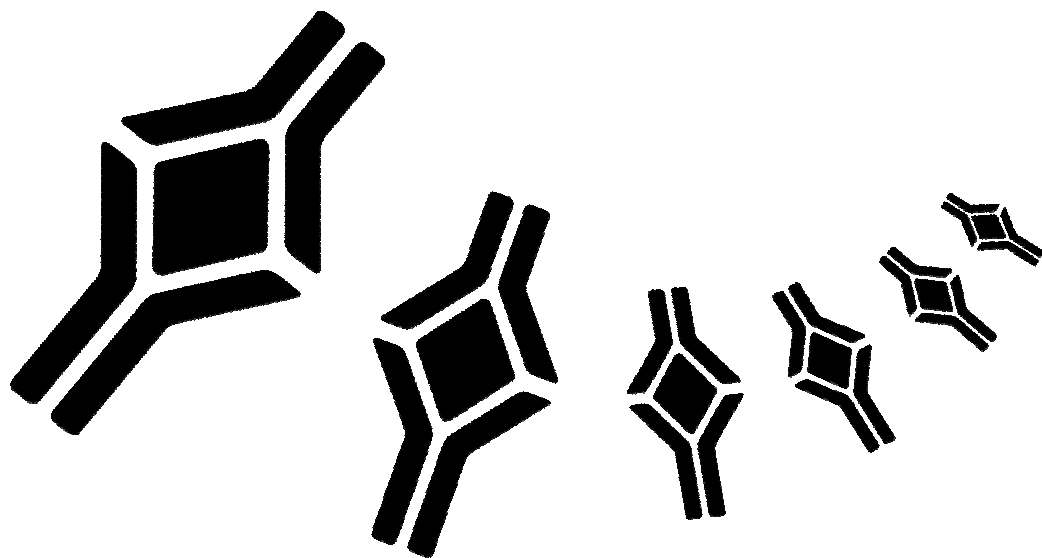


BioVendor

Research
and Diagnostic Products



HUMAN CLUSTERIN ELISA

Product Data Sheet

Cat. No.: RD194034200R

For Research Use Only

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**»» This kit is manufactured by:
BioVendor – Laboratorní medicína a.s.**

»» Use only the current version of Product Data Sheet enclosed with the kit!

1. INTENDED USE

The RD194034200R Human Clusterin ELISA is a sandwich enzyme immunoassay for the quantitative measurement of human clusterin.

»» Features

- **It is intended for research use only**
- The total assay time is less than 3.5 hours
- The kit measures clusterin in serum, plasma (EDTA,citrate,heparin), cerebrospinal fluid (CSF), urine, cell culture, and cell lysate
- Assay format is 96 wells
- Quality Controls are human serum based
- Standard is human serum based native protein
- Components of the kit are provided ready to use, concentrated or lyophilized

2. STORAGE, EXPIRATION

Store the complete kit at 2-8°C. Under these conditions, the kit is stable until the expiration date (see label on the box).

For stability of opened reagents see Chapter 9.

3. INTRODUCTION

Clusterin (Apolipoprotein J; SP-40,40; TRPM-2; SGP-2; pADHC-9; CLJ; T64; GP III; XIP8) is a highly conserved disulfide-linked secreted heterodimeric glycoprotein of 75-80 kDa but truncated forms targeted to nucleus have also been identified.

The protein is constitutively secreted by a number of cell types including epithelial and neuronal cells and is a major protein in physiological fluids including plasma, milk, urine, cerebrospinal fluid and semen. Due to its wide tissue distribution many diverse physiological functions have been attributed to clusterin including sperm maturation, membrane recycling, lipid transportation, tissue remodelling, complement inhibition and cell-cell or cell-substratum interactions. Moreover, it was proposed, that clusterin functions as an extra cellular chaperon that stabilizes stressed proteins in a folding-competent state and protein has also been implicated in programmed cell death. Another defining prominent of clusterin is its induction in many severe physiological disturbances states including kidney degenerative diseases, prostate and vesicle carcinogenesis, ovarian cancer and several neurodegenerative conditions (Alzheimer's disease).

Recent study demonstrate, that serum clusterin level increases significantly in diabetic type II patients and in patients with developing coronary heart disease, or myocardial infarction. These data raise the possibility that elevated clusterin levels in serum may represent a strong indication of vascular damage.

In patients with systemic lupus erythematosus (SLE) was found reduced serum clusterin levels that correlated inversely with disease activity. Lowered clusterin levels could be involved in the pathogenesis of SLE on account of decreased protective effects.

Another interesting observations obtain in rat model suggest that measurement of urinary clusterin levels may be a useful clinical valuable marker for the severity of renal tubular damage. Furthermore, urinary clusterin may also help to differentiate between tubular and glomerular forms of proteinuria.

