



AccuDiag™
Beta 2-Microglobulin
ELISA Kit

REF 4200

PIC TM4200YR1

IVD See External Label 2-8°C 96 Tests

Beta 2-Microglobulin ELISA

Method	Enzyme Linked Immunosorbent Assay
Principle	Sandwich Complex
Detection Range	0.4-2.8 µg/mL
Sample	20 µL Serum
Sensitivity	0.1 µg/mL
Incubation Time	80 minutes
Shelf Life	12 Months from the manufacturing date

PRODUCT FEATURES

- Very easy to use with little training**
- Highly specific and consistent Assay**
- Provides accurate results quickly**
- Reading of results both visually and as absorbance data**

INTENDED USE

The Diagnostic Automation, Inc. β₂-Microglobulin ELISA is intended for the quantitative determination of β₂-microglobulin in human serum. This assay is for use as an aid in the diagnosis of kidney disease.

SIGNIFICANCE AND SUMMARY

Beta-2-microglobulin (β₂-MG) is expressed by the nucleated cells of the body and on many tumor lines. Human β₂-MG is a low molecular weight protein (MW 11600) consisting of a single polypeptide chain of 99 amino acids.^{1,2} It is identical to the small chain of the HLA-A, -B, and -C major histocompatibility complex

antigens.^{3,5} In structure and amino acid sequence, it resembles the CH₃ region of IgG, though it is antigenically distinct.

β₂-MG is eliminated via the kidneys. After filtration through the glomeruli, it is reabsorbed and catabolized by the proximal tubular cells through endocytosis.⁶ It is found at low levels in the serum and urine of normal individuals. Typically only trace amounts of β₂-MG are excreted in the urine and higher rates are interpreted as evidence of tubular dysfunction. Urinary excretion is markedly increased in tubulointerstitial disorders, and where aminoglycosides and anti-inflammatory compounds are present.^{7,9} β₂-MG is also excreted in increased amounts in the urine of patients with upper urinary tract infections¹⁰ and connective-tissue diseases such as rheumatoid arthritis and Sjogren's syndrome.¹¹

Elevated serum concentrations in the presence of normal glomerular filtration rate suggest increased β₂-MG production or release. In patients with rheumatoid arthritis¹², systemic lupus erythematosus¹³, sarcoidosis¹⁴ and some viral diseases including cytomegalovirus, non-A and non-B hepatitis and infectious mononucleosis,^{15,16} the β₂-MG serum level changes in relation to disease activity. The Diagnostic Automation, Inc. β₂-MG ELISA provides a sensitive and reliable assay for the measurement of β₂-microglobulin in human serum. The kit features a standard range of 0.625 to 10 µg/ml and will determine a minimum detectable concentration of 0.1 µg/ml. The assay provides results in less than 2 hours in a microtiter plate format.

ASSAY PRINCIPLE

The Diagnostic Automation, Inc. β₂-MG ELISA test is based on the principle of a solid phase enzyme-linked immunosorbent assay (ELISA). The assay system utilizes a monoclonal anti-β₂-MG antibody for solid phase immobilization (on the microtiter wells). A sheep anti-β₂-MG antibody is in the antibody-enzyme (horseradish peroxidase) conjugate solution. The diluted test sample is allowed to react first with the immobilized antibody for 30 minutes at 37°C. The sheep anti-β₂-MG-HRPO conjugate is then added and reacted with the immobilized antigen for 30 minutes at 37°C, resulting in the β₂-MG molecules being sandwiched between the solid phase and enzyme-linked antibodies. The wells are washed with water to remove unbound-labeled antibodies. A solution of TMB is added and incubated for 20 minutes at room temperature, resulting in the development of a blue color. The color development is stopped with the addition of 1N HCl, changing the color to yellow. The concentration of β₂-MG is directly proportional to the color intensity of the test sample. Absorbance is measured spectrophotometrically at 450nm.

SPECIMEN COLLECTION AND PREPARATION

1. Serum should be prepared from a whole blood specimen obtained by acceptable medical techniques. This kit is for use with serum samples without additives only. Avoid grossly hemolytic (bright red), lipemic (milky), or turbid samples.
2. Specimens should be capped and may be stored for up to 48 hours at 2-8°C. Specimens held for a longer time should be frozen only once at -20°C prior to assay. Thawed samples should be inverted several times prior to testing.

