PRODUCT INFORMATION

INTENDED USE
ENTERAGAM is a medical food product intended for the dietary management of chronic diarrhea and loose stools. ENTERAGAM must be administered under medical supervision.

DESCRIPTION
Each ENTERAGAM PACKET (10 g net weight) contains a light-colored powder consisting of 5 g of serum-derived bovine immunoglobulin/protein isolate (SBI), 5 g dextrose (also known as glucose) and trace amounts of sunflower lecithin.

SBI is composed of >90% protein which consists primarily of immunoglobulins (e.g., >50% IgG) along with other proteins and peptides that are similar to those commonly consumed by humans in beef products.

ENTERAGAM does not contain any milk-derived ingredients such as lactose, casein, or whey. ENTERAGAM is gluten-free, dye-free, and soy-free.

DIRECTIONS FOR USE
Add at least 4 oz of liquid (water or other liquid as preferred) to a cup or glass

- Note that warm liquids may help the product dissolve more quickly
- Do not dissolve in hot liquids as this may degrade the proteins in the product

Pour content of packet into liquid and stir until fully mixed (do not shake).

Consume all the solution immediately.

Alternatively, product can be mixed with soft foods such as pudding or yogurt.

DOSING
The recommended starting dose of ENTERAGAM is based on the number of loose or watery stools experienced per day.

<table>
<thead>
<tr>
<th># of loose/watery stools per day</th>
<th># of packets per day</th>
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<tbody>
<tr>
<td>5 or fewer</td>
<td>1 to 2 packets</td>
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<tr>
<td>6-10</td>
<td>2 packets</td>
</tr>
<tr>
<td>11-15</td>
<td>3 packets</td>
</tr>
<tr>
<td>16+</td>
<td>4 packets</td>
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</table>

Once stools normalize (1-2 stools per day with good consistency which typically occurs within 2-4 weeks), the daily intake can be decreased to 1 packet per day. Intake may be increased during flare-ups or decreased for mild constipation. There is no restriction on the length of time ENTERAGAM may be consumed.

Pediatric Patients – Children 2 years and older can be administered one half (1/2) PACKET of ENTERAGAM once daily (or in divided doses) in liquids or soft food according to the healthcare provider’s instructions.

MEDICAL FOODS
ENTERAGAM is a medical food as defined by the Orphan Drug Act. Medical supervision is required.

The term medical food, as defined by the Orphan Drug Act (21 U.S.C. 360ee[b][3]) of 1988, is “a food which is formulated to be consumed or administered enterally under the supervision of a physician and which is intended for the specific dietary management of a disease or condition for which distinctive nutritional requirements, based on recognized scientific principles, are established by medical evaluation.” Ingredients in medical foods must be generally recognized as safe (GRAS) and/or approved food additives.

ENTERAGAM is manufactured in compliance with current Good Manufacturing Practice (cGMP) for medical foods.

Generally Recognized as Safe
The ingredients in ENTERAGAM are generally recognized as safe (GRAS). GRAS is a statutory safety standard that the FDA requires of all ingredients added to food products. Therefore, ENTERAGAM is safe for use in the general population.

CHRONIC DIARRHEA
A variety of intestinal disorders (e.g., irritable bowel syndrome with diarrhea [IBS-D], inflammatory bowel disease [IBD]) are associated with chronic diarrhea and loose stools. While the pathophysiological mechanisms that cause the chronic diarrhea and loose stools associated with intestinal disorders are not well understood, there is evidence that exposure to external antigens (foreign substances such as food ingredients like lactose), toxins, or other environmental insults (including infection) can elicit changes in the lining of the intestine that alter its ability to absorb key nutrients (e.g., protein, carbohydrate, fat, vitamins, minerals) and water. Malabsorption of such nutrients can lead to malnutrition or protracted undernutrition and play a central role in contributing to or even exacerbating chronic diarrhea and loose stools in patients with intestinal disorders.
PHARMACOLOGY

Mechanism of Action
Immunoglobulins found in SBI have been shown to bind to certain microbial components with immune-activating potential from a variety of bacteria, fungi and viruses, including those implicated in human disease. Unlike common dietary proteins, SBI contains concentrated amounts of unique proteins that may aid in the management of chronic diarrhea or loose and frequent stools. While the mechanism of action of ENTERAGAM has not been fully elucidated, this binding of inflammatory antigens may prevent their passage into the lamina propria, presumably due to steric exclusion. The resultant dampening of immune response in the gut-associated lymphoid tissue (GALT) is believed to allow for restoration of intestinal homeostasis, leading to resumption of normal gut function and nutrient absorption.