Areas of investigation:

Coronary heart diseases

Myocardial infarction

Neurodegenerative diseases

Kidney degenerative disease

Renal tubular damage

4. TEST PRINCIPLE

In the BioVendor Human Clusterin ELISA, standards, quality controls and samples are incubated in microplate wells pre-coated with monoclonal anti-human clusterin antibody. After 60 minutes incubation and washing, biotin labelled second monoclonal anti-human clusterin antibody is added and incubated with captured clusterin for 60 minutes. After another washing, streptavidin-HRP conjugate is added. After 30 minutes incubation and the last washing step, the remaining conjugate is allowed to react with the substrate solution (TMB). The reaction is stopped by addition of acidic solution and absorbance of the resulting yellow product is measured. The absorbance is proportional to the concentration of clusterin. A standard curve is constructed by plotting absorbance values against concentrations of standards, and concentrations of unknown samples are determined using this standard curve.

5. PRECAUTIONS

- **For professional use only**
- Wear gloves and laboratory coats when handling immunodiagnostic materials
- Do not drink, eat or smoke in the areas where immunodiagnostic materials are being handled
- This kit contains components of human origin. These materials were found non-reactive for HBsAg, HCV antibody and for HIV 1/2 antigen and antibody. However, these materials should be handled as potentially infectious, as no test can guarantee the complete absence of infectious agents
- This kit contains components of animal origin. These materials should be handled as potentially infectious
- Avoid contact with the acidic Stop Solution and Substrate Solution, which contains hydrogen peroxide and tetramethylbenzidine (TMB). Wear gloves and eye and clothing protection when handling these reagents. Stop and/or Substrate Solutions may cause skin/eyes irritation. In case of contact with the Stop Solution and the Substrate Solution wash skin/eyes thoroughly with water and seek medical attention, when necessary
- The materials must not be pipetted by mouth

6. TECHNICAL HINTS

- Reagents with different lot numbers should not be mixed
- Use thoroughly clean glassware
- Use deionized (distilled) water, stored in clean containers
- Avoid any contamination among samples and reagents. For this purpose, disposable tips should be used for each sample and reagent
- Substrate Solution should remain colourless until added to the plate. Keep Substrate Solution protected from light
- Stop Solution should remain colourless until added to the plate. The colour developed in the wells will turn from blue to yellow immediately after the addition of the Stop Solution. Wells that are green in colour indicate that the Stop Solution has not mixed thoroughly with the Substrate Solution
- Dispose of consumable materials and unused contents in accordance with applicable national regulatory requirements

7. REAGENT SUPPLIED

<i>Kit Components</i>	<i>State</i>	<i>Quantity</i>
Antibody Coated Microtiter Strips	ready to use	96 wells
Biotin Labelled Antibody Conc. (50x)	concentrated	0.26 ml
Streptavidin-HRP Conjugate	ready to use	13 ml
Master Standard	lyophilized	2 vials
Quality Control HIGH	lyophilized	2 vials
Quality Control LOW	lyophilized	2 vials
Biotin-Ab Diluent	ready to use	13 ml
Dilution Buffer	ready to use	50 ml
Wash Solution Conc. (10x)	concentrated	100 ml
Substrate Solution	ready to use	13 ml
Stop Solution	ready to use	13 ml
Product Data Sheet + Certificate of Analysis	-	1 pc

8. MATERIAL REQUIRED BUT NOT SUPPLIED

- Deionized (distilled) water
- Test tubes for diluting samples
- Glassware (graduated cylinder and bottle) for Wash Solution (Dilution Buffer)
- Precision pipettes to deliver 5-1000 µl with disposable tips
- Multichannel pipette to deliver 100 µl with disposable tips
- Absorbent material (e.g. paper towels) for blotting the microtiter plate after washing
- Vortex mixer
- Orbital microplate shaker capable of approximately 300 rpm
- Microplate washer (optional). [Manual washing is possible but not preferable.]
- Microplate reader with 450 ± 10 nm filter, preferably with reference wavelength 630 nm (alternatively another one from the interval 550-650nm)
- Software package facilitating data generation and analysis (optional)

9. PREPARATION OF REAGENTS

- All reagents need to be brought to room temperature prior to use
- Always prepare only the appropriate quantity of reagents for your test
- Do not use components after the expiration date marked on their label

- Assay reagents supplied ready to use:

Antibody Coated Microtiter Strips

Stability and storage:

Return the unused strips to the provided aluminium zip-sealed bag with desiccant and seal carefully. Remaining Microtiter Strips are stable 3 month stored at 2-8°C and protected from the moisture.

Streptavidin-HRP Conjugate

Biotin-Ab Diluent

Dilution Buffer

Substrate Solution

Stop Solution

Stability and storage:

Opened reagents are stable 3 month when stored at 2-8°C.

