

**MMP9 (Human)
ELISA Kit
Catalog Number KA0179
96 assays**

**Introduction
Intended Use**

The MMP9 (Human) ELISA Kit is an enzyme-linked immunosorbent assay for the quantitative detection of human MMP-9. The human MMP-9 ELISA is for research use only. Not for diagnostic or therapeutic procedures.

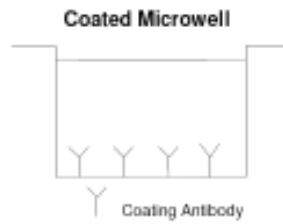
Background

Matrix metalloproteinases (MMPs) form a family of enzymes with major actions in the remodelling of extracellular matrix (ECM) components. MMP-9, also called Gelatinase B, is the most complex family member in terms of domain structure and regulation of its activity. MMP-9 activity is under strict control at various levels: transcription of the gene by cytokines and cellular interactions; activation of the pro-enzyme by a cascade of enzymes comprising serine proteases and other MMPs; and regulation by specific tissue inhibitors of MMPs (TIMPs) or unspecific inhibitors. Further glycosylation has a limited effect on the net activity of Gelatinase B and chemotactic factors are another level of control of activity. The main function of MMPs is degradation of the extracellular physiologic function including wound healing, bone resorption and mammary involution. MMPs also contribute to pathological conditions such as rheumatoid arthritis, coronary artery disease and cancer. They are thought to promote the growth of these tumor cells once they have metastasized. MMP-9 plays an important role in tumor invasion, angiogenesis and metastasis. Increased levels of MMP-9 have been demonstrated in colorectal cancer, in acute leukemia, breast cancer, human melanoma and bladder cancer. MMP-9 potentiates pulmonary metastasis formation and glioma invasion. Apart from its function in tumor formation and spread, MMP-9 with its destructive effects is in close association with lung diseases and asthma. Leukocyte recruitment to the central nervous system MMP-9 means an involvement in the pathogenesis of multiple sclerosis. MMP-9 has a crucial role in reproductive endocrinology and shows a changed expression pattern after myocardial infarction.

Principle of the Assay

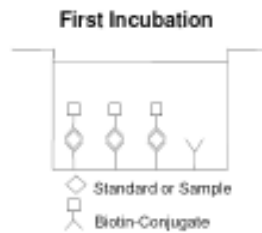
An anti-human MMP-9 coating antibody is adsorbed onto microwells.

Figure 1



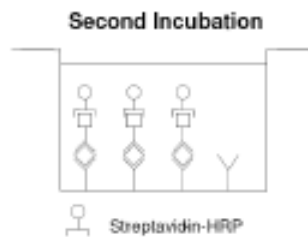
Human MMP-9 present in the sample or standard binds to antibodies adsorbed to the microwells. A biotin-conjugated anti-human MMP-9 antibody is added and binds to human MMP-9 captured by the first antibody.

Figure 2



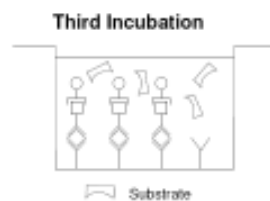
Following incubation unbound biotin-conjugated anti-human MMP-9 antibody is removed during a wash step. Streptavidin-HRP is added and binds to the biotin-conjugated anti-human MMP-9 antibody.

Figure 3



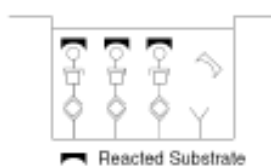
Following incubation unbound Streptavidin-HRP is removed during a wash step, and substrate solution reactive with HRP is added to the wells.

Figure 4



A coloured product is formed in proportion to the amount of human MMP-9 present in the sample or standard. The reaction is terminated by addition of acid and absorbance is measured at 450 nm. A standard curve is prepared from 7 human MMP-9 standard dilutions and human MMP-9 sample concentration determined.

