Important Nutritional Considerations of the Gastrointestinal Tract

Dr. Ron Grabowski
October, 2011
Ron Grabowski, R.D., D.C.

Dr. Ron Grabowski is a practicing Doctor of Chiropractic in Houston, Texas. He has presented over 500 seminars and lectures on nutrition throughout the United States and in Europe, publishing several articles and a textbook in clinical nutrition.

Receiving his Bachelor of Science degree in Nutrition from North Dakota State University, he went on to be awarded his Doctor of Chiropractic degree from Texas Chiropractic College in Pasadena, Texas in 1989 where he became a professor and postgraduate diplomate lecturer. His dietitian experience includes tenure at some of the leading hospitals in the nation - The New York Hospital, Memorial Sloan Kettering in New York City (affiliated with Cornell Medical Center), Memorial Care System and the University of Texas M.D. Anderson Cancer Center in Houston, Texas.

Dr. Grabowski has served on the State of Texas Governor’s Childhood Obesity Taskforce and is a member of the American Dietetic Association, American Chiropractic Association and the Endocrine Society. In addition to his chiropractic practice, he has developed numerous vitamin and mineral formulas for supplement companies. Professional athletes, including those of Olympic standing, seek his expertise in nutrition consultation.

His research interests include nutritional support of the athlete and the use of supplements in clinical practice for the prevention and treatment of chronic diseases such as diabetes, heart disease, arthritis, fibromyalgia and gastrointestinal disorders.
Gastrointestinal Immunity
Non-Immunologic factors

- Gastric acid
- Peristalsis
- Microbial flora
- Epithelium (tight junctions)
- Bile acids
- Digestive enzymes
- Mucus
- Hepatic filtration
Stomach Histology

- **Rugae**: Folds in stomach when empty
- **Gastric pits**: Openings for gastric glands
  - Contain cells
    - Surface mucous: Mucus
    - Mucous neck: Mucus
    - Parietal: Hydrochloric acid and intrinsic factor
    - Chief: Pepsinogen
    - Endocrine: Regulatory hormones
Layers of Immunity

- Lumen
  - IgM
  - IgA
- Epithelium
  - IgM
  - IgA
- Lamina Propria

Circulation

Secretory component
GUT-ASSOCIATED LYMPHOID TISSUE (GALT)

- The gut-associated lymphoid tissue represents the largest mass of lymphoid tissue in the human body.
- It constitutes an important element of the total immunologic capacity of the host.
- The regulatory events of the intestinal immune response occur in different physiologic compartments:
  - Aggregated in follicles and Peyer's patches and distributed within the mucosa, the intestinal epithelium, and secretory sites.
  - The intraepithelial T lymphocytes mainly exhibit a suppressor and cytotoxic phenotype, whereas the lamina propria cells exhibit a helper and inducer phenotype.
  - The lamina propria is endowed with lymphocytes belonging to the B cell lineage.
**Immunoglobulin A (IgA)**

- Antibody production is abundant at mucosal surfaces.
- Secretory IgA is resistant to intraluminal proteolysis and does not activate complement or inflammatory responses, which makes secretory IgA ideal for protecting mucosal surfaces.
- IgA1 immunocytes predominate in the small intestine, whereas IgA2-producing cells are most frequent in the colon, the latter being more resistant to bacterial proteases.
- The secretory IgA antibodies in the gut are part of the common mucosal immune system, which includes the respiratory tract, and lacrimal, salivary, and mammary glands.
- Consequently, an immune response initiated in the gut-associated lymphoid tissue can affect immune responses at other mucosal surfaces.
Changes in Gastric pH
(Influence Bacterial Flora)

- pH 2.0
  - Normal
  - Organisms destroyed

- pH 7.0
  - Achlorhydria
  - Organisms remain viable
  - Achlorhydria permits ingested pathogens to reach intestine.
  - Dietary nitrate
    - Bacteria
      - Nitrite
        - Nitrosamine (carcinogen)
Normal Flora

