



# **q-FOB™ Quantitative Fecal Occult Blood Test Kit**

## **Enzyme Linked ImmunoSorbent Assay (ELISA) for the Quantitative Measurement of Human Hemoglobin Level in Stool**



### **INTENDED USE**

This q-FOB™ test kit is intended for detection of fecal occult blood by the quantitative determination of human hemoglobin levels in stool samples. This assay exclusively measures human hemoglobin without cross-reaction to animal blood. The test is useful for detecting the severity of gastrointestinal bleeding and in the aid of screening for colorectal adenoma/polyps and cancer, as well as other inflammatory bowel diseases (Crohn's disease, Ulcerative Colitis, etc.).

### **INTRODUCTION**

Detection of abnormally high level of fecal hemoglobin is recommended by America Cancer Society (ACS), Center for Disease Control and Prevention (CDC) and Center for Medical Service (CMS) of the Department of Health of the United States. The Fecal Occult Blood (FOB) Rapid Test was used in the past 40 years. Screening for occult blood by means of guaiac tests has an unsatisfactory sensitivity for the detection of colorectal neoplasm with a dietary restriction drawback. Immunochemical FOB test dramatically increases the analytical sensitivity and specificity in the detection of human hemoglobin in feces. A few clinical trials showed that immunochemical FOB test is superior in clinical diagnostic sensitivity and specificity compared to guaiac FOB test. However, these rapid tests do not give an insight to the severity of the bleeding in the lower gastrointestinal system.

This q-FOB™ assay using human hemoglobin-specific antibodies would bring significant advantages over the qualitative rapid FOB tests. The assay does not require dietary restrictions such as no raw meat, vitamin C rich food (salad, fruits, etc.). This q-FOB™ assay detects human hemoglobin level in 100-fold lower concentrations than the guaiac FOB test and avoids false-negative results. Because highly specific human hemoglobin antibodies are used, false positive results are practically excluded.

### **ASSAY PRINCIPLE**

This ELISA is designed, developed and produced for the quantitative measurement of human hemoglobin in stool sample. The assay utilizes the two-site "sandwich" technique with two selected antibodies that bind to different epitopes of human hemoglobin.

Assay standards, controls and patient samples are added directly to wells of a microtiter plate that is coated with hemoglobin antibodies. Subsequently, a horseradish peroxidase (HRP)-conjugated human hemoglobin specific antibody is added to each well. After an incubation period, a "sandwich" of "antibody – human hemoglobin – HRP-conjugated antibody" is formed. The unbound antibody and buffer matrix is removed in the subsequent washing step. For the detection of this immunocomplex, the well is then incubated with a substrate solution in a timed reaction and then measured in a spectrophotometric microplate reader. The enzymatic activity of the immunocomplex bound to the wall of each microtiter well is directly proportional to the amount of human hemoglobin in a test sample. A standard curve is generated by plotting the absorbance versus the respective human hemoglobin concentration for each standard on point-to-point or 4 parameter curve fitting. The concentration of fecal

human hemoglobin in test samples is determined directly from this standard curve.

### **REAGENTS: Preparation and Storage**

This test kit must be stored at 2 – 8°C upon receipt. For the expiration date of the kit, refer to the label on the kit box. All components are stable until this expiration date.

### **Prior to use allow all reagents to come to room temperature.**

Reagents from different kit lot numbers should not be combined or interchanged.

#### **1. q-FOB Antibody Coated Microplate (Cat. No. 30520)**

One microplate with 12 x eight strips (96 wells total) coated with anti-hemoglobin. The plate is framed and sealed in a foil zipper bag with a desiccant. This reagent should be stored at 2 – 8°C and is stable until the expiration date on the kit box.

#### **2. q-FOB Tracer Antibody (Cat. No. 30556)**

One vial containing 0.9 mL HRP-labeled anti-human hemoglobin antibody in a stabilized protein matrix. This reagent must be diluted with Tracer Antibody Diluent (Cat. 30525) before use. This reagent should be stored at 2 – 8°C and is stable until the expiration date on the kit box.

#### **3. Tracer Antibody Diluent (Cat No. 30525)**

One bottle containing 20 mL of buffer containing protein stabilizers. This reagent should be stored at 2 – 8°C and is stable until the expiration date printed on the kit box.