Figure 5



General Information Materials Supplied

List of komponent

Component	Amount
Microwell Plate coated with monoclonal antibody to human MMP-9	1 aluminium pouch
Biotin-Conjugate anti-human MMP-9 polyclonal antibody	1 vial (100µl)
Streptavidin-HRP	1 vial (150µl)
human MMP-9 Standard lyophilized, 30 ng/ml upon reconstitution	2 vials
Assay Buffer Concentrate 20x (PBS with 1% Tween 20 and 10% BSA)	1 vial (5 ml)
Wash Buffer Concentrate 20x (PBS with 1% Tween 20)	1 bottle (50 ml)
Substrate Solution (tetramethyl-benzidine)	1 vial (15ml)
Stop Solution (1M Phosphoric acid)	1 vial (15 ml)
Blue-Dye	1 vial (0.4 ml)
Green-Dye	1 vial (0.4 ml)
Red-Dye	1 vial (0.4 ml)
Adhesive Films	4 slices

Storage Instruction

Store kit reagents between 2° and 8°C. Immediately after use remaining reagents should be returned to cold storage (2° to 8°C), or to -20°C, respectively. Expiry of the kit and reagents is stated on labels. Expiry of the kit components can only be guaranteed if the components are stored properly, and if, in case of repeated use of one component, this reagent is not contaminated by the first handling.

Materials Required but Not Supplied

- _ 5 ml and 10 ml graduated pipettes
- _ 5 µl to 1000 µl adjustable single channel micropipettes with disposable tips
- _ 50 µl to 300 µl adjustable multichannel micropipette with disposable tips
- _ Multichannel micropipette reservoir
- _ Beakers, flasks, cylinders necessary for preparation of reagents
- _ Device for delivery of wash solution (multichannel wash bottle or automatic wash system)
- _ Microwell strip reader capable of reading at 450 nm (620 nm as optional reference wave length)
- _ Glass-distilled or deionized water
- _ Statistical calculator with program to perform regression analysis

Precautions for Use

- _ All reagents should be considered as potentially hazardous. We therefore recommend that this product is handled only by those persons who have been trained in laboratory techniques

and that it is used in accordance with the principles of good laboratory practice. Wear suitable protective clothing such as laboratory overalls, safety glasses and gloves. Care should be taken to avoid contact with skin or eyes. In the case of contact with skin or eyes wash immediately with water. See material safety data sheet(s) and/or safety statement(s) for specific advice.

- _ Reagents are intended for research use only and are not for use in diagnostic or therapeutic procedures.
- _ Do not mix or substitute reagents with those from other lots or other sources.
- _ Do not use kit reagents beyond expiration date on label.
- _ Do not expose kit reagents to strong light during storage or incubation.
- _ Do not pipette by mouth.
- _ Do not eat or smoke in areas where kit reagents or samples are handled.
- _ Avoid contact of skin or mucous membranes with kit reagents or specimens.
- _ Rubber or disposable latex gloves should be worn while handling kit reagents or specimens.
- _ Avoid contact of substrate solution with oxidizing agents and metal.
- _ Avoid splashing or generation of aerosols.
- _ In order to avoid microbial contamination or cross-contamination of reagents or specimens this may invalidate the test use disposable pipette tips and/or pipettes.
- _ Use clean, dedicated reagent trays for dispensing the conjugate and substrate reagent.
- _ Exposure to acid inactivates the conjugate.
- _ Glass-distilled water or deionized water must be used for reagent preparation.
- _ Substrate solution must be at room temperature prior to use.
- _ Decontaminate and dispose specimens and all potentially contaminated materials as they could contain infectious agents. The preferred method of decontamination is autoclaving for a minimum of 1 hour at 121.5°C.
- _ Liquid wastes not containing acid and neutralized waste may be mixed with sodium hypochlorite in volumes such that the final mixture contains 1.0% sodium hypochlorite. Allow 30 minutes for effective decontamination. Liquid waste containing acid must be neutralized prior to the addition of sodium hypochlorite.
- Limitation
 - _ Since exact conditions may vary from assay to assay, a standard curve must be established for every run.
 - _ Bacterial or fungal contamination of either screen samples or reagents or cross-contamination between reagents may cause erroneous results.
 - _ Disposable pipette tips, flasks or glassware are preferred, reusable glassware must be washed and thoroughly rinsed of all detergents before use.
 - _ Improper or insufficient washing at any stage of the procedure will result in either false positive or false negative results. Empty wells completely before dispensing fresh wash solution, fill with Wash Buffer as indicated for each wash cycle and do not allow wells to sit uncovered or dry for extended periods.
 - _ The use of radioimmunotherapy has significantly increased the number of patients with human anti-mouse IgG antibodies (HAMA). HAMA may interfere with assays utilizing murine monoclonal antibodies leading to both false positive and false negative results. Serum samples containing antibodies to murine immunoglobulins can still be analysed in such assays when murine immunoglobulins (serum, ascitic fluid, or monoclonal antibodies of irrelevant specificity) are added to the sample.

