



Instruction Manual

Bordetella pertussis Toxin IgG ELISA

Enzyme immunoassay based on microtiter plate
for the detection and quantitative determination
of human IgG antibodies against **Bordetella pertussis Toxin**
in serum and plasma



Cat. No.: ILE-BPT04
Storage: 2-8°C
For in-vitro diagnostic use only

May 2013

IMMUNOLAB GmbH, Otto-Hahn-Str. 16, D-34123 Kassel
Tel: +561 491742-0, Fax: +561 491742-20, E-Mail: info@immunolab.de

Contents	Page
1. Intended Use	3
2. General Information	3
3. Principle of the Tests	3
4. Limitations, Precautions and General Comments	4
5. Reagents Provided	4
6. Materials Required but not Provided	5
7. Specimen Collection and Handling	6
8. Assay Procedure	6
9. Evaluation	7
10. Assay Characteristics	8
11. References	8

Symbole und Übersetzungen / Symbols and Translations

Symbol	English	French	German	Italian	Spanish	Greek
CAL	Calibrator	Etalon	Kalibrator	Calibratore	Calibrador	Πρότυπο Διάλυμα
CONJ	Conjugate	Conjugué	Konjugat	Coniugato	Conjugado	Διάλυμα Συμπλόκου
CONC	Concentrate (<n>-fold)	Concentré (<n> fois)	Konzentrat (<n>-fach)	Concentrato (<n>-volte)	Concentrado (<n>-veces)	Συμπύκνωσ η (<n> φορές)
SAMP DIL	Sample Diluent	Diluant échantillon	Proben- verdünner	Diluente del campione	Diluyente de muestra	Διάλυμα Αραίωσης Δειγμάτων
STOP	Stop Solution	Solution d'arrêt	Stopp-Lösung	Soluzione d'arresto	Solución de parada	Διάλυμα Αναστολής
SUBS	Substrate	Substrat	Substrat	Substrato	Sustrato	Διάλυμα Υποστρώ ματος
MT PLATE	Microtiter plate	Microplaque	Mikrotiterplatte	Piastre	Placa microtiter	Μικρόπλακα
WASH BUF	Wash buffer	Tampon de lavage	Waschpuffer	Soluzione di lavaggio	Tampón de lavado	Πλυστικό Διάλυμα

1. Intended Use

The IMMUNOLAB Bordetella pertussis IgG Antibody ELISA Test Kit has been designed for the detection and the quantitative determination of specific IgG antibodies against Bordetella pertussis in serum and plasma. Further applications in other body fluids are possible and can be requested from the Technical Service of IMMUNOLAB.

Laboratory results can never be the only base of a medical report. The patient history and further tests have additionally to be taken into account.

2. General Information

Whooping cough is a disease of the respiratory tracts which is caused by Bordetella pertussis bacteria. It is transmitted by airborne infection. The gramnegative Coccobacillus produces a series of biologically active molecules. The different compounds appear either during the pathogenesis or during the process of immunization against pertussis and show different effects. A characterisation has been made for the pertussis toxin (pt), the filamentary haemagglutinine (fha) and different lipopolysaccharides (lps).

Pertussis shows a high rate of transmission (rates of infection of over 90 % have been found for non-vaccinated household members) and can cause severe diseases, especially for very young children. From 10749 patients under one year between 1980 and 1989 69 % were brought into hospital, 22 % suffered from pneumonia, 0.9 % showed an Encephalopathy and 0.6 % died. For older children and adults (including already vaccinated persons) the infection may be observed by an unspecified bronchitis or inflammation of the upper respiratory tracts. Even asymptomatic cases are quite common.

The serological response following pertussis disease or immunization with pertussis vaccine has been measured with agglutination assays, precipitins, complement fixation and enzyme-linked immunosorbent assay (ELISA). Enzyme-linked immunosorbent assays, in which Bordetella antigen (containing toxin, FHA and LPS and standardized in U/ml) is bound to a solid phase support, are sensitive, easy to perform and can be used both to determine seropositivity with a single serum and to indicate recent Bordetella infection by determination of IgM and IgA.

