

# SCIENCE BRIEF: IMPROVED GLUTEN DIGESTION WITH INNOVATIVE ENZYME SOLUTIONS

*The growing awareness of gluten intolerance has resulted in a new approach to enzyme-based dietary supplementation for improved carbohydrate and gluten digestion: Introducing Transformation's Professional Protocol (TPP™) CARBO-G.*

Transformation Enzyme Corporation (TEC) is a nutritional supplement company specializing in the development of high quality enzyme-based products for the health care professional. Through clinical and observational research, our efforts focus on teaching the importance of nutrient acquisition as the foundation of wellness and healthy living.

***“All disease begins in the gut”  
-Hippocrates (ca. 460 BC - ca. 370 BC)***

A poor diet and a digestive system that fails to process food for bioavailability and absorption will undermine the body's coping ability and create conditions favorable for disease and metabolic disorders. Based on this fact, we strive to educate health care professionals worldwide on the benefits of a balanced diet and proper digestion. The primary benefits of supplementation with digestive enzymes are:

- 1. A healthy and optimally functioning digestive system**
- 2. Enhanced bioavailability of nutrients for cellular vitality and healthy immune system**
- 3. Efficient and timely removal of metabolic waste and environmental toxins**

Historically, supplemental digestive enzymes were obtained from the pancreatic juice of animals, commonly bovine and porcine. However, in the past several decades, enzymes derived from non-animal sources have gained increased recognition. Plant enzymes such as bromelain and papain are being commonly used. More current research suggests mycelial enzymes from *Aspergillus oryzae* and *Aspergillus niger* as well as other microorganisms have been proven safe and effective, and often times clinically superior to traditional “animal” and “plant” enzymes for digestion.

Transformation's scientific staff with decades of combined experience in biochemistry, nutrition, and cellular and molecular biology has designed a new formula to facilitate the breakdown of grains containing gluten that normally tend to be difficult to digest. This article will review the growing need for supplemental digestive enzymes and highlight the unique benefits of our “New & Improved” Carbo-G formula.

## **The Importance of Good Nutrition and, More Importantly, Optimal Digestion**

It is estimated that over 80 million Americans are affected by various forms of digestive diseases. According to the National Institutes of Health (NIH), the related health care cost is estimated at over \$107 billion.

A significant factor contributing to these increases can be attributed to poor diet, improper digestion, stressful lifestyles, and the prevalence of toxins in the environment. While genetics may play a part, there is more and more evidence pointing to the fact that the vast majority of all disease can be traced back to poor diet, mal-digestion, and the inability of the gut to function properly.

In clinical practices, we are seeing more and more food-related immune responses. These food intolerances or sensitivities arise from undigested food molecules. These unrecognized “chemicals” 1) damage the cells in the small intestines, 2) trigger immune cells in the intestines to attack the self, and 3) create a situation where the damaged intestines allow undigested food molecules to “leak” into the blood, triggering an immune response. This immune response may manifest anywhere in the body and in many different forms, and that is what brings the patient to seek help.

While traditional medicine treats the symptoms with immuno-suppressive drugs, the more natural approach is to heal the intestinal lining with probiotics, L-Glutamine, and various nutritional supplements. But isn't the true

## Did you know?

- According to the Centers for Disease Control and Prevention **inflammatory bowel disease (IBD)** is one of the five most prevalent gastrointestinal disease burdens in the United States, with an overall health care cost of more than \$1.7 billion. Each year in the United States, IBD accounts for more than 700,000 physician visits, 100,000 hospitalizations, and disability in 119,000 patients. Over the long term, up to 75% of patients with Crohn's disease and 25% of those with ulcerative colitis will require surgery. ([www.cdc.gov/ibd](http://www.cdc.gov/ibd))
- **Celiac disease** is an autoimmune digestive disease that damages the villi of the small intestine and interferes with absorption of nutrients from food. An estimated 2.8 million Americans are diagnosed with celiac disease while an additional 95% of celiacs are undiagnosed. The celiac disease diagnosis rate may reach 50-60% by 2019. ([www.celiaccentral.org](http://www.celiaccentral.org))
- Dr. James Braly, allergist and immunologist, estimates the incidence of **gluten sensitivity** to be around 30% of the U.S. population. Dr. Fine of Enterolab, based on results of IgA antibody tests and gene tests from his laboratory, estimates 30-40%. However, as some people have no symptoms, so are never tested, some commentators feel that the actual number is closer to 50%.
- According to the Centers for Disease Control and Prevention, if 4 million children are born in the United States every year, approximately 36,500 children will eventually be diagnosed with an **Autism Spectrum Disorder**. Assuming the prevalence rate has been constant over the past two decades, we can estimate that about 730,000 individuals between the ages of 0 to 21 have an ASD. ([www.cdc.gov/ncbddd/autism/data](http://www.cdc.gov/ncbddd/autism/data))

