

Version 2 Last updated 18 November 2021

ab221828 Human Procalcitonin SimpleStep ELISA® Kit

For the quantitative measurement of human Procalcitonin in serum, plasma, urine, milk, saliva, and cell culture supernatant samples.

This product is for research use only and is not intended for diagnostic use.

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1. Overview

Procalcitonin *in vitro* SimpleStep ELISA® (Enzyme-Linked Immunosorbent Assay) kit is designed for the quantitative measurement of human Procalcitonin protein in serum, plasma, urine, milk, saliva, and cell culture supernatant samples.

The SimpleStep ELISA® employs an affinity tag labeled capture antibody and a reporter conjugated detector antibody which immunocapture the sample analyte in solution. This entire complex (capture antibody/analyte/detector antibody) is in turn immobilized via immunoaffinity of an anti-tag antibody coating the well. To perform the assay, samples or standards are added to the wells, followed by the antibody mix. After incubation, the wells are washed to remove unbound material. TMB Development Solution is added and during incubation is catalyzed by HRP, generating blue coloration. This reaction is then stopped by addition of Stop Solution completing any color change from blue to yellow. Signal is generated proportionally to the amount of bound analyte and the intensity is measured at 450 nm. Optionally, instead of the endpoint reading, development of TMB can be recorded kinetically at 600 nm.

Human Procalcitonin is a 116-amino acid precursor protein of the peptide hormone called Calcitonin coded by the gene CALCA. Procalcitonin is mainly produced by the C-cells of the thyroid and certain endocrine cells of the lung. Under normal expression conditions, Procalcitonin is cleaved into three specific fragments: a N-terminal residue, Calcitonin, and Katalcalciton. Levels of unprocessed Procalcitonin have been shown to rise significantly after bacterial infection, trauma, and shock. Calcitonin regulates the blood phosphate and calcium levels by promoting incorporation into bones. Populations with chronic kidney disease have been shown to have higher procalcitonin levels. The antibodies used in this product were raised to the propeptide sequence residues 26-82. The standard protein used in this product has been calibrated to the full-length procalcitonin residues 26-141.

2. Protocol Summary

Prepare all reagents, samples, and standards as instructed



Add 50 μ L standard or sample to appropriate wells



Add 50 μ L Antibody Cocktail to all wells



Incubate at room temperature for 1 hour



Aspirate and wash each well three times with 350 μ L 1X Wash Buffer
PT



Add 100 μ L TMB Development Solution to each well and incubate
for 10 minutes.



Add 100 μ L Stop Solution and read OD at 450 nm

3. Precautions

Please read these instructions carefully prior to beginning the assay.

- All kit components have been formulated and quality control tested to function successfully as a kit.
- We understand that, occasionally, experimental protocols might need to be modified to meet unique experimental circumstances. However, we cannot guarantee the performance of the product outside the conditions detailed in this protocol booklet.
- Reagents should be treated as possible mutagens and should be handled with care and disposed of properly. Please review the Safety Datasheet (SDS) provided with the product for information on the specific components.
- Observe good laboratory practices. Gloves, lab coat, and protective eyewear should always be worn. Never pipet by mouth. Do not eat, drink or smoke in the laboratory areas.
- All biological materials should be treated as potentially hazardous and handled as such. They should be disposed of in accordance with established safety procedures.

4. Storage and Stability

Store kit at +4°C immediately upon receipt. Kit has a storage time of 1 year from receipt, providing components have not been reconstituted.

Refer to list of materials supplied for storage conditions of individual components.

5. Limitations

- Assay kit intended for research use only. Not for use in diagnostic procedures.
- Do not mix or substitute reagents or materials from other kit lots or vendors. Kits are QC tested as a set of components and performance cannot be guaranteed if utilized separately or substituted.

