



ELISA PRODUCT INFORMATION & MANUAL

Human TNF-alpha ELISA Kit (Colorimetric) *NBP1-83741*

Enzyme-linked Immunosorbent Assay for quantitative detection. For research use only.

Not for diagnostic or therapeutic procedures.

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1 Intended Use

The human TNF alpha total ELISA is an enzyme-linked immunosorbent assay for the quantitative detection of human TNF alpha. **The human TNF alpha ELISA is for research use only. Not for diagnostic or therapeutic procedures.**

2 Summary

TNF alpha is a multifunctional cytokine involved in many different pathways, in homeostasis and pathophysiology of mammals. It can show opposing biological effects suggesting complex regulatory mechanisms.

TNF alpha, also known as cachectin, was first detected as a cytotoxic factor inducing lysis of certain tumor cells. The TNF alpha gene is member 2 of the TNF-superfamily (consisting of at least 20 distinct members).

TNF alpha release is mainly triggered by viral infections and endotoxins, lipopolysaccharides or other bacterial components, by tissue injury, DNA-damage and by IL-1, PDGF and TNF alpha itself. It is primarily expressed in macrophages, but also in monocytes, neutrophils, NK-cells, mast-cells, endothelial cells and activated lymphocytes. TNF alpha expression in endothelial cells and fibroblasts can be induced by IL-17. The expression of other cytokines, chemokines, reactive oxygen intermediates, nitric oxide and prostaglandins is stimulated by TNF alpha.

The initially membrane bound TNF alpha is enzymatically cleaved by TACE (= ADAM17). The soluble monomers aggregate to homotrimers and are secreted into blood and other biological fluids. The membrane bound and the soluble form are biologically active and bind to the TNF-receptors TNFR1 (= TNFRSF1A, p55-60) and TNFR2 (= TNFRSF1B, TNFBR2, p75-80).

Upon ligand binding, receptors form trimers leading to conformational changes, protein dissociation (SODD = silencer of death domains, BAG4, Bcl2-associated athanogene 4) and association (TRADD = TNF-R1 associated death domain protein) and yielding the following biological activities:

- transcription of anti-apoptotic factors and proteins involved in cell proliferation and inflammation via binding of TRAF2 (TNF-R associated

factor 2) and RIPK1 (TNF-R interacting serine-threonine kinase 1) and activation of the transcription factor NF kappa B.

- cell proliferation, differentiation but also apoptosis via TRAF2 binding, kinases activation, activation of c-Jun and ATF2 (JNK-MAPK-pathway).
- apoptosis via the binding of FADD (Fas associating protein with death domain) to TRADD and activation of caspases (including caspase 8 = FLICE).

- necrosis, a caspase independent cell death, mediated by NADPH oxidases, which form a complex with TRADD and RIPK1, leading to the generation of oxygen species.

TNF-R2 contains no DD (death domain), but exhibits its function via direct TRAF binding.

Thus the multiple biological functions of TNF alpha comprise cellular proliferation and differentiation, tumorigenesis, apoptotic or necrotic cell death (including certain tumor cell lines), immunoregulatory activities, lipid metabolism, coagulation and endothelial function. It promotes local or systemic inflammation (TNF alpha is a potent pyrogen) and stimulates the acute phase response. Very high expressions of TNF alpha after infection can lead to septic shock (TNF alpha is highly cytotoxic.), whereas sustained low levels induce cachexia and inflammation.

Dysregulation of TNF alpha is involved in many diseases:

Cancer: Diverse roles of TNF alpha in cancer have been described, depending on the tumor type, tumor microenvironment and on overall TNF alpha expression levels and expression kinetics. A model was proposed, in which single very high TNF alpha levels lead to tumor regression and that chronic low-dose levels are associated with tumor progression.

Systemic lupus erythematosus (SLE): Murine models of SLE show contradictory effects of TNF alpha: anti-autoimmune effect at low TNF alpha levels (TNF alpha administration leads to an attenuation of symptoms and TNF alpha blockade to generation of SLE-symptoms), pro-inflammatory effect at high TNF alpha levels (TNF alpha blockade damped the disease).

