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A GUT HEALTH CRISIS

Impact of GLP-1 Medications on Digestive Wellness, and What You Can Do To Stop It

GLP-1: The Naturally Produced Hormone

- Glucagon-like Peptide-1 or GLP-1 is part of a group of metabolic hormones — called incretin hormones — that help decrease blood glucose levels.
- The majority of GLP-1s are produced by L-cells lining the small intestine and colon; smaller quantities are secreted by the pancreas and the central nervous system.
- Primarily triggered by food consumption, GLP-1 release occurs 10 – 15 minutes after eating.
- It remains in the blood system for several hours, but nerve activity and other hormones can affect GLP-1 production and levels.

Factors Impacting GLP-1 Secretion

- Gut Microbiome Health
- Diet & Nutrition Status
- Exercise/Movement
- Poor sleep and high stress
- Conditions like PCOS
- Age-related decline in pancreatic beta-cell function
- Hormonal shifts
- Metabolic enzyme production

GLP-1: Key to Blood Glucose Homeostasis

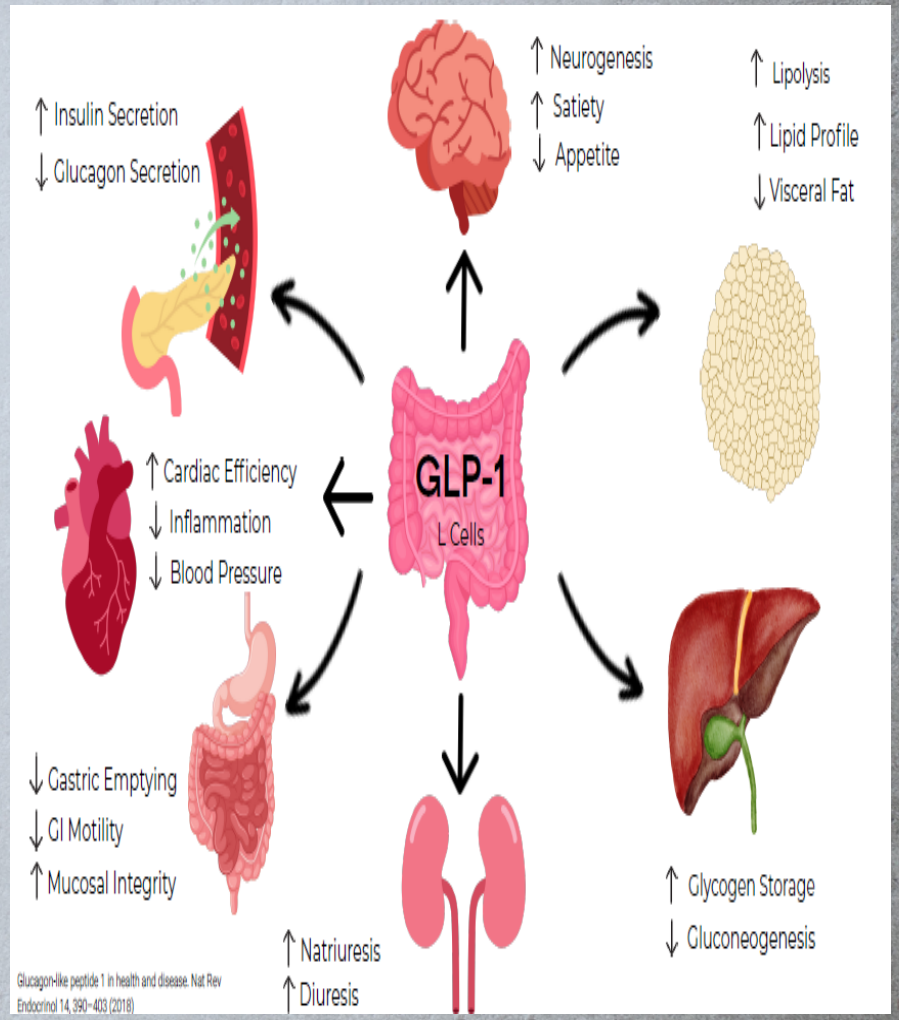
- Remarkably, GLP-1 is glucose-dependent — **it reduces blood glucose levels only after a person eats**; it does not reduce glucose levels on its own.
- In clinical studies, GLP-1 administered intravenously to fasting patients failed to reduce blood sugar levels compared with patients who consumed a meal.
- This inability to induce hypoglycemia, or low blood sugar levels, in IV-administered GLP-1 led to the development of GLP-1 receptor agonists.