MATERIALS AND COMPONENTS

Materials provided with the test kit

1. **Antibody-Coated Wells (1 plate, 96 wells)**
Microtiter wells coated with murine monoclonal anti-β₂-MG.
2. **Enzyme Conjugate Reagent (22 ml)**



Contains sheep anti-β₂-MG conjugated to horseradish peroxidase.

3. **Reference Standard Set (1 ml/vial)**

Contains 0, 0.625, 1.25, 2.5, 5, and 10 μg/ml β₂-MG in sample diluent, pre-diluted 101-fold, lyophilized.

4. **Sample Diluent (1 bottle, 100 ml)**

2% BSA in buffered solution containing preservative.

5. **TMB Reagent (1 bottle, 11 ml)**

Contains 3, 3', 5, 5' tetramethylbenzidine (TMB) stabilized in buffer solution.

6. **Stop Solution (1N HCl) (1 bottle, 11 ml)**

Contains diluted hydrochloric acid.

Materials required but not provided

1. Distilled or deionized water
2. Precision pipettes: 5 μl, 10 μl, 50 μl, 100 μl, 200 μl, and 1.0 ml
3. Disposable pipette tips
4. Microtiter well reader capable of reading absorbance at 450nm.
5. Vortex mixer, or equivalent
6. Absorbent paper
7. Graph paper
8. Optional quality control material (from DAI or BioRad)

REAGENT PREPARATION

1. All reagents should be allowed to reach room temperature (18-25°C) before use.
2. All reagents should be mixed by gentle inversion or swirling prior to use. Do not induce foaming.
3. Reconstitute each lyophilized standard with 1.0 ml distilled water. Allow the reconstituted material to stand for at least 20 minutes and mix gently.
4. Reconstituted standards should be stored sealed at 2-8°C, and are stable for at least 30 days at this temperature.

ASSAY PROCEDURE

NOTE: Patient samples and control serum need to be diluted before use. Prepare a series of small tubes (such as 1.5 ml microcentrifuge tubes) and mix 10 μl serum with 1.0 ml Sample Diluent (101-fold dilution). Do not dilute the standards, they have already been pre-diluted 101-fold.

1. Secure the desired number of coated wells in the holder.
2. Dispense 20 μl of standards, diluted specimens, and diluted controls into appropriate wells.
3. Dispense 200 μl of Sample Diluent into each well. Thoroughly mix for 30 seconds. It is very important to mix completely.
4. Incubate at 37°C for 30 minutes.
5. Remove the incubation mixture by flicking plate contents into a waste container.
6. Rinse and flick the microtiter wells 5 times with deionized or distilled water. **DO NOT USE TAP WATER.**
7. Strike the wells sharply onto absorbent paper or paper towels to remove all residual water droplets.
8. Dispense 200 μl of Enzyme Conjugate Reagent into each well. Gently mix for 10 seconds.
9. Incubate at 37°C for 30 minutes.
10. Remove the contents and wash plate as described above in steps 5-7.
11. Dispense 100 μl TMB Reagent into each well. Gently mix for 10 seconds.

12. Incubate at room temperature, in the dark, for 20 minutes.
13. Stop the reaction by adding 100 μl of Stop Solution (1N HCl) to each well.
14. Gently mix for 10 seconds. **It is important to make sure that all the blue color changes to yellow color completely.**
15. Read absorbance at 450 nm with a microtiter well reader within 15 minutes.

RESULTS

1. Calculate the mean absorbance value (OD at 450 nm) for each set of reference standards, controls and samples.
2. Construct a standard curve by plotting the mean absorbance obtained for each reference standard against its concentration in μg/ml on graph paper, with absorbance on the vertical (y) axis and concentration on the horizontal (x) axis.
3. Using the mean absorbance value for each sample, determine the corresponding concentration of β₂-MG in μg/ml from the standard curve.
4. Depending on experience and/or the availability of computer capabiother methods of data reduction may be employed.