- Microbial colonization begins after birth, but the development of the intestinal microflora and the gut barrier is a gradual process.
- The bacteria of the adult human gut include transient and indigenous types.
- The mouth harbors a complex microflora consisting of facultative and strict anaerobes, which includes streptococci, bacteroides, lactobacilli, and yeasts.
- The upper bowel (stomach, duodenum, and jejunum) has a sparse microflora with $1 \times 10^8$ colony-forming units/L contents.
Large Intestine & Normal Flora

From the ileum and through the remainder of the digestive tract, bacterial concentrations gradually increase, reaching $1 \times 10^{11} - 10^{12}$ colony-forming units/g in the colon.

Up to 500 species of bacteria may be present in the adult human large intestine.

Several reports indicated that 5 genera account for most of the viable forms of anaerobic bacteria in the large intestine: *Bacteroides*, *Eubacterium*, *Bifidobacterium*, *Peptostreptococcus*, and *Fusobacterium*.

Various facultative and aerobic organisms are present in the colon.

It is estimated that bacteria account for 35–50% of the volume of the contents in the human colon.
Gastroesophageal Reflux Disease (GERD)

- Estimated 44 percent of the U.S. adult population (61 million Americans) have heartburn.
- Hallmark of acid regurgitation, at least once a month.
- Approximately 14 percent of Americans have gastroesophageal symptoms weekly, and 7 percent have symptoms daily.
Medications

- **Histamine H₂-receptor antagonists**
  - Cimetidine (Tagamet)
  - Famotidine (Pepcid)
  - Nizatidine (Acid)
  - Ranitidine (Zantac)

- **Proton pump inhibitors (PPI’s)**
  - Nexium (Esomeprazole)
  - Prevacid (Lansoprazole)
  - Prilosec (Omeprazole)
  - Protonix (Pantoprazole)
  - Aciphex (Rabeprazole)
  - Dexilant (dexlansoprazole)
  - Zegerid (omeprazole w/sodium bicarbonate)
  - Kapidex (dexlansoprazole)
Proton Pump Inhibitors

- There are a number of risk factors for vitamin B12 deficiency, including prolonged use of proton pump inhibitors. (Am Fam Physician. 2011 Jun 15;83(12):1425-30)

- Uncommon adverse effects include rebound acid hypersecretion syndrome, fragility fractures, interstitial nephritis, electrolyte derangements, pneumonia, enteric infection and vitamin B12 deficiency. (Aust Fam Physician 2011 Sep;40(9):705-8)
Lifestyle Modifications for Patients with GERD

- Avoid large meals.
- Avoid acidic foods (citrus- and tomato-based products), alcohol, caffeinated beverages, chocolate, onions, garlic, and peppermint.
- Decrease dietary fat intake.
- Avoid lying down within three to four hours after a meal.
- Avoid medications that may potentiate GERD symptoms, including calcium channel blockers, beta agonists, alpha-adrenergic agonists, theophylline, nitrates, and some sedatives.
- Elevate the head of the bed 10 to 20 cm (4 to 8 inches).
- Avoid wearing clothing that is tight around the waist.
- Lose weight.
- Stop smoking.
Indications for surgery include failed medical management.
- Patient preference for surgery despite successful medical management.
- Complications of GERD.
- Medical complications attributable to a large hiatal hernia.
- Atypical symptoms with reflux documented on 24-hour pH monitoring.
Long-term Follow-up Studies

- Statistics indicate that within three to five years of surgery, 52 percent of patients are taking antireflux medications again.
- It is estimated that as many as 20 percent of patients have complications from anti-reflux surgery.
Peptic Ulcer Disease