- **Assay reagents supplied concentrated or lyophilized:**

Human Clusterin Master Standard

Refer to the Certificate of Analysis for current volume of Dilution Buffer needed for reconstitution of standard!!!

Reconstitute the lyophilized Master Standard with Dilution Buffer just prior to the assay. Let it dissolve at least 15 minutes with occasional gentle shaking (not to foam). The resulting concentration of the clusterin in the stock solution is **160 ng/ml**.

Prepare set of standards using Dilution Buffer as follows:

<i>Volume of Standard</i>	<i>Dilution Buffer</i>	<i>Concentration</i>
Stock	-	160 ng/ml
250 µl of stock	250 µl	80 ng/ml
250 µl of 80 ng/ml	250 µl	40 ng/ml
250 µl of 40 ng/ml	250 µl	20 ng/ml
250 µl of 20 ng/ml	250 µl	10 ng/ml
250 µl of 10 ng/ml	250 µl	5 ng/ml

Prepared Standards are ready to use, do not dilute them.

Stability and storage:

Do not store the Standard stock solution and set of standards.

Quality Controls HIGH, LOW

Refer to the Certificate of Analysis for current volume of Dilution Buffer needed for reconstitution and for current Quality Control concentration!!!

Reconstitute each Quality Control (HIGH and LOW) with Dilution Buffer just prior to the assay. Let it dissolve at least 15 minutes with occasional gentle shaking (not to foam).

Reconstituted Quality Controls are ready to use, do not dilute them.

Stability and storage:

Do not store the reconstituted Quality Controls.

Biotin Labelled Antibody Conc. (50x)

Prepare the working Biotin Labelled Antibody solution by adding 1 part Biotin Labelled Antibody Concentrate (50x) with 49 parts Biotin-Ab Diluent. Example: 20 µl of Biotin Labelled Antibody Concentrate (50x) + 980 µl of Biotin-Ab Diluent for 1 strip (8 wells).

Stability and storage:

Opened Biotin Labelled Antibody Concentrate (50x) is stable 3 months when stored at 2-8°C.

Do not store the diluted Biotin Labelled Antibody solution.

Wash Solution Conc. (10x)

Dilute Wash Solution Concentrate (10x) ten-fold in distilled water to prepare a 1x working solution. Example: 100 ml of Wash Solution Concentrate (10x) + 900 ml of distilled water for use of all 96-wells.

Stability and storage:

The diluted Wash Solution is stable 1 month when stored at 2-8°C. Opened Wash Solution Concentrate (10x) is stable 3 months when stored at 2-8°C.

10. PREPARATION OF SAMPLES

The kit measures human clusterin in serum, plasma (EDTA, citrate, heparin), CSF, urine, cell culture and cell lysate.

Samples should be assayed immediately after collection or should be stored at -20°C. Mix thoroughly thawed samples just prior to the assay and avoid repeated freeze/thaw cycles, which may cause erroneous results. Avoid using hemolyzed or lipemic samples.

Serum or plasma samples:

Dilute samples just prior to perform the test 3 000x with Dilution Buffer in two steps as follows:

Dilution A (50x):

Add 5 µl of sample into 245 µl of Dilution Buffer and **mix well** (not to foam). Vortex is recommended.

Dilution B (60x):

Add 5 µl of Dilution A into 295 µl of Dilution Buffer to prepare final dilution 3 000x. **Mix well** (not to foam). Vortex is recommended.

CSF samples:

Dilute CSF samples just prior to perform the test 100x with Dilution Buffer, e.g. 5 µl of sample + 495 µl Dilution Buffer. **Mix well** (not to foam). Vortex is recommended.

Urine samples:

Dilute urine samples just prior to perform the test 10x with Dilution Buffer, e.g. 15 µl of sample + 135 µl of Dilution Buffer for singlets or 25 µl of sample + 225 µl of Dilution Buffer for duplicates. **Mix well** (not to foam). Vortex is recommended.

Stability and storage:

Serum and plasma samples should be stored at -20°C, or preferably at -70°C for long-term storage. CSF and urine samples should be stored at -70°C.

Do not store the diluted samples.

See Chapter 13 for stability of serum and plasma samples when stored at 2-8°C, effect of freezing/thawing and effect of sample matrix (serum/plasma) on the concentration of human clusterin.

Note: It is recommended to use a precision pipette and a careful technique to perform the dilution in order to get precise results.

Ask for protocol at info@biovendor.com if assaying cell culture and cell lysate samples.