Chronic intestinal inflammation (Crohn's disease (CD), Inflammatory bowel disease (IBD), Ulcerative Colitis (UC)): An essential effect of TNF alpha/TNF-R1 activity on induction of chronic intestinal inflammation was shown. In IBD overexpression of TNF alpha in monocytes/macrophages of gut and intestinal tissue has been described.

Psoriasis: In psoriatic patients TNF alpha was shown to be increased systemically and in cutaneous tissue. TNF alpha expression in

peripheral blood mononuclear cells (PBMCs) was highly elevated in patients in active phase of the disease and elevated in chronic psoriasis. In an animal model it was shown that TNF alpha dependent activation of resident T cells was essential for Psoriasis development.

Pulmonary disorders (Cystic Fibrosis (CF), Asthma): In cystic fibrosis high levels of TNF alpha were observed. TNF alpha, is over-expressed in persistent severe asthma. In allergic asthma, under low antigen exposure, TNF alpha contributes to elevated histamine release. In a mouse model for asthma, airway inflammation was caused by TNF alpha mediated activation of phospholipase A2.

Rheumatoid arthritis (RA), Ankylosing spondylitis (AS): TNF alpha has stimulating effects on matrix degrading proteases (matrix metallo-proteinases, MMPs), tissue remodeling and osteoclasts, causing bone resorption leading to joint erosions. In a mouse model for RA, elevated levels of TNF alpha were observed in bone marrow. Cytokines, synthesized by TNF alpha activated synovial cells, were shown to induce RA. In AS patients, TNF alpha concentration was shown to be elevated in the sacroiliac joint.

Transplantation (Graft-versus-host disease, Allograft rejection):

Measurement of TNF alpha levels was shown to be useful in transplantation research. TNF alpha was reported to be markedly elevated in renal allograft rejection. Evidence has been presented on increased TNF alpha levels in Bone Marrow Transplants (BMT). BMT patients with major transplant related complications such as interstitial pneumonitis and severe acute graft-versus-host disease showed significantly increased TNF alpha levels.

Atherosclerosis, arterial calcification: Increased risk of recurrent myocardial infarction, atherosclerotic thickening of carotid intima-media, disturbances in triglyceride and glucose homeostasis and age-related atherosclerosis have been connected to circulating TNF alpha levels. TNF alpha induced mechanisms lead to increased aortic calcium accumulation in animals with type 2 diabetes mellitus.

Insulin Resistance (IR) and Obesity: In adipose tissue of rodent models for obesity and in adipose individuals increased TNF alpha expression was observed. In adipose tissue and in IR chronic low-grade inflammation was shown. Increased TNF alpha levels affect insulin pathway regulation.

Neurodegenerative diseases (Multiple sclerosis (MS), Alzheimer's Disease, Prion Disease, Parkinson): TNF alpha is produced from activated microglial cells and leads to neuronal degeneration, apoptosis of neuronal tissue and increased inflammation. TNF alpha

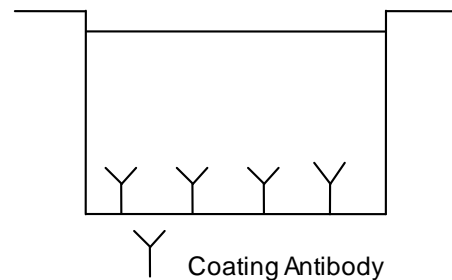
administration caused oligodendrocytes cell death - a symptom of MS
– in coculture with astrocytes and microglia.

3 Principles of the Test

An anti-human TNF alpha coating antibody is adsorbed onto microwells.

