Gluten and Health:
The Connection Between Gut Health, Food Sensitivities and Allergies

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Over the past five years, gluten and the proteins in wheat have received intense attention from the media and consumers. There are several reasons for this. First, celiac disease once thought to be rare (1 in 3000) has been documented to be much more prevalent than medical science had previously known - even though new data shows that it affects only 1 percent (1 in 133) of the U.S. population. Second, in addition to increased incidence, data suggest that its prevalence in the population has actually increased in the last half century. Third, a recently identified condition called non-celiac gluten sensitivity (NCGS) has been postulated as affecting 4-6 percent of the population. Fourth, autoimmune diseases, asthma and certain allergies are thought to be increasing. Increases in these conditions are partly due to greater awareness and better diagnosis, but that is not the whole story.

Current thinking includes a complicated array of external factors such as changes in the environment and diets and internal factors such as genetic and gastrointestinal changes. These factors vary widely from the 'clean theory' - that we are too clean - or that we ingest acid reducing medicines and antibiotics to a greater degree than in the past, or to changes in wheat cultivars. Outlined below are some factors that have been shown to contribute to these complex health conditions with additional supporting information provided by the rest of the handout.

• Food intolerances, sensitivities and allergies can all cause or be symptoms of digestive difficulties. Left untreated or unresolved, these difficulties can lead to bacterial overgrowth in the gut, chronic inflammation, gastric or intestinal necrosis and in some cases death (e.g., anaphylactic shock) [Skypala 2011; NIAID-Sponsored Expert Panel et al. 2010; Sicherer and Sampson 2010].

• While at least 20% of people report having food allergies, the incidence in much less than that (Chafen et al, 2010). A 2010 JAMA review said that the actual prevalence is greater than 1-2% and less than 10%. Several references gave estimates at 3-4% [Chafen et al, 2010; Sicherer and Sampson, 2010].

• When stomach pH increases to pH of 5 or higher by use of antacid medications for ulcers or gastric reflux, or by decreased acid production due to age or illness, digestion of proteins is one of the problems created. Without acid, pepsinogen in the stomach fails to be activated to pepsin decreasing protein hydrolysis. Thus proteins leave the stomach incompletely digested resulting in large peptides and in some cases, intact proteins to pass into the small intestine [Pali-Scholl & Jensen-Jarolim 2011]. Undigested proteins or large peptides in the small intestine increase the risk that the intact protein will either interact with the immune tissues in the gut or cross the gut barrier and trigger a cascade of immune responses.

• Low pH in the stomach also helps kill pathogenic bacterial and helps reduce the risk of intestinal and other infections [Canani 2010]. When the pH rises, bacterial overgrowth in the stomach and the gut is enabled and tight junctions in the gut are threatened. [Leonard 2007]. Loss of tight junctions lead to 'leaky gut' and allow proteins and infectious and other agents to enter the body [Guttman and Finley, 2009].

Wheat Foods
C O U N C I L

• While antacids or gastric acid-inhibiting drugs are generally considered safe to use, a side effect of their use could be an impact on pH and potential bacterial overgrowth.

• A life-long diet free of wheat, rye and barely is essential for those who have celiac disease. It is not clear whether those who are gluten-sensitive must permanently remove wheat from their diets. Wheat must be avoided by those who have wheat allergy. However, up to two-thirds who have wheat allergies as a child out-grow them by late childhood or early adolescence [Keet et al, 2009].

WHAT IS GOOD DIGESTIVE OR GUT HEALTH?

Good digestion or gut health is the ability to eat and process food in a way that does not cause discomfort at any point in the process from chewing and swallowing all the way through elimination (e.g., bowel movement). Abnormal digestive problems can result from food intolerances, sensitivities and allergies. Symptoms of poor digestive health include stomach ulcers, heartburn (reflux), bloating, diarrhea, excessive gas, cramping or other intestinal pain, and constipation. Left untreated or resolved, these conditions can lead to bacterial overgrowth in the gut, chronic inflammation, gastric or intestinal necrosis and even death (e.g., anaphylactic shock) [Sky-pala 2011; NIAID-Sponsored Expert Panel et al. 2010; Sicherer and Sampson 2010]. While more than 20% of people report having food allergies, the actual prevalence is estimated to be closer to 3-4% [Sicherer and Sampson, 2010; Chafen et al, 2010].