11. ASSAY PROCEDURE

1. Pipet **100 µl** of diluted Standards, Quality Controls, Dilution Buffer (=Blank) and samples, preferably in duplicates, into the appropriate wells. See *Figure 1* for example of work sheet.
2. Incubate the plate at room temperature (ca. 25°C) for **1 hour**, shaking at ca. 300 rpm on an orbital microplate shaker.
3. Wash the wells 5-times with Wash Solution (0.35 ml per well). After final wash, invert and tap the plate strongly against paper towel.
4. Add **100 µl** of Biotin Labelled Antibody solution into each well.
5. Incubate the plate at room temperature (ca. 25°C) for **1 hour**, shaking at ca. 300 rpm on an orbital microplate shaker.
6. Wash the wells 5-times with Wash Solution (0.35 ml per well). After final wash, invert and tap the plate strongly against paper towel.
7. Add **100 µl** of Streptavidin-HRP Conjugate into each well.
8. Incubate the plate at room temperature (ca. 25°C) for **30 min**, shaking at ca. 300 rpm on an orbital microplate shaker.
9. Wash the wells 5-times with Wash Solution (0.35 ml per well). After final wash, invert and tap the plate strongly against paper towel.
10. Add **100 µl** of Substrate Solution into each well. Avoid exposing the microtiter plate to direct sunlight. Covering the plate with e.g. aluminium foil is recommended.
11. Incubate the plate for **10 minutes** at room temperature. The incubation time may be extended [up to 20 minutes] if the reaction temperature is below than 20°C. Do not shake the plate during the incubation.
12. Stop the colour development by adding **100 µl** of Stop Solution.
13. Determine the absorbance of each well using a microplate reader set to 450 nm, preferably with the reference wavelength set to 630 nm (acceptable range: 550 – 650 nm). Subtract readings at 630 nm (550 - 650 nm) from the readings at 450 nm. **The absorbance should be read within 5 minutes following step 12.**

Note: If some samples and standard/s have absorbances above the upper limit of your microplate reader, perform a second reading at 405 nm. A new standard curve, constructed using the values measured at 405 nm, is used to determine clusterin concentration of off-scale standards and samples. The readings at 405 nm should not replace the readings for samples that were “in range” at 450 nm.

Note 2: Manual washing: Aspirate wells and pipet 0.35 ml Wash Solution into each well. Aspirate wells and repeat four times. After final wash, invert and tap the plate strongly against paper towel. Make certain that Wash Solution has been removed entirely.

	strip 1+2	strip 3+4	strip 5+6	strip 7+8	strip 9+10	strip 11+12
A	Standard 160	Blank	Sample 8	Sample 16	Sample 24	Sample 32
B	Standard 80	Sample 1	Sample 9	Sample 17	Sample 25	Sample 33
C	Standard 40	Sample 2	Sample 10	Sample 18	Sample 26	Sample 34
D	Standard 20	Sample 3	Sample 11	Sample 19	Sample 27	Sample 35
E	Standard 10	Sample 4	Sample 12	Sample 20	Sample 28	Sample 36
F	Standard 5	Sample 5	Sample 13	Sample 21	Sample 29	Sample 37
G	QC HIGH	Sample 6	Sample 14	Sample 22	Sample 30	Sample 38
H	QC LOW	Sample 7	Sample 15	Sample 23	Sample 31	Sample 39

Figure 1: Example of a work sheet.

12. CALCULATIONS

Most microplate readers perform automatic calculations of analyte concentration. The standard curve is constructed by plotting the mean absorbance (Y) of Standards against the known concentration (X) of Standards in logarithmic scale, using the four-parameter algorithm. Results are reported as concentration of clusterin ng/ml in samples.

Alternatively, the logit log function can be used to linearize the standard curve, i.e. logit of the mean absorbance (Y) is plotted against log of the known concentration (X) of Standards.

The measured concentration of samples calculated from the standard curve must be multiplied by their respective dilution factor, because samples have been diluted prior to the assay, e.g. 20 ng/ml (from standard curve) x 3 000 (dilution factor) = 60 000 ng/ml = 60 µg/ml.