Assay Protocol

Reagent Preparation

Buffer Concentrates should be brought to room temperature and should be diluted before starting the test procedure. If crystals have formed in the Buffer Concentrates, warm them gently until they have completely dissolved.

a. Wash Solution (1x)

Pour entire contents (50 ml) of the Wash Buffer Concentrate (20x) into a clean 1000 ml graduated cylinder. Bring to final volume of 1000 ml with glass-distilled or deionized water. Mix gently to avoid foaming. The pH of the final solution should adjust to 7.4. Transfer to a clean wash bottle and store at 2° to 25°C. Please note that Wash Buffer is stable for 30 days. Wash Buffer may also be prepared as needed according to the following table:

Number of Strips	Wash Buffer Concentrate 20x (ml)	Distilled Water (ml)
1-6	25	475
1-12	50	950

b. Assay Buffer (1x)

Pour the entire contents (5 ml) of the Assay Buffer Concentrate (20x) into a clean 100 ml graduated cylinder. Bring to final volume of 100 ml with distilled water. Mix gently to avoid foaming. Store at 2° to 8°C. Please note that the Assay Buffer (1x) is stable for 30 days. Assay Buffer (1x) may also be prepared as needed according to the following table:

Number of Strips	Assay Buffer Concentrate 20x (ml)	Distilled Water(ml)
1-6	2.5	47.5
1-12	5.0	95.0

c. Biotin-Conjugate

Please note that the Biotin-Conjugate should be used within 30 minutes after dilution. Make a 1:100 dilution of the concentrated Biotin-Conjugate solution with Assay Buffer (1x) in a clean plastic tube as needed according to the following table:

Number of Strips	Biotin-Conjugate (ml)	Assay Buffer (1x) (ml)
1-6	0.03	2.97
1-12	0.06	5.94

d. Streptavidin-HRP

Please note that the Streptavidin-HRP should be used within 30 minutes after dilution. Make a 1:200 dilution of the concentrated Streptavidin-HRP solution with Assay Buffer (1x) in a clean plastic tube as needed according to the following table:

Number of Strips	Streptavidin-HRP (ml)	Assay Buffer (1x) (ml)
1-6	0.03	5.97
1-12	0.06	11.94

e. Human MMP-9 Standard

Reconstitute human MMP-9 standard by addition of distilled water. Reconstitution volume is stated on the label of the standard vial. Swirl or mix gently to insure complete and homogeneous solubilization (concentration of reconstituted standard = 30 ng/ml). Allow the standard to reconstitute for 10-30 minutes. Mix well prior to making dilutions. After usage remaining standard cannot be stored and has to be discarded. Standard dilutions can be prepared directly on the microwell plate (see protocol. d) or alternatively in tubes (see External Standard Dilution).

External Standard Dilution

Label 7 tubes, one for each standard point.