6. Materials Supplied

| Item | Quantity | Storage Condition |
|---|----------|-------------------|
| Human Procalcitonin Capture Antibody 10X | 600 µL | +4°C |
| Human Procalcitonin Detector Antibody 10X | 600 µL | +4°C |
| Human Procalcitonin Lyophilized Recombinant Protein | 2 Vials | +4°C |
| Antibody Diluent 4BI | 6 mL | +4°C |
| Wash Buffer PT 10X | 20 mL | +4°C |
| TMB Development Solution | 12 mL | +4°C |
| Stop Solution | 12 mL | +4°C |
| Sample Diluent NS | 50 mL | +4°C |
| Anti-tag coated microplate (12 x 8 well strips) | 96 Wells | +4°C |
| Plate Seal | 1 | +4°C |

7. Materials Required, Not Supplied

These materials are not included in the kit, but will be required to successfully perform this assay:

- Microplate reader capable of measuring absorbance at 450 or 600 nm.
- Method for determining protein concentration (BCA assay recommended).
- Deionized water.
- Multi- and single-channel pipettes.
- Tubes for standard dilution.
- Plate shaker for all incubation steps.
- Optional: Phenylmethylsulfonyl Fluoride (PMSF) (or other protease inhibitors).

8. Technical Hints

- Samples generating values higher than the highest standard should be further diluted in the appropriate sample dilution buffers.
- Avoid foaming or bubbles when mixing or reconstituting components.
- Avoid cross contamination of samples or reagents by changing tips between sample, standard and reagent additions.
- Ensure plates are properly sealed or covered during incubation steps.
- Complete removal of all solutions and buffers during wash steps is necessary to minimize background.
- As a guide, typical ranges of sample concentration for commonly used sample types are shown below in Sample Preparation (section 11).
- All samples should be mixed thoroughly and gently.
- Avoid multiple freeze/thaw of samples.
- Incubate ELISA plates on a plate shaker during all incubation steps.
- When generating positive control samples, it is advisable to change pipette tips after each step.

- Note that use of a machine to perform these wash steps may increase the average and range of background values observed. For this assay it is suggested to manually wash the plate using a pipette to add and remove wash buffer. Waiting 15 seconds between addition and removal of wash buffer will also help decrease background.
- To avoid high background always add samples or standards to the well before the addition of the antibody cocktail.
- This kit is sold based on number of tests. A 'test' simply refers to a single assay well. The number of wells that contain sample, control or standard will vary by product. Review the protocol completely to confirm this kit meets your requirements. Please contact our Technical Support staff with any questions.

9. Reagent Preparation

- Equilibrate all reagents to room temperature (18-25°C) prior to use. The kit contains enough reagents for 96 wells. The sample volumes below are sufficient for 48 wells (6 x 8-well strips); adjust volumes as needed for the number of strips in your experiment.
- Prepare only as much reagent as is needed on the day of the experiment. Capture and Detector Antibodies have only been tested for stability in the provided 10X formulations.

9.1 1X Wash Buffer PT:

Prepare 1X Wash Buffer PT by diluting Wash Buffer PT 10X with deionized water. To make 50 mL 1X Wash Buffer PT combine 5 mL Wash Buffer PT 10X with 45 mL deionized water. Mix thoroughly and gently.

9.2 Antibody Cocktail:

Prepare Antibody Cocktail by diluting the capture and detector antibodies in Antibody Diluent 4BI. To make 3 mL of the Antibody Cocktail combine 300 µL 10X Capture Antibody and 300 µL 10X Detector Antibody with 2.4 mL Antibody Diluent 4BI. Mix thoroughly and gently.

10. Standard Preparation

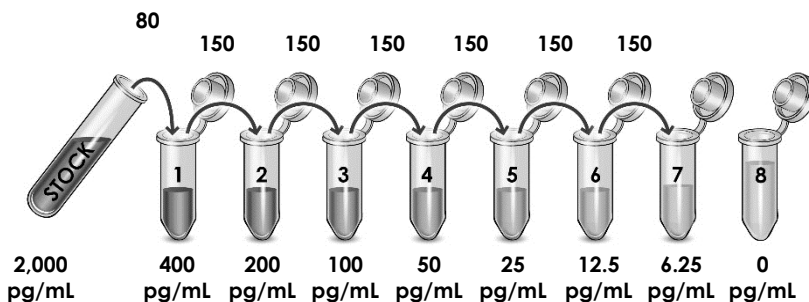
- Always prepare a fresh set of standards for every use.
- Discard working standard dilutions after use as they do not store well.
- The following section describes the preparation of a standard curve for duplicate measurements (recommended).

