for Dengue IgM antibodies.
c. If the Dengue IgM Units is > 11 then interpret the sample as Positive for Dengue IgM antibodies.

19. PERFORMANCE CHARACTERISTICS
The kit has been evaluated with the known panel of Dengue IgM positive and Negative samples. The samples included cross-reacting samples; Epstein-Barr virus, RA, Leptospira, Malaria, Hepatitis-A, Influenza A & B, S. typhi. Following is the in-house evaluation.

<table>
<thead>
<tr>
<th>Dengue IgM Antibody</th>
<th>Positive</th>
<th>Equivocal</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Samples</td>
<td>115</td>
<td>5490</td>
<td></td>
</tr>
<tr>
<td>Dengue Positive</td>
<td>114</td>
<td>3</td>
<td>5484</td>
</tr>
<tr>
<td>Dengue Negative</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dengue Equivocal</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dengue Negative</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity : 99.13% Specificity : 99.84%

Precision : Within-run and between-run precisions have been determined by testing 10 replicates of five samples: 1 negative and 4 dengue IgM positive; 2 weak positive, 1 medium positive & 1 strong positive. The C.V.(% of negative, weak positive, medium positive & strong positive values were within 10%.

20. LIMITATION OF THE TEST
1. The test should be used for detection of IgM antibodies of Dengue in human serum / plasma.
2. This is only a screening test and will only indicate the presence or absence of Dengue antibodies in the specimen. All reactive samples should be confirmed by confirmatory test. Therefore for a definitive diagnosis, the patients clinical history, symptomatology as well as serological data should be considered. The results should be reported only after complying with the above procedure.

3. False positive results can be obtained due to cross reaction with Epstein-BARR virus, RA, Leptospirosis, Malaria, Hepatitis-A, Influenza A & B, S. typhi Japanese encephalitis, west nile virus disease. This occurs in less then 1% of the sample tested.

4. Immuno-depressive treatments presumably after the immune response to infection, inducing negative results in IgM in Dengue patients.

21. LIMITED EXPRESSED WARRANTY DISCLAIMER
The manufacturer limits the warranty to the test kit, as much as that the test kit will function as an in vitro diagnostic assay within the limitations and specifications as described in the product instruction-manual, when used strictly in accordance with the instructions contained therein. The manufacturer disclaims any warranty expressed or implied including such expressed or implied warranty with respect to merchantability, fitness for use or implied utility for any purpose. The manufacture’s liability is limited to either replacement of the product or refund of the purchase price of the product and in no case liable to for claim of any kind for an amount greater than the purchase price of the goods in respect of which damages are likely to be claimed.

The manufacturer shall not be liable to the purchaser or third parties for any injury, damage or economic loss, howsoever caused by the product in the use or in the application there of.

22. REFERENCES

23. TROUBLE SHOOTING CHART

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Controls and calibrator out of validation limit</td>
<td>a) Incorrect temperature timing or pipetting</td>
<td>Check procedure &amp; repeat assay</td>
</tr>
<tr>
<td></td>
<td>b) Improper preparation of reagents, improper mixing of reagents.</td>
<td>Check procedure &amp; repeat assay</td>
</tr>
<tr>
<td></td>
<td>c) Cross contamination of Controls and calibrator</td>
<td>Pipette carefully and do not interchange caps. Repeat assay</td>
</tr>
<tr>
<td></td>
<td>d) Incorrect reading filter or readings without reference filter.</td>
<td>Check the filter used. It should be 450nm. If no reference filter is used absorbance will increase.</td>
</tr>
<tr>
<td></td>
<td>e) Interference in the optical pathway</td>
<td>Check the reader. Clean or dry the bottom of micro wells, check for bubbles &amp; repeat the readings.</td>
</tr>
<tr>
<td></td>
<td>f) Used components from different lots.</td>
<td>Do not use components from different lots as they are adjusted for each batch released.</td>
</tr>
<tr>
<td></td>
<td>g) Expired Reagents</td>
<td>Check the kit expiry date. Use the kit with-in shelf life.</td>
</tr>
<tr>
<td>2. No colour or light colour developed at the end of assay</td>
<td>a) Any one reagent has been added in wrong sequence.</td>
<td>Check procedure and repeat assay</td>
</tr>
<tr>
<td></td>
<td>b) Inactivated conjugate, wrong dilution used, improper conservation</td>
<td>Check for contamination, recheck assay</td>
</tr>
<tr>
<td></td>
<td>c) Microplate inactivated, due to improper conservation</td>
<td>Keep unused strips in aluminium pouch and seal with cclip &amp; rod with the dessicant pouch inside</td>
</tr>
<tr>
<td></td>
<td>d) Inactivated substrate, improper conservation or preparation</td>
<td>Use freshly prepared substrate solution Recheck procedure, repeat assay</td>
</tr>
</tbody>
</table>

For in vitro diagnostic use only, not for medicinal use

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