IMPAIRED PROTEIN DIGESTION AND FOOD ALLERGIES

When the gut is working properly, proteins in all food (including gluten in wheat, rye and barley), are broken down from into smaller components called peptides. The stomach's strong acid changes pepsinogen to its active protein-splitting form pepsin. The low pH in the stomach (pH 1-3) not only helps to denature and hydrolyze proteins, it is ideal for optimal activity of pepsin. Thus, the stomach plays a key role in the first steps of protein digestion enabling smaller peptides that move from the stomach into the small intestine where they are ready for digestion into smaller peptides and finally become mono and dipeptides. The amino acids are then readily absorbed and used to build the proteins the body needs. The presence of large peptides or intact proteins in the small intestine due to inadequate breakdown by the stomach increases the likelihood that these may enter the body without being fully broken down and thereby have the capacity to trigger food allergies.

When stomach acid pH is increased (pH of 5 or higher) by either treatment with antacid medications for ulcers or gastric reflux, or due to age or illnesses, large, intact proteins are more likely to pass from stomach into the small intestine without being broken down [Pali-Schöll & Jensen-Jarolim, 2011]. The small intestine houses a great deal of the body's immunological function and it is highly suspicious of any "foreign" invaders (including bacteria and viruses) that usually take the form of proteins. Large peptides or intact proteins in the small intestine, can react with the immune tissue in the gut or can be taken up by other body tissues leading to a cascade of immune responses. In some cases, the immune responses cause digestive discomfort (diarrhea, gas, bloating). In other cases, the symptoms may be less obvious and take longer to emerge (headache, respiratory allergies, asthma, hives) and seemingly be unrelated to food reactions [Sapone et al 2012]. Some reactions may become more severe over time. The most severe food allergies cause anaphylactic shock, which can be life threatening.

STOMACH pH, ANTACIDS AND FOOD ALLERGIES

Proper stomach pH is required for protein digestion but it also helps prevent the risk of intestinal infections [Canani and Terrun 2010]. Young children do not reach adult pH levels until about two years of age [Euler 1977], and 50% of all patients 60 and older have low stomach acid levels [Davies 1930]. In addition, approximately 25 to 54% of adults in Western countries are affected by heartburn or gastric reflux each year and take antacids or medications that reduce acid production [Everhart 2008].

Regardless of the type used, antacids have been shown to significantly decrease gastric acidity [Aihara 2003]. While antacids are generally considered safe to use for people of all ages, including pregnant women, antacids have been shown to lead to bacterial overgrowth in the stomach and the gut [Leonard 2007]. Metabolites and products of bacteria, including enteric infections and toxins, can impair the intestinal barrier allowing proteins and other compounds to enter the body, setting the stage for allergies, autoimmune disorders, and inflammatory disease (Fasano 2011). In addition, up to 25% of patients in a human cohort study were found to have allergic sensitivities characterized by elevated IgE formation toward typical dietary components (e.g., milk, nuts, carrots, tomato) after being treated with antacids for 3 months and sensitization continued in 6% of participants for 5 months after treatment had stopped [Untersmayr et al. 2005]. In a study of pregnant mice fed fish protein along with antacids, allergies were induced in the mothers. Their offspring were also more likely to develop allergies if exposed to fish [Schöll et al. 2007].

GLUTEN-FREE: CURE-ALL OR BAND AID?

The explosion of gluten-free products in the marketplace in response to consumer concern about wheat and gluten has been remarkable. However, the claim that the elimination of these foods will cure many of our most serious illnesses such as diabetes and heart disease is highly debatable and has little support in the medical literature.