S1, S2, S3, S4, S5, S6, S7

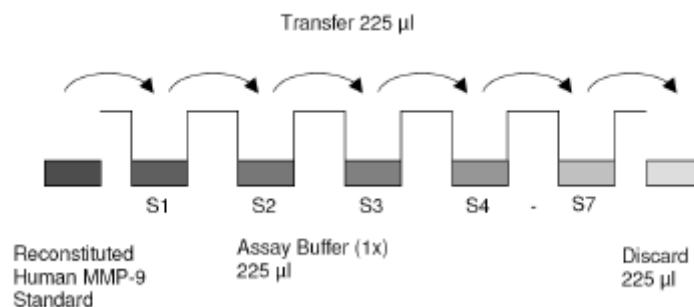
Then prepare 1:2 serial dilutions for the standard curve as follows:

Pipette 225 μ l of Assay Buffer (1x) into each tube.

Pipette 225 μ l of reconstituted standard (concentration = 30 ng/ml) into the first tube, labelled S1, and mix (concentration of standard 1= 15 ng/ml).

Pipette 225 μ l of this dilution into the second tube, labelled S2, and mix thoroughly before the next transfer. Repeat serial dilutions 5 more times thus creating the points of the standard curve (see Figure 6). Assay Buffer (1x) serves as blank.

Figure 6



f. Colour-giving Reagents:

Blue-Dye, Green-Dye

In order to help our customers to avoid any mistakes in pipetting the Abnova ELISAs, Abnova offers a tool that helps to monitor the addition of even very small volumes of a solution to the reaction well by giving distinctive colours to each step of the ELISA procedure. This procedure is optional, does not in any way interfere with the test results, and is designed to help the customer with the performance of the test, but can also be omitted, just following the instruction booklet. Alternatively, the dye solutions from the stocks provided (Blue-Dye, Green-Dye) can be added to the reagents according to the following guidelines:

_ Diluent: Before standard and sample dilution add the Blue-Dye at a dilution of 1:250 (see table below) to the appropriate diluent (1x) according to the test protocol. After addition of Blue-Dye, proceed according to the instruction booklet.

5 ml Sample Diluent	20 μ l Blue-Dye
12 ml Sample Diluent	48 μ l Blue-Dye
50 ml Sample Diluent	200 μ l Blue-Dye

_ Biotin-Conjugate: Before dilution of the concentrated Biotin-Conjugate, add the Green-Dye at a dilution of 1:100 (see table below) to the Assay Buffer (1x) used for the final conjugate dilution. Proceed after addition of Green-Dye according to the instruction booklet: Preparation of Biotin-Conjugate.

3 ml Assay Buffer (1x)	30 µl Green-Dye
6 ml Assay Buffer (1x)	60 µl Green-Dye

_ Streptavidin-HRP: Before dilution of the concentrated Streptavidin-HRP, add the Red-Dye at a dilution of 1:250 (see table below) to the Assay Buffer (1x) used for the final Streptavidin-HRP dilution. Proceed after addition of Red-Dye according to the instruction booklet: Preparation of Streptavidin-HRP.

6 ml Assay Buffer (1x)	24 µl Red-Dye
12 ml Assay Buffer (1x)	48 µl Red-Dye

Sample Preparation

Cell culture supernatant, serum and plasma (citrate, heparinized) were tested with this assay. Other body fluids might be suitable for use in the assay. Remove serum or plasma from the clot or cells as soon as possible after clotting and separation. Pay attention to a possible “Hook Effect” due to high sample concentrations. Samples containing a visible precipitate must be clarified prior to use in the assay. Do not use grossly hemolyzed or lipemic specimens. Samples should be aliquoted and must be stored frozen at -20°C to avoid loss of bioactive human MMP-9. If samples are to be run within 24 hours, they may be stored at 2° to 8°C. Avoid repeated freeze-thaw cycles. Prior to assay, the frozen sample should be brought to room temperature slowly and mixed gently.

