

# **BÜHLMANN fCAL<sup>®</sup> turbo**

Calprotectin turbidimetric assay  
for professional use

**Reagent Kit**

**B-KCAL-RSET**

Revision date: 2016-06-29

## ENGLISH

### INTENDED USE

The BÜHLMANN fCAL<sup>®</sup> turbo is an *in vitro* diagnostic test for the quantitative determination of calprotectin in human stool specimens intended as an aid in the assessment of intestinal mucosal inflammation. The assay results can be used as an aid to diagnosis in distinguishing organic, inflammatory disease of the gastrointestinal tract (inflammatory bowel disease, IBD, e.g. Crohn's disease or ulcerative colitis, UC) from functional disease (irritable bowel syndrome, IBS) [ref. 1-7], in patients with chronic abdominal pain, above the age of four [ref. 8-9], and as an aid to IBD disease monitoring [ref. 10-12].  
For laboratory use only.

### PRINCIPLE OF THE ASSAY

The BÜHLMANN fCAL<sup>®</sup> turbo test is a particle enhanced turbidimetric immunoassay (PETIA) and allows quantification of calprotectin in fecal extracts on clinical chemistry analysers. Fecal samples are extracted with extraction buffer (B-CAL-EX) using the BÜHLMANN CALEX<sup>®</sup> Cap extraction device (Code: B-CALEX-C50 / B-CALEX-C200 / B-CALEX-C500) or a manual weighing method and applied at a final dilution of 1:500. The extracts are incubated with reaction buffer and mixed with polystyrene nanoparticles coated with calprotectin-specific antibodies (immunoparticles). Calprotectin available in the sample mediates immunoparticle agglutination. Sample turbidity, measured by light absorbance, increases with calprotectin-immunoparticle complex formation and is proportional to calprotectin concentration. The detected light absorbance allows quantification of calprotectin concentration via interpolation on an established calibration curve.

### REAGENTS SUPPLIED

| Reagents                                                                                                 | Quantity        | Code      | Preparation  |
|----------------------------------------------------------------------------------------------------------|-----------------|-----------|--------------|
| <b>Reaction Buffer (R1)</b><br>MOPS buffered saline                                                      | 1 vial<br>35 mL | B-KCAL-R1 | Ready to use |
| <b>Immunoparticles (R2)</b><br>Polystyrene beads coated with avian antibodies against human calprotectin | 1 vial<br>7 mL  | B-KCAL-R2 | Ready to use |

Table 1

### REAGENT STORAGE AND STABILITY

- **Do not freeze reagents!** Shelf life of unopened reagents at 2-8 °C: see expiry date on package label.
- Shelf life of opened reagents at 2-8 °C: see expiry date on package label.
- On board stability: at least 60 days at up to 15 °C.

### WARNINGS AND PRECAUTIONS

- This test is for *in vitro* use only, and must be handled by qualified personnel, in accordance with good laboratory practices (GLP).

- The immunoparticles contain potentially infectious substances of animal origin and should be handled with due caution. Disposal of any discarded materials should be in accordance with local requirements.
- R1 contains MOPS that can be irritating to eye and skin. Handle with due caution.
- R2 contains polystyrene nanoparticles.

### MATERIALS REQUIRED BUT NOT PROVIDED

| Reagents                                                                                            | Quantity                           | Code                                        |
|-----------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------|
| <b>BÜHLMANN fCAL<sup>®</sup> turbo Calibrator Kit</b><br>Calibrators 1-6 for instrument calibration | 1 x 6 vials<br>1 mL/vial           | B-KCAL-CASET                                |
| <b>BÜHLMANN fCAL<sup>®</sup> turbo Control Kit</b><br>Controls low and high                         | 3 x 2 vials<br>1 mL/vial           | B-KCAL-CONSET                               |
| <b>CALEX<sup>®</sup> Cap Device</b><br>Extraction device filled with extraction buffer              | 50 tubes<br>200 tubes<br>500 tubes | B-CALEX-C50<br>B-CALEX-C200<br>B-CALEX-C500 |
| <b>Extraction Kit</b><br>Extraction buffer for alternative extraction method                        | 12 bottles<br>125 mL               | B-CAL-EX12                                  |

Table 2

### SPECIMEN COLLECTION AND HANDLING

The BÜHLMANN fCAL<sup>®</sup> turbo is designed for calprotectin quantification in fecal sample extracts. Fecal samples are collected, extracted and diluted to a final concentration of 1:500 using the BÜHLMANN CALEX<sup>®</sup> Cap Device (Code: B-CALEX-C50 / B-CALEX-C200 / B-CALEX-C500).