What Are GLP-1 Agonists?

- GLP-1 agonists (also known as GLP-1 receptor agonists, incretin mimetics, or GLP-1 analogs) represent a class of medications used to treat T2DM and, in some cases, obesity.
  - Examples of drugs in this class include Exenatide, Liraglutide, Dulaglutide, and Semaglutide.
- GLP-1 agonists mimic the natural hormone glucagon-like peptide-1, which helps regulate insulin release and blood sugar control.
- GLP-1's decrease food intake via actions affecting the hypothalamus and brainstem; delayed stomach emptying; protecting and increasing beta cell mass; altered taste perception and food palatability, which helps reduce intake; and inflammation.

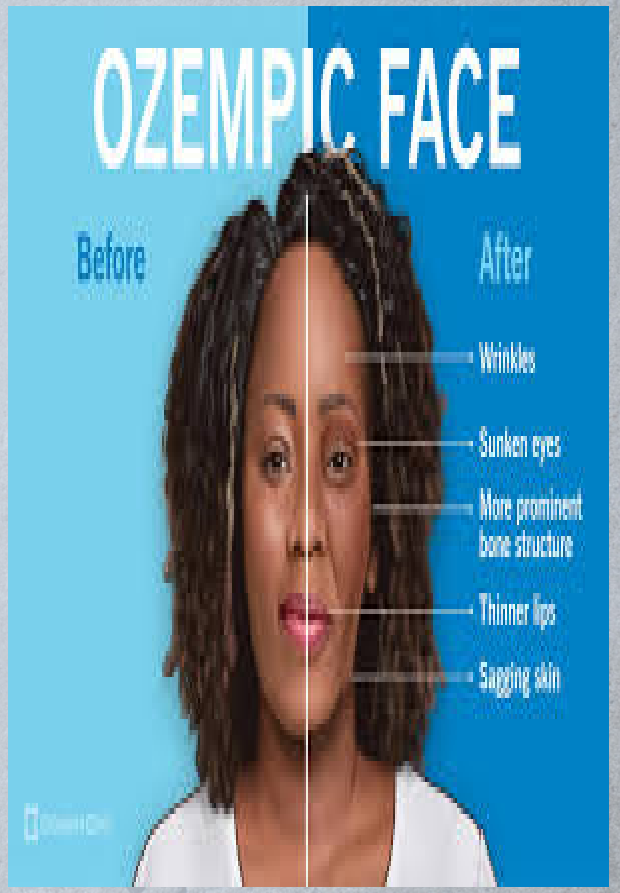
How Do GLP-1 Agonists Work for Weight Loss ?

- **Stimulate insulin release & improve sensitivity** :After a meal, GLP-1 agonists trigger the pancreas to release more insulin, and enhance the responsiveness of cells to insulin, meaning that less insulin is needed to lower blood glucose levels which promotes fat burn and satiety.
- **Reduce glucagon**:
- They suppress the release of glucagon, a hormone that raises blood sugar by releasing glucose from the liver, which helps to reduce inflammation.
- **Slow gastric emptying:**
- GLP-1 agonists can slow down the rate at which food leaves the stomach, making you feel fuller for longer and potentially leading to reduced food intake.



Common Side Effects of GLP-1's

- Nausea (42.2%)
- Vomiting (21.9%)
- Diarrhea (21.9%)
- Constipation (8.4%)
- Low blood sugar (hypoglycemia)
- Headaches/Dizziness/Fatigue
- Food aversions & appetite changes
- Injection site reactions
- Dehydration



Common Side Effects of Poor Digestion

Abdominal pain, cramping, or discomfort

Bloating and gas

Diarrhea or constipation

Heartburn and acid reflux

Nausea and vomiting

Fatigue and lethargy

Irritability and mood changes

Skin problems, such as eczema or psoriasis

Joint pain

Weight loss or gain

More Serious Side Effects

- GLP-1 can inhibit gastric acid secretion and slow gastric emptying, which can delay the absorption of nutrients in the small intestine.
- GLP-1 can interfere with gallbladder function by reducing the release cholecystokinin (CCK), which is essential for emptying the gallbladder and properly digesting fats.
    - Rapid weight loss associated with GLP-1 RAs can also contribute to gallstone formation.
- GLP-1 generally inhibits exocrine pancreatic secretion. Specifically, it reduces the release of digestive enzymes like amylase and lipase from the pancreas.
- While GLP-1 has been linked to pancreatic function, there's no direct causal link between its actions and increased pancreatic activity or inflammation.