Figure 1

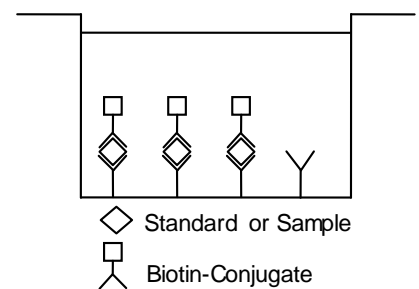
Coated Microwell



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

Figure 2

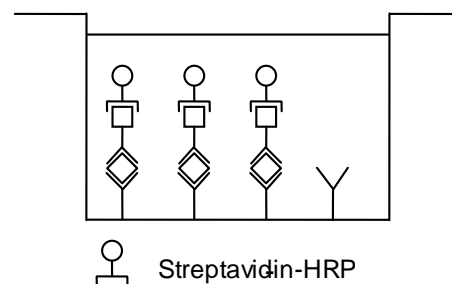
First Incubation



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

Figure 3

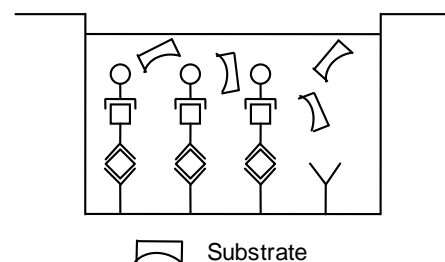
Second Incubation



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

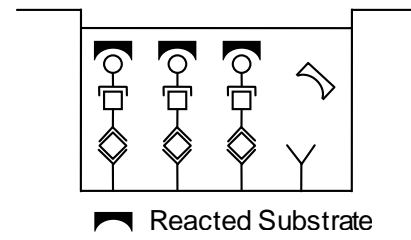
Figure 4

Third Incubation



A coloured product is formed in proportion to the amount of human TNF alpha 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 TNF alpha standard dilutions and human TNF alpha sample concentration determined.

Figure 5



4 Reagents Provided

4.1 Reagents for human TNF alpha total ELISA NBP1-83741 (96 Tests)

- 1 aluminium pouch with a **Microwell Plate coated** with monoclonal antibody to human TNF alpha
- 1 vial (70 µl) **Biotin-Conjugate** anti-human TNF alpha polyclonal antibody
- 1 vial (150 µl) **Streptavidin-HRP**
- 2 vials human TNF alpha **Standard** lyophilized, 3000 pg/ml upon reconstitution
- 1 vial (12 ml) **Sample Diluent**
- 1 vial (5 ml) **Assay Buffer Concentrate 20x**
(PBS with 1% Tween 20, 10% BSA)
- 1 bottle (50 ml) **Wash Buffer Concentrate 20x**
(PBS with 1% Tween 20)
- 1 vial (15 ml) **Substrate Solution** (tetramethyl-benzidine)
- 1 vial (15 ml) **Stop Solution** (1M Phosphoric acid)
- 4 **Adhesive Films**

4.2 Reagents for human TNF alpha total ELISA NBP1-83741 (10x96 tests)

- 10 aluminium pouches with a **Microwell Plate coated** with monoclonal antibody to human TNF alpha
- 10 vials (70 µl) **Biotin-Conjugate** anti-human TNF alpha polyclonal antibody
- 10 vials (150 µl) **Streptavidin-HRP**
- 10 vials human TNF alpha **Standard** lyophilized, 3000 pg/ml upon reconstitution
- 7 vials (12 ml) **Sample Diluent**
- 2 vials (5 ml) **Assay Buffer Concentrate 20x**
(PBS with 1% Tween 20, 10% BSA)
- 6 bottles (50 ml) **Wash Buffer Concentrate 20x**
(PBS with 1% Tween 20)
- 10 vials (15 ml) **Substrate Solution** (tetramethyl-benzidine)
- 1 vial (100 ml) **Stop Solution** (1M Phosphoric acid)
- 20 **Adhesive Films**

5 Storage Instructions – ELISA Kit

Store kit reagents between 2° and 8°C. Immediately after use remaining reagents should be returned to cold storage (2° to 8°C). 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.

6 Specimen Collection and Storage Instructions

Cell culture supernatant, serum and plasma (EDTA, citrate, heparin) were tested with this assay. Other biological samples 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.

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 TNF alpha. If samples are to be run within 24 hours, they may be stored at 2° to 8°C (for sample stability refer to 13.5).

Avoid repeated freeze-thaw cycles. Prior to assay, the frozen sample should be brought to room temperature slowly and mixed gently. Do not thaw samples in a 37°C water bath. Do not vortex or sharply agitate samples.

7 Materials Required But Not Provided

- 5 ml and 10 ml graduated pipettes
- 5 μ l to 1000 μ l adjustable single channel micropipettes with disposable tips
- 50 μ l to 300 μ l 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

8 Precautions for Use

- All chemicals 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 which 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.