**Important:** After extraction, centrifuge the CALEX<sup>®</sup> Cap Device for 10 minutes at 1000 x g and continue with the assay procedure ».

**Alternative method:** Manual weighing 1:50 with BÜHLMANN extraction buffer (Code: B-CAL-EX12), centrifugation (10 min. at 1000 x g) followed by an additional 1:10 dilution in BÜHLMANN extraction buffer.

**Specimen storage:** Fecal samples can be stored at 2-8 °C for 6 days. The extracts are stable at 2-8 °C for up to 6 days and can be stored frozen (at -20 °C) for at least 6 months.

### ASSAY PROCEDURE

#### Application Notes / Assay Installation

Assay procedures for the BÜHLMANN fCAL<sup>®</sup> turbo are established on several clinical chemistry analysers. Validated Application Notes describing installation and analysis on specific instruments are available from BÜHLMANN upon request. Corresponding instrument manuals must be considered for instrument setup, maintenance, operation and precautions.

#### Reagent Preparation

The reagents supplied are ready to use. Mix gently before loading onto the instrument. The reagent bottles may fit directly into the instrument, unless otherwise stated in the Application Note.

## Establishment of the Calibration Curve

The BÜHLMANN fCAL® turbo Calibrator (Code: B-KCAL-CASET) is used to establish a six point standard curve according to the instrument manual. Calibrator values are lot-specific. A new calibration must be performed for each new calibrator lot. Otherwise, calibration should be performed every 4 to 8 weeks according to the instrument specific Application Notes. Refer to the QC-data sheet provided with the BÜHLMANN fCAL® turbo Calibrator for assigned calibrator values. Contact BÜHLMANN support if calibration cannot be performed without error.

## QC Controls

The BÜHLMANN fCAL® turbo Controls, Low and High, (Code: B-KCAL-CONSET) must be assayed each day before running patient fecal sample extracts to validate the calibration curve. The controls have assigned value ranges indicated on the QC-data sheet supplied with each lot of the BÜHLMANN fCAL® turbo Control Kit. The control measurements must be within the indicated value ranges to obtain valid results for patient fecal sample extracts. If the control values are not valid, perform the following procedures:

- Repeat QC control measurement with fresh controls.
- Recalibrate the instrument.

Contact BÜHLMANN support if valid control values cannot be reproduced.

## Patient Fecal Sample Extract Measurement

Once a calibration curve is established and validated with the QC controls, patient fecal extracts may be measured. Perform patient fecal extract measurement according to the Application Note and instrument manual.

## Results

The results are calculated automatically on the analyser and presented in µg/g.

## REFERENCE INTERVALS AND CUT-OFF

The BÜHLMANN fCAL® turbo is standardized against the BÜHLMANN fCAL® ELISA. The results from both assays are highly comparable (see performance characteristics). BÜHLMANN recommends applying the same cut-off values as for the BÜHLMANN fCAL® ELISA:

### Normal values below 50 µg/g

Calprotectin values <50 µg/g are not indicative of inflammation in the gastrointestinal tract. Patients with low calprotectin levels are likely not to be in need of invasive procedures to determine the inflammation cause [ref. 8].

### Elevated values between 50 and 200 µg/g

Calprotectin values between 50 and 200 µg/g can represent mild organic disease such as inflammation caused by NSAIDs, mild diverticulitis and IBD in remission phase. The low inflammatory response shown within this range may suggest repeating the measurement and performing further investigations.

### Elevated values above 200 µg/g

Calprotectin values >200 µg/g are indicative of active organic disease with inflammation in the gastrointestinal tract. Appropriate further investigative and curative procedures by specialists are suggested.

