



Test Definition: EFPO

Electrolyte and Osmolality Panel, Feces

Overview

Useful For

Workup of cases of chronic diarrhea

Diagnosis of factitious diarrhea (where patient adds water to stool to simulate diarrhea)

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
NA_F	Sodium, F	No	Yes
K_F	Potassium, F	No	Yes
CL_F	Chloride, F	Yes	Yes
OSMOF	Osmolality, F	Yes	Yes
MG_F	Magnesium, F	Yes	Yes
OG_F	Osmotic Gap, F	No	Yes
POU_F	Phosphorus, F	Yes	Yes

Method Name

OG_F: Calculation

NA_F, K_F, CL_F: Indirect Ion-Selective Electrode (ISE) Potentiometry

OSMOF: Freezing Point Depression

POU_F: Photometric, Ammonium Molybdate

MG_F: Colorimetric Titration

NY State Available

Yes

Specimen

Specimen Type

Fecal

Ordering Guidance

This test is **only** clinically valid if performed on watery specimens. In the event a formed fecal specimen is submitted, the test will not be performed.

Specimen Required

Patient Preparation: No barium, laxatives, or enemas may be used for 96 hours prior to start of, or during, collection.

Supplies: Stool containers-24, 48, 72 Hour Kit (T291) Note: A random collection is required, but may be submitted in containers provided for timed collection.

Container/Tube: Stool container

Specimen Volume: 10 g

Collection Instructions:

1. Collect a very liquid, random stool specimen.
2. **Do not add preservative to the specimen.** If a preservative is added, testing will be canceled.

Forms

If not ordering electronically, complete, print, and send a [Renal Diagnostics Test Request](#) (T830) with the specimen.

Specimen Minimum Volume

5 g

Reject Due To

Preservatives added	Reject
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Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Fecal	Frozen (preferred)	14 days	
	Ambient	48 hours	
	Refrigerated	7 days	

Clinical & Interpretive

Clinical Information

The concentration of electrolytes in fecal water and their rate of excretion are dependent upon 3 factors:

- Normal daily dietary intake of electrolytes
- Passive transport from serum and other vascular spaces to equilibrate fecal osmotic pressure with vascular osmotic pressure
- Electrolyte transport into fecal water due to exogenous substances and rare toxins (eg, cholera toxin)

Fecal osmolality is normally in equilibrium with vascular osmolality, and sodium is the major effector of this equilibrium. Fecal osmolality is normally 2 x (sodium + potassium) unless there are exogenous factors inducing a change in composition, such as the presence of other osmotic agents (magnesium sulfate, saccharides) or drugs inducing secretions, such as phenolphthalein or bisacodyl.

Osmotic diarrhea is caused by ingestion of poorly absorbed ions or sugars.(1) There are multiple potential causes of osmotic diarrhea. Measurement of phosphate and/or magnesium in liquid stool can assist in identifying intentional or inadvertent use of magnesium and/or phosphate containing laxatives as the cause.(2-4) The other causes of osmotic diarrhea include ingestion of osmotic agents such as sorbitol or polyethylene glycol laxatives, or carbohydrate malabsorption due most commonly to lactose intolerance. Carbohydrate malabsorption can be differentiated from other osmotic causes by a low stool pH (<6).(5,6)

Non-osmotic causes of diarrhea include bile acid malabsorption, inflammatory bowel disease, endocrine tumors, and neoplasia.(1) Secretory diarrhea is classified as non-osmotic and is caused by disruption of epithelial electrolyte transport when secretory agents such as anthraquinones, phenolphthalein, bisacodyl, or cholera toxin are present. The fecal fluid usually has elevated electrolytes (primarily sodium and chloride) and a low osmotic gap (<50 mOsm/kg). Infection is a common secretory process; however, it does not typically cause chronic diarrhea (defined as symptoms >4 weeks). Differentiating osmotic from non-osmotic causes of diarrhea is the goal of liquid stool testing.(1,7) The primary way this is accomplished is through the measurement of sodium and chloride and calculation of the osmotic gap, which uses an assumed normal osmolality of 290 mOsm/kg rather than direct measurement of the osmolality.