This combined effect of SBI fulfills a distinctive nutritional requirement associated with various GI conditions where chronic diarrhea or loose stools is present that cannot be provided by normal dietary proteins alone.

Digestibility
Following ingestion, proteins are subject to chemical and enzymatic degradation in the GI tract, resulting in small peptides and individual amino acids that are able to cross the epithelial barrier and become absorbed into the bloodstream. Absorption of foreign protein into the bloodstream can result in a risk of acute allergic response (i.e., anaphylaxis). The digestion and safety of SBI (5 g, 10 g, or 20 g per day for 14 days) was studied in 42 normal, healthy volunteers. Results of the study showed a significant dose-dependent increase in the plasma concentrations of both total and essential amino acids. Despite this extensive digestion, bovine IgG was found in the feces of subjects, thereby, demonstrating that the disulfide bond-stabilized molecule is capable of surviving transit through the GI tract to regions where therapeutic response may be initiated. No adverse events suggestive of allergic reaction were reported in the study; moreover, quantifiable bovine IgG was determined to not be present in plasma samples.

Survival and Elimination
The unique compositional structure of immunoglobulins helps them avoid degradation during gastrointestinal transit in order to reach the areas of the intestines where they can impart the intended benefit. Differences in survival through the GI tract may occur as a result of variations in transit time because of co-administration with proton pump inhibitors, GI infection, hydration state, or disease resulting in diarrhea.

Previous studies using immunoglobulin preparations similar to SBI have shown that up to 50% of orally-administered immunoglobulins survive initial digestive processes in the stomach. Transit time following oral ingestion of bovine immunoglobulins occurs between 6 and 40 hours, depending on the health of the individual. In infants with diarrhea, approximately 5-12% of orally-administered immunoglobulins are excreted in feces. Other studies in adults with compromised GI tracts show that approximately 10-20% of orally-administered immunoglobulins are excreted in the feces.

PRECAUTIONS AND WARNINGS
ENTERAGAM contains beef protein; therefore, patients who have an allergy to beef or any component of ENTERAGAM should not take this product.

Pregnancy, Labor and Delivery and Nursing Mothers
ENTERAGAM has not been studied in pregnant women, in women during labor or delivery or in nursing mothers. The choice to administer ENTERAGAM during pregnancy, labor or delivery, or in nursing mothers is at the clinical discretion of the prescribing physician.

Pediatric Use
ENTERAGAM has not been studied specifically in clinical trials in pediatric populations. However, four case reports have been presented where ENTERAGAM was used successfully in five older infants or children to help manage diarrhea or chronic loose and frequent stools associated with various disorders; no AEs were reported in any of these pediatric patients following use of 5-10 g SBI per day.

In addition, immunoglobulin preparations similar to SBI (0.18 to 1.0 g total protein per day) have been evaluated in two clinical studies involving a total of 117 infants and children; no AEs were reported for up to 8 months of immunoglobulin therapy.

DRUG AND FOOD INTERACTIONS
No significant interactions of ENTERAGAM with commonly prescribed medications or therapies have been reported. There are no known adverse food interactions with ENTERAGAM.

PRODUCT SAFETY: ADVERSE EVENTS / ADVERSE REACTIONS
As previously stated, the ingredients in ENTERAGAM are generally recognized as safe (GRAS) for use in the general population. The safety profile of the product has been documented in clinical trials and retrospective chart reviews that describe adverse events (AEs) / adverse reactions across over 400 subjects / patients.

