

Human alpha1-Antitrypsin ELISA Kit



Instruction Manual

PromoKine

Contents

Intended Use	3
Introduction	3
Material Supplied	5
Material Required but not Supplied	5
Preparation and Storage of Reagents	6
Sample Preparation	7
Assay Procedure	10
Results	12
Limitations	13
Quality Control	13
Performance Characteristics	14
Precautions	17
Technical Hints	17
General Notes on the Test and Test Procedure	18
References	18
Ordering Information	20

Intended Use

The described Enzyme-Linked-Immuno-Sorbent-Assay (ELISA) is intended for the quantitative determination of α -1-Antitrypsin in serum, plasma, and stool. **It is for research use only.**

Introduction

Intestinal protein loss is a serious consequence of various systemic or local gastrointestinal diseases (e. g. allergies, chronic inflammation, malignancies). These pathologies damage the mucosal integrity and/or cause lymphostasis, thereby leading to an increased transfer of plasma proteins into the bowel lumen. Subsequently, hypoproteinemia accompanied with edema may develop. This condition is diagnosed by exclusion of other sources of protein loss and by proof of an elevated α 1-antitrypsin concentration in stool.

In serum, α 1-antitrypsin represents the majority of serine protease inhibitors and protects tissues from protease damages during inflammation. The protein is synthesized primarily in the liver but also to a small extent in intestinal macrophages, monocytes, and intestinal epithelial cells. Since α 1-antitrypsin is relatively resistant against enzymatic digestion, the secreted amount in stool reflects the internal concentration of the protein. An elevated α 1-antitrypsin stool concentration is therefore a widely recognized marker for intestinal protein loss and for an increased mucosal permeability.

In clinical routine, the α 1-antitrypsin clearance (ratio of the α 1-antitrypsin ELISA values of stool and serum samples) has been established along with the sole determination of the 24h α 1-antitrypsin secretion in stool. Thus the group of J. S. Fordtran reports that the sole determination of of the α 1-antitrypsin concentration in stool yielded false positive or false negative results in 21 % of the patients compared to the α 1-antitrypsin clearance measurement (Strygler et al. 1990).

The analytical quality of PromoKine's α 1-antitrypsin ELISA surpasses by far the conventional radial immunodiffusion (RID) technique in the determination of serum, stool and tissue culture supernatants. In direct comparison, the concentrations measured with the ELISA were approximately 30 % above the corresponding RID levels. Cell culture

supernatants of an intestinal cell line as well as fecal samples of lymphostasis patients yielded negative results with RID. Our ELISA could detect α 1-antitrypsin in all of these samples, in some of them even in very high concentrations.

These results clearly prove that the α 1-antitrypsin ELISA is far more sensitive than the conventional method and that it recognizes not only hepatic but also enteral α 1-antitrypsin. The discrepancy of both methods and hence the superiority of the ELISA to RID is especially striking in the analysis of extremely high enteral protein losses.

The combination of two specific antibodies in our α 1-antitrypsin ELISA widely excludes the possibility of false negative results thereby enabling a reliable determination of enteral protein loss.

Indications

- Suspected enteric protein loss
- Crohn's disease
- Necrotic enterocolitis
- Chronic mesenteric ischemia
- Viral, bacterial, allergic, or autoimmune-induced gastrointestinal inflammation

Material Supplied

Content	Kit Components	Quantity
PLATE	One holder with precoated strips	12 x 8 wells
WASHBUF	ELISA wash concentrate 10x	2 x 100 ml
SAMPLEBUF	Sample buffer, ready-to-use	2 x 70 ml
CONJ	Conjugate, (goat anti α -1-antitrypsin, peroxidase-labelled)	200 μ l
STD	Standards, lyophilized (0; 3.3; 10; 30; 90 μ g/l)*	2 x 5 vials
CTRL1	Control, ready-to-use	1 vial
CTRL2	Control, ready-to-use	1 vial
SUB	TMB substrate (Tetramethylbenzidine), ready-to-use	1 x 15 ml
STOP	ELISA stop solution, ready-to-use	1 x 15 ml
IDK Extract [®]	Extraction Buffer Concentrate, IDK Extract [®] 2.5x	2 x 100 ml

*The used standards have been calibrated on the WHO reference material CRM 470.