Measurement of osmolality can be useful in the evaluation of chronic diarrhea to help identify whether a specimen has been diluted with hypotonic fluid to simulate diarrhea.(1,8)

Chronic diarrhea with elevations in fecal chloride concentrations are caused by congenital chloridorrhea. This is a rare condition associated with a genetic defect in a protein responsible for transport of chloride ions across the mucosal membranes in the lower intestinal tract in exchange for bicarbonate ions. It plays an essential part in intestinal chloride absorption, therefore mutations in this gene have been associated with congenital chloride diarrhea.(9)

Acquired chloridorrhea is a rare condition which has been described as causing profuse, chloride-rich diarrhea and a surprising contraction metabolic alkalosis rather than metabolic acidosis often associated with typical diarrhea. Contributors to acquired chloridorrhea include chronic intestinal inflammation and reduction of chloride/bicarbonate transporter expression in genetically susceptible persons post-bowel resection and ostomy placement. Acquired chloridorrhea is rare but may be an under-recognized condition in post-bowel resection patients.(10)

Reference Values

An interpretive report will be provided

Interpretation

Osmotic Gap:

Osmotic gap is calculated as $290 \text{ mOsm/kg} - (2[\text{Na}] + 2[\text{K}])$. Typically, stool osmolality is similar that seen in serum since the gastrointestinal (GI) tract does not secrete water.(1)

An osmotic gap above 50 mOsm/kg is suggestive of an osmotic component contributing to the symptoms of diarrhea.(1,5,7)

Magnesium-induced diarrhea should be considered if the osmotic gap is above 75 mOsm/kg and is likely if the magnesium concentration is above 110 mg/dL.(1)

An osmotic gap of 50 mOsm/kg or less is suggestive of secretory causes of diarrhea.(1,5,7)

A highly negative osmotic gap or a fecal sodium concentration greater than plasma or serum suggests the possibility of either sodium phosphate or sodium sulfate ingestion by the patient.(4)

Phosphorus:

Phosphorus elevation above 102 mg/dL is suggestive of phosphate-induced diarrhea.(4)

Osmolality:

Osmolality below 220 mOsm/kg indicates dilution with a hypotonic fluid.(1)

Sodium and Potassium:

High sodium and potassium in the absence of an osmotic gap indicate active electrolyte transport in the GI tract that might be induced by agents such as cholera toxin or hypersecretion of vasoactive intestinal peptide.(1)

Sodium:

Sodium is typically found at lower concentrations (mean 30 +/- 5 mmol/L) in patients with osmotic diarrhea caused by magnesium-containing laxatives, while typically at higher concentrations (mean 104 +/- 5 mmol/L) in patients known to be taking secretory laxatives.(8)

Chloride:

Chloride may be low (<20 mmol/L) in sodium sulfate-induced diarrhea.(5)

Markedly elevated fecal chloride concentration in infants (>60 mmol/L) and adults (>100 mmol/L) is associated with congenital and secondary chloridorrhea.(6)

Cautions

Prolonged storage at incorrect temperatures may cause osmolality to increase due to bacterial metabolism generating osmotically active products.

In very rare cases, gammopathy, in particular type IgM (Waldenstrom macroglobulinemia), may cause unreliable results.

Phospholipids contained in liposomal drug formulations (eg, AmBisome) may be hydrolyzed in the test due to the acidic reaction pH and thus lead to elevated phosphate results.(1,2)

Falsely high chloride values have been reported from patients receiving perchlorate medication. This is due to an interference of perchlorate ions with chloride ion-selective electrode determination.