Pancreatitis, Gastroparesis, & Malnutrition

- **Pancreatitis**
- occurred at a rate of about 5 cases per 1,000 (0.5%) users of semaglutide and 8 cases per 1,000 (0.8%) users of liraglutide.
  Gastroparesis
- was seen at a rate of about 10 cases per (1%) semaglutide users and 7 cases per 1,000 (0.7%) liraglutide users.
- **Body Composition**
  Liraglutide, was the only GLP-1 to achieve significant weight reduction without significantly reducing lean mass.
- Tirzepatide and semaglutide were the most effective for weight and fat mass reduction but the least effective in preserving lean mass.

How GLP-1 Affects the Pancreas

- **Receptor Expression:** GLP-1 receptors are found on both pancreatic islet cells (which produce insulin) and exocrine duct cells, which are responsible for producing digestive enzymes.
- **Overgrowth and Inflammation:** Stimulation of these receptors by GLP-1 RAs can lead to overgrowth of the duct cells, causing hyperplasia and potentially chronic, low-grade inflammation.
- **Enzyme Secretion:** This inflammation can disrupt the normal functioning of the pancreatic acini, the cells responsible for producing and releasing enzymes like elastase.
- **Pancreatic Injury:** Some studies suggest that GLP-1 RAs might cause direct pancreatic injury, potentially impacting enzyme production.

MALNUTRTION AND MUSCLE WASTING

- Ozempic, and other similar weight-loss medications, can increase the risk of malnutrition and muscle wasting.
- Rapid weight loss and calorie deficits will result in loss of both fat and muscle mass.
- While some studies show a similar reduction in lean mass with these medications as with lifestyle-based treatments for obesity, the rapid nature of the weight loss can pose a risk for those not adequately addressing muscle maintenance.

Systemic Review Findings On Microbiome Impact of GLP-1

- Liraglutide consistently promoted the growth of Akkermansia muciniphila. It also increased levels of Faecalibacterium prausnitzii and reduced the prevalence of inflammation-associated microbes.
- Both liraglutide and exenatide also increased Lactobacillus reuteri, a beneficial microbe that enhances intestinal barrier function and promotes GLP-1 secretion.
- Dulaglutide showed promising signs in animals, increasing beneficial bacteria like Bacteroides, Akkermansia, and Ruminococcus. Human studies reported only minor shifts, with Lactobacillus being one notable increase.
- Semaglutide produced mixed results in animal models. While it boosted A. muciniphila, it also appeared to reduce overall microbial diversity.

Gofron KK, Wasilewski A, Malgorzewicz S. Effects of GLP-1 analogues and agonists on the gut microbiota: a systematic review. Nutrients. 2025 Apr 9;17(8):1303.

GLP-1 & SIBO

- While GLP-1 agonists are known to have potential gastrointestinal side effects, the specific connection to SIBO (Small Intestinal Bacterial Overgrowth) is not definitively established.
- Some studies suggest that GLP-1 agonists can alter the gut microbiome, potentially leading to changes in gut bacteria, which could indirectly contribute to SIBO.
- However, more research is needed to determine the direct causal relationship between GLP-1 agonists and SIBO.

PATIENT TESTIMONY

I’ve been suffering from SIBO for + 7 years. Test showed both types of gas present. I tried herbal antibiotics, regular antibiotics, and a lot of other protocols.

The Rifaximin course was taken with another antibiotic. Gave me relief for about 2 months. SIBO came back with a vengeance.

CandiBactin AR + BR also only brought temporary relief.

All my symptoms were gone as soon as I got on Ozempic. My gastroenterologist won’t believe it but as soon as I skip a dose they come back.