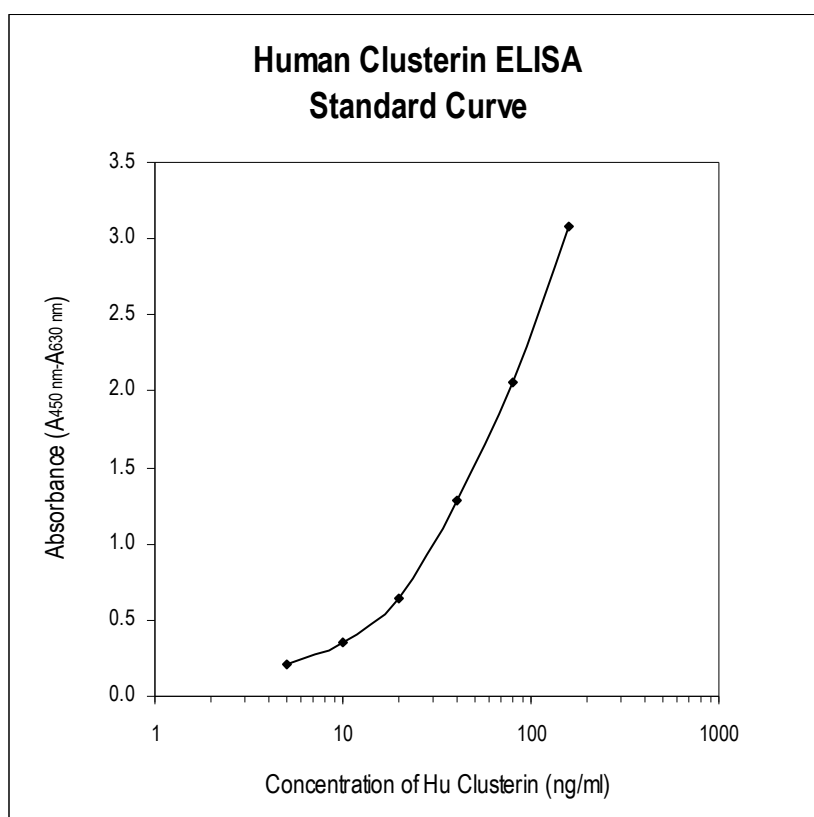


Figure 2: Typical Standard Curve for Human Clusterin ELISA.

13. PERFORMANCE CHARACTERISTICS

» Typical analytical data of BioVendor Human Clusterin ELISA are presented in this chapter

- **Sensitivity**

Limit of Detection (LOD) (defined as concentration of analyte giving absorbance higher than mean absorbance of blank* plus three standard deviations of the absorbance of blank: $A_{\text{blank}} + 3 \times \text{SD}_{\text{blank}}$) is calculated from the real human clusterin values in wells and is 0.5 ng/ml.

*Dilution Buffer is pipetted into blank wells.

- **Limit of assay**

Results exceeding clusterin level of 160 ng/ml should be repeated with more diluted samples. Dilution factor needs to be taken into consideration in calculating the clusterin concentration.

Results from assaying of urine samples exceeding clusterin level of 40 ng/ml should be repeated with more diluted urine samples for correct values. Dilution factor needs to be taken into consideration in calculating the clusterin concentration.

- **Specificity**

The antibodies used in this ELISA are specific for human clusterin.

Sera of several mammalian species were measured in the assay. See results below.

For details please contact us at info@biovendor.com.

<i>Mammalian serum sample</i>	<i>Observed crossreactivity</i>
Bovine	no
Cat	no
Dog	no
Goat	no
Hamster	no
Horse	no
Monkey	yes
Mouse	no
Pig	no
Rabbit	no
Rat	no
Sheep	no

➤➤ **Presented results are multiplied by respective dilution factor**

• **Precision**

Intra-assay (Within-Run) (n=8)

<i>Sample</i>	<i>Mean ($\mu\text{g/ml}$)</i>	<i>SD ($\mu\text{g/ml}$)</i>	<i>CV (%)</i>
1	68.0	4.8	7.0
2	103.6	5.6	5.4

Inter-assay (Run-to-Run) (n=8)

<i>Sample</i>	<i>Mean ($\mu\text{g/ml}$)</i>	<i>SD ($\mu\text{g/ml}$)</i>	<i>CV (%)</i>
1	62.4	5.3	8.5
2	95.8	6.7	7.0

• **Spiking Recovery**

Serum samples were spiked with different amounts of clusterin and assayed.

<i>Sample</i>	<i>Observed ($\mu\text{g/ml}$)</i>	<i>Expected ($\mu\text{g/ml}$)</i>	<i>Recovery O/E (%)</i>
1	59.2	-	-
	139.6	139.2	100.3
	104.0	99.2	104.8
	81.6	79.2	103.0
2	75.6	-	-
	319.2	315.6	101.1
	196.8	195.6	100.6
	145.0	135.6	106.9

• **Linearity**

Serum samples were serially diluted with Dilution Buffer and assayed.