- The predominant causes in the United States are infection with Helicobacter pylori and use of nonsteroidal anti-inflammatory drugs.
- Approximately 500,000 persons develop peptic ulcer disease in the United States each year.
- In 70 percent of patients it occurs between the ages of 25 and 64 years.
- The annual direct and indirect health care costs of the disease are estimated at about $10 billion.
- The incidence of peptic ulcers is declining, possibly as a result of the increasing use of proton pump inhibitors and decreasing rates of Helicobacter pylori infection.
Vitamins C and E and their relationship with Helicobacter pylori

- Adding vitamins C (500mg/bid) and E (200IU/bid) to standard triple therapy increases the eradication rate of H. pylori.
- Vitamins C and E may increase the eradication rate via increasing the effectiveness of the antibiotics by decreasing oxidative stress in the gastric mucosa and strengthening the immune system.

(J Clin Pharm Ther. 2011 Jul 11)
Gastric Cancer

- Gastric cancer is now the 13th most common cause of cancer mortality in the United States.
- In developing countries, the incidence of gastric cancer is much higher and is second only to lung cancer in rates of mortality.
- The typical patient with gastric cancer is male (male-to-female ratio, 1.7:1) and between 40 and 70 years of age (mean age, 65 years).
- Native Americans, Hispanic Americans, and blacks are twice as likely as whites to have gastric carcinoma.
Types of Tumors

- Ninety-five percent of all malignant gastric tumors are adenocarcinomas; the remaining 5 percent include lymphomas, stromal tumors, and other rare tumors.
- The overall declining incidence of gastric carcinoma is related to distal stomach tumors caused by *Helicobacter pylori* infection.
Inflammatory Bowel Diseases

**Crohn’s Disease**
- Involves entire GI tract
- Constant abdominal pain
- Usually not real bloody
- Skip disease
- Layers involved:
  - Mucosa
  - Submucosa
  - Muscularis
  - Serosa
- Fistula

**Ulcerative colitis**
- Usually involves colon and distal small intestine.
- Crampy pain and pain relieved with bowel movement.
- Bloody diarrhea
- Continuous pattern
- Layers involved:
  - Mucosa
  - Submucosa
  - Muscularis
- Fistula is rare
Crohn’s Disease
Signs/Symptoms

- Abdominal pain
- Abscess
- Anemia
- Ankylosing spondylosis
- Anorexia
- Aphthous stomatitis
- Bowel obstruction
- Cheilosis
- Cholelithiasis
- Clubbing
- Colic
- Constipation
- Cystitis
- Diarrhea
- Episcleritis
- Erythema nodosum
- Fever
- Fistula
- GI bleeding
- Hypoalbuminemia
- Malnutrition
- Megacolon
- Nephrolithiasis
- Primary sclerosing cholangitis
- Pyoderma gangrenosum
- Right lower quadrant pain
- Sacroiliitis
- Skip lesions
- Weight loss
Crohn’s Disease

- Patients with extensive disease and weigh less than 80% of IBW merit measurement of plasma retinol concentration.

Gut (1983)
Fistulas

- Crohn’s patients with fistulas had a 54% lower vitamin C levels than the normal subjects.

Gastroenterology
Controlled Study (Crohn’s Disease)

Eighty percent (80%) of patients on a low CHO diet which excluded all refined sugar had symptom relief within 18 months, while 40% of patients on a high CHO diet which was high in refined CHO had to discontinue the diet due to flare ups.

Z. Gastroenterol
Study

- 216 patients with IBD
- Low serum folate levels were found in 59%.
- Low RBC folate in 26%.

(Scand. J. Gastroenterol)
Study

- 54 patients with Crohn’s disease.
- Marked correlation between vitamin A and the activity of the disease.

Hepatogastroentero. (1985)
Exacerbations

- 33 patients with Crohn’s disease.
- **Provoking Foods:**
  - 1. Wheat (69%)
  - 2. Dairy products (48%)
  - 3. Yeast (31%)
  - 4. Corn (24%)
  - 5. Potato (17%)
  - 6. Banana, tomato, wine, and eggs (14%)
Vitamin K and Vitamin D in Inflammatory Bowel Disease

- Vitamin K and D deficiency and decreased bone mineral density (BMD) were highly prevalent in patients with inflammatory bowel disease (IBD), especially Crohn's disease (CD).
- Dietary intakes of these vitamins, however, were above the adequate intakes in IBD patients, suggesting that malabsorption is the basis for hypovitaminosis K and D and decreased BMD.