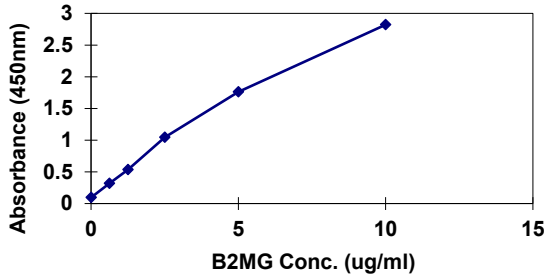
PROCEDURAL NOTES

1. Manual Pipetting: It is recommended that no more than 32 wells be used for each assay runs. Pipetting of all standards, samples, and controls should be completed within 3 minutes.
2. Automated Pipetting: A full plate of 96 wells may be used in each assay run. However, it is recommended that pipetting of all standards, samples, and controls be completed within 3 minutes.
3. All standards, samples, and controls should be run in duplicate concurrently so that all conditions of testing are the same. **It is recommended that the wells be read within 15 minutes following addition of Stop Solution.**

EXAMPLE OF STANDARD CURVE

Results of a typical standard run with absorbency readings at 450nm shown on the Y axis against β₂-MG concentrations shown on the X axis. This standard curve is for the purpose of illustration only, and should not be used to calculate unknowns. Each user should obtain their own standard curve and patient data in each experiment.

β ₂ -MG (μg/ml)	Absorbance (450 nm)
0	0.095
0.625	0.317
1.25	0.534
2.5	1.043
5.0	1.763
10.0	2.821



Within-run precision was determined by replicate determinations of three different serum samples in one assay. Within-assay variability is shown below:

Serum Sample	1	2	3
Number of Replicates	20	20	20
Mean β 2-MG (μ g/ml)	0.92	1.63	4.43
Standard Deviation	0.100	0.108	0.228
Coefficient of Variation (%)	10.8%	6.6%	5.2%

b. Inter-Assay Precision

Between-run precision was determined by replicate measurements of three different serum samples over a series of individually calibrated assays. Between-assay variability is shown below:

Serum Sample	1	2	3
Number of Replicates	24	24	24
Mean β 2-MG (μ g/ml)	0.83	2.03	4.90
Standard Deviation	0.065	0.097	0.350
Coefficient of Variation (%)	7.8%	4.8%	7.2%

VI. Recovery and Linearity Studies

a. Recovery

Various patient serum samples of known β 2-MG levels were combined and assayed in duplicate. The mean recovery was 98.0%.

Expected Concentration (μ g/ml)	Observed Concentration (μ g/ml)	% Recovery
9.9	10.0	101%
8.2	8.9	109%
7.4	6.5	88%
5.3	5.3	98%
3.5	3.8	109%
1.5	1.4	94%
0.63	0.67	106%
		Mean: 100.7%

b. Linearity

Three patient samples were serially diluted to determine linearity. The mean recovery was 95.7%.

#	Dilution	Expected Conc. (μ g/ml)	Observed Conc. (μ g/ml)	% Expected
1.	Undiluted	-----	10.33	-----
	1:2	5.17	5.08	102%
	1:4	2.58	2.65	103%
	1:8	1.29	1.33	103%
	1:16	0.64	0.63	98%
				Mean = 102%
2.	Undiluted	----	6.95	----
	1:2	3.48	3.27	94%
	1:4	1.74	1.64	96%
	1:8	0.87	0.79	91%
	1:16	0.43	0.42	98%
				Mean = 95%
3.	Undiluted	----	7.16	----
	1:2	3.58	3.23	90%
	1:4	1.79	1.69	94%
	1:8	0.90	0.74	82%
	1:16	0.45	0.42	93%
				Mean = 90%

EXPECTED VALUES

It is recommended that each laboratory establish its own normal range. However, healthy individuals are expected to have β 2-MG serum values between 0 - 2.0 μ g/ml.¹⁸

The range of β 2-microglobulin concentration in serum was determined with the Diagnostic Automation, Inc. β 2-Microglobulin ELISA on a sample population of 66 healthy adults. The following was observed:

Mean = 1.42 μ g/ml
 S.D. = 0.508 μ g/ml
 Mean \pm 2SD = 0.4 - 2.8 μ g/ml

PERFORMANCE CHARACTERISTICS

I. Accuracy

A statistical study using 124 healthy and non-healthy patient samples, ranging in β 2-MG concentration from 0.4 μ g/ml to 17.2 μ g/ml, demonstrated good correlation with a commercially available kit as shown below. Comparison between the Diagnostic Automation, Inc. β 2-MG ELISA and the DPC Immulite® 2000 β 2-MG kit provided the following data:

N = 124
 Correlation coefficient = 0.9534
 Slope = 0.9342 (variance = 0.0007, SE = 0.0268)
 Intercept = 0.0498 (variance = 0.0095, SE = 0.0974)
 DAI Mean = 2.72 μ g/ml
 DPC Mean = 2.85 μ g/ml

Similarly, an additional study using a second commercial kit was performed on 30 known patient samples with elevated levels of β 2-MG (3.2 μ g/ml to 65.8 μ g/ml). The study demonstrated high correlation; the data is presented below.