The cut-off level suggested for adults (50 µg/g) can also be used for children aged from 4 to 17 years regardless of sex [ref. 8].

## LIMITATIONS

- Sample carryover: a minor sample carryover (0.5 %) which might cause slightly increased levels has been detected.
- Reagent R2, occasionally frozen cannot be used anymore. Freezing R2 will lead to reduced sensitivity and precision in low level samples and in the worst case to decreased measurement levels.
- The assay is designed for fecal extract samples prepared using the specific BÜHLMANN extraction buffer (B-CAL-EX). Application of other extraction buffers could lead to incorrect results.
- Evaporation of calibrators and controls on the analyser could lead to incorrect results. Run the assay immediately after loading the analyser.
- A minor hook effect in extracts >8000 µg/g might occur. Values >8000 µg/g are rare (<0.5 %) but might be measured falsely between 1000 and 2000 µg/g. It has not been observed that the value of extracts >8000 µg/g could be determined as below 1000 µg/g.
- Patients who are taking NSAIDs regularly may have elevations in their fecal calprotectin levels.

## PERFORMANCE CHARACTERISTICS

The presented performance characteristics have been determined on Mindray BS-380 (registered trademark of Mindray Medical International).

### Detection Limits

BÜHLMANN fCAL® turbo has a Limit of Quantification (LoQ) of 19 µg/g calprotectin on the BS-380 analyser, where LoQ is defined as the lowest actual amount of an analyte that can be reliably detected and at which the total error meets accuracy requirements.

### Precision

The precision of BÜHLMANN fCAL® turbo calibrated with the calibrator kit (B-KCAL-CASET) was determined in a 20-day precision study to CLSI guideline EP5-A3. Four fecal extracts and 2 controls (B-KCAL-CONSET) were measured on the BS-380 analyser.

| Fecal extracts | Mean value (µg/g) | Within-Run CV (%) | Between-Day CV (%) | Between-Run CV (%) | Total CV (%) |
|----------------|-------------------|-------------------|--------------------|--------------------|--------------|
| Low            | 52                | 3.91              | 3.10               | 3.60               | 6.15         |
| Medium low     | 84                | 1.99              | 3.98               | 0.87               | 4.54         |
| Medium high    | 418               | 0.64              | 0.15               | 1.54               | 1.67         |
| High           | 2024              | 0.32              | 1.79               | 1.12               | 2.14         |
| Control low    | 74                | 4.43              | 5.24               | 0.51               | 6.88         |
| Control high   | 259               | 0.62              | 2.48               | 1.52               | 2.97         |

Table 3 : Precision results

### **Linearity**

BÜHLMANN fCAL<sup>®</sup> turbo calibrated with the calibrator kit (B-KCAL-CASET) is linear within the range of 21-2058 µg/g on the BS-380 analyser. Concentrations outside this range will be diluted by the analyser-specific protocol 1:10 and retested.

### **Hook Effect**

For the BÜHLMANN fCAL<sup>®</sup> turbo no hook effect is observed for calprotectin concentrations up to 8000 µg/g.

### **Interference**

No interference is detected with Haemoglobin (0.05 g/L), Triglycerides (Intralipid<sup>®</sup>) (1 g/L) or Bilirubin (0.5 mg/L) on the BS-380 analyser. As samples for BÜHLMANN fCAL<sup>®</sup> turbo are extracted at high dilution (1:500) interfering concentrations lower than standard were used. No interference was observed with standard, orally-administered drugs and food additives prescribed for gastrointestinal complaints. The interference study was designed in accordance with the CLSI guideline EP07-A2.

### **Method Comparison**

Results obtained with BÜHLMANN fCAL<sup>®</sup> turbo on the BS-380 analyser were compared with those obtained by the BÜHLMANN fCAL<sup>®</sup> ELISA by Passing-Bablok regression. The study included 112 fecal extracts in the range of 30-1800 µg/g (Fig. 1).

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### **SHIPPING DAMAGE**

Please notify your distributor, if this product was received damaged.