10.1 IMPORTANT: If the protein standard vial has a volume identified on the label, reconstitute the Procalcitonin standard by adding that volume of Sample Diluent NS indicated on the label. Alternatively, if the vial has a mass identified, reconstitute the Procalcitonin standard by adding 1,000 μL Sample Diluent NS. Hold at room temperature for 10 minutes and mix gently. This is the 2,000 pg/mL **Stock Standard** Solution.

10.2 Label eight tubes, Standards 1– 8.

10.3 Add 320 μL Sample Diluent NS into tube number 1 and 150 μL of Sample Diluent NS into numbers 2-8.

10.4 Use the Stock Standard to prepare the following dilution series. Standard #8 contains no protein and is the Blank control:



11. Sample Preparation

| Typical Sample Dynamic Range | |
|------------------------------|------------|
| Sample Type | Range |
| Human Plasma - Heparin | 3.13 – 50% |
| Human Plasma - EDTA | 3.13 – 50% |
| Human Plasma - Citrate | 3.13 – 50% |
| Human Serum | 3.13 – 50% |
| Human Urine | 1.56 – 25% |
| Human Milk | 3.13 – 50% |
| Human Saliva | 3.13 – 50% |
| Cell Culture Supernatants | 3.13 – 50% |

11.1 Plasma:

Collect plasma using citrate, EDTA or heparin. Centrifuge samples at 2,000 x g for 10 minutes. Dilute samples into Sample Diluent NS and assay. Store un-diluted plasma samples at -20°C or below for up to 3 months. Avoid repeated freeze-thaw cycles.

11.2 Serum:

Samples should be collected into a serum separator tube. After clot formation, centrifuge samples at 2,000 x g for 10 minutes and collect serum. Dilute samples into Sample Diluent NS and assay. Store un-diluted serum at -20°C or below. Avoid repeated freeze-thaw cycles.

11.3 Cell Culture Supernatants:

Centrifuge cell culture media at 2,000 x g for 10 minutes to remove debris. Collect supernatants and dilute samples into Sample Diluent NS and assay. Store un-diluted samples at -20°C or below. Avoid repeated freeze-thaw cycles.

11.4 Urine:

Centrifuge urine at 2,000 x g for 10 minutes to remove debris. Collect supernatants, dilute in Sample Diluent NS and assay. Store un-diluted samples at -20°C or below. Avoid repeated freeze-thaw cycles.

11.5 Saliva:

Centrifuge saliva at 800 x g for 10 minutes to remove debris. Collect supernatants and dilute samples into Sample Diluent NS and assay. Store un-diluted samples at -20°C or below. Avoid repeated freeze-thaw cycles.

11.6 Milk:

This kit was optimized for use with whole milk. Dilute the whole milk samples in Sample Diluent NS and assay. Store un-diluted milk at -20°C or below. Avoid repeated freeze-thaw cycles.

12. Plate Preparation

- The 96 well plate strips included with this kit are supplied ready to use. It is not necessary to rinse the plate prior to adding reagents.
- Unused plate strips should be immediately returned to the foil pouch containing the desiccant pack, resealed and stored at 4°C.
- For each assay performed, a minimum of two wells must be used as the zero control.
- For statistical reasons, we recommend each sample should be assayed with a minimum of two replicates (duplicates).
- Differences in well absorbance or “edge effects” have not been observed with this assay.