9 Preparation of Reagents

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.

9.1 Wash Buffer (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.

Transfer to a clean wash bottle and store at 2° to 25°C. Please note that Wash Buffer (1x) is stable for 30 days.

Wash Buffer (1x) 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

9.2 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

9.3 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

9.4 Streptavidin-HRP

Please note that the Streptavidin-HRP should be used within 30 minutes after dilution.

Make a 1:100 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	0.06	5.94
1 - 12	0.12	11.88

9.5 Human TNF alpha total Standard

Reconstitute **human TNF alpha total 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 = 3000 pg/ml).

Allow the standard to reconstitute for 10-30 minutes. Mix well prior to making dilutions.

The standard has to be used immediately after reconstitution and cannot be stored.

Standard dilutions can be prepared directly on the microwell plate (see 10.c) or alternatively in tubes (see 9.5.1).

9.5.1 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 Sample Diluent into each tube.

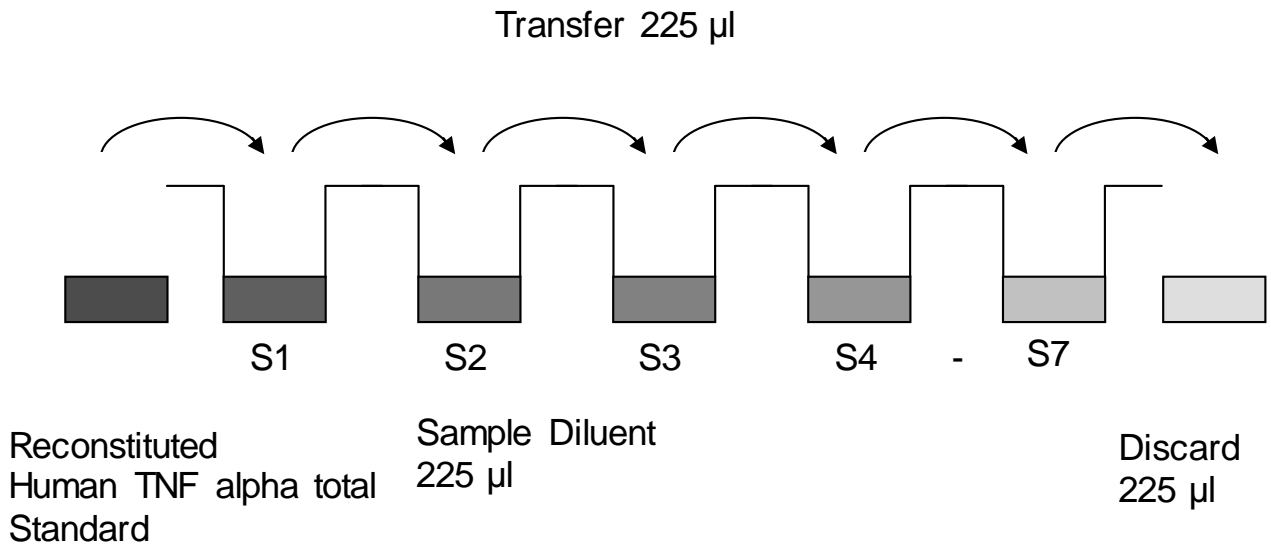
Pipette 225 μ l of reconstituted standard (concentration = 3000 pg/ml) into the first tube, labelled S1, and mix (concentration of standard 1 = 1500 pg/ml).

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).

Sample Diluent serves as blank.