Current Rec's For Managing Side Effects

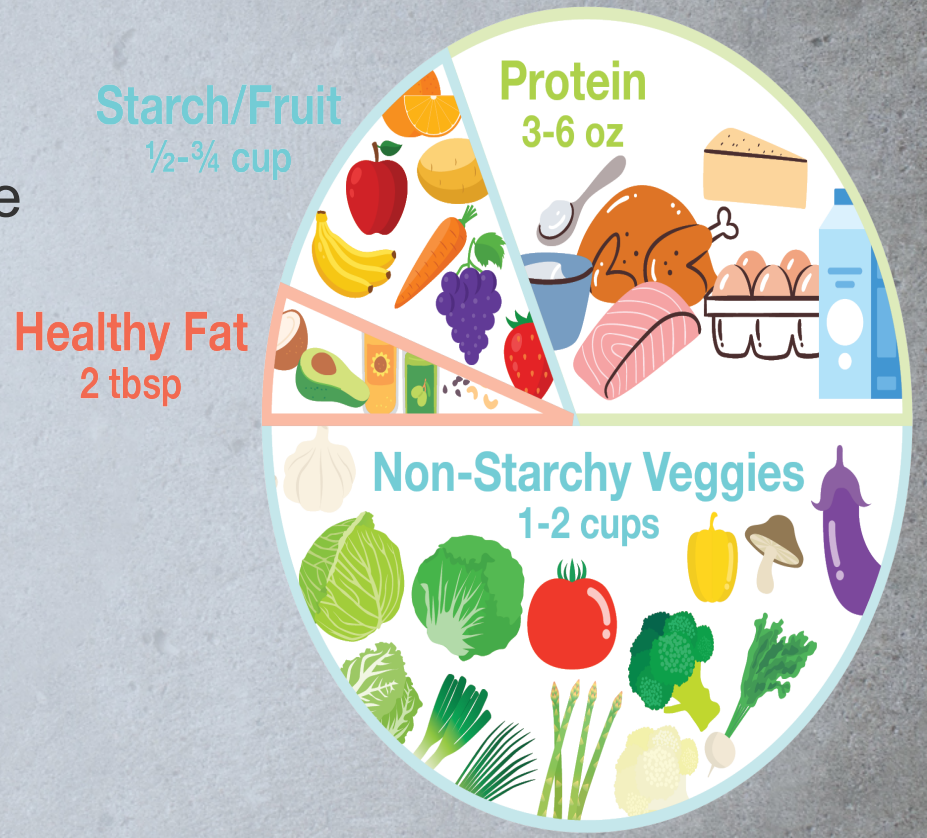
- Eight 8-ounce glasses of water a day to help with nausea and risk of dehydration
- Lowering the dose of GLP-1 medication or prescribe an anti-nausea medication.
- Recommend eating bland, low-fat foods such as crackers, toast, and rice; choose foods that contain water such as soups and gelatin; skip sweet, sugary foods, drinks.
- Don't eat or cook strong-smelling food.
- Don't eat too quickly and don't have a large drink with meals.
- Don't lie down soon after eating. This will reduce pressure on your abdomen.
- Avoid high-processed foods, and limit red meat.
- Antiemetic drugs for nausea and diarrhea (Benadryl, Bonine, Phenergan, Dramamine, Gravol).
- Eat smaller meals and eat slowly. Pay attention to your fullness

- WHERE IS THE SUPPORT FOR THE PANCREAS & PREVENTION OF MALNUTRITION!

NATURAL SOLUTIONS FOR GLP-1 SUPPORT

Natural Ways to Increase GLP-1

- **Fiber** slows digestion and promotes the release of short-chain fatty acids (SCFAs) which can stimulate GLP-1 release from cells in the gut.
- **Prebiotics** from fiber rich foods have been shown to raise GLP-1 and PYY and decrease ghrelin release in humans
- Incorporating adequate **protein** triggers more release of GLP-1 compared to carbohydrates.
- Studies have shown that monounsaturated **fatty acids** (MUFA) stimulate GLP-1 secretion, while saturated fatty acids do not.
- **Berberine** can support GLP-1 production and improve insulin sensitivity while **Curcumin** can stimulate GLP-1 secretion.
- Chronic stress and lack of sleep can negatively impact GLP-1 production, so incorporating **stress-reducing** practices and **sleep** hygiene are beneficial.



Bacillus Subtillus & GLP-1

Bacillus subtilis is being explored for its potential in delivering GLP-1 for treating type 2 diabetes and other related conditions.