13. Assay Procedure

- Equilibrate all materials and prepared reagents to room temperature prior to use.
 - We recommend that you assay all standards, controls and samples in duplicate.
- 13.1 Prepare all reagents, working standards, and samples as directed in the previous sections.
 - 13.2 Remove excess microplate strips from the plate frame, return them to the foil pouch containing the desiccant pack, reseal and return to 4°C storage.
 - 13.3 Add 50 µL of all sample or standard to appropriate wells.
 - 13.4 Add 50 µL of the Antibody Cocktail to each well.
 - 13.5 Seal the plate and incubate for 1 hour at room temperature on a plate shaker set to 400 rpm.
 - 13.6 Wash each well with 3 x 350 µL 1X Wash Buffer PT. Wash by aspirating or decanting from wells then dispensing 350 µL 1X Wash Buffer PT into each well. Wash Buffer PT should remain in wells for at least 10 seconds. Complete removal of liquid at each step is essential for good performance. After the last wash invert the plate and tap gently against clean paper towels to remove excess liquid.
 - 13.7 Add 100 µL of TMB Development Solution to each well and incubate for 10 minutes in the dark on a plate shaker set to 400 rpm.

Given variability in laboratory environmental conditions, optimal incubation time may vary between 5 and 20 minutes.

Note: The addition of Stop Solution will change the color from blue to yellow and enhance the signal intensity about 3X. To avoid signal saturation, proceed to the next step before the high concentration of the standard reaches a blue color of O.D.600 equal to 1.0.
 - 13.8 Add 100 µL of Stop Solution to each well. Shake plate on a plate shaker for 1 minute to mix. Record the OD at 450 nm. This is an endpoint reading.
 - 13.9 Alternative to 13.7 – 13.8: Instead of the endpoint reading at 450 nm, record the development of TMB Substrate kinetically. Immediately after addition of TMB Development Solution begin recording the blue color development with elapsed

time in the microplate reader prepared with the following settings:

| Mode | Kinetic |
|-------------|------------------------|
| Wavelength: | 600 nm |
| Time: | up to 20 min |
| Interval: | 20 sec - 1 min |
| Shaking: | Shake between readings |

Δ **Note:** that an endpoint reading can also be recorded at the completion of the kinetic read by adding 100 µL Stop Solution to each well and recording the OD at 450 nm.

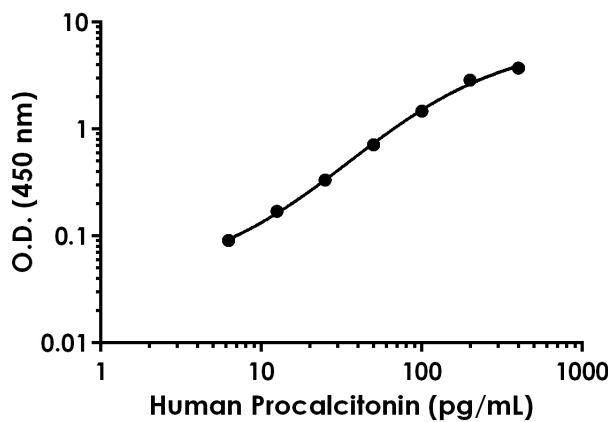
13.10 Analyze the data as described below.

14. Calculations

- 14.1 Calculate the average absorbance value for the blank control (zero) standards. Subtract the average blank control standard absorbance value from all other absorbance values.
 - 14.2 **Create a standard curve** by plotting the average blank control subtracted absorbance value for each standard concentration (y-axis) against the target protein concentration (x-axis) of the standard. Use graphing software to draw the best smooth curve through these points to construct the standard curve.
- Δ **Note:** Most microplate reader software or graphing software will plot these values and fit a curve to the data. A four parameter curve fit (4PL) is often the best choice; however, other algorithms (e.g. linear, semi-log, log/log, 4 parameter logistic) can also be tested to determine if it provides a better curve fit to the standard values.
- 14.3 Determine the concentration of the target protein in the sample by interpolating the blank control subtracted **absorbance values against the standard curve**. Multiply the resulting value by the appropriate sample dilution factor, if used, to obtain the concentration of target protein in the sample.
 - 14.4 Samples generating absorbance values greater than that of the highest standard should be further diluted and reanalyzed. Similarly, samples which measure at an absorbance values less than that of the lowest standard should be retested in a less dilute form.