Clinical Trials
In clinical trials completed to date under IRB approved protocols, 211 subjects have received at least one dose of SBI. The most common AEs reported in each study are shown in Table 1 and included abdominal cramps, constipation, diarrhea, flatulence, headache, and nausea. The majority of these AEs were judged by the investigators as mild or moderate in intensity. There have been a total of four serious adverse events (SAEs) reported in the clinical trials and none were attributed to SBI.
Retrospective Chart Reviews
Reviews of medical charts for 190 patients where ENTERAGAM was used in the management of chronic diarrhea and loose stools have resulted in twenty-six publications that are listed at the end of this document. These publications, comprised of posters, abstracts as well as peer-reviewed manuscripts cover a wide variety of disease states such as: IBS-D, IBD, lymphocytic colitis, fecal incontinence, celiac disease (as well as non-celiac gluten sensitivity), short bowel syndrome, chronic pancreatitis, pancreatic insufficiency, drug-induced diarrhea, mastocytic enterocolitis and infectious enteropathy.

- In four of the publications, AEs of constipation, cramping, diarrhea, and nausea were reported (see details provided in Table 1).
- In twenty-two of the publications, no AEs were reported.
- No SAEs were recorded in any of the chart review work.

Post-marketing surveillance
Since ENTERAGAM was introduced in 2013, it is estimated that nearly 3 million doses of product have been administered to over 22,000 patients in the United States. The overall AE rate is less than 0.2%. The most common AEs reported by patients administered ENTERAGAM included mild nausea, constipation, headache, increased urination, increased diarrhea and joint pain. No serious AEs have been attributed to ENTERAGAM during post-marketing surveillance.

To report SUSPECTED ADVERSE REACTIONS, contact Entera Health, Inc. at 1-855-4ENTERA (1-855-436-8372) or FDA at 1-800-FDA-1088 (1-800-332-1088) or www.fda.gov/medwatch.

<table>
<thead>
<tr>
<th>TABLE 1. CLINICAL SAFETY EXPERIENCE</th>
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<tr>
<td>Population Studied</td>
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<tr>
<td>Normal, Healthy Adult Volunteers</td>
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<tr>
<td>Irritable Bowel Syndrome (IBS) and Small Intestinal Bacterial Overgrowth (SIBO)</td>
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<tr>
<td>Retrospective Chart Review</td>
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<td>Inflammatory Bowel Disease</td>
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<td>--------------------------</td>
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<tr>
<td>Other Diarrheal Conditions</td>
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<tr>
<td>Human Immunodeficiency Virus</td>
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</table>

**NONCLINICAL DATA**

Animal and *in vitro* models support the above proposed mechanism of action of ENTERAGAM.

The antibodies contained in SBI have been shown to bind, *in vitro*, to many different microbial components from multiple bacterial, fungal, and viral organisms. Indeed, SBI binding has been confirmed for lipopolysaccharide (LPS), peptidoglycan, zymosan, flagellin, cyclic diadenylate monophosphate, cytosine phosphate-linked guanine, muramyl dipeptide, rotaviral enterotoxin NSP4 and *C. difficile* toxin A and B. These antigens are capable of activating the intestinal immune system if allowed access through a damaged intestinal epithelial barrier.

In a co-culture model of damaged intestinal epithelium, SBI was shown to block (presumably through steric exclusion) movement of an endotoxin mimic (Pam3CSK4) across compromised tight junctions.

Two different animal models have been utilized to assess the effect of SBI on managing gut barrier function. In the mdr1a-/- mouse model of spontaneous colitis, alterations in gut barrier allow bacteria and other luminal antigens (factors associated with GI immune cell activation) to cross the epithelium. When SBI was included in the diet of mdr1a mice the expression of mucosal TNF-α, IL-6, IL-2, IL-17, IFN-γ, and inducible nitric oxide synthase was significantly decreased (all P <0.005) while there was an increase in anti-inflammatory TGFβ. In addition, consumption of SBI led to decreased crypt permeability, mitigation of the reduction of tight junction protein (E-cadherin and zona occluden-1) expression, attenuated loss of muc2 and trefoil factor 3 expression, and a reduction in neutrophil recruitment and activation in mesenteric lymph nodes and lamina propria. Together these findings are consistent with the hypothesis that SBI supports intestinal barrier function.