cause the undigested food molecules? Shouldn't the first line of defense be to ensure digestion of all foods including those difficult grains, proteins, and allergy-prone foods?

Let's focus on two key variables: food choices and digestion. These can be addressed immediately simply by paying attention to what one eats (organic, fresh, and whole foods minimally processed) and by supplementing with digestive enzymes. The benefits to your patient's overall health are extensive and include:

- Bioavailability of valuable nutrients to the cell
  - Proteins supply amino acids, the structural components for every cell, tissue, muscle, and organ
  - Carbohydrates are the body's main energy source
  - Fats supply fatty acids for energy and for building cell walls, cholesterol, and hormones
  - Vitamins and minerals are key to all the processes that take place in the body and serve as cofactors for many biochemical reactions
- Efficient, appropriate, and healthy immune function
- Maintenance of a healthy lining of the intestines
- Timely elimination of waste for decreased toxicity

When the body is completely digesting nutritious foods, the nutrients are made available to the cells and thus the opportunity for achieving true health and wellness is present.

## TPP™ CARBO-G: Formula Rationale

There are many health benefits associated with eating a balanced diet that includes complex carbohydrates such as wheat, rye, barley, and oats. These grains provide starch (energy), fiber, protein, vitamins, and minerals. However, the digestion of these grains may sometimes be challenging and cause occasional bloating, diarrhea, gas, and abdominal cramps. In some people, the inability to digest the protein known as gluten results in more serious intestinal or inflammatory conditions.

Supplemental enzymes are an increasingly popular option for helping maintain optimum digestion of these foods. However, before a proteolytic enzyme can reach the gluten, the polysaccharides which encase the protein must first be broken down. To accomplish this, Transformation Enzyme Corporation introduces its new and improved Professional Protocol Carbo-G formula.

## TPP™ CARBO-G: Ingredient Highlights

TPP™ Carbo-G contains digestive enzymes from microbial fungal sources that are safe, effective, and GI tract stable. This means the digestive enzymes in TPP™ Carbo-G do not require an enteric coating to survive the environment of the stomach but rather initiate digestion in the stomach and continue the digestive process in the small intestines. This is a key point because it allows maximum time for the supplemental enzymes to assist the endogenous enzymes to complete the breakdown

of the carbohydrates and proteins that may be triggering immune reactions.

**Proteolytic Enzymes**

Dipeptidyl Peptidase IV (DPP-IV) is an enzyme that breaks down the proline and glutamine bonds in the wheat protein gluten. Incomplete digestion of these peptides is linked to the food intolerances associated with ingestion of foods containing gluten proteins. DPP-IV is considered an exo-protease, meaning it cleaves mainly the terminal bonds on an amino acid chain. It is this “exo” property that assists our endogenous enzymes and makes DPP-IV especially effective in the digestion of gluten. The DPP-IV in TPP™ Carbo-G is obtained from the controlled fermentation of select *Asperigillus* species and is effective in a pH of 2.0-8.0 making it ideal to support protein digestion in the stomach and small intestines. This product contains 500 DPP-IV per capsule which has been found effective in clinical settings.

**Professional Protocol Carbo-G:  
New and Improved Formula  
for Carbs and Gluten**

Supplement Facts		
Serving Size 1 Capsule		
Servings Per Container 90		
Amount Per Serving		% Daily Value
Tzyme™ Enzyme Blend	353 mg	
Dipeptidyl peptidase IV	500 DPP-IV	†
Protease Blend	46,890 HUT	†
Phytase	90 FTU	†
Diastase	42 DP	†
Alpha-galactosidase	525 GalU	†
Amylase	3495 DU	†
Pectinase	30 endo-PGU	†
Glucoamylase	12 AFU	†
Lipase	340 FIP	†
Invertase	14 SU	†
Lactase	140 ALU	†
Protease 3.0	2 SAPU	†
Alkaline protease	100 USP	†
Cellulase	60 CU	†
Hemicellulase	60 HCU	†
Bifidobacterium infantis (300,000,000 CFU at time of formulation)	30 mg	†
Herbal Blend	63 mg	†
Fennel (seed), Ginger (rhizome), Flax seed, Peppermint (leaf), Artichoke (leaves) extract		