15. Typical Data

Typical standard curve – data provided for demonstration purposes only. A new standard curve must be generated for each assay performed.



| Standard Curve Measurements | | | |
|-----------------------------|------------|-------|-------------|
| Concentration (pg/mL) | O.D 450 nm | | Mean O.D |
| | 1 | 2 | |
| 0 | 0.079 | 0.083 | 0.081 |
| 6.25 | 0.175 | 0.169 | 0.172 |
| 12.5 | 0.259 | 0.244 | 0.252 |
| 25 | 0.422 | 0.408 | 0.415 |
| 50 | 0.777 | 0.812 | 0.794 |
| 100 | 1.560 | 1.550 | 1.555 |
| 200 | 2.908 | 3.011 | 2.960 |
| 400 | 3.808 | 3.795 | 3.802 |

Figure 1. Example of human Procalcitonin standard curve. The Procalcitonin standard curve was prepared as described in Section 10. Raw data values are shown in the table. Background-subtracted data values (mean +/- SD) are graphed.

16. Typical Sample Values

SENSITIVITY –

The calculated minimal detectable dose (MDD) is 1.51 pg/mL. The MDD was determined by calculating the mean of zero standard replicates (n=24) and adding 2 standard deviations then extrapolating the corresponding concentration.

RECOVERY –

Three concentrations of human Procalcitonin were spiked in duplicate to the indicated biological matrix to evaluate signal recovery in the working range of the assay.

| Sample Type | Average % Recovery | Range (%) |
|------------------------------|--------------------|-----------|
| Human Plasma – Heparin (50%) | 93 | 90 – 100 |
| Human Plasma - EDTA (50%) | 78 | 75 – 82 |
| Human Plasma - Citrate (50%) | 83 | 79 – 88 |
| Human Serum (50%) | 79 | 74 – 82 |
| Human Urine (5%) | 90 | 88 – 92 |
| Human Milk (25%) | 79 | 75 – 88 |
| Human Saliva (50%) | 94 | 84 – 104 |
| RPMI Culture Media (50%) | 100 | 99 – 101 |

Linearity of Dilution

Linearity of dilution is determined based on interpolated values from the standard curve. Linearity of dilution defines a sample concentration interval in which interpolated target concentrations are directly proportional to sample dilution.

Native human Procalcitonin was measured in urine and milk in a 2-fold dilution series. Sample dilutions are made in Sample Diluent NS. Recombinant human Procalcitonin was spiked into serum, plasma, saliva, and RPMI culture media and diluted in a 2-fold dilution series in Sample Diluent NS.

| Dilution Factor | Interpolated value | 50% Human Serum | 50% Human Plasma (Citrate) | 50% Human Plasma (EDTA) | 50% Human Plasma (Heparin) |
|-----------------|--------------------|-----------------|----------------------------|-------------------------|----------------------------|
| Undiluted | pg/mL | 157 | 172 | 223 | 219 |
| | % Expected value | 100 | 100 | 100 | 100 |
| 2 | pg/mL | 79 | 82 | 103 | 101 |
| | % Expected value | 101 | 96 | 92 | 93 |
| 4 | pg/mL | 42 | 44 | 51 | 50 |
| | % Expected value | 106 | 102 | 92 | 91 |
| 8 | pg/mL | 22 | 22 | 26 | 24 |
| | % Expected value | 112 | 104 | 95 | 86 |
| 16 | pg/mL | 11 | 12 | 13 | 13 |
| | % Expected value | 113 | 108 | 96 | 92 |

| Dilution Factor | Interpolated value | 25% Human Urine | 50% Human Milk | 50% Human Saliva | 50% RPMI Culture Media |
|-----------------|--------------------|-----------------|----------------|------------------|------------------------|
| Undiluted | pg/mL | 365 | 82 | 169 | 241 |
| | % Expected value | 100 | 100 | 100 | 100 |
| 2 | pg/mL | 213 | 40 | 80 | 98 |
| | % Expected value | 117 | 98 | 95 | 81 |
| 4 | pg/mL | 93 | 20 | 41 | 51 |
| | % Expected value | 101 | 97 | 97 | 85 |
| 8 | pg/mL | 48 | 8 | 22 | 24 |
| | % Expected value | 105 | 79 | 104 | 80 |
| 16 | pg/mL | 25 | ND | 11 | 12 |
| | % Expected value | 109 | ND | 103 | 81 |