<i>Sample</i>	<i>Dilution</i>	<i>Observed ($\mu\text{g/ml}$)</i>	<i>Expected ($\mu\text{g/ml}$)</i>	<i>Recovery O/E (%)</i>
1	-	79.3	-	-
	2x	41.8	39.7	105.4
	4x	20.9	19.8	105.4
	8x	10.4	9.9	104.9
2	-	141.4	-	-
	2x	68.6	70.7	97.0
	4x	32.2	35.4	91.1
	8x	15.2	17.7	86.0

- **Effect of sample matrix**

Heparin, citrate and EDTA plasmas were compared to respective serum samples from the same 10 individuals. Results are shown below:

Volunteer No.	Serum ($\mu\text{g/ml}$)	Plasma ($\mu\text{g/ml}$)		
		EDTA	Citrate	Heparin
1	140.4	177.5	108.9	129.7
2	127.7	179.2	113.0	104.9
3	126.8	170.5	106.0	107.8
4	113.4	157.6	96.3	92.5
5	130.8	166.2	108.5	113.1
6	85.5	109.8	57.3	74.3
7	82.4	126.7	73.7	86.3
8	85.3	114.8	64.1	74.0
9	88.0	109.3	59.2	82.7
10	89.4	149.1	79.1	74.4
Mean ($\mu\text{g/ml}$)	107.0	146.1	86.6	94.0
Mean Plasma/Serum (%)	-	136.6	81.0	87.8
Coefficient of determination R^2	-	0.83	0.89	0.89

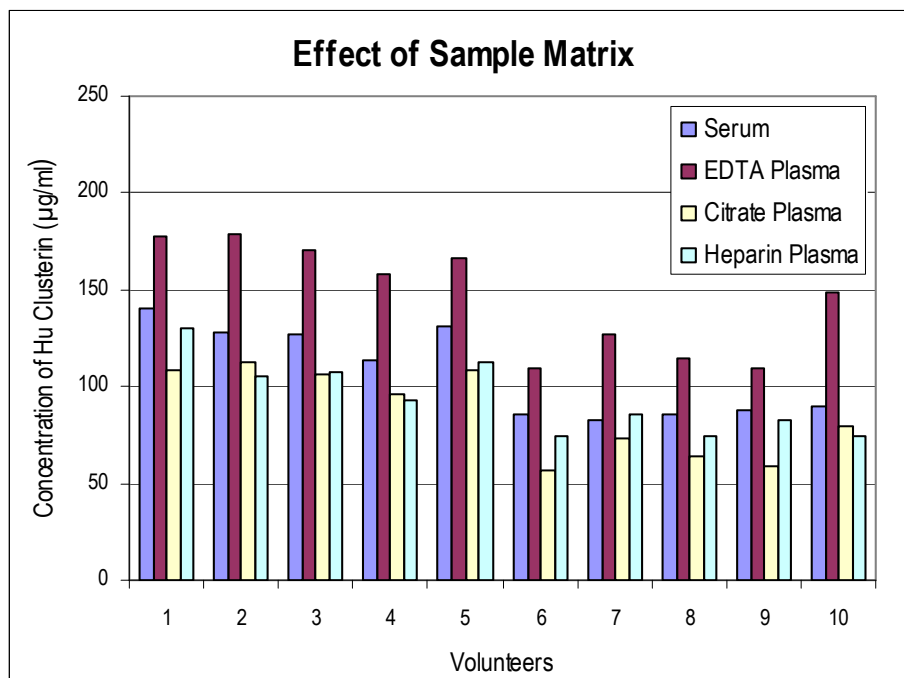


Figure 3: Clusterin levels measured using Human Clusterin ELISA from 10 individuals using serum, heparin, citrate and EDTA plasma, respectively.

- **Stability of samples stored at 2-8°C**

Samples should be stored at -20°C. However, no decline in concentration of clusterin was observed in serum and plasma samples after 7 days when stored at 2-8°C. To avoid microbial contamination, samples were treated with ϵ -aminocaproic acid and sodium azide, resulting in the final concentration of 0.03% and 0.1%, respectively.

Sample	Incubation Temp, Period	Serum ($\mu\text{g/ml}$)	Plasma ($\mu\text{g/ml}$)		
			EDTA	Citrate	Heparin
1	-20°C	99.6	199.4	72.9	89.6
	2-8°C, 1 day	68.2	189.9	63.8	104.0
	2-8°C, 7 days	72.6	209.7	65.1	158.1
2	-20°C	71.6	188.0	48.6	58.9
	2-8°C, 1 day	101.7	178.8	63.0	81.3
	2-8°C, 7 days	102.3	235.5	84.6	99.0
3	-20°C	71.9	155.6	54.0	72.5
	2-8°C, 1 day	62.4	165.5	54.6	87.1
	2-8°C, 7 days	75.1	137.0	58.7	97.4

- **Effect of Freezing/Thawing**

No decline was observed in concentration of human clusterin in serum and plasma samples after repeated (5x) freeze/thaw cycles. However it is recommended to avoid unnecessary repeated freezing/thawing of the samples.