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### **REACH**

None of the materials and reagents in the kit require a Safety Data Sheet (MSDS) according to CLP-Regulation (EC) No 1272/2008 and directive EC 1907/2006 (REACH).

| N   | Linear Regression<br>(turbo vs. ELISA) |                                        | Altman Bland analysis<br>(turbo vs. ELISA) |            |            |
|-----|----------------------------------------|----------------------------------------|--------------------------------------------|------------|------------|
|     | Slope                                  | Coefficient of determination ( $R^2$ ) | Bias (%)                                   | Lower LoA* | Upper LoA* |
| 112 | 1,05                                   | 0,91                                   | -2.5                                       | -47.8 %    | 42.9 %     |

Table 4 : Method comparison results

\*LoA = Limits of agreement

## Method Comparison

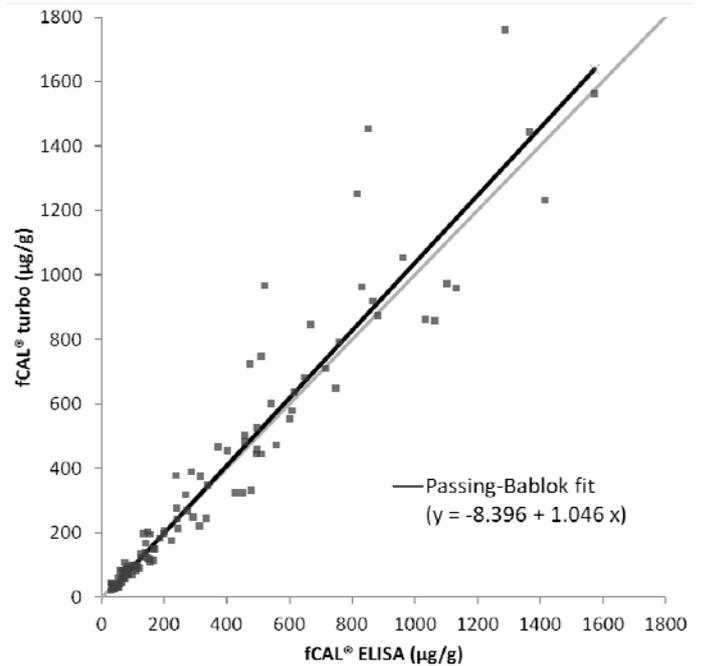


Fig. 1: Scatterplot of 112 samples included in the method comparison analysis.

1. Fagerhol MK: Lancet 2000; 356, 1783 – 4.
2. Tibble JA et al.: Gut 2000; 47, 506 – 13.
3. Tibble JA et al.: Gastroenterol 2002; 123, 450 – 60.
4. Konikoff MR and Denson LA: Inflamm Bowel Dis 2006; 12(6), 524 – 34.
5. Jahnsen J et al.: Tidsskr Nor Legeforen 2008; 128, 743 – 5.
6. Manz M. et al.: BMC Gastroenterology 2012; 12, 5.
7. Pavlidis P. et al. Scand J Gastroenterol. 2013; 48, 1048 – 54.
8. Fagerberg UL et al.: J Pediatr Gastroenterol Nutr 2005; 40, 450 – 5.
9. Kapel N et al.: J Pediatr Gastroenterol Nutr 2010; 50.
10. Lin et al.: Inflamm Bowel Dis 2014; 20: 1407 – 1415.
11. Wright et al.: Gastroenterology 2015; 148, 938 – 947.
12. Naismith GD et al.: J Crohns Colitis 2014; 8, 1022 – 9.

| Symbol                                                                            | Explanation                               |
|-----------------------------------------------------------------------------------|-------------------------------------------|
|  | Expiration date                           |
|  | Catalogue Number                          |
|  | Lot number                                |
|  | <i>In Vitro</i> Diagnostic Medical Device |

| Symbol                                                                             | Explanation                  |
|------------------------------------------------------------------------------------|------------------------------|
|  | Consult Instructions for Use |
|  | Manufacturer                 |
|   | Temperature limitations      |

CE

IVD