ND – Non-Detectable

PRECISION –

Mean coefficient of variations of interpolated values from three concentrations of human urine within the working range of the assay.

| | Intra-Assay | Inter-Assay |
|-------|-------------|-------------|
| n = | 8 | 3 |
| CV(%) | 2.9 | 4.4 |

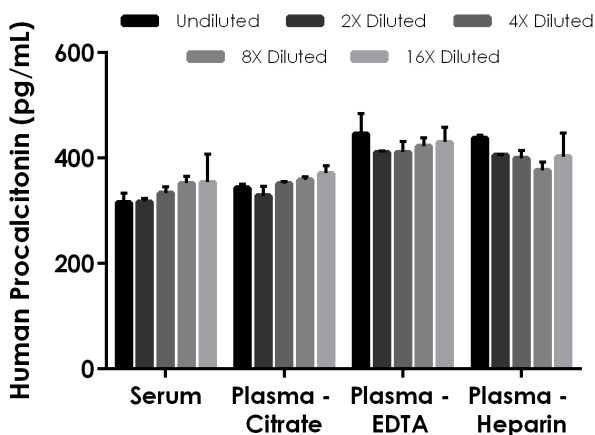


Figure 2. Interpolated concentrations of spiked Procalcitonin in human serum and plasma samples. The concentrations of Procalcitonin were measured in duplicates, interpolated from the Procalcitonin standard curves and corrected for sample dilution. Undiluted samples are as follows: serum 50%, plasma (citrate) 50%, plasma (EDTA) 50%, and plasma (heparin) 50%. The interpolated dilution factor corrected values are plotted (mean \pm SD, $n=2$). The mean Procalcitonin concentration was determined to be 335 pg/mL in neat serum, 351 pg/mL in neat plasma (citrate), 424 pg/mL in neat plasma (EDTA) and 405 pg/mL in neat plasma (heparin).

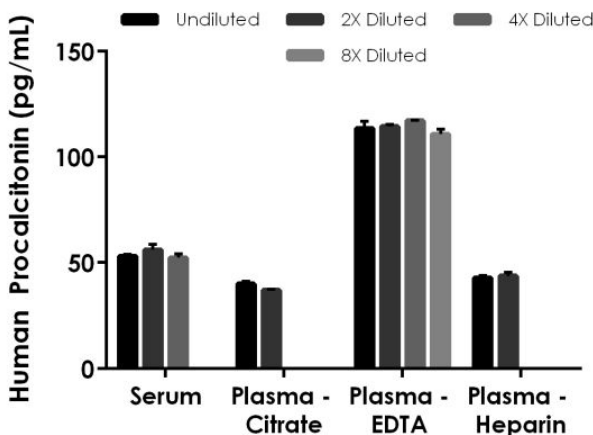


Figure 3. Interpolated concentrations of native Procalcitonin in human serum and plasma samples. The concentrations of Procalcitonin were measured in duplicates, interpolated from the Procalcitonin standard curves and corrected for sample dilution. Undiluted samples are as follows: serum 50%, plasma (citrate) 50%, plasma (EDTA) 50%, and plasma (heparin) 50%. The interpolated dilution factor corrected values are plotted (mean \pm SD, $n=2$). The mean Procalcitonin concentration was determined to be 54 pg/mL in neat serum, 38 pg/mL in neat plasma (citrate), 114 pg/mL in neat plasma (EDTA) and 43 pg/mL in neat plasma (heparin).