† Daily Value not established

Other Ingredients: Cellulose, Water

Additionally, the protease blend in TPP™ Carbo-G contains acid, neutral, alkaline, endo and exo peptidases. This comprehensive proteolytic enzyme blend assists in the digestion of all dietary proteins, including gluten. The proteases work in a broad pH range making them effective for digestion in the stomach and small intestines.

Complete protein digestion is important for everyone, not just those suffering from food intolerances. The proteolytic enzymes in this formula are used to help digest protein to produce amino acids, which are important building blocks in the human body. These amino acids are used to build muscles, metabolic enzymes, neurotransmitters, and many other essential biochemicals. Proteolytic enzyme supplementation can therefore be essential to maintaining overall health and allows you to get the maximum nutrition from the protein consumed in a typical diet.

**Carbohydrases**

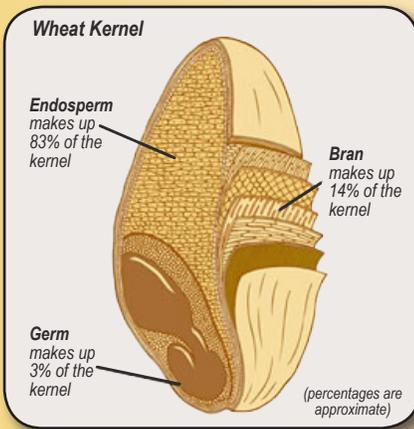
TPP™ Carbo-G contains a comprehensive blend of carbohydrases that work synergistically for maximum digestion of all carbohydrates – starch, fiber, and sugar. Specifically, the enzymes alpha-galactosidase, phytase, glucoamylase, amylase, and diastase support digestion of grains. This is vital for persons suffering from gluten intolerances since the endosperm must first be broken down in order to expose the gluten to the proteases. TPP™ Carbo-G is unique in that it addresses both the breakdown of the grain as well as the gluten.

In addition, the enzymes phytase, cellulase, and hemicellulase break down fiber and promote the release of vital nutrients often “locked” within these chemical structures. This does not, however, negatively impact or diminish the presence of fiber necessary for proper elimination of wastes. The proprietary carbohydrase blend in TPP™ Carbo-G is acid stable and works in a wide pH range, therefore functioning throughout the gastrointestinal tract.

***The only thing that any biological system ultimately requires is an ensured way of delivering nutrients to the cells.***

**Probiotics**

TPP™ Carbo-G contains the probiotic *B. Lactis* in support of a healthy GI tract. Recently, a team of researchers based in Finland demonstrated for the first time that *B. lactis* probiotic bacteria are capable of shielding epithelial cells from cellular damage caused by gliadin exposure. *B. lactis* decreased or eliminated the compromise in cell wall resistance caused by gliadin. This means *B. lactis* overcame the mechanism that gives rise to decreased



## What Is Gluten?

A grain of wheat is composed of three parts – the endosperm, the bran, and the germ. The bran and the germ provide mostly fiber and nutrients. The endosperm is the largest portion and this is where the gluten is found. Gluten is a mixture of proteins called gliadins and glutelins. It is the gluten proteins that give wheat dough its elastic texture. Gluten is also used in many processed foods such as condiments to provide stability and thickness. In addition to wheat, other grains such as barley and rye contain gluten and oats contain a similar but slightly different protein.

In spite of the fact that humans have been eating grains for nearly 10,000 years, most have not yet fully evolved to digest them completely. Historically, wheat was more expensive and reserved mainly for the rich, but with

advanced agricultural practices it has been made much more available to the masses. Add to these advances the technology of genetic engineering and now we have wheat that is more difficult to digest and also has more gluten. The result is far more gluten in the diet from obvious sources as well as hidden ones. It's no wonder we continue to see food intolerances run rampant in our patients.