Assay Procedure

1. Samples from apparently healthy donors will not need external predilution. For pathological samples with expected higher values of MMP-9 predilute your samples 1:10 to 1:25 with Assay Buffer (1x) before starting with the test procedure according to one of the following schemes:

1:10 dilution: 25 µl sample + 225 µl Assay Buffer (1x)

1:25 dilution: 10 µl sample + 240 µl Assay Buffer (1x)

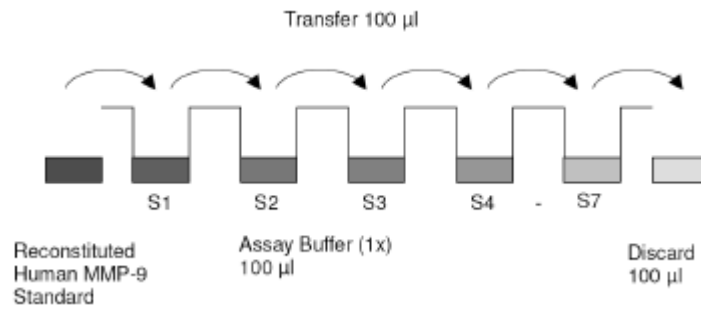
2. Determine the number of microwell strips required to test the desired number of samples plus appropriate number of wells needed for running blanks and standards. Each sample, standard, blank and optional control sample should be assayed in duplicate. Remove extra microwell strips from holder and store in foil bag with the desiccant provided at 2°-8°C sealed tightly.

3. Wash the microwell strips twice with approximately 400 µl Wash Buffer per well with thorough aspiration of microwell contents between washes. Allow the Wash Buffer to sit in the wells for about 10 – 15 seconds before aspiration. Take care not to scratch the surface of the microwells. After the last wash step, empty wells and tap microwell strips on absorbent pad or paper towel to remove excess Wash Buffer. Use the microwell strips immediately after washing. Alternatively microwell strips can be placed upside down on a wet absorbent paper for not longer than 15 minutes. Do not allow wells to dry.

4. Standard dilution on the microwell plate (Alternatively the standard dilution can be prepared in tubes): Add 100 µl of Assay Buffer (1x) in duplicate to all standard wells. Pipette

100 µl of prepared standard (concentration = 30 ng/ml), in duplicate, into well A1 and A2 (see Table 1). Mix the contents of wells A1 and A2 by repeated aspiration and ejection (concentration of standard 1 S1 = 15 ng/ml), and transfer 100 µl to wells B1 and B2, respectively (see Figure 7). Take care not to scratch the inner surface of the microwells. Continue this procedure 5 times, creating two rows of human MMP-9 standard dilutions ranging from 15 to 0.23 ng/ml. Discard 100 µl of the contents from the last microwells (G1, G2) used.

Figure 7



In case of an external standard dilution pipette 100 µl of these standard dilutions (S1-S7) in the standard wells according to plate layout.

5. Add 100 µl of Assay Buffer (1x) in duplicate to the blank wells.
6. Add 90 µl of Assay Buffer (1x) to the sample wells.
7. Add 10 µl of each sample in duplicate to the sample wells.
8. Prepare Biotin-Conjugate.
9. Add 50 µl of Biotin-Conjugate to all wells.
10. Cover with an adhesive film and incubate at room temperature (18 to 25°C) for 2 hours, if available on a microplate shaker set at 100 rpm.
11. Prepare Streptavidin-HRP.
12. Remove adhesive film and empty wells. Wash microwell strips 4 times according to point c. of the test protocol. Proceed immediately to the next step.
13. Add 100 µl of diluted Streptavidin-HRP to all wells, including the blank wells.
14. Cover with an adhesive film and incubate at room temperature (18° to 25°C) for 1 hour, if available on a microplate shaker set at 100 rpm.
15. Remove adhesive film and empty wells. Wash microwell strips 4 times according to point c. of the test protocol. Proceed immediately to the next step.
16. Pipette 100 µl of TMB Substrate Solution to all wells.

17. Incubate the microwell strips at room temperature (18° to 25°C) for about 10 min. Avoid direct exposure to intense light. The colour development on the plate should be monitored and the substrate reaction stopped (see next point of this protocol) before positive wells are no longer properly recordable. Determination of the ideal time period for colour development has to be done individually for each assay. It is recommended to add the stop solution when the highest standard has developed a dark blue colour. Alternatively the colour development can be monitored by the ELISA reader at 620 nm. The substrate reaction should be stopped as soon as Standard 1 has reached an OD of 0.6 – 0.65.