(Osteoporos Int. 2009 Jun;20(6):935-42.)
Vitamin D and Its Relationship with the Gastrointestinal Tract

- Vitamin D insufficiency has been linked to higher rates of cancers including colon cancer and gastrointestinal diseases, in particular IBD and colorectal cancer.

(Therap Adv Gastroenterol. 2011)
Glutamine

- Human studies
  - Under normal conditions, glutamine is a nonessential amino acid.
  - In catabolic patients, glutamine has been postulated to be a conditionally essential nutrient.
  - Numerous human studies showed that supplemental glutamine results in improved GI function.
  - Role for glutamine;
    - ameliorating the mucosal atrophy seen in prolonged states of parenteral nutrition.
    - healing of GI mucosa after damage from either radio- or chemotherapy.
    - Improving gut and systemic immune function.
    - Attaining nitrogen balance and in weaning from parenteral nutrition.
    - Reducing episodes of bacterial translocation and clinical sepsis.
Zinc

- Central component of hundreds of metalloenzymes, including alkaline phosphatase, carboxypeptidases, thymidine kinase, and DNA and RNA polymerases.
- Zinc is an important component in cell membrane structure and function, functions as an antioxidant, and protects against lipid peroxidation.
- The importance of zinc in protein synthesis and on transcription proteins, in which zinc fingers are important in regulating gene expression, points to its importance among cells with a high rate of turnover, such as GI epithelia and cells of the immune system.
- Zinc deficiency has also been associated with important changes in immune function, including reduced B and T cell function, decreased delayed cutaneous hypersensitivity reactions, decreased phagocytosis, and reduced cytokine production.
Zinc Supplementation and Diarrhea

- In patients with acute diarrhea and low rectal mucosal zinc concentrations, zinc supplements were associated with a reduced duration of acute diarrhea.
- Zinc supplements also improved markers of intestinal permeability in children with diarrheal diseases.
- In a randomized, controlled trial among 937 Indian children, zinc supplementation was associated with a decrease in the mean number of watery stools per day and in the number of days with watery diarrhea.
- In Peru, children with persistent diarrhea had a substantial reduction in duration of illness after receiving zinc.
- A recent pooled analysis showed that zinc-supplemented children with acute diarrhea had a significant reduction of continuing diarrhea and that children with persistent diarrhea had a lower probability of continuing diarrhea, treatment failure, or death.
Human studies – Vitamin A

- Children with mild vitamin A deficiency are at increased risk of diarrhea, respiratory infections, and death.
- A meta-analysis of these and other trials confirmed that an 30% reduction in infant and young child mortality was seen with vitamin A supplementation.
- Poor vitamin A status has been associated with impaired barrier function of the GI tract.
Macronutrient and micronutrient assessment should be an essential part of nutritional assessment of all patients with IBD.

(Curr Nutr Metab Care. 2011)
Prebiotics

- Defined as nondigestible food ingredients that beneficially affect the host by selectively stimulating the growth and activity of one species or a limited number of species of bacteria in the colon.
- Compared with probiotics, which introduce exogenous bacteria into the human colon, prebiotics stimulate the preferential growth of a limited number of health-promoting commensal flora already residing in the colon.
- The oligosaccharides in human breast milk are considered the proteotypic prebiotic because they facilitate the preferential growth of bifidobacteria and lactobacilli in the colon of exclusively breast-fed neonates.
Many human studies confirm that fructose oligosaccharides have a bifidogenic effect on human colonic endogenous flora.

Several clinical studies also showed a bifidogenic effect of inulin-type fructans in humans.