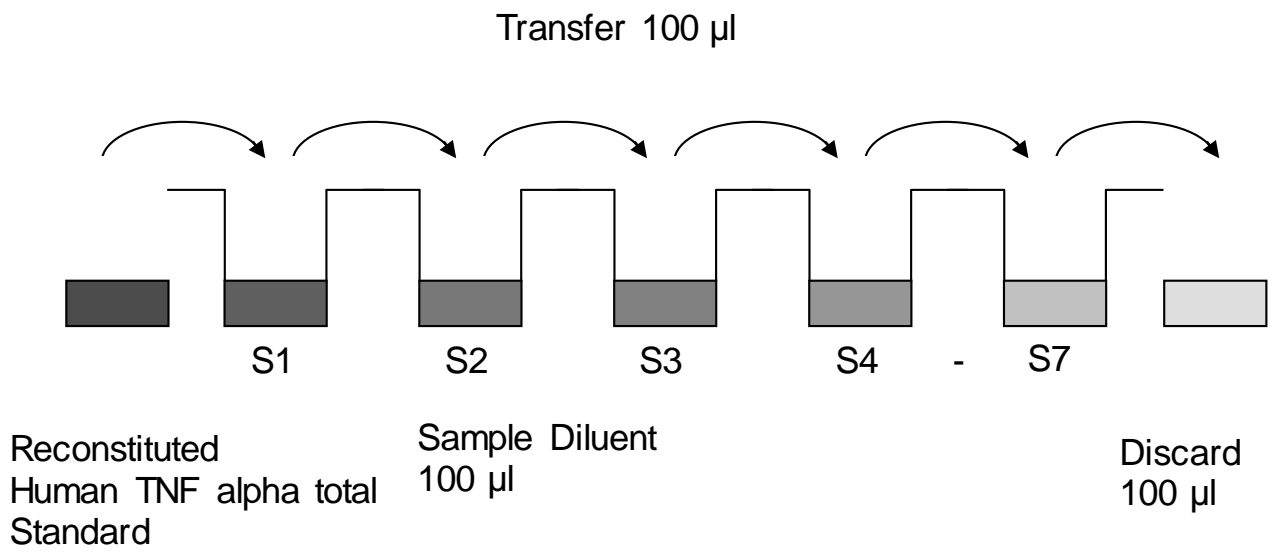
Figure 6



10 Test Protocol

- a. 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.
- b. 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.**
- c. **Standard dilution on the microwell plate** (Alternatively the standard dilution can be prepared in tubes - see 9.5.1):
Add 100 µl of Sample Diluent in duplicate to all **standard wells**.
Pipette 100 µl of prepared **standard** (see Preparation of Standard 9.5, concentration = 3000 pg/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 = 1500 pg/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 TNF alpha standard dilutions ranging from 1500.0 to 23 pg/ml. Discard 100 µl of the contents from the last microwells (G1, G2) used.

Figure 7



In case of an **external standard dilution** (see 9.5.1), pipette 100 µl of these standard dilutions (S1 - S7) in the standard wells according to Table 1.

Table 1

Table depicting an example of the arrangement of blanks, standards and samples in the microwell strips:

	1	2	3	4
A	Standard 1 (1500 pg/ml)	Standard 1 (1500 pg/ml)	Sample 1	Sample 1
B	Standard 2 (750 pg/ml)	Standard 2 (750 pg/ml)	Sample 2	Sample 2
C	Standard 3 (375 pg/ml)	Standard 3 (375 pg/ml)	Sample 3	Sample 3
D	Standard 4 (188 pg/ml)	Standard 4 (188 pg/ml)	Sample 4	Sample 4
E	Standard 5 (94 pg/ml)	Standard 5 (94 pg/ml)	Sample 5	Sample 5
F	Standard 6 (47 pg/ml)	Standard 6 (47 pg/ml)	Sample 6	Sample 6
G	Standard 7 (23 pg/ml)	Standard 7 (23 pg/ml)	Sample 7	Sample 7
H	Blank	Blank	Sample 8	Sample 8

- d. Add 100 µl of **Sample Diluent** in duplicate to the **blank wells**.
- e. Add 50 µl of **Sample Diluent** to the **sample wells**.
- f. Add 50 µl of each **sample** in duplicate to the **sample wells**.
- g. Prepare **Biotin-Conjugate** (see Preparation of Biotin-Conjugate 9.3).
- h. Add 50 µl of **Biotin-Conjugate** to all wells.
- i. 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 400 rpm.
- j. Prepare **Streptavidin-HRP** (refer to Preparation of Streptavidin-HRP 9.4).
- k. Remove adhesive film and empty wells. **Wash** microwell strips 6 times according to point b. of the test protocol. Proceed immediately to the next step.
- l. Add 100 µl of diluted **Streptavidin-HRP** to all wells, including the blank wells.
- m. 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 400 rpm.
- n. Remove adhesive film and empty wells. **Wash** microwell strips 6 times according to point b. of the test protocol. Proceed immediately to the next step.
- o. Pipette 100 µl of **TMB Substrate Solution** to all wells.
- p. 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 0.9 – 0.95.