18. Stop the enzyme reaction by quickly pipetting 100 µl of Stop Solution into each well. It is important that the Stop Solution is spread quickly and uniformly throughout the microwells to completely inactivate the enzyme. Results must be read immediately after the Stop Solution is added or within one hour if the microwell strips are stored at 2 - 8°C in the dark.

19. Read absorbance of each microwell on a spectro-photometer using 450 nm as the primary wave length (optionally 620 nm as the reference wave length; 610 nm to 650 nm is acceptable). Blank the plate reader according to the manufacturer's instructions by using the blank wells. Determine the absorbance of both the samples and the standards.

Note: In case of incubation without shaking the obtained O.D. values may be lower than indicated below. Nevertheless the results are still valid.

Data Analysis

Calculation of Results

_ Calculate the average absorbance values for each set of duplicate standards and samples. Duplicates should be within 20 per cent of the mean value.

_ Create a standard curve by plotting the mean absorbance for each standard concentration on the ordinate against the human MMP-9 concentration on the abscissa. Draw a best fit curve through the points of the graph (a 5-parameter curve fit is recommended).

_ To determine the concentration of circulating human MMP-9 for each sample, first find the mean absorbance value on the ordinate and extend a horizontal line to the standard curve. At the point of intersection, extend a vertical line to the abscissa and read the corresponding human MMP-9 concentration.

_ If instructions in this protocol have been followed samples have been diluted 1:10 (10 µl sample + 90 µl Assay Buffer (1x)) on the plate, the concentration read from the standard curve must be multiplied by the

final dilution factor (depending on the predilution factor), for example:

Not prediluted samples: x 10

1:10 prediluted samples: x 100

1:25 prediluted samples: x 250

Calculation of samples with a concentration exceeding standard 1 may result in incorrect, low human MMP-9 levels (Hook Effect). Such samples require further external predilution according to expected human MMP-9 values with Assay Buffer (1x) in order to precisely quantitate the actual human MMP-9 level.

_ It is suggested that each testing facility establishes a control sample of known human MMP-concentration and runs this additional control with each assay. If the values obtained are not within the expected range of the control, the assay results may be invalid.

_ A representative standard curve is shown in Figure 8. This curve cannot be used to derive test results. Each laboratory must prepare a standard curve for each group of microwell strips assayed.

Figure 8

Representative standard curve for human MMP-9 ELISA. Human MMP-9 was diluted in serial 2-fold steps in Assay Buffer (1x). Do not use this standard curve to derive test results. A standard curve must be run for each group of microwell strips assayed.

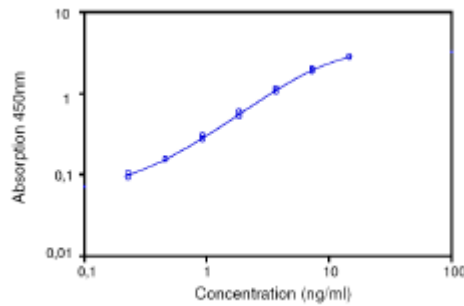


Table 1. Typical data using the human MMP-9 ELISA
Measuring wavelength: 450 nm
Reference wavelength: 620 nm

Standard	Human MMP-9 Concentration (ng/ml)	O.D. at 450 nm	Mean O.D. at 450 nm	C.V. (%)
1	15.00	2.69	2.72	1.2
	15.00	2.76		
2	7.50	1.81	1.88	3.9
	7.50	1.95		
3	3.75	1.01	1.06	3.7
	3.75	1.10		
4	1.88	0.51	0.54	4.9
	1.88	0.57		
5	0.94	0.26	0.28	4.7
	0.94	0.29		
6	0.47	0.15	0.15	0.1
	0.47	0.15		
7	0.23	0.09	0.10	3.2
	0.23	0.10		
Blank	0	0.04	0.04	
	0	0.03		

The OD values of the standard curve may vary according to the conditions of assay performance (e.g. operator, pipetting technique, washing technique or temperature effects). Furthermore shelf life of the kit may affect enzymatic activity and thus colour intensity. Values measured are still valid.