Research indicates that *B. subtilis* can be used to create an oral delivery system for GLP-1, which can reduce blood glucose levels.

Additionally, studies suggest that *B. subtilis* may have a protective effect on pancreatic islets and liver, which are relevant to diabetes.

Research also suggests that *B. subtilis* can improve gut health, potentially influencing GLP-1 levels. Furthermore, *B. subtilis* can be used to ferment Pyropia (red algae) to produce hypoglycemic peptides, which may have therapeutic potential.

WHY ENZYMES

Improved Nutrient Absorption: Digestive enzymes break down complex food molecules into smaller, more easily absorbable forms. This means the body can better utilize the nutrients, even when consumed in smaller quantities.

Reduced Digestive Discomfort: When food is not properly broken down, it can lead to digestive discomfort, bloating, and gas, which can further reduce appetite. Digestive enzymes help alleviate these issues.

Potential for Appetite Regulation: Some studies suggest that digestive enzymes, particularly lipase, may play a role in appetite regulation by influencing the release of hormones like leptin, which signals fullness.

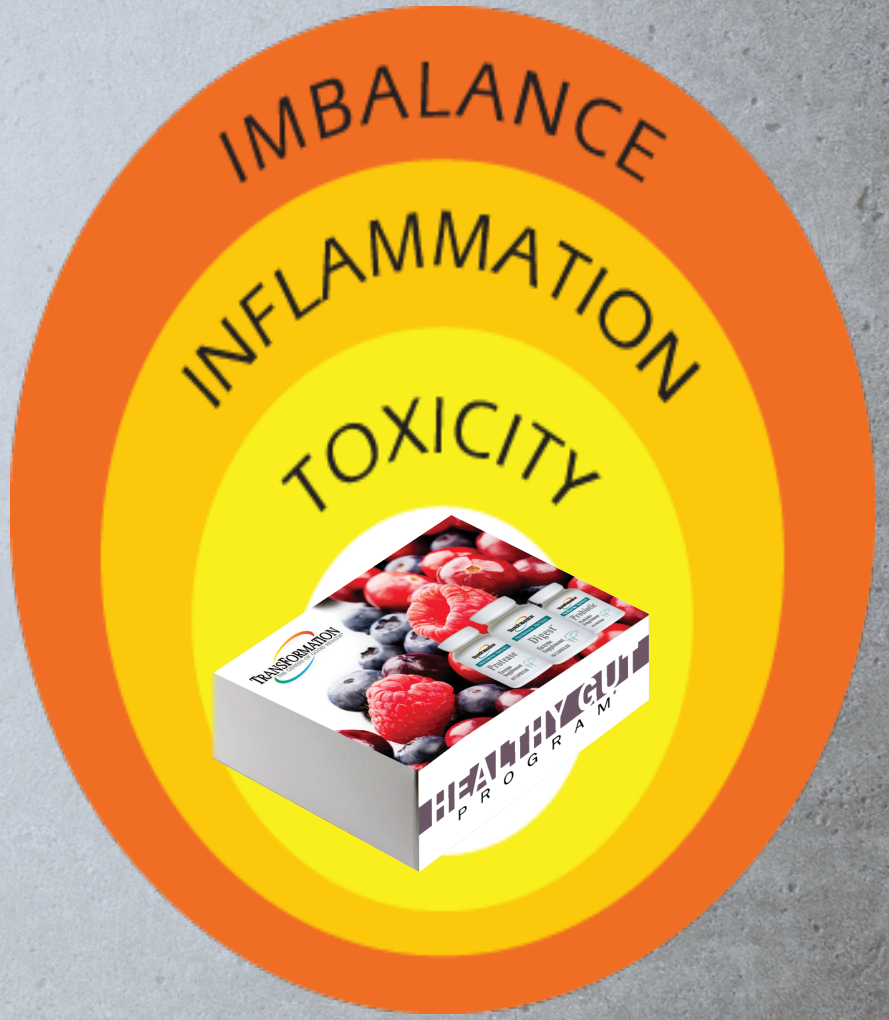
Supporting overall gut health: Digestive enzymes can help minimize the issues of undigested food particles, which can lead to digestive discomfort, bloating and gas.