The bifidogenic effect is not simply that prebiotics are preferential substrates for bifidobacteria but that prebiotics interact with other bacteria and are associated with environmental changes, such as changes in luminal pH, and other factors to achieve the overall bifidogenic effect.

Some studies suggest that prebiotics improve Ca2+ absorption from the human colon.
Irritable Bowel Syndrome

Signs/Symptoms

- Abdominal pain relieved by defecation.
- Altered stool form.
- Altered stool frequency
- Altered stool passage
- Bloating or abdominal distension.
- Change in frequency or consistency of stool
- Constipation
- Depression
- Diarrhea
- Dysmenorrhea
- Dyspepsia
- Dysuria, nocturia
- Early satiety
- Excessive belching
- Fatigue
- Headache
- Heartburn
- Hysteria
- Nausea
- Passage of mucus
- Rectal mucus
- Sensation of incomplete evacuation
- Urinary frequency
Lifestyle Considerations

- Increase dietary fiber (20-30 gm/day)
  - Add slowly into the diet, since rapid introduction may result in severe flatulence.
- Avoid gastric irritants
- Avoid gas producing food items (beans, onions, cabbage, cauliflower, broccoli, brussels sprouts, etc.)
- Consume three moderate sized meals and three snacks per day.
- R/O food allergies or intolerances.
  - Wheat, corn dairy products, and citrus foods are most common.
- Consume liquids with food.
- Avoid or limit sucrose and refined carbohydrates.
- Avoid all products containing methylxanthines (cocoa, chocolate, coffee, tea, etc.)
- Reduce stress
- Exercise on a regular basis (minimum of three times/week)
- Avoid all artificial sweeteners
- Avoid chewing gum, carbonated beverages and other foods that cause an individual to swallow air.
- Avoid items that contain sorbitol or mannitol, since these items may promote flatus or diarrhea.
- Avoid alcohol
Colon Cancer and Nutrient Relationships
Vitamin D and Calcium

- A low vitamin D status and inadequate calcium intake are important risk factors for various types of cancer.
- Colon, rectal, breast, gastric, endometrial, renal and ovarian cancer exhibit a significant inverse relationship between incidence and oral intake of calcium.

(Anticancer Res. 2009 Sep)
Selenium and Cancer

- Scientific data accumulated so far using experimental animal models and from clinical studies devoted to investigating the effects of Se confirm strong relationship or correlation between Se supplementation and tumor frequency of prostate, lungs, liver and colon. (Neoplasma – 2010)
- Selenium has cancer-preventive activity that is mediated, in part, through selenoproteins. (Cancer Prev Res 2010 May)
Magnesium and Colon cancer

- Total magnesium consumption has been linked to a significantly lower risk of colorectal adenoma, particularly in those subjects with a low Ca:Mg intake.
- An inverse association trend was found for hyperplastic polyps. (AJCN 2007 Sep)
B-Vitamins and Colon Cancer

- It has been found that low folate and vitamin B(6) intake was associated with an increased risk of p53-overexpressing colon cancers but not wild-type tumors.

(Gastroenterology 2008 Sep)
Vitamin K and Colon Cancer

- Vitamin K2 (menaquinone-4: MK4) has been reported to inhibit cell growth and induce apoptosis in various tumor cells. (Int J Mol Med. 2009)

- Results suggest that vitamins K2, K3 and K5 exert effective antitumor effects on colorectal cells (CRC) in vitro and in vivo by inducing caspase-dependent apoptotic death of tumor cells, suggesting that these K vitamins may be promising agents for the treatment of patients with CRC. (Int J Oncol. 2007 Aug)
Diagnostic Studies
Commonly asked questions

1. Will I receive a copy of the presentation slides?  
   **YES**

2. Is the presentation being recorded?  
   **YES**

**You will receive an email linking to both within the next 24 hours. It will also be available on our website at www.spectracell.com in our webinar library.**