Performance Characteristics

- Sensitivity

The limit of detection of human MMP-9 defined as the analyte concentration resulting in an absorbance significantly higher than that of the dilution medium (mean plus 2 standard deviations) was determined to be 0,05 ng/ml (mean of 6 independent assays).

- Reproducibility

- a. Intra-assay

Reproducibility within the assay was evaluated in 4 independent experiments. Each assay was carried out with 6 replicates of 7 serum samples containing different concentrations of human MMP-9. 2 standard curves were run on each plate. Data below show the mean human MMP-9 concentration and the coefficient of variation for each sample (see Table 3). The calculated overall intra-assay coefficient of variation was 7,3%. Table 2 The mean human MMP-9 concentration and the coefficient of variation for each sample

Sample	Experiment	Mean human MMP-9 Concentration (ng/ml)	Coefficient of Variation (%)
1	1	1424.8	4.4
	2	1314.8	1.3
	3	1496.3	5.8
	4	1517.1	2.6
2	1	1324.7	16.9
	2	1231.5	17.5
	3	1297.7	17.6
	4	1412.3	16.9
3	1	105.1	5.5
	2	101.7	6.2
	3	103.8	5.0
	4	130.2	7.7
4	1	1709.0	2.1
	2	1747.7	3.2
	3	1752.8	2.4
	4	1889.9	8.2
5	1	94.1	12.9
	2	87.2	7.4
	3	98.4	2.8
	4	115.9	8.2
6	1	67.3	5.8
	2	68.7	5.0
	3	69.1	6.8
	4	86.4	6.5
7	1	95.9	7.6
	2	91.3	3.5
	3	96.3	10.0
	4	131.9	4.5

- b. Inter-assay

Assay to assay reproducibility within one laboratory was evaluated in 3 independent experiments. Each assay was carried out with 6 replicates of 7 serum samples containing different concentrations of human MMP-9. 2 standard curves were run on each plate. Data below show the mean human MMP-9 concentration and the coefficient of variation calculated

on 18 determinations of each sample (see Table 4). The calculated overall inter-assay coefficient of variation was 10,2%.

Table 3 The mean human IFN_γ concentration and the coefficient of variation of each sample

Sample	Mean human MMP-9 Concentration (ng/ml)	Coefficient of Variation (%)
1	1438.2	6.3
2	1316.5	5.7
3	110.2	12.2
4	1774.9	4.5
5	98.9	12.4
6	72.9	12.4
7	103.9	18.1

- Spike Recovery

The spike recovery was evaluated by spiking 4 levels of human MMP-9 into serum. The amount of endogenous human MMP-9 in unspiked serum was subtracted from the spike values. Recoveries were determined in 2 independent experiments with 4 replicates each. The overall mean recovery was 103.1%.

- Dilution Parallelism

Serum samples with different levels of human MMP-9 were analysed at serial 2 fold dilutions with 4 replicates each. The recovery ranged from 103.2% to 114.0% with an overall recovery of 107.4% (see Table 4).

Table 4

Sample	Dilution	Expected human MMP-9 Concentration (ng/ml)	Observed human MMP-9 Concentration (ng/ml)	Recovery of Expected human MMP-9 Concentration (%)
1	1:250		1419.0	
	1:500	709.5	809.1	114.0
	1:1000	354.7	372.1	104.9
	1:2000	177.4	186.8	105.3
2	1:250		778.6	
	1:500	389.3	401.6	103.2
	1:1000	194.6	207.7	106.7
	1:2000	97.3	107.3	110.3

- Sample Stability

- a. Freeze-Thaw Stability

Aliquots of serum samples (unspiked or spiked) were stored at -20°C and thawed 5 times, and the human MMP-9 levels determined. There was no significant loss of human MMP-9 immunoreactivity detected by freezing and thawing.

- b. Storage Stability

Aliquots of serum samples (spiked or unspiked) were stored at -20°C, 2-8°C, room temperature (RT) and at 37°C, and the human IFN_γ level determined after 24 h. There was no significant loss of human IFN_γ immunoreactivity detected during storage under above conditions.