GLP-1 FOUNDATION SUPPORT

1. ***1-2 before meal to Enhance*** digestion and absorption of nutrients

2. ***1-2 caps TID for*** *Improve* blood flow, detoxification, inflammation

3. **1 cap at bedtime** to support microbiome and bowel regularity



Complete Lifestyle Support For GLP-1 Users

PHASE 1

Instructions, pill box, bracelet, and the first 21-day supply of supplements to get started.

PHASE 2

Additional recipes and "TPP" instructions for the next 21-day supply of supplements.

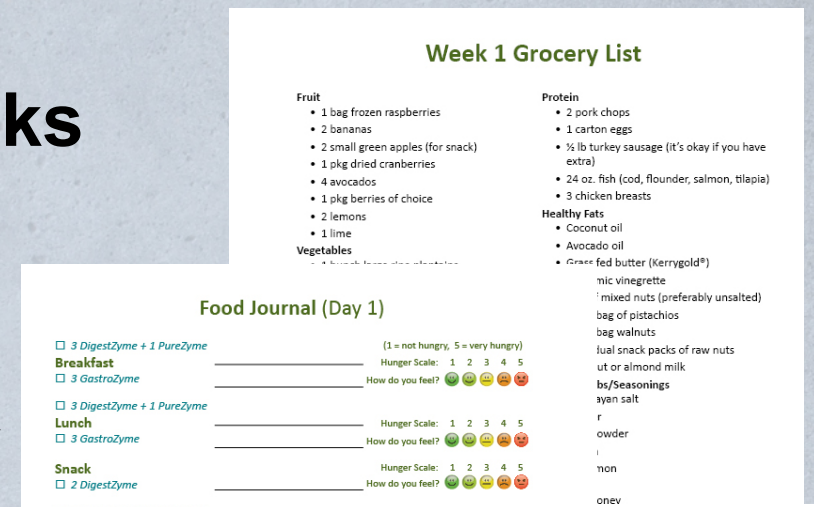
PHASE 3

Additional recipes and the final 21-day supply of supplements to complete your *Thrive* Program.

What's Included

Each booklet provides 3 weeks of:

- Meal plans (9 weeks total)
- Recipes high in protein, complex carbs, healthy fats, fiber, polyphenols, fermented foods
- Grocery lists
- Food exchange list
- Food journals
- Supplement protocol
- Facebook Support Group



Week 1 Grocery List

Fruit
- 1 bag frozen raspberries
- 2 bananas
- 2 small green apples (for snack)
- 1 pkg dried cranberries
- 4 avocados
- 1 pkg berries of choice
- 2 lemons
- 1 lime

Vegetables

Protein
- 2 pork chops
- 1 carton eggs
- ½ lb turkey sausage (it's okay if you have extra)
- 24 oz. fish (cod, flounder, salmon, tilapia)
- 3 chicken breasts

Healthy Fats
- Coconut oil
- Avocado oil
- Grass fed butter (Kerrygold®)

nic vinegrette
mixed nuts (preferably unsalted)
bag of pistachios
bag walnuts
lual snack packs of raw nuts
ut or almond milk

bs/Seasonings
ayan salt
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owder
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Food Journal (Day 1)

☐ *3 DigestZyme + 1 PureZyme*
Breakfast (1 = not hungry, 5 = very hungry)
☐ *3 GastroZyme* Hunger Scale: 1 2 3 4 5
How do you feel?

☐ *3 DigestZyme + 1 PureZyme*
Lunch
☐ *3 GastroZyme* Hunger Scale: 1 2 3 4 5
How do you feel?

Snack
☐ *2 DigestZyme* Hunger Scale: 1 2 3 4 5
How do you feel?

☐ *3 DigestZyme + 1 PureZyme*
Dinner
☐ *3 GastroZyme* Hunger Scale: 1 2 3
How do you feel?

Bedtime
☐ *3 Plantadophilus + 3 PureZyme*
Notes/Comments:

Food Journal (Day 2)

☐ *3 DigestZyme + 1 PureZyme*
Breakfast (1 = not hungry, 5 = very hu
☐ *3 GastroZyme* Hunger Scale: 1 2 3
How do you feel?

☐ *3 DigestZyme + 1 PureZyme*
Lunch
☐ *3 GastroZyme* Hunger Scale: 1 2 3
How do you feel?

Snack
☐ *2 DigestZyme* Hunger Scale: 1 2 3
How