In a separate study, colitis was induced in altered Schaedler flora (ASF) mice who were administered dextran sodium sulfate (DSS), and *E. coli* (LF82, a strain originally isolated from a Crohn's patient known to exacerbate the inflammatory condition). SBI significantly maintained colon mucosal height (*p* < 0.05), cecal stromal structure (*p* < 0.05), and colonic glandular tissue (*p* < 0.05) in DSS-LF82 mice treated with SBI compared to control mice given DSS-LF82 and treated with hydrolyzed collagen. Western blot analysis also demonstrated that SBI binds to multiple components of each ASF species and LF82 *E. coli*. 
Provided below is a listing of published clinical studies and retrospective chart reviews involving over 400 subjects and/or patients administered SBI that support its use in the dietary management of chronic diarrhea and loose stools in a wide variety of patient types.

**Irritable Bowel Syndrome with Diarrhea (IBS-D)**


**Inflammatory Bowel Disease (IBD), Ischemic Colitis and Microscopic Colitis with Chronic Diarrhea**


Good L, Panas R. Case Series Investigating the Clinical Practice Experience of Serum-Derived Bovine Immunoglobulin/Protein Isolate (SBI) in the Clinical Management of Patients with Inflammatory Bowel Disease. *J Gastrointest & Dig Systems*. 2015; 5(2) http://dx.doi.org/10.4172/2161-069X.1000268.


**Fecal Incontinence with Chronic Diarrhea**

Good L, Panas R. Management of Severe Watery Stools with Fecal Incontinence in Ileorectal Anastomosis Patient with Serum-Derived Bovine Immunoglobulin Therapy. Poster presented (#842) at 2015 ACG Annual Scientific Meeting, Honolulu, HI. October 19, 2015.


**Celiac and Non-Celiac Gluten Sensitivity with Chronic Diarrhea**

Iduru S, Burnett BP. Management of Celiac Disease and Non-Celiac Gluten Sensitivity with Serum-Derived Bovine Immunoglobulin/Protein Isolate. Poster presented (#1343) at 2015 ACG Annual Scientific Meeting, Honolulu, HI. October 19, 2015.

Good L, Panas R. Nutritional Management of Celiac Disease Using Serum-Derived Bovine Immunoglobulin/Protein Isolate in a Patient with Poor Gluten-Free Diet Compliance. Poster presented (#627) at 2015 ACG Annual Scientific Meeting, Honolulu, HI. October 18, 2015.

**Other Enteropathy with Chronic Diarrhea**


Mah'moud M, Anderson M, Young HE. Use of Serum-Derived Bovine Immunoglobulin/Protein Isolate (SBI) for the Management of DMARD-Induced Chronic Loose and Frequent Stools. Poster presented (#1018) at 2015 ACG Annual Scientific Meeting, Honolulu, HI. October 18, 2015.

Roy J, Klein GL, Young HE. Clinical Management of Mastocytic Enterocolitis with Serum-Derived Bovine Immunoglobulin/Protein Isolate. Poster presented (#1483) at 2015 ACG Annual Scientific Meeting, Honolulu, HI. October 20, 2015.

**Pediatric Studies**


**HIV-Associated Enteropathy with Chronic Diarrhea**


Shaw AL, Burnett BP, Weaver EW. Serum-Derived Bovine Immunoglobulin Protein Isolate, a New Medical Food for the Clinical Dietary Management of HIV-Associated Enteropathy. Presented at the 26th ANAC Conference, November 23, 2013, Atlanta, GA.


All published and presented, peer-reviewed data is available upon request.
HOW SUPPLIED / STORAGE AND HANDLING

<table>
<thead>
<tr>
<th>Product #</th>
<th>Description</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>53703-100-03</td>
<td>ENTERAGAM Commercial Product</td>
<td>30 packets per carton</td>
</tr>
<tr>
<td>53703-100-11</td>
<td>ENTERAGAM Professional Samples</td>
<td>30 packets per carton</td>
</tr>
</tbody>
</table>

"Entera Health, Inc. does not represent this product code to be a National Drug Code (NDC) number. Instead, Entera Health has assigned a product code formatted according to standard industry practice to meet the formatting requirements of pharmacy and health insurance computer systems.

Store packets at 20-25°C (68-77°F): excursions permitted between 15-30°C (59-86°F). [see USP Controlled Room Temperature]

REFERENCES

1. 21 USC Section 360ee(b)(3).