Pertussis Toxin (PT) is highly specific in contrast to other Bordetella genus proteins. PT is also a component of numerous vaccines. For this reason a simple, quick and sensitive ELISA was developed for the detection of IgG antibodies to Bordetella pertussis Toxin. This test is standardized according to an international reference preparation.

3. Principle of the Tests

The IMMUNOLAB Bordetella pertussis IgG antibody test kit is based on the principle of the enzyme immunoassay (EIA). Pertussis Toxin antigen is bound on the surface of the microtiter strips. Diluted patient serum or ready-to-use standards are pipetted into the wells of the microtiter plate. A binding between the IgG antibodies of the serum and the immobilized Bordetella antigen takes place. After a one hour incubation at room temperature, the plate is rinsed with diluted wash solution, in order to remove unbound material. Then ready-to-use anti-human-IgG peroxidase conjugate is added and incubated for 30 minutes. After a further washing step, the substrate (TMB) solution is pipetted and incubated for 20 minutes, inducing the development of a blue dye in the wells. The color development is terminated by the addition of a stop solution, which changes the color from blue to yellow. The resulting dye is measured spectrophotometrically at the wavelength of 450 nm. The concentration of the IgG antibodies is directly proportional to the intensity of the color.

4. Limitations, Precautions and General Comments

- Only for in-vitro use! Do not ingest or swallow! The usual laboratory safety precautions as well as the prohibition of eating, drinking and smoking in the lab have to be followed.
- All sera and plasma or buffers based upon, have been tested respective to HBsAg, HIV and HCV with recognized methods and were found negative. Nevertheless precautions like the use of latex gloves have to be taken.
- Serum and reagent spills have to be wiped off with a disinfecting solution (e.g. sodium hypochlorite, 5%) and have to be disposed of properly.
- All reagents have to be brought to room temperature (18 to 25 °C) before performing the test.
- Before pipetting all reagents should be mixed thoroughly by gentle tilting or swinging. Vigorous shaking with formation of foam should be avoided.
- It is important to pipet with constant intervals, so that all the wells of the microtiter plate have the same conditions.
- When removing reagents out of the bottles, care has to be taken that the stoppers are not contaminated. Further a possible mix-up has to be avoided. The content of the bottles is usually sensitive to oxidation, so that they should be opened only for a short time.
- In order to avoid a carry-over or a cross-contamination, separate disposable pipet tips have to be used.
- All reagents have to be used within the expiry period.
- In accordance with a Good Laboratory Practice (GLP) or following ISO9001 all laboratory devices employed should be regularly checked regarding the accuracy and precision. This refers amongst others to microliter pipets and washing or reading (ELISA-Reader) instrumentation.
- The contact of certain reagents, above all the stopping solution and the substrate with skin, eye and mucosa has to be avoided, because possible irritations and acid burns could arise, and there exists a danger of intoxication.

5. Reagents Provided

Components	Volume / Qty.
Bordetella pertussis Toxin antigen coated microtiter strips	12
Standards with 0, 25, 50 and 150 IU/mL	2 mL
Enzyme Conjugate	15 mL
Substrate	15 mL
Stop Solution	15 mL
Sample Diluent	60 mL
Washing Buffer (10×)	60 mL
Plastic foils	2
Plastic bag	1

Storage and Stability (refer to the expiry date on the outer box label)

Store kit components at 2-8°C. After use, the plate should be resealed, the bottle caps replaced and tightened and the kit stored at 2-8°C. The opened kit should be used within three months.

Universal Reagents

Washing buffer, substrate and stop solution are identical for all infectious disease test kits from IMMUNOLAB with Peroxidase as detecting enzyme and may be interchanged between products and lots. All other reagents are assigned to a special kit lot and must not be mixed.

5.1. Mikrotiter Strips

12 strips with 8 breakable wells each, coated with Bordetella pertussis Toxin antigen (strain Tohama). Ready-to-use.

5.2. Standards

4 x 2 mL, human serum diluted with PBS, with 0, 25, 50 and 150 IU/mL of IgG antibodies against Bordetella pertussis Toxin. Addition of 0.01 % methylisothiazolone and 0.01 % bromonitrodioxane. Ready-to-use.