There are currently three recognized categories of wheat and gluten-related disorders: (1) Celiac disease, also called gluten intolerance;(2) wheat allergy; and (3) gluten sensitivity; also called non-celiac gluten sensitivity (NCGS) or non-celiac wheat sensitivity. Celiac disease, an autoimmune disorder characterized by degradation of the intestinal wall, affects approximately 1% of people of European origin (Europe, North and South America, and Australia) (Sapone et al 2012). Wheat allergy is an allergic response to wheat that can affect the skin, gastrointestinal or respiratory tract. Estimates of wheat allergy vary greatly but may be between 2 and 9% in children and 3% in adults (Sapone et al 2012). NCGS has been only recently described in the medical literature. Its existence as a separate diagnosis is controversial partly because it is difficult to characterize being neither a true allergy nor an autoimmune disorder. In a survey of patients seen in Celiac Clinic, NCGS was found to affect as many as 6% of people with symptoms such as abdominal pain, eczema or rash, headache, foggy mind, and fatigue. Since there are currently no laboratory biomarkers to measure NCGS, an elimination diet followed by a challenge is used to determine if gluten removal is helpful.

While a gluten-free diet is essential for those who have true wheat allergies or celiac disease, it is not clear whether those who are gluten-sensitive must permanently remove wheat from their diets. While gliadin (a component of gluten) has been implicated in increasing gut permeability, many other factors including bacterial overgrowth of certain gut microflora, food components such as spices, and even stress have also been shown to affect gut permeability (Ulluwishewa et al. 2011). For example, infection with enteric bacteria can increase the likelihood of leaky gut syndrome, a condition in which the intestinal barrier becomes more permeable allowing antigens (proteins) to get through the intestinal wall and pose a threat to the immune system (Fasano 2011).

Removing gluten from the diet may not resolve the inflammatory conditions within the intestine or stop leaky gut syndrome. However, if the gut is allowed to heal using dietary and pharmacologic measures (e.g., antibiotics, probiotics and dietary measures) and lifestyle factors (stress reduction, exercise) that restore the gut microflora so that the inflammatory conditions are arrested, gluten as well as other food sensitivities may be resolved (Ulluwishewa et al. 2011).

Food intolerances, sensitivities and allergies may pose serious risks to health and quality of life. However, avoidance of a food without medical reason also has cost, convenience and potential unnecessary nutritional ramifications. Thus, the importance of correct diagnosis and help with dietary planning is underscored. It is imperative that patients with these conditions are treated by their healthcare providers. Registered dietitians with their expert understanding of food and nutrition are ideally suited to assist patients in identifying, treating and resolving or managing food intolerances.

References:

Aihara T, Nakamura E, Amagase K, Tomita K, Fujishita T, Furutani K, et al. Pharmacological control of gastric acid secretion for the treatment of acid-related peptic disease: past, present, and future. Pharmacol Ther 2003;98:109–27. [PMID: 12667890]

Aziz I, Sanders DS. Emerging concepts: from coeliac disease to non-coeliac gluten sensitivity. Proc Nutr Soc. 2012 Sep 6:1-5. [Epub ahead of print]

Canani RB, Terrin G. Gastric acidity inhibitors and the risk of intestinal infections. Curr Opin Gastroenterol. 2010; 26(1):31-5. [PMID: 19907324]

Carroccio A, Mansueto P, Iacono G, et al. Non-Celiac Wheat Sensitivity Diagnosed by Double-Blind PlaceboControlled Challenge: Exploring a New Clinical Entity.Am J Gastroenterol. 2012 Jul 24. doi: 10.1038/ ajg.2012.236. [Epub ahead of print] [PMID: 22825366]

Chafen JJ, Newberry SJ, Riedl MA, et al. Diagnosing and managing common food allergies: a systematic review. JAMA. 2010; 303(18):1848-56. [PMID: 20460624]

Davies D, James TG. An investigation into the gastric secretion of a hundred normal persons over the age of sixty. Brit J Med 1930;1:1–14.