## Should I Avoid Gluten?

So, is the answer to eat gluten free? Perhaps, but this might not be realistic and 100% attainable, and in the overall picture, gluten is unfairly singled out and blamed. It is our stressful lifestyles, our diets lacking “whole” foods, and our toxic environment that challenges digestion of *all* foods and compromises our health. In fact, concerns about gluten may be what brings in clients, but further investigation reveals they have many *more* food sensitivities.

Also, just because a food is “gluten free” does not necessarily mean it is healthy. Foods that are naturally gluten free like fruits, vegetables, brown rice, and legumes are good choices. However, those processed or baked foods that traditionally contained gluten and now have been reformulated to use something other than gluten need to be scrutinized for ingredients that may be far worse than the gluten itself. Thus, the need for a comprehensive approach including a healthy diet, enzymes to support digestion of all foods and maintain a healthy digestive system is more important than ever.

cell wall resistance and increased permeability that occurs during an adverse reaction to wheat gliadin.

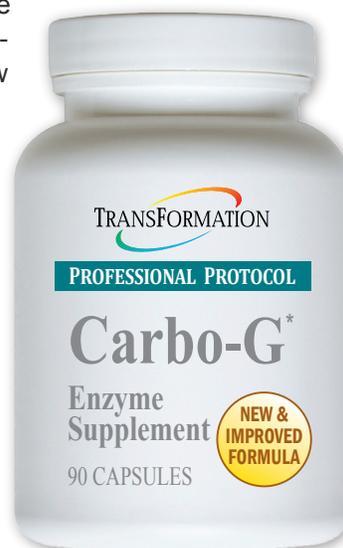
Additionally, probiotic organisms produce digestive enzymes which act to support the endogenous enzymes of the host. Probiotic bacteria are known to produce lactases, proteases, amylases, and sucrases. Animal studies show that the enzymes produced by probiotics play important roles in the digestive tracts of mammals. Laboratory animals lacking a healthy colony of flora in their gut ecology have significantly reduced intestinal activities of these essential enzymes, and as a result do not show the same health and productivity as animals with normal gut flora. Studies show that supplementation of probiotic organisms can improve these enzyme activities as well as the animal's health and productivity. Similar results have been noted in humans

## Dietary Ingredients

**Fennel** has traditionally been used to aid digestion and relieve indigestion, gas pains, and abdominal cramps. The oil component in fennel appears to relax the smooth muscle lining of the digestive tract, which gives rise to its soothing effect.

**Ginger** has been commonly used by traditional herbalists for gastrointestinal upset and nausea. Ginger is also believed to promote digestion by increasing the flow of saliva, gastric juices, and bile.

**Peppermint** has traditionally been used to provide relief from common digestive conditions such as gas, nausea, and indigestion. Peppermint may also stimulate the flow of bile, which can promote the digestion of fats. Constituents found in peppermint appear to have a spasmolytic effect which acts to relax smooth muscle and ease intestinal spasms.



**Flax seed** is a balanced source of omega fatty acids and has traditionally been used for colon conditions, gastritis, bladder problems, and inflammation.

**Artichoke leaf extract** has a history of use for support of liver, gallbladder, and digestive disorders. It has been incorporated in this formula as a pre-biotic to support the health of natural flora found in the human GI tract.

## Summary

Since 1991, Transformation has worked closely with health professionals to provide high quality enzyme-based supplements designed to support more effective acquisition of essential nutrients through improved digestion. Transformation's founder and principle formulator, Dr. DicQie Fuller-Looney, has over thirty years of specialized clinical experience observing and working with individuals with digestive concerns like gluten intolerance. Her products and success speak for themselves.

TPP™ Carbo-G is an innovative enzyme blend that includes both the enzymes that break down the polysaccharides which encase gluten as well as the DPP-IV protease necessary to digest gluten proteins. It also contains a probiotic and herbs to help reduce the symptoms of occasional food intolerances. For those who are striving for a gluten-free diet, TPP™ Carbo-G is the perfect digestive enzyme formula.



When food intolerances have gone undetected for a time, inflammatory conditions may persist in the GI tract and/or systemically throughout the body. Synergistic formulas that may be considered are TPP™ Protease and TPP™ Probioic.

## Recommended Usage

Take one (1) capsule at the beginning of every meal or snack with at least 8 oz. of liquid. Contents may be removed from capsule and taken by spoon immediately after mixing with a small amount of tepid water. Usage may be increased according

to need as directed by health care practitioner.