- q. 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.
- r. 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.

11 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 TNF alpha 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 TNF alpha 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 TNF alpha concentration.
- **If instructions in this protocol have been followed, samples have been diluted 1:2 (50 µl sample + 50 µl Sample Diluent) and the concentration read from the standard curve must be multiplied by the dilution factor (x 2).**
- **Calculation of samples with a concentration exceeding standard 1 may result in incorrect, low human TNF alpha levels. Such samples require further external predilution according to expected human TNF alpha values with Sample Diluent in order to precisely quantitate the actual human TNF alpha level.**
- It is suggested that each testing facility establishes a control sample of known human TNF alpha 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 TNF alpha total ELISA. Human TNF alpha was diluted in serial 2-fold steps in Sample Diluent. Do not use this standard curve to derive test results. A standard curve must be run for each group of microwell strips assayed.

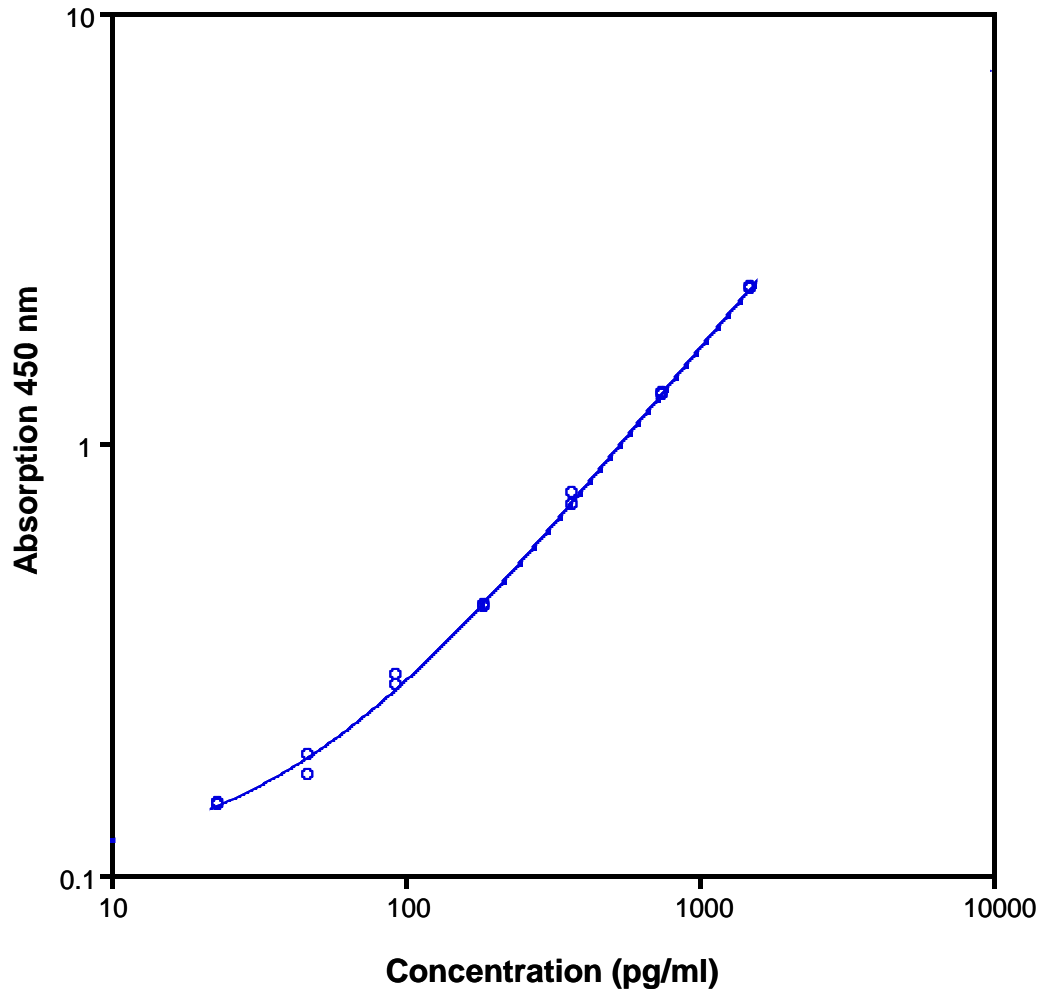


Table 2

Typical data using the human TNF alpha ELISA

Measuring wavelength: 450 nm

Reference wavelength: 620 nm

Standard	Human TNF alpha Concentration (pg/ml)	O.D. at 450 nm	Mean O.D. at 450 nm	C.V. (%)
1	1500	2.312 2.278	2.295	0.7
2	750	1.304 1.314	1.309	0.4
3	375	0.768 0.720	0.744	3.3
4	188	0.424 0.417	0.420	0.8
5	94	0.291 0.276	0.284	2.7
6	47	0.190 0.170	0.180	5.5
7	23	0.147 0.145	0.146	1.0
Blank	0	0.090 0.092	0.091	1.4

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.

12 Limitations

- 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.

13 Performance Characteristics

13.1 Sensitivity

The limit of detection of human TNF alpha 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 5.0 pg/ml (mean of 6 independent assays).

13.2 Reproducibility

13.2.1 Intra-assay