El-Serag HB, Petersen NJ, Carter J, et al. Gastroesophageal reflux among different racial groups in the United States. Gastroenterology. 2004; 126:1692–1699. [PMID: 15188164]

Euler AR, Byrne WJ, Cousins LM, Ament ME, Walsh JH. Increased serum gastrin concentrations and gastric acid hyposecretion in the immediate newborn period. Gastroenterology 1977;72:1271– 3. [PMID: 870375]

Everhart, JL, ed. The Burden of Digestive Diseases. National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, United States Department of Health and Human Services. http://tinyurl.com/6tvh7h7 Accessed September 19, 2012.

Fasano A. Leaky Gut and Autoimmune Diseases. Clinic Rev Allerg Immunol 2012 Feb;42(1):71-8. [PMID:22109896] http://tinyurl.com/asdyncg Accessed August 29, 2012

Fasano A. Zonulin and Its Regulation of Intestinal Barrier Function: The Biological Door to Inflammation, Autoimmunity, and Cancer Physiol Rev 91: 151–175, 2011; doi:10.1152/physrev.00003.2008. [PMID:21248165] http://tinyurl.com/cdjd8dp Accessed 8/29/2012

Guttman JA, Finlay BB. Tight junctions as targets of infectious agents. Biochim Biophys Acta. 2009;1788(4):832-41. [PMID: 19059200]

Heikkinen M, Pikkarainen P, Takala J, Julkunen R. General practitioners' approach to dyspepsia. Survey of consultation frequencies, treatment, and investigations. Scand J Gastroenterol 1996;31:648–53. [PMID:8819212] http://tinyurl.com/7ysaaem

Keet CA, Matsui EC, Dhillon G, Lenehan P, Paterakis M, Wood RA. Leonard J, Marshall JK, Moayyedi P. Systematic review of the risk of enteric infection in patients taking acid suppression. Am J Gastroenterol 2007; 102:2047–57. [PMID: 17509031]

NIAID-Sponsored Expert Panel, Boyce JA, Assa'ad A, Burks AW, et al. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. J Allergy Clin Immunol. 2010 Dec;126(6 Suppl):S1-58. [PMID: 21134576]

Pali-Schöll, IP and Jensen-Jarolim E. Anti-acid medication as a risk factor for food allergy. Allergy 2011; 66: 469-477 [PMID: 21121928]

Sapone A, Bai JC, Ciacci C, et al. Spectrum of gluten-related disorders: consensus on new nomenclature and classification. BMC Medicine 2012, 10:13 Accessed August 29, 2012 [PMID: 22313950] Schöll I, Ackermann U, Ozdemir C, et al. Anti-ulcer treatment during pregnancy induces food allergy in mouse mothers and a Th2-bias in their offspring. FASEB J. 2007;21:1264-70. [PMID: 17227952]

Sicherer SH, Sampson HA. Food allergy. J Allergy Clin Immunol. 2010;125(2 Suppl 2):S116-25. [PMID: 20042231]

Skypala I. Adverse food reactions-an emerging issue for adults. J Am Diet Assoc. 2011 Dec;111(12):1877-91. [PMID: 22117664]

The natural history of wheat allergy. Ann Allergy Asthma Immunol. 2009;102(5):410-5. [PMID: 19492663]

Ulluwishewa D, Anderson RC, McNabb WC, et al. Regulation of Tight Junction Permeability by Intestinal Bacteria and Dietary Components. J Nutr. 2011;141:769-76. [PMID: 21430248] http://tinyurl.com/a5p833h Accessed 9/5/12

Untersmayr E, Bakos N, Schöll I, Kundi M, Roth-Walter F, Szalai K, et al. Anti-ulcer drugs promote IgE formation toward dietary antigens in adult patients. FASEB J 2005;19:656–8. [PMID: 15671152]

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