N = 30
 Correlation coefficient = 0.9932
 Slope = 1.0097 (variance = 0.0005, SE = 0.0223)
 Intercept = 0.4941 (variance = 0.1548, SE = 0.3934)
 DAI Mean = 12.86 μ g/ml
 Dade Behring = 12.25 μ g/ml

II. Sensitivity

The minimum detectable concentration of the Diagnostic Automation, Inc. β 2-MG ELISA assay as measured by 2SD from the mean of a zero standard is estimated to be at least 0.1 μ g/ml.

III. Precision

a. Intra-Assay Precision



V. Specificity

The following hormones were tested for cross-reactivity:

HORMONE TESTED	CONCENTRATION	PRODUCED COLOR INTENSITY EQUI. TO β -MG IN SERUM (μ g/ml)
Alpha-Fetoprotein (AFP)	1,000 ng/ml	0.0
	5,000 ng/ml	0.0
	10,000 ng/ml	0.0
Carcinoembryonic Antigen (CEA)	1,000 ng/ml	0.0
	5,000 ng/ml	0.0
	10,000 ng/ml	0.0
Ferritin	1,000 ng/ml	0.0
	5,000 ng/ml	0.0
	10,000 ng/ml	0.0
Prostate Specific Antigen (PSA)	1,000 ng/ml	0.0
	5,000 ng/ml	0.0
	10,000 ng/ml	0.0
Human IgG	5 g/l	0.0
	10 g/l	0.0
	25 g/l	0.0

IV. Hook Effect

No high dose hook effect is observed in this assay at β 2-MG levels up to 250 μ g/ml.

QUALITY CONTROL

Good laboratory practice requires that quality control specimens (controls) be run with each calibration curve to verify assay performance. Controls containing sodium azide cannot be used. To ensure proper performance, control material should be assayed repeatedly to establish mean values and acceptable ranges.

LIMITATIONS OF THE PROCEDURE

1. Reliable and reproducible results will be obtained when the assay procedure is carried out with a complete understanding of the package insert instructions and with adherence to good laboratory practice.
2. The results obtained from the use of this kit should be used only as an adjunct to other diagnostic procedures and information available to the physician.
3. Serum samples demonstrating gross lipemia, gross hemolysis, or turbidity should not be used with this test.
4. The wash procedure is critical. Insufficient washing will result in poor precision and falsely elevated absorbance readings.

PRECAUTIONS

1. CAUTION: This kit contains human material. The source material used for manufacture of this kit tested negative for HBsAg, HIV 1/2 and HCV by FDA-approved methods. However, no method can completely assure absence of these agents. Therefore, all human blood products, including serum samples, should be considered potentially infectious. Handling and disposal should be as defined by an appropriate national biohazard safety guideline or regulation, where it exists.²¹
2. Do not use reagents after expiration date and do not mix or use components from kits with different lot numbers.
3. Do not use the reagent when it becomes cloudy or contamination is suspected.
4. Do not use the reagent if the vial is damaged.

5. Replace caps on reagents immediately. Do not switch caps.
6. Each well can be used only once.
7. Do not pipette reagents by mouth.
8. Solutions containing additives or preservatives, such as sodium azide, should not be used in the enzyme reaction.
9. Avoid contact with 1N HCl. It may cause skin irritation and burns. If contact occurs, wash with copious amounts of water and seek medical attention if irritation persists.
10. For in vitro diagnostic use.

STORAGE

1. Store the unopened kit at 2-8°C upon receipt and when it is not in use, until the expiration shown on the kit label. Refer to the package label for the expiration date.
2. The opened and used reagents are stable until the expiration date if stored properly at 2-8°C.
3. Keep microtiter plate in a sealed bag with desiccant to minimize exposure to damp air.

INSTRUMENTATION

A microtiter well reader with a bandwidth of 10 nm or less and an optical density range of 0 to 3 OD or greater at 450 nm wavelength is acceptable for absorbance measurement.

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MANUFACTURER AND BRAND DETAILS

ISO 13485-2016

ISO 13485
Quality
Management for
Medical Devices
CERTIFIED

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Date Adopted	2022-09
Brand Name	AccuDiag™
REF 4200	AccuDiag™ - β 2-Microglobulin ELISA
PIC	TM4200YR1
EU REP	AR Experts BV, Boeingavenue 209 1119 PD Schiphol-Rijk, The Netherlands info@ar-experts.eu

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