5.3. Enzyme Conjugate

15 mL, anti-human-IgG-HRP (rabbit), in protein-containing buffer solution. Addition of 0.01 % methylisothiazolone and 0.01 % bromonitrodioxane and 5 mg/L Proclin™. Ready-to-use.

5.4. Substrate

15 mL, TMB (tetramethylbenzidine). Ready-to-use.

5.5. Stop Solution

15 mL, 0.5 M sulfuric acid. Ready-to-use.

5.6. Sample Diluent

60 mL, PBS/BSA buffer. Addition of 0.095 % sodium azide. Ready-to-use.

5.7. Washing Buffer

60 mL, PBS + Tween 20, 10x concentrate. Final concentration: dilute 1+9 with deionized water. If during the cold storage crystals precipitate, the concentrate should be warmed up at 37°C for 15 minutes.

5.8. Plastic Foils

2 pieces to cover the microtiter strips during the incubation.

5.9. Plastic Bag

Resealable, for the dry storage of non-used strips.

6. Materials Required but not Provided

- 5 µL-, 100 µL- and 500 µL micro- and multichannel pipets
- Microtiter Plate Reader (450 nm)
- Microtiter Plate Washer
- Reagent tubes for the serum dilution
- Deionized water

7. Specimen Collection and Handling

Principally serum or plasma (EDTA, heparin) can be used for the determination. Serum is separated from the blood, which is aseptically drawn by venipuncture, after clotting and centrifugation. The serum or plasma samples can be stored refrigerated (2-8°C) for up to 7 days. For a longer storage they should be kept at -20°C. The samples should not be frozen and thawed repeatedly. Lipemic, hemolytic or bacterially contaminated samples can cause false positive or false negative results.

For the performance of the test the samples (not the standards) have to be diluted 1:101 with ready-to-use sample diluent (e.g. 5 µL serum + 500 µL sample diluent).

8. Assay Procedure

8.1. Preparation of Reagents

Washing Solution: dilute before use 1+9 with deionized water. If during the cold storage crystals precipitate, the concentrate should be warmed up at 37°C for 15 minutes.

- Strict adherence to the protocol is advised for reliable performance. Any changes or modifications are the responsibility of the user.
- All reagents and samples must be brought to room temperature before use, but should not be left at this temperature longer than necessary.
- A standard curve should be established with each assay.
- Return the unused microtiter strips to the plastic bag and store them dry at 2-8°C.

8.2. Assay Steps

1. Prepare a sufficient amount of microtiter wells for the standards, controls and samples as well as for a substrate blank.
2. Pipet 100 µL each of the **diluted** (1:101) samples and the **ready-to-use** standards and controls respectively into the wells. Leave one well empty for the substrate blank.
3. Cover plate with the enclosed foil and incubate at room temperature for 60 minutes.
4. Empty the wells of the plate (dump or aspirate) and add 300 µL of diluted washing solution. This procedure is repeated totally three times. Residuals of the washing buffer are afterwards removed by gentle tapping of the microtiter plate on a tissue cloth.
5. Pipet 100 µL each of ready-to-use conjugate into the wells. Leave one well empty for the substrate blank.
6. Cover plate with the enclosed foil and incubate at room temperature for 30 minutes.
7. Empty the wells of the plate (dump or aspirate) and add 300 µL of diluted washing solution. This procedure is repeated totally three times. Residuals of the washing buffer are afterwards removed by gentle tapping of the microtiter plate on a tissue cloth.
8. Pipet 100 µL each of the ready-to-use substrate into the wells. This time also the substrate blank is pipetted.
9. Cover plate with the enclosed foil and incubate at room temperature for 20 minutes in the dark (e.g. drawer).
10. To terminate the substrate reaction, pipet 100 µL each of the ready-to-use stop solution into the wells. Pipet also the substrate blank.
11. After thorough mixing and wiping the bottom of the plate, perform the reading of the absorption at 450 nm (optionally reference wavelength of 620 nm). The color is stable for at least 60 minutes.