#### **4. ELISA Wash Concentrate (Cat. No. 10010)**

One bottle contains 30 mL of 30-fold concentrate. Before use the contents must be diluted with **870 mL** of distilled water and mixed well. Upon dilution this yields a working wash solution containing a surfactant in phosphate buffered saline with a non-azide, non-mercury preservative. The diluted wash solution may be stored at room temperature and is stable until the expiration date on the kit box.

#### **5. ELISA HRP Substrate (Cat. No. 10020)**

One bottle contains 12 mL of tetramethylbenzidine (TMB) with hydrogen peroxide. This reagent should be stored at 2 – 8°C and is stable until the expiration date on the kit box.

#### **6. ELISA Stop Solution (Cat. No. 10030)**

One bottle contains 12 mL of 0.5 M sulfuric acid. This reagent may be stored at 2 – 8°C or room temperature and is stable until the expiration date on the kit box.

#### **7. q-FOB Standards (Cat. No. 30561 – 30565)**

One vial contains liquid standard level 1. Four vials each contain human hemoglobin in a lyophilized bovine serum-based matrix with a non-azide, non-mercury preservative. **Refer to vials for exact concentration for each standard.** These

reagents should be stored at 2 – 8°C and are stable until the expiration date on the kit box.

**8. q-FOB Controls (Cat. No. 30566 – 30567)**

Two vials each contain human hemoglobin in a lyophilized bovine serum based matrix with a non-azide, non-mercury preservative. Refer to vials for exact concentration range for each control. Both controls should be stored at 2 – 8°C and are stable until the expiration date on the kit box.

**SAFETY PRECAUTIONS**

The reagents must be used in professional laboratory. The source material for reagents containing bovine serum was derived in the contiguous 48 United States. It was obtained only from healthy donor animals maintained under veterinary supervision and found free of contagious diseases. Wear gloves while performing this assay and handle these reagents as if they are potentially infectious. Avoid contact with reagents containing TMB, hydrogen peroxide, or sulfuric acid. TMB may cause irritation to skin and mucous membranes and cause an allergic skin reaction. TMB is a suspected carcinogen. Sulfuric acid may cause severe irritation on contact with skin. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale fumes. On contact, flush with copious amounts of water for at least 15 minutes. Use Good Laboratory Practices.

**MATERIALS REQUIRED BUT NOT PROVIDED**

1. Fecal sample collection tube (Epitope Cat. No.: 30210)
2. Precision single channel pipettes capable of delivering 100 µL, and 1000 µL etc.
3. Disposable pipette tips suitable for above volume dispensing.
4. Disposable plastic 100 mL and 1000 mL bottle with caps.
5. Aluminum foil.
6. Deionized or distilled water.
7. Plastic microtiter well cover or polyethylene film.
8. ELISA multichannel wash bottle or automatic (semi-automatic) washing system.
9. Spectrophotometric microplate reader capable of reading absorbance at 450 nm and 620 nm.

**SPECIMEN COLLECTION**

Only one fecal sample is required. Fresh fecal sample must be collected by using Epitope Diagnostics Fecal Sample Collection Device (Cat# 30210). This tube is specially designed for easy collection of a substantially small amount of fecal sample into the tube pre-filled with sample extraction buffer. The collected fecal sample must be transported, kept at 2-8°C and tested within 7 days. Otherwise, fecal sample must be stored below -20°C for a longer storage period. Avoid more than three freeze- thaw cycles for each specimen.

**It is strongly recommended to use Epitope Diagnostics Fecal Sample Collection Device (Cat# 30210) for sample collection. The clinical validation data of this test were generated by using this sampling tube!**

**ASSAY PROCEDURE**

**1. Reagent Preparation**

- (1) Prior to use allow all reagents to come to room temperature. Reagents from different kit lot numbers should not be combined or interchanged.
- (2) ELISA Wash Concentrate (Cat. 10010) must be diluted to working solution prior use. Please see REAGENTS section for details.
- (3) Reconstitute q-FOB standards (Cat. 30561-30565) and controls (Cat. 30566-30567) with 1 mL of deionized or distilled water.