TPP™ Carbo-G is a vegetarian product containing absolutely no fillers or binders. This product is dairy free, gluten free, and soy free. As with the majority of Transformation's products, TPP™ Carbo-G is presented in a vegetable capsule made of cellulose and water. The capsules easily pull apart for those who cannot swallow a capsule. Consult your physician before taking.

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**\*This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.**

## References

### ENZYME STABILITY

Mamadou M, Marr S, Paydon K, Medhektar R. "Stability and Activity of Supplemental Digestive Enzymes in Simulated Gastric Fluid" presented at the Scripps Conference in San Diego, January 7-9, 2005.

### PROTEASE

Burford TW, Cooke MB, Redd LL, Hudson GM, Shelmadine BD, Willoughby DS. "Protease supplementation improves muscle function after eccentric exercise." *Med Sci Sports Exerc.* 2009 Oct;41(10):1908.

### DDP-IV

Stepniak D, Spaenij-Dekking L, Mitea C, Moester M, de Ru A, Baak-Pablo R, van Veelen P, Edens L, Koning F. "Highly efficient gluten degradation with a newly identified prolyl endoprotease: implications for celiac disease." *Am J Physiol Gastrointest Liver Physiol.* 2006 Oct;291(4):G621-9.

### BROMELAIN

Choi HS, Sa YS. "Fibrinolytic and antithrombotic protease from *Spirodela polyrhiza*." *Biosci Biotechnol Biochem.* 2001 Apr;65(4):781-6.

Felton GE. "Fibrinolytic and antithrombotic action of bromelain may eliminate thrombosis in heart patients." *Med Hypotheses.* 1980 Nov;6(11):1123-33.

Kumakura S, Yamashita M, Tsurufuji S. "Effect of bromelain on kaolin-induced inflammation in rats." *Eur J Pharmacol.* 1988 Jun 10;150(3):295-301.

Maurer HR. "Bromelain: biochemistry, pharmacology and medical use." *Cell Mol Life Sci.* 2001 Aug;58(9):1234-45.

Taussig SJ, Batkin S. "Bromelain, the enzyme complex of pineapple (*Ananas comosus*) and its clinical application. An update." *J Ethnopharmacol.* 1988 Feb-Mar;22(2):191-203.

### AN NO

Ganiats TG, Norcross WA, Halverson AL, Burford PA, Palinkas LA. "Does Beano prevent gas? A double-blind crossover study of oral alpha-galactosidase to treat dietary oligosaccharide intolerance." *J Fam Prac.* 1994; 39(5):441-5.

Graham H, Fadel JG, Newman CW, Newman RK. "Effect of pelleting and B-gluconase supplementation on the ileal and fecal digestibility of a barley-based diet in the pig." *J Anim Sci.* 1989; 67:1293-1298

Mroz Z, Jongbloed AW, Kemme PA. "Apparent digestibility and retention of nutrients bound to phytate complexes as influenced by microbial phytase and feeding regimen in pigs." *J Anim Sci.* 1994 Jan;72(1):126-32.

Murai A, Kobayashi T, Okada T, Okumura J. "Improvement of growth and nutritive value in chicks with non-genetically modified phytase product from *Aspergillus niger*." *Br Poult Sci.* 2002; 43(5 Suppl):687-95.

Nakae Y, Onouchi H, Kagaya M, Kondo T. "Effects of aging and gastric lipolysis on gastric emptying of lipid in liquid meal." *J Gastroenterol.* 1999; 34:445-449.

### PROBIOTICS

Lindfors K, Blomqvist T, Juuti-Uusitalo K, Stenman S, Venäläinen J, Mäki M, Kaukinen K. "Live probiotic *Bifidobacterium lactis* bacteria inhibit the toxic effects induced by wheat gliadin in epithelial cell culture." *Clin Exp Immunol.* 2008 Jun;152(3):552-8.

### DIETARY INGREDIENTS

*Physicians' Desk Reference for Herbal Medicines*, 3rd edition. Montvale, NJ: Thompson PDR; 2004.

*The Complete German Commission E Monographs, Therapeutic Guide to Herbal Medicines*, 1st ed. Integrative Medicine Communications, 1998.

<http://naturaldatabase.therapeuticresearch.com>