Material Required but not Supplied

- Ultra-pure water*
- Laboratory balance
- Precision pipettors and disposable tips to deliver 10-1000 μ l
- Foil to cover the microtiter plate
- Horizontal microtiter plate shaker
- A multi-channel dispenser or repeating dispenser
- Centrifuge capable of 3000 x g
- Vortex-Mixer

- Standard laboratory glass or plastic vials, cups, etc.
- Microtiter plate reader at 450 nm (reference wave length 620 or 690 nm)

* We recommend the use of Ultra Pure Water (Water Type 1; ISO 3696), which is free of undissolved and colloidal ions and organic molecules (free of particles > 0.2 µm) with an electrical conductivity of 0.055 µS/cm at 25 °C (≥ 18.2 MΩ cm).

Preparation and Storage of Reagents

- To run the assay more than once, ensure that reagents are stored at the conditions stated on the label. **Prepare only the appropriate amount necessary for each run.** The kit can be used up to 4 times within the expiry date stated on the label.
- Reagents with a volume less than **100 µl** should be centrifuged before use to avoid loss of volume.
- Preparation of the wash buffer:** The wash buffer concentrate (**WASHBUF**) has to be diluted with ultra pure water **1:10** before use (**100 ml WASHBUF + 900 ml ultra pure water**), mix well. Crystals could occur due to high salt concentration in the stock solutions. The crystals must be redissolved at room temperature or in a water bath at 37 °C before dilution of the buffer solutions. The WASHBUF is stable at 2–8 °C until the expiry date stated on the label. Wash buffer (1:10 diluted WASHBUF) can be stored in a closed flask at **2–8 °C for one month**.
- Preparation of the extraction buffer:** The extraction buffer concentrate IDK Extract® has to be diluted with ultra pure water **1:2.5** before use (**100 ml IDK Extract® + 150 ml ultra pure water**), mix well. Crystals could occur due to high salt concentration in the stock solutions. Before dilution, the crystals must be redissolved at 37°C in a water bath. The IDK Extract® is stable at 2–8 °C until the expiry date stated on the label. Extraction buffer (1:2.5 diluted IDK Extract®) can be stored in a closed flask at **2–8 °C for three months**.
- The lyophilized standards (**STD**) and controls (**CTRL**) are stable at 2–8 °C until the expiry date stated on the label. Before use, the standards and controls have to be reconstituted with **500 µl of ultra-pure water**. Allow the vial content to dissolve for 10 minutes

and mix thoroughly by gentle inversion to ensure complete reconstitution. **Reconstituted standards and controls can be stored at 2–8 °C for four weeks.**

- Preparation of the conjugate: Before use, the conjugate concentrate (**CONJ**) has to be diluted **1:101** in wash buffer (**100 µl CONJ + 10 ml wash buffer**). The CONJ is stable at 2–8 °C until expiry date stated on the label. **Conjugate (1:101 diluted CONJ) is not stable and cannot be stored.**
- All other test reagents are ready to use. Test reagents are stable until the expiry date (see label of test package) when stored at **2–8 °C**.

Storage and Preparation of Samples

Storage

Stool samples

The sample stability is as follows:

Raw stool: 3 days at room temperature (15–30 °C), 3 days at 2–8 °C or at least 4 weeks at -20 °C

Stool extracts: 9 days at room temperature, 2–8 °C or -20 °C, maximum 3 freeze/thaw cycles

Serum and plasma samples

Fresh collected blood should be centrifuged within one hour. Store samples at -20 °C if not assayed on the same day. Lipemic or hemolytic samples may give erroneous results. Samples should be mixed well before assaying.

Extraction of the stool samples

Extraction buffer (1:2.5 diluted IDK Extract®) is used as a sample extraction buffer.

We recommend the following sample preparation:

Stool Sample Application System (SAS) (available at Immundiagnostik, Germany)

Stool sample tube – Instructions for use

Please note that the dilution factor of the final stool suspension depends on the amount of stool sample used and the volume of the buffer.

SAS with 1.5 ml extraction buffer:

Applied amount of stool: 15 mg

Buffer Volume: 1.5 ml

Dilution Factor: 1:100

Please follow the instructions for the preparation of stool samples using the SAS as follows:

- a) The raw stool sample has to be thawed. For particularly heterogeneous samples we recommend a mechanical homogenisation using an applicator, inoculation loop or similar device.
- b) **Fill the empty sample tube** with **1.5 ml** of ready to use IDK Extract® extraction buffer before using it with the sample. Important: Allow the extraction buffer to reach room temperature.
- c) Unscrew the tube (orange part of cap) to open. Insert the orange dipstick into the sample. The lower part of the dipstick has notches which need to be covered completely with stool after inserting it into the sample. Place dipstick back into the tube. When putting the stick back into the tube, excess material will be stripped off, leaving 15 mg of sample to be diluted. Screw tightly to close the tube.
- d) Shake the tube well until no stool sample remains in the notches. Important: Please make sure that you have a maximally homogenous suspension after shaking. Especially with more solid samples, soaking the sample in the tube with buffer for ~10 minutes improves the result.
- e) Allow sample to stand for ~10 minutes until sediment has settled. Floating material like shells of grains can be neglected.
- f) Carefully unscrew the complete cap of the tube including the blue ring plus the dipstick. Discard cap and dipstick. Make sure that the sediment will not be dispersed again.