(4) Test Configuration

ROW	STRIP 1	STRIP 2	STRIP 3
A	STD 1	STD 5	SAMPLE 3
B	STD 1	STD 5	SAMPLE 4
C	STD 2	C 1	SAMPLE 5
D	STD 2	C 1	SAMPLE 6
E	STD 3	C 2	SAMPLE 7
F	STD 3	C 2	SAMPLE 8
G	STD 4	SAMPLE 1	
H	STD 4	SAMPLE 2	

- (5) Place a sufficient number of antibody coated microwell strips (Cat. 30520) in a holder to run human hemoglobin standards, controls and unknown samples in duplicate.
- (6) Prepare working Tracer Antibody by 1:21 fold dilution of the Hemoglobin Tracer Antibody by adding the tracer antibody (Cat. 30556) to the tracer antibody diluent (Cat. 30525). Following is a table that outlines the relationship of strips used and antibody required.

Strip no.	Tracer Diluent	Tracer Antibody
1	2 mL	100 µL
2	3 mL	150 µL
3	4 mL	200 µL
4	5 mL	250 µL
5	6 mL	300 µL
6	7 mL	350 µL
7	8 mL	400 µL
8	9 mL	450 µL
9	10 mL	500 µL
10	11 mL	550 µL
11	12 mL	600 µL
12	13 mL	650 µL

*Note: this antibody mixture should be freshly prepared before running the assay.*

- (7) Load all reagents onto a DS2 or DSX system according to the computer program.

**2. Patient Sample Preparation**

If the Epitope Diagnostics Fecal Sample Collection Tube (Cat. 30210) is use, there is no sample preparation required.

Before assay bring all patient samples to room temperature. Unscrew the **white cap** of the sample collection tube and load the samples onto the DS2 or DSX system. It is important to make sure that there are no air bubbles on the surface of the collection tube.

**3. Assay Procedure**

**This assay procedure is programmed for the DS2 or DSX system.**

- (1) Add **100 µL** of standards, controls and patient samples into the designated microwell.
- (2) Incubate plate at **39 °C**, for **20 minutes** with initial shaking for two minutes at low speed.
- (3) Wash each well 5 times by dispensing 350 µL of working wash solution into each well and then completely aspirating the contents. Alternatively, an automated microplate washer can be used.
- (4) Add **100 µl** diluted Tracer Antibody to each of the wells.
- (5) Incubate plate at **39 °C**, for **12 minutes** with initial shaking for two minutes at low speed.
- (6) Wash each well 5 times by dispensing 350 µL of working wash solution into each well and then completely aspirating the contents. Alternatively, an automated microplate washer can be used.
- (7) Add **100 µL** of ELISA HRP Substrate (Cat. 10020) into each of the wells.

- (8) Incubate plate at **39 °C for 8 minutes** with initial shaking for 8 seconds at low speed.
- (9) Add **100 µL** of ELISA Stop Solution (Cat. 10030) into each of the wells.
- (10) Read the absorbance at 450 nm with a reference of 620 nm and initial shaking for 3 seconds at low speed.

**Note: an alternative manual test can be performed by using the assay procedure as described below.**

- (1) Add **100 µL** of standards, controls and patient samples into the designated microwell.
- (2) Mix gently and cover the plate with one plate sealer and also with aluminum foil to avoid exposure to light. Incubate plate at room temperature for **60 minutes**.
- (3) Wash each well 5 times by dispensing 350 µL of working wash solution into each well and then completely aspirating the contents. Alternatively, an automated microplate washer can be used.
- (4) Add **100 µL** of diluted Tracer Antibody
- (5) Cover the plate with an aluminum foil to avoid exposure to light. Incubate plate at room temperature for **45 minutes**.
- (6) Wash each well 5 times by dispensing 350 µL of working wash solution into each well and then completely aspirating the contents. Alternatively, an automated microplate washer can be used.
- (7) Add **100 µL** of ELISA HRP Substrate (Cat. 10020) into each of the wells.
- (8) Cover the plate with an aluminum foil to avoid exposure to light. Incubate plate at room temperature for **10-20 minutes**.
- (9) Add **100 µL** of ELISA Stop Solution (Cat. 10030) into each of the wells. Mix gently.
- (10) Read the absorbance at 450 nm with a reference at 620 nm.

#### PROCEDURAL NOTES

1. It is recommended that all standards, controls and unknown samples be assayed in duplicate. The average absorbance reading of each duplicate should be used for data reduction and the calculation of results.
2. Keep light-sensitive reagents in the original amber bottles.
3. Store any unused antibody-coated strips in the foil zipper bag with desiccant to protect from moisture.
4. Careful technique and use of properly calibrated pipetting devices are necessary to ensure reproducibility of the test.
5. Incubation times or temperatures other than those stated in this insert may affect the results.
6. Avoid air bubbles in the microwell as this could result in lower binding efficiency and higher CV% of duplicate reading.
7. All reagents should be mixed gently and thoroughly prior to use. Avoid foaming.