Reproducibility within the assay was evaluated in 3 independent experiments. Each assay was carried out with 6 replicates of 8 serum samples containing different concentrations of human TNF alpha. 2 standard curves were run on each plate. Data below show the mean human TNF alpha concentration and the coefficient of variation for each sample (see Table 3). The calculated overall intra-assay coefficient of variation was 7.7%.

Table 3

The mean human TNF alpha concentration and the coefficient of variation for each sample

Sample	Experiment	Mean Human TNF alpha Concentration (pg/ml)	Coefficient of Variation (%)
1	1	5328	6.6
	2	4990	9.4
	3	5474	3.4
2	1	4818	6.4
	2	4149	9.9
	3	4558	11.3
3	1	3523	12.2
	2	2967	5.3
	3	3478	5.7
4	1	2236	5.1
	2	2207	2.8
	3	2381	5.9
5	1	1528	6.7
	2	1379	11.6
	3	1310	8.4
6	1	889	2.0
	2	805	9.0
	3	827	7.4
7	1	607	14.9
	2	492	8.2
	3	507	7.3
8	1	216	6.3
	2	286	10.7

Sample	Experiment	Mean Human TNF alpha Concentration (pg/ml)	Coefficient of Variation (%)
	3	267	8.0

13.2.2 Inter-assay

Assay to assay reproducibility within one laboratory was evaluated in 3 independent experiments. Each assay was carried out with 6 replicates of 8 serum samples containing different concentrations of human TNF alpha. 2 standard curves were run on each plate. Data below show the mean human TNF alpha 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 8.1%.

Table 4

The mean human TNF alpha concentration and the coefficient of variation of each sample

Sample	Mean Human TNF alpha Concentration (pg/ml)	Coefficient of Variation (%)
1	5264	4.7
2	4508	7.5
3	3323	9.3
4	2275	4.1
5	1405	7.9
6	840	5.2
7	535	11.7
8	256	14.0

13.3 Spike Recovery

The spike recovery was evaluated by spiking 4 levels of human TNF alpha into serum samples. Recoveries were determined in 3 independent experiments with 6 replicates each.

The unspiked serum was used as blank in these experiments.

The recovery ranged from 76% to 115% with an overall mean recovery of 90%.

Recoveries were shown to depend on the serum used.

13.4 Dilution Parallelism

4 serum samples with different levels of human TNF alpha were analysed at serial 2 fold dilutions with 4 replicates each.

The recovery ranged from 97.1% to 128.6% with an overall recovery of 112.7% (see Table 5).