Dilution I: 1:100

Dilution of samples

Stool samples

The supernatant of the sample preparation procedure (**dilution I**) is further diluted **1:250** in wash buffer. For example:

20 µl supernatant (dilution I) + **980 µl** wash buffer, mix well = **dilution II (1:50)**

200 µl dilution II + **800 µl** wash buffer, mix well = **dilution III (1:5)**

This results in a final dilution of **1:25,000**.

For analysis, pipet **100 µl of dilution III** per well.

Serum/plasma samples

Normal samples are diluted **1:40,000**. Samples from patients with Morbus Crohn etc. are diluted **1:250,000** and **1:1000,000**. Use the corresponding dilution factor to calculate the α 1-antitrypsin concentration.

1:40,000 dilution

For example:

- **10 µl** serum + 990 µl SAMPLEBUF (sample buffer), mix well = **1:100 (dilution Ia)**
- **100 µl** dilution Ia + 900 µl SAMPLEBUF (sample buffer), mix well = **1:10 (dilution IIa)**
- **25 µl** dilution IIa + 975 µl SAMPLEBUF (sample buffer), mix well = **1:40 (dilution IIIa)**.
- This results in a final dilution of **1:40,000**.

1:250,000 dilution

For example:

- **10 µl** serum + 990 µl SAMPLEBUF (sample buffer), mix well = **1:100 (dilution Ib)**
- **10 µl** dilution Ib + 990 µl SAMPLEBUF (sample buffer), mix well = **1:10 (dilution IIb)**

- **20 µl** dilution IIb + 480 µl SAMPLEBUF (sample buffer), mix well = **1:40 (dilution IIIb)**.
- This results in a final dilution of **1:250,000**.
- For analysis, pipet **100 µl** of the final dilution step (IIIa/IIIb) per well.

Assay Procedure

Principle of the Test

The assay utilizes the sandwich technique with two selected polyclonal antibodies that bind to human α 1-antitrypsin. Standards, controls and prediluted samples which are assayed for human α 1-antitrypsin are added into the wells of a micro plate coated with a high affine polyclonal anti-human α 1-antitrypsin antibody. During the first incubation step, α 1-antitrypsin is bound by the immobilized antibody. Then a peroxidase-conjugated polyclonal anti-human α 1-antitrypsin antibody is added into each microtiter well and a sandwich of capture antibody – human α 1-antitrypsin – peroxidase-conjugate is formed. Tetramethylbenzidine (TMB) is used as peroxidase substrate. Finally, an acidic stop solution is added to terminate the reaction. The colour changes from blue to yellow. The intensity of the yellow colour is directly proportional to the concentration of α 1-antitrypsin. A dose response curve of the absorbance unit (optical density, OD at 450 nm) vs. concentration is generated, using the values obtained from the standard. α 1-antitrypsin present in the samples is determined directly from this curve.

1. **Bring all reagents and samples to room temperature (15–30 °C) and mix well.**
2. Take as many microtiter strips as needed from kit. Store unused strips covered at 2–8 ° C. Strips are stable until expiry date stated on the label.
3. Mark the positions of **STD** (Standard) **SAMPLE** (Sample) **CTRL** (Controls) on a protocol sheet.
4. For automated ELISA processors, the given protocol may need to be adjusted according to the specific features of the respective automated platform. For further details please contact us.