Sample	Number of f/t cycles	Serum ($\mu\text{g/ml}$)	Plasma ($\mu\text{g/ml}$)		
			EDTA	Citrate	Heparin
1	1x	104.7	145.7	58.1	89.0
	3x	91.1	166.2	58.3	73.2
	5x	96.3	186.2	64.2	89.7
2	1x	78.2	145.7	51.2	56.6
	3x	95.2	149.5	57.3	87.4
	5x	84.1	186.6	56.1	72.9
3	1x	102.5	168.9	60.9	85.7
	3x	99.3	209.0	71.3	80.3
	5x	108.8	208.9	56.0	113.6

14. DEFINITION OF THE STANDARD

Standard in this assay is human serum based native clusterin. Native clusterin is 75-80 kDa heterodimeric glycoprotein. 1ng/ml of human serum based standard corresponds to 1ng/ml of recombinant human clusterin which was used in previous Biovendor Clusterin ELISA.

15. PRELIMINARY POPULATION AND CLINICAL DATA

The following results were obtained when serum samples from 200 unselected donors (100 female + 100 male) 4-80 years old were assayed with the Biovendor Human Clusterin ELISA in our laboratory.

- **Normal value**

Population Mean (mean +/- SEM): 95.0 +/- 1.5 µg/ml

Normal Range (mean +/- 2SD): 95.0 +/- 42.2 µg/ml

- **Reference range**

The data quoted in these instructions should be used for guidance only. It is recommended that each laboratory include its own panel of control sample in the assay. Each laboratory should establish its own normal and pathological references ranges for clusterin levels with the assay.

- **Age and sex dependent distribution of clusterin**

Sex	Age years	n	Mean	SD	Min.	Max.
			Clusterin (µg/ml)			
Men	4-19	17	89.9	16.4	62.5	106.5
	20-29	20	88.6	19.8	52.5	132.5
	30-39	15	96.6	21.6	56.0	147.0
	40-49	15	91.9	20.9	67.5	131.5
	50-59	15	88.1	15.4	64.0	107.0
	60-80	18	97.8	20.7	71.5	135.0
Women	3-19	17	93.0	23.0	64.0	157.5
	20-29	20	97.2	14.8	51.5	113.0
	30-39	15	99.6	17.5	64.5	133.5
	40-49	15	108.1	22.4	80.5	164.0
	50-59	16	95.2	25.9	59.0	127.5
	60-80	17	94.9	35.0	54.0	164.5

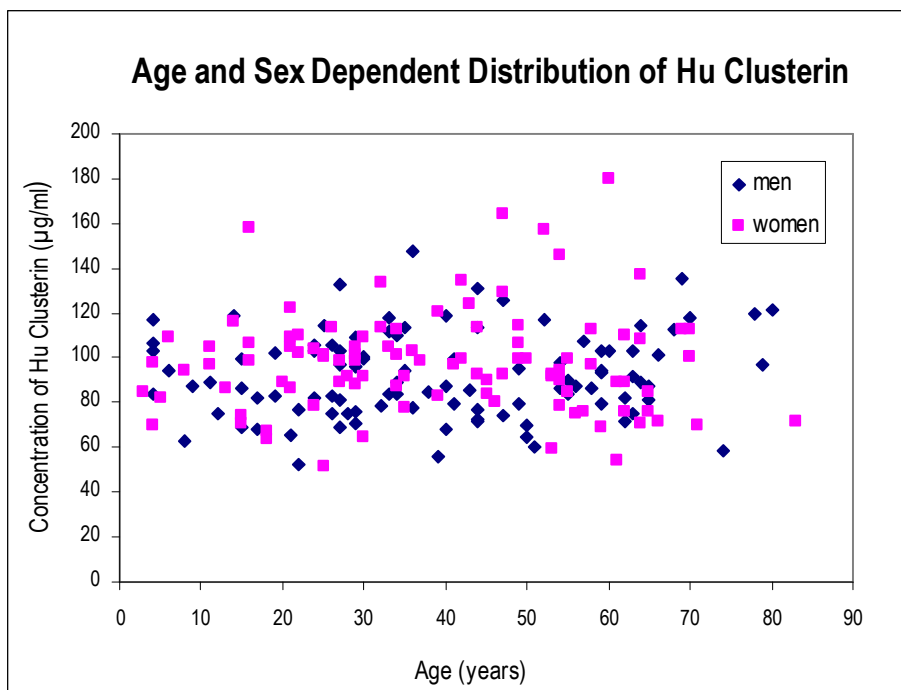


Figure 4: Clusterin concentration plotted against donor age.

16. METHOD COMPARISON

BioVendor Human Clusterin ELISA has not been compared to any other immunoassay.