Clinical Reference

1. Steffer KJ, Santa Ana CA, Cole JA, Fordtran JS: The practical value of comprehensive stool analysis in detecting the cause of idiopathic chronic diarrhea. *Gastroenterol Clin North Am.* 2012 Sep;41(3):539-560
2. Ho J, Moyer TP, Phillips SF: Chronic diarrhea: the role of magnesium. *Mayo Clin Proc.* 1995 Nov;70(11):1091-1092
3. Fine KD, Santa Ana CA, Fordtran JS: Diagnosis of magnesium-induced diarrhea. *N Engl J Med.* 1991 Apr 11;324(15):1012-1017
4. Fine KD, Ogunji F, Florio R, Porter J, Ana CS: Investigation and diagnosis of diarrhea caused by sodium phosphate. *Dig Dis Sci.* 1998 Dec;43(12):2708-2714
5. Eherer AJ, Fordtran JS: Fecal osmotic gap and pH in experimental diarrhea of various causes. *Gastroenterology.* 1992 Aug;103(2):545-551
6. Caspary WF: Diarrhea associated with carbohydrate malabsorption. *Clin Gastroenterol.* 1986 Jul;15(3):631-655
7. Sweetser S: Evaluating the patient with diarrhea: a case-based approach. *Mayo Clin Proc.* 2012 Jun;87(6):596-602
8. Phillips S, Donaldson L, Geisler K, Pera A, Kochar R: Stool composition in factitial diarrhea: a 6-year experience with stool analysis. *Ann Intern Med.* 1995 Jul 15;123(2):97-100
9. Makela S, Kere J, Holmberg C, Hoglund P: SLC26A3 mutations in congenital chloride diarrhea. *Hum Mutat.* 2002 Dec;20(6):425-438. doi: 10.1002/humu.10139

10. Ali OM, Shealy C, Saklayen M: Acute pre-renal failure: acquired chloride diarrhea after bowel resection. Clin Kidney J. 2012 Aug;5(4):356-358. doi: 10.1093/ckj/sfs082

Performance

Method Description

Osmotic Gap:

Calculated result=290 mOsm/kg - 2(stool Na [mmol/L] + stool K [mmol/L])

Osmolality:

The depression of the freezing point of serum or other fluid is used to measure osmolality in most osmometers. The extent of lowering below 0 degrees C (the freezing point of water) is a function of the concentration of substances dissolved in the serum. By definition, 1 milliosmole per kilogram lowers the freezing point 0.001858 degrees C. (Schnidler EI, Brown SM, Scott MG: Electrolytes and Blood Gases. In: Rifai N, Horvath AR, Wittwer CT, eds: Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018:610-612)

Sodium, Potassium, and Chloride:

The Roche cobas c 501 analyzer makes use of the unique properties of certain membrane materials to develop an electrical potential (electromotive force: EMF) for the measurements of ions in solution. The electrode has a selective membrane in contact with both the test solution and internal filling solution. The internal filling solution contains the test ion at a fixed concentration. The membrane EMF is determined by the difference in concentration of the test ion in the test solution and the internal filling solution. The EMF develops according to the Nernst equation for a specific ion in solution. (Package insert: ISE reagent. Roche Diagnostics; V14, 02/2018)

Phosphorus:

In the presence of sulfuric acid, inorganic phosphate and ammonium molybdate form an ammonium phosphomolybdate complex. The concentration of phosphomolybdate formed is measured photometrically and is directly proportional to the inorganic phosphate concentration. (Package insert: Phosphorus reagent. Roche Diagnostics; V9.0, 09/2019)

Magnesium:

In an alkaline solution, magnesium forms a purple complex with xylydyl blue, a diazonium salt. The magnesium concentration is measured photometrically via the decrease in the xylydyl blue absorbance. (Package insert: Magnesium reagent. Roche Diagnostics; V8.0, 01/2020)

PDF Report

No

Day(s) Performed

Monday, Thursday

Report Available

1 to 3 days

Specimen Retention Time

7 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees

- Authorized users can sign in to [Test Prices](#) for detailed fee information.
- Clients without access to Test Prices can contact [Customer Service](#) 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact [Customer Service](#).

Test Classification

This test has been modified from the manufacturer's instructions. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

82438-Chloride

83735-Magnesium

84302-Sodium

84100-Phosphorus

84999 x 2-Osmolality, Potassium

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
EFPO	Electrolyte and Osmolality Panel, F	88697-8

Result ID	Test Result Name	Result LOINC® Value
NA_F	Sodium, F	15207-4
K_F	Potassium, F	15202-5
CL_F	Chloride, F	15158-9
MG_F	Magnesium, F	29911-5
OG_F	Osmotic Gap, F	73571-2
POU_F	Phosphorus, F	88713-3
OSMOF	Osmolality, F	2693-0