5. We recommend to carry out the tests in duplicate.

1.	Wash each well 5 times by dispensing 250 µl wash buffer into each well. After the final washing step, remove residual buffer by tapping the plate on absorbent paper.
2.	Add 100 µl of STD (standard), SAMPLE (sample) and CTRL (controls) into respective well.
3.	Cover the plate tightly and incubate for 1 hour at room temperature (15–30 °C) on a horizontal shaker.
4.	Discard the contents of each well. Wash each well 5 times by dispensing 250 µl wash buffer into each well. After the final washing step remove residual buffer by tapping the plate on absorbent paper.
5.	Add 100 µl conjugate into each well.
6.	Cover the plate tightly and incubate for 1 hour at room temperature (15–30 °C) on a horizontal shaker.
7.	Discard the contents of each well. Wash each well 5 times by dispensing 250 µl wash buffer into each well. After the final washing step remove residual buffer by tapping the plate on absorbent paper.
8.	Add 100 µl of SUB (TMB substrate) into each well.
9.	Incubate for 10–20 minutes at room temperature (15–30 °C) in the dark*.
10.	Add 100 µl of STOP (stop solution) into each well, mix thoroughly.
11.	Determine absorption immediately with an ELISA reader at 450 nm against 620 nm (or 690 nm) as a reference. If no reference wavelength is available, read only at 450 nm. If the extinction of the highest standard exceeds the range of the photometer, absorption must be measured immediately at 405 nm against 620 nm as a reference.

*The intensity of the colour change is temperature sensitive. We recommend to observe the colour change and stopping the reaction upon good differentiation.

Results

The following algorithms can be used alternatively to calculate the results. We recommend using the "4-Parameter-algorithm".

1. 4-Parameter-algorithm

It is recommended to use a linear ordinate for the optical density and a logarithmic abscissa for the concentration. When using a logarithmic abscissa, the zero standard must be specified with a value less than 1 (e. g. 0.001).

2. Point-to-point-calculation

We recommend a linear ordinate for the optical density and a linear abscissa for the concentration.

3. Spline-algorithm

We recommend a linear ordinate for the optical density and a linear abscissa for the concentration. When using a logarithmic abscissa, the zero calibrator must be specified with a value less than 1 (e. g. 0.001).

The plausibility of the pairs of values should be examined before the automatic evaluation of the results. If this option is not available with the program used, the duplicate values should be evaluated manually.

Stool samples

Multiply the obtained results by the dilution factor of **25,000** to get the real concentration.

In case another dilution factor has been used, multiply the obtained result with the dilution factor used.

Serum and plasma samples

For the calculation of the α 1-antitrypsin concentration in serum and plasma samples, the result must be multiplied by **40,000 or 250,000** and **additionally by a factor of 3** for each sample.

In case **another dilution factor** has been used, multiply the obtained result with the dilution factor used.

Clearance

Use the following formula to calculate the clearance:

$$\text{Clearance (ml/day)} = (V * F) / S$$

V = volume of faeces in ml/day, mean value from 3 days (1 ml stool=1 g)

F = mean faeces α 1-antitrypsin concentration from 3 days, calculated from the standard curve and multiplied by the dilution factor (μ g/l or mg/dl)

S = mean serum α 1-antitrypsin concentration from 3 days (mg/dl), calculated from the standard curve and multiplied by the dilution factor (μ g/l or mg/dl)

Limitations

Samples with concentrations above the measurement range (see definition below) must be further diluted and re-assayed. Please consider this greater dilution when calculating the results.

Samples with concentrations lower than the measurement range (see definition below) cannot be clearly quantified.

The upper limit of the measurement range can be calculated as:
highest concentration of the standard curve \times sample dilution factor to be used

The lower limit of the measurement range can be calculated as:
detection limit \times sample dilution factor to be used

Quality Control

PromoCell recommends the use of external/commercial control samples for internal quality control if available.

Control samples should be analyzed with each run. Results, generated from the analysis of control samples, should be evaluated for acceptability using appropriate statistical methods. The results for the patient samples may not be valid, if within the same assay one or more values of the quality control sample are outside the acceptable limits.

Reference range

Based on studies of stool samples of apparently healthy persons (n = 76) the following reference range was estimated:

α -1-Antitrypsin-Clearance : < 27.5 ml/day
 Cut off-value: < 26.8 ml/dl
 α -1-Antitrypsin concentration (serum and plasma): 90 - 180 mg/dl*

*(L. Thomas 5. edition; Labor und Diagnose)

These normal ranges should be used as a guideline only. It is recommended that each laboratory establishes an own expected range for its patient population.

Performance Characteristics

Precision and Reproducibility

Intra-Assay-Variation

The precision (intra-assay variation) of the PromoKine α -1-Antitrypsin ELISA test was calculated from 20 replicate determinations on each one of two samples.

Intra-Assay (n= 20)

Sample	α -1-Antitrypsin mean value [mg/dl]	Intra-Assay CV [%]
1	15.2	4.5
2	42.2	13.1

Inter-Assay (n=20)

The total precision (inter-assay variation) of the PromoKine α -1-Antitrypsin ELISA test was calculated from data on 2 samples obtained in 20 different assays by three technicians on two different lots of reagents over a period of three months.