Table 5

Sample	Dilution	Expected Human TNF alpha Concentration (pg/ml)	Observed Human TNF alpha Concentration (pg/ml)	Recovery of Expected Human TNF alpha Concentration (%)
1	1:2		4937	
	1:4	2469	2996	121.4
	1:8	1498	1781	118.9
	1:16	890	975	109.5
2	1:2		4590	
	1:4	2295	2925	127.5
	1:8	1463	1582	108.2
	1:16	791	1017	128.6
3	1:2		5986	
	1:4	2993	3442	115.0
	1:8	1721	1751	101.8
	1:16	876	969	110.6

4	1:2		5550	
	1:4	2775	3119	112.4
	1:8	1560	1514	97.1
	1:16	757	766	101.2

Recoveries were shown to depend on the serum used.

13.5 Sample Stability

13.5.1 Freeze-Thaw Stability

Aliquots of serum samples (spiked or unspiked) were stored at -20°C and thawed 5 times, and the human TNF alpha levels determined. A significant decrease of human TNF alpha immunoreactivity was detected. Therefore samples should be stored in aliquots at -20°C and thawed only once.

13.5.2 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 TNF alpha level determined after 25 h. There was no significant loss of human TNF alpha immunoreactivity detected during storage at -20°C and 2-8°C. A significant loss of human TNF alpha immunoreactivity was detected during storage at RT and 37°C after 24 h.

13.6 Specificity

The assay detects both natural and recombinant Product. The interference of circulating factors of the immune system was evaluated by spiking these proteins at physiologically relevant concentrations into a human TNF alpha positive serum. There was no interference detected, namely not with TNF-R (60 kDa and 80 kDa).

13.7 Expected Values

A panel of 40 sera samples from randomly selected apparently healthy donors (males and females) was tested for human TNF alpha.

There were no detectable human TNF alpha levels found. Elevated Product levels depend on the type of immunological disorder.

14 Reagent Preparation Summary

14.1 Wash Buffer (1x)

Add **Wash Buffer Concentrate 20x** (50 ml) to 950 ml distilled water.

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

14.2 Assay Buffer (1x)

Add **Assay Buffer Concentrate 20x** (5 ml) to 95 ml distilled water.

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

14.3 Biotin-Conjugate

Make a 1:100 dilution of **Biotin-Conjugate** in Assay Buffer (1x):

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

14.4 Streptavidin-HRP

Make a 1:100 dilution of **Streptavidin-HRP** in Assay Buffer (1x):

Number of Strips	Streptavidin-HRP (ml)	Assay Buffer (1x) (ml)
1 - 6	0.06	5.94
1 - 12	0.12	11.88

14.5 Human TNF alpha Standard

Reconstitute lyophilized **human TNF alpha standard** with distilled water. (Reconstitution volume is stated on the label of the standard vial.)

15 Test Protocol Summary

1. Determine the number of microwell strips required.
2. Wash microwell strips twice with Wash Buffer.
3. Standard dilution on the microwell plate: Add 100 µl Sample Diluent, in duplicate, to all standard wells. Pipette 100 µl prepared standard into the first wells and create standard dilutions by transferring 100 µl from well to well. Discard 100 µl from the last wells.
Alternatively external standard dilution in tubes (see 9.5.1): Pipette 100 µl of these standard dilutions in the microwell strips.
4. Add 100 µl Sample Diluent, in duplicate, to the blank wells.
5. Add 50 µl Sample Diluent to sample wells.
6. Add 50 µl sample in duplicate, to designated sample wells.
7. Prepare Biotin-Conjugate.
8. Add 50 µl Biotin-Conjugate to all wells.
9. Cover microwell strips and incubate 2 hours at room temperature (18° to 25°C).
10. Prepare Streptavidin-HRP.
11. Empty and wash microwell strips 6 times with Wash Buffer.
12. Add 100 µl diluted Streptavidin-HRP to all wells.
13. Cover microwell strips and incubate 1 hour at room temperature (18° to 25°C).
14. Empty and wash microwell strips 6 times with Wash Buffer.
15. Add 100 µl of TMB Substrate Solution to all wells.
16. Incubate the microwell strips for about 10 minutes at room temperature (18° to 25°C).
17. Add 100 µl Stop Solution to all wells.
18. Blank microwell reader and measure colour intensity at 450 nm.

Note: If instructions in this protocol have been followed, samples have been diluted 1:2 (50 µl sample + 50 µl Sample Diluent) and the concentration read from the standard curve must be multiplied by the dilution factor (x 2).