17. TROUBLESHOOTING AND FAQs

»» Weak signal in all wells

Possible explanations:

- Omission of a reagent or a step
- Improper preparation or storage of a reagent
- Assay performed before reagents were allowed to come to room temperature
- Improper wavelength when reading absorbance

»» High signal and background in all wells

Possible explanations:

- Improper or inadequate washing
- Overdeveloping; incubation time with Substrate Solution should be decreased before addition of Stop Solution
- Incubation temperature over 30°C

»» High coefficient of variation (CV)

Possible explanation:

- Improper or inadequate washing
- Improper mixing Standards, Quality Controls or samples

18. REFERENCES

»» References to clusterin:

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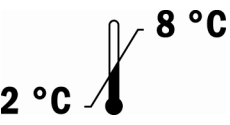

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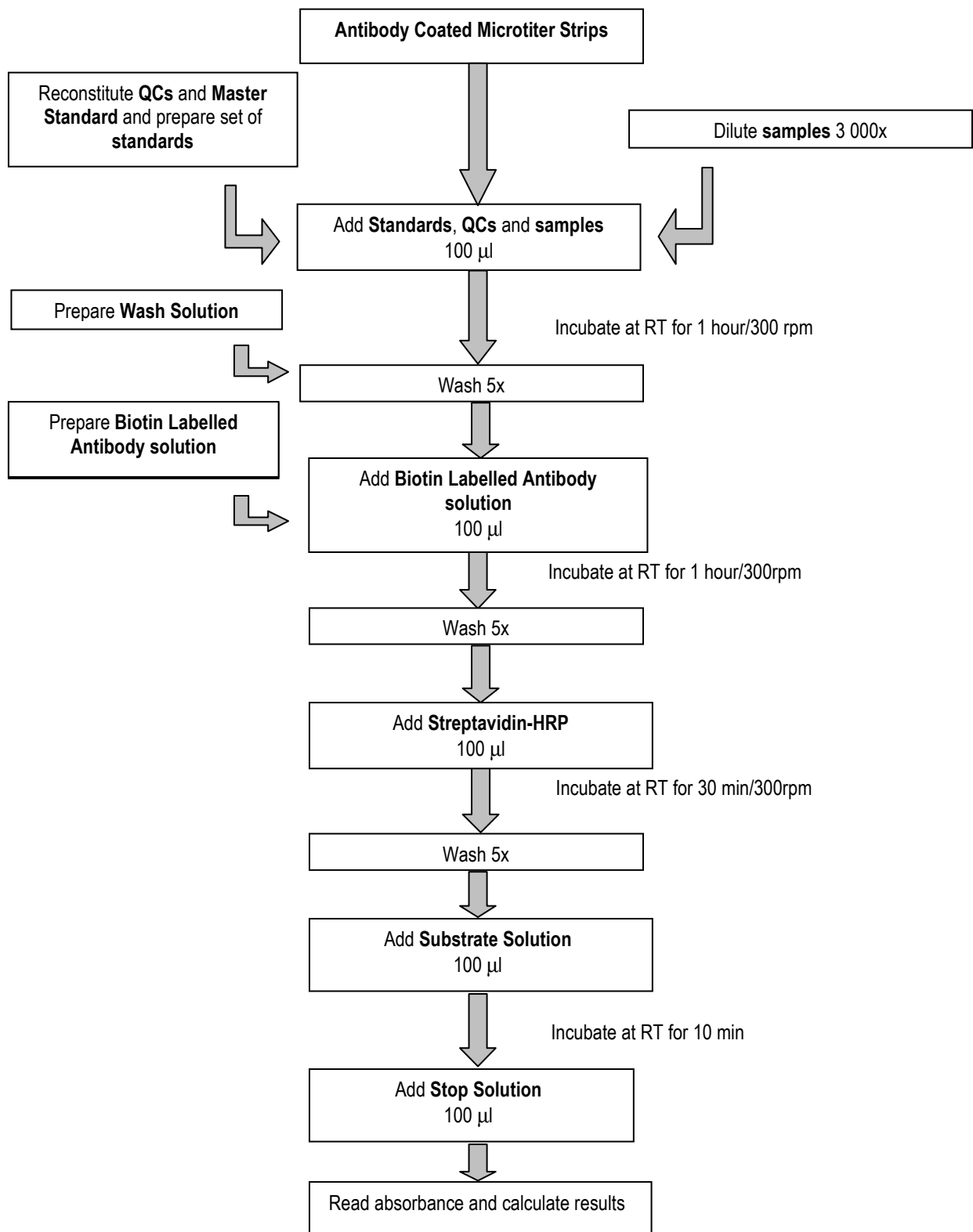
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»» For more references on this product see our WebPages at www.biovendor.com

19. EXPLANATION OF SYMBOLS

	Catalogue number
	Content
	Lot number
	See instructions for use
	Biological hazard
	Expiry date
	Storage conditions
	Identification of packaging materials

Assay Procedure Summary



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NOTES





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