9. Evaluation

Example

	OD Value	Corrected OD
Substrate Blank	0.020	
Standard 1 (0 IU/mL)	0.030	0.010
Standard 1 (25 IU/mL)	0.507	0.487
Standard 1 (50 IU/mL)	1.531	1.511
Standard 1 (150 IU/mL)	2.492	2.472

The above table contains only an example, which was achieved under arbitrary temperature and environmental conditions. The described data constitute consequently **no reference values** which have to be found in other laboratories in the same way.

9.1. Qualitative Evaluation

The calculated absorptions for the patient sera, as mentioned above, are compared with the value for the cut-off standard (=25 IU/mL). If the value of the sample is higher, there is a positive result. For a value below the cut-off standard, there is a negative result. It seems reasonable to define a range of +/-20 % around the value of the cut-off as a grey zone. In such a case the repetition of the test with the same serum or with a new sample of the same patient, taken after 2-4 weeks, is recommended. Both samples should be measured in parallel in the same run.

The absorbance value of Standard 4 needs to be at least twice as high compared to Standard 2

9.2. Quantitative Evaluation

The ready-to-use standards and controls of the Bordetella pertussis Toxin IgG antibody kit are calibrated using the WHO reference preparation 06/140. As such they are expressed in International Units (IU). This results in an exact and reproducible quantitative evaluation. Consequently for a given patient follow-up controls become possible. The values for controls and standards in units are printed on the labels of the vials.

For a quantitative evaluation the absorptions of the standards and controls are graphically drawn *point-to-point* against their concentrations. From the resulting reference curve the concentration values for each patient sample can then be extracted in relation to their absorptions. It is also possible to use automatic computer programs. As curve fit *point-to-point* has to be chosen.

Standard 2 with its concentration of 25 IU/mL serves as cut-off standard. Analogous to the qualitative evaluation a range of +/-20% around the cut-off is defined as a grey zone. Thus results between 20 and 30 IU/mL are reported as borderline.

10. Assay Characteristics

Bordetella pertussis Toxin ELISA	IgG
Intra-Assay-Präzision	7,0 – 9,0 %
Inter-Assay-Präzision	7.2 – 11.5 %
Inter-Lot-Präzision	4.5 – 15.8 %
Analytische Sensitivität	0,43 U/mL
Wiederfindung	101 %
Linearität	98 – 124 %
Kreuzreaktivität	Keine Kreuzreaktivität auf Adenovirus, Parainfluenza und RSV
Interferenzen	Keine Interferenz mit Bilirubin bis zu 0,3 mg/mL, Hämoglobin bis zu 8,0 mg/mL und Triglyzeriden bis zu 5,0 mg/mL.
Klinische Spezifität	94 %
Klinische Sensitivität	100 %

11. References

1. Chodorowska, M. et al. ELISA test used for serologic diagnosis of Pertussis. Med. Dosw. Microbiol., **48**: 15 (1996).
2. Cherry et al.: The Epidemiology of Pertussis: A Comparison of the Epidemiology of the Disease Pertussis With the Epidemiology of Bordetella pertussis Infection. Pediatrics 115, 1422 (2005)
3. Finger, H. et al. Serological diagnosis of whooping cough. Dev. Biol. Stand., **610**: 331 (1985).
4. Granström, G. et al. Specific Immunoglobulin A to bordetella pertussis antigen. J. Clin. Microbiol. **26**: 869 (1988).
5. Kuno-Sakai, H. et al.: A simple and sensitive ELISA of antibodies to Pertussis antigens. Vaccine **10**: 350 (1992).
6. Nagel, J. et al.: Improved serodiagnosis of whooping cough caused by Bordetella pertussis. Dev. Biol. Stand. **610**: 325 (1985).
7. Reizenstein, E. et al.: Comparison of five calculation modes for antibody ELISA against Pertussis. J. Immunol. Methods **183**: 279 (1995).
8. Sato, Y. et al.: An improved ELISA system for the measurement of IgG antibodies against pertussis. Dev. Biol. Stand. **73**: 167 (1991).
9. Steketee, R. W. et al.: A comparison of laboratory and clinical methods for diagnosing pertussis. J. Infect. Dis. **157**: 441 (1988).
10. Watanabe M. et al. : Characterization of serological responses to Pertussis ; Clinical and Vaccine Immunology 13 (3), 314 (2006).