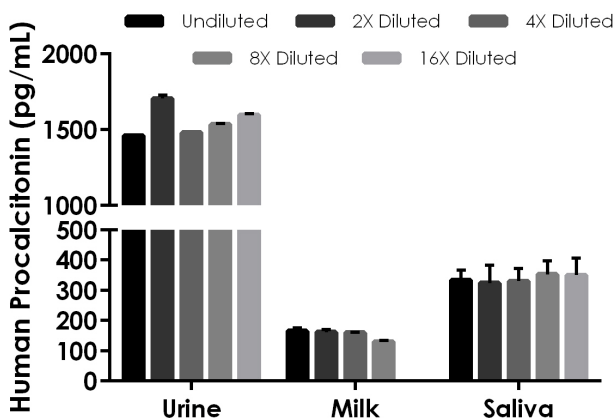


Figure 4. Interpolated concentrations of native Procalcitonin in human urine, milk, and spiked Procalcitonin in human saliva samples. The concentrations of Procalcitonin were measured in duplicates, interpolated from the Procalcitonin standard curves and corrected for sample dilution. Undiluted samples are as follows: urine 25%, milk 50%, and saliva 50%. The interpolated dilution factor corrected values are plotted (mean \pm SD, $n=2$). The mean Procalcitonin concentration was determined to be 1,555 pg/mL in neat urine, 154 pg/mL in neat milk, and 338 pg/mL in neat saliva.

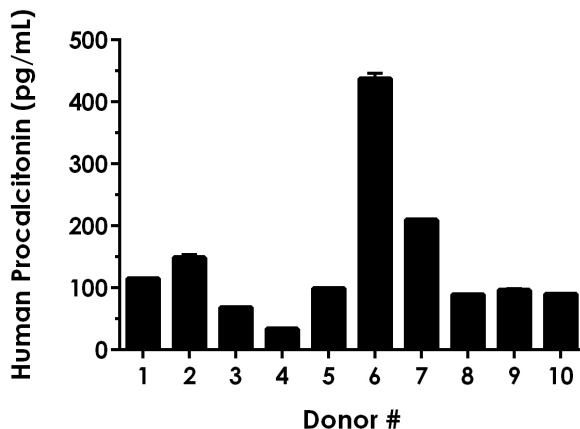


Figure 5. Serum from ten individual healthy human male donors was measured in duplicate. Interpolated dilution factor corrected values are plotted (mean \pm SD, $n=2$). The mean Procalcitonin concentration in neat serum was determined to be 139 pg/mL with a range of 33 – 438 pg/mL.

17. Assay Specificity

This kit recognizes both native and recombinant human Procalcitonin protein in serum, plasma, urine, milk, saliva, and cell culture supernatant samples only.

CROSS REACTIVITY -

Recombinant proteins corresponding to the amino acid ranges 85-107 and 95-116 of the gene CALCA were prepared at 10,000 pg/mL each and assayed for cross-reactivity. No cross-reactivity was observed.

18. Species Reactivity

This kit recognizes human Procalcitonin protein.

Mouse, rat, and cow species reactivity was determined by measuring 50% serum samples of various species, interpolating the protein concentrations from the human standard curve, and expressing the interpolated concentrations as a percentage of the protein concentration in human serum assayed at the same dilution.

Reactivity < 3% was determined for the following species:

- Mouse
- Rat
- Cow

Please contact our Technical Support team for more information.

19. Troubleshooting

| Problem | Reason | Solution |
|-------------------------------|--|--|
| Poor standard curve | Inaccurate Pipetting | Check pipettes |
| | Improper standard dilution | Prior to opening, briefly spin the stock standard tube and dissolve the powder thoroughly by gentle mixing |
| Low Signal | Incubation times too brief | Ensure sufficient incubation times; increase to 2 or 3 hour standard/sample incubation |
| | Inadequate reagent volumes or improper dilution | Check pipettes and ensure correct preparation |
| | Incubation times with TMB too brief | Ensure sufficient incubation time until blue color develops prior addition of Stop solution |
| Large CV | Plate is insufficiently washed | Review manual for proper wash technique. If using a plate washer, check all ports for obstructions. |
| | Contaminated wash buffer | Prepare fresh wash buffer |
| Low sensitivity | Improper storage of the ELISA kit | Store your reconstituted standards at -80°C, all other assay components 4°C. Keep TMB Development Solution protected from light. |
| Precipitate in Diluent | Precipitation and/or coagulation of components within the Diluent. | Precipitate can be removed by gently warming the Diluent to 37°C. |

20. Notes

Technical Support

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