Inter-Assay (n= 20)

Sample	α -1-Antitrypsin mean value [mg/dl]	Inter-Assay CV [%]
1	16.15	9.8
2	54.46	14.8

Analytical Sensitivity

The detection limit was set as B0 + 2 SD. The Zero-standard was measured 20 times. The values were estimated in relation to the concentration of the calibration curve and resulted in a detection limit of 0.72 μ g/l without consideration of the sample dilution factor.

Specificity

No cross reactivity with other plasma proteins in stool was observed. No cross reactivity with alpha-1-antitrypsin in mouse serum was observed.

Spiking Recovery

Two samples were spiked with different α -1-antitrypsin calibrator amounts and measured with the assay.

Unspiked Sample [$\mu\text{g/l}$]	Spike [$\mu\text{g/l}$]	α -1-Antitrypsin expected [$\mu\text{g/l}$]	α -1-Antitrypsin measured [$\mu\text{g/l}$]
6.3	1.65	7.95	7.2
6.3	5	11.3	11.4
6.3	15	21.3	20.9
6.3	45	51.3	46.7
5.6	1.65	7.3	7.0
5.6	5	10.6	10.9
5.6	15	20.6	17.5
5.6	45	50.6	46.7

Linearity

Two patient serum samples were diluted with wash buffer. The results are shown below (n= 2):

Sample	Dilution	Expected [mg/dl]	Measured [mg/dl]
A	1:12,500	48	48.88
	1:25,000	24.5	23.25
	1:50,000	12.3	11.9
	1:100,000	6.1	6
B	1:12,500	158.4	158.4
	1:25,000	79.3	99
	1:50,000	39.6	33
	1:100,000	19.8	22.1

Precautions

- For research use only.
- The quality control guidelines should be followed.
- Human material used in the kit components was tested and found to be negative for HIV, Hepatitis B and Hepatitis C. However, for safety reasons, all kit components should be treated as potentially infectious.
- Reagents of the kit package contain sodium azide or ProClin as bactericides. Sodium azide and ProClin are toxic. The substrates for the enzymatic colour reactions are toxic and carcinogenic. Avoid contact with skin or mucous membranes.
- Stop solution is composed of sulphuric acid, which is a strong acid. Even diluted, it still must be handled with care. It can cause acid burns and should be handled with gloves, eye protection, and appropriate protective clothing. Any spill should be wiped out immediately with copious quantities of water.

Technical Hints

- Do not interchange different lot numbers of any kit component within the same assay. Furthermore we recommend not assembling wells of different microtiter plates for analysis, even if they are of the same batch.
- Control samples should be analyzed with each run.
- Reagents should not be used beyond the expiration date shown on the kit label.
- Substrate solution should remain colourless until use.
- To ensure accurate results, proper adhesion of plate sealers during incubation steps is necessary.
- Avoid foaming when mixing reagents.
- Do not mix plugs and caps from different reagents.
- The assay should always be performed according the enclosed manual.

General Notes on the Test and Test Procedure

- All reagents in the kit package are for research use only.
- Incubation time, incubation temperature and pipetting volumes of the components are defined by the producer. Any variation of the test procedure, which is not coordinated with the producer, may influence the results of the test. PromoCell can therefore not be held responsible for any damage resulting from wrong use.
- Warranty claims and complaints in respect of deficiencies must be lodged within 14 days after receipt of the product. The product should be send to PromoCell together with a written complaint.

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Ordering Information

Product Name	Product Description	Size	Catalog Number
α 1-Antitrypsin ELISA Kit, human	Human alpha1-Antitrypsin (alpha1-Proteinase Inhibitor) ELISA Kit	96 Tests	PK-EL-K6750

***For in vitro research use only.
Not for diagnostic or therapeutic procedures.***

PromoCell GmbH

Sickingenstr. 63/65
69126 Heidelberg
Germany

North America

Phone: 1 – 866 – 251 – 2860 (toll free)
Fax: 1 – 866 – 827 – 9219 (toll free)

Deutschland

Telefon: 0800 – 776 66 23 (gebührenfrei)
Fax: 0800 – 100 83 06 (gebührenfrei)

France

Téléphone: 0800 90 93 32 (ligne verte)
Téléfax: 0800 90 27 36 (ligne verte)

United Kingdom

Phone: 0800 – 96 03 33 (toll free)
Fax: 0800 – 169 85 54 (toll free)

Other Countries

Phone: +49 6221 – 649 34 0
Fax: +49 6221 – 649 34 40

Email: info@promokine.info