#### INTERPRETATION OF RESULTS

For the DS2 and DSX system, it is recommended to use a linear/linear, point-to-point or 4-parameter standard curve fitting.

1. Calculate the average absorbance for each pair of duplicate test results.
2. Subtract the average absorbance of the Diluted Fecal Sample Extraction Buffer (0 ng/mL) from the average absorbance of all other readings to obtain corrected absorbance.
3. The standard curve is generated by the corrected absorbance of all standard levels on the ordinate against the standard concentration on the abscissa using point-to-point or log-log paper. Appropriate computer assisted data reduction programs may also be used for the calculation of results.

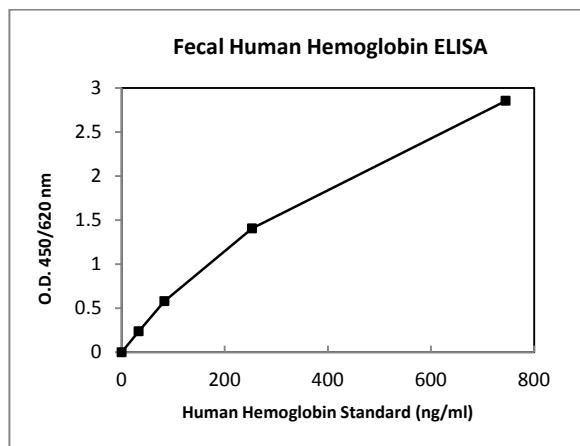
The fecal human hemoglobin concentrations for the controls and the patient samples are read directly from the standard curve using their respective corrected absorbance.

**Patient Fecal Hemoglobin (µg Hemoglobin/gram stool) = Read value directly from assay (ng/ml) x 0.5**

#### EXAMPLE DATA AND STANDARD CURVE

A typical absorbance data and the resulting standard curve from this fecal human hemoglobin ELISA are represented. **This curve should not be used in lieu of standard curve run with each assay.**

Well I.D.	OD 450/620 nm Absorbance			Results ng/mL
	Readings	Average	Corrected	
0	0.041	0.039	0.000	
ng/mL	0.038			
33	0.280	0.277	0.238	
ng/mL	0.274			
83	0.615	0.619	0.580	
ng/mL	0.623			
253	1.464	1.444	1.405	
ng/mL	1.424			
745	2.976	2.892	2.853	
ng/mL	2.807			
Control 1	0.447	0.450	0.411	58.2
	0.452			ng/mL
Control 2	1.054	1.054	1.016	173
	1.053			ng/mL



#### EXPECTED VALUES

Stool samples from normal healthy adults aged 17 – 81 were collected and measured with this ELISA. Following is a recommended cut-off for patient sample interrelation.

	Fecal Hemoglobin (ng/ml)	Fecal Hemoglobin (µg Hb /g stool)
Negative (normal)	< 58	< 29
Positive (light)	58-70	29-35
Positive (medium)	70-128	35-64
Positive (strong)	> 128	> 64

Each laboratory has the choice to use either nano-gram hemoglobin per milliliter extraction buffer or micro-gram hemoglobin per gram stool for report the test results.

**LIMITATION OF THE PROCEDURE**

1. A strong positive of fecal hemoglobin is likely to indicate a more significant clinical pathological condition of a patient. However, light positive of fecal hemoglobin does not indicate a lesser possibility of polyps, adenoma or cancer.
2. A normal fecal hemoglobin level does not rule out the presence of any gastrointestinal diseases.
3. For sample values reading greater than highest standard, it is recommend to re-assay samples with dilution.
4. Water deionized with polyester resins may inactivate the horseradish peroxidase enzyme.

**QUALITY CONTROL**

To assure the validity of the results each assay should include adequate controls.

**PERFORMANCE CHARACTERISTICS**

**Sensitivity**

The sensitivity of the human hemoglobin ELISA as determined by the 95% confidence limit on 20 duplicate determination of zero standard is approximately 0.5 ng/mL.

**High Dose “hook” effect**

This assay has showed that it did not have any high dose “hook” for fecal sample hemoglobin level up to 2,000,000 µg/gram stool.

**Precision**

The intra-assay precision is validated by measuring two controls samples in a single assay with 16-replicate determinations.

Mean Hemoglobin Value (ng/mL)	CV (%)
60.7	3.8
90.2	3.1

The inter-assay precision is validated by measuring two control samples in duplicate in 16 individual assays.

Mean Hemoglobin Value (ng/mL)	CV (%)
68.3	6.9
206	6.6

The inter-sample precision was performed by collecting two specimens from one bowel movement. These paired samples are measured in an assay according to the assay procedure. The results indicate that there are very satisfactory agreements of the two samples collected from one bowel movement.

Fecal Hemoglobin (ng/ml)			
Patients	Sample 1	Sample 2	CV%
1	9.3	7.5	15
2	1.6	1.2	20
3	22.5	20.2	7.6
4	482	461	3.3
5	870	872	0.2

**Linearity**

Two samples were diluted with assay buffer and assayed. The results in the value of ng/mL are as follows:

#	DILUTION	OBSERVED VALUE	EXPECTED VALUE	RECOVERY %
1	Neat	410	-	-
	1:2	236	205	115
	1:4	105	103	103
	1:8	47.7	51.2	93
2	Neat	192	-	-
	1:2	89.0	95.9	93
	1:4	47.3	48.0	99
	1:8	17.7	24.0	74

**Recovery**

Two assay standards were spiked together and assayed. The results in the value of ng/mL are as follows:

#	Orig. Value	Amount Spiked	Observed Value	Expected Value	Recovery %
1	31.6	27.4	61.2	59.0	104
2	22.4	91.5	98.9	114	108

**WARRANTY**

This product is warranted to perform as described in its labeling and literature when used in accordance with all instructions. Epitope Diagnostics, Inc. DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, and in no event shall Epitope Diagnostics, Inc. be liable for consequential damages. Replacement of the product or refund of the purchase price is the exclusive remedy for the purchaser. This warranty gives you specific legal rights and you may have other rights, which vary from state to state.

**REFERENCES**

1. Sieg A, Scheida M, John MR, Hertel A, Schroter M, Luthgens K, Schmidt-Gayk H. Validity of new immunological human fecal hemoglobin and albumin tests in detecting colorectal neoplasms- an endoscopy-controlled study. Z Gastroenterol. 1998 Jun;36(6):485-90. Review.
2. Sieg A, Hertel A, John MR, Luthgens K, Schmidt-Gayk H. Screening for colorectal neoplasms with a new immunological human faecal haemoglobin and albumin test. Eur J Cancer Prev. 1998 Aug;7(4):279-85.
3. Levi Z, Rozen P, Hazazi R, Vilkin A, Waked A, Maoz E, Birkenfeld S, Leshno M, Niv Y. A quantitative immunochemical fecal occult blood test for colorectal neoplasia. Ann Intern Med. 2007 Feb 20;146(4):244-55.
4. Fraser CG, Matthew CM, Mowat NA, Wilson JA, Carey FA, Steele RJ. Immunochemical testing of individuals positive for guaiac faecal occult blood test in a screening programme for colorectal cancer: an observational study. Lancet Oncol. 2006 Feb;7(2):127-31.
5. Federici A, Giorgi Rossi P, Borgia P, Bartolozzi F, Farchi S, Gausticchi G. The immunochemical faecal occult blood test leads

to higher compliance than the guaiac for colorectal cancer screening programmes: a cluster randomized controlled trial. J Med Screen. 2005;12(2):83-8

**qFOB™ - Condensed Assay Protocol for DS2/DSX, etc.**

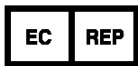
1. **100 µl Calibrators, controls and extracted patient samples**  
*Incubate @ 39°C for 20 min*  
*Wash 5 x*
2. **100 µl Tracer Antibody**  
*Incubate @ 39°C for 12 min*  
*Wash 5 x*
3. **100 µl TMB Substrate**  
*Incubate @ 39°C for 8 min s*
4. **100 µl Stop Solution**
5. **Read absorbance at 450/620 nm**



Distribuito in ITALIA da  
**Li StarFish S.r.l.**  
 Via Cavour, 35  
 20063 Cernusco S/N (MI)  
 telefono 02-92150794  
 fax 02-92157285  
 info@listarfish.it  
 www.listarfish.it



This product is developed and manufactured by  
**Epitope Diagnostics, Inc.**  
 7110 Carroll Road  
 San Diego, CA 92121, USA



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 Schiffgraben 41  
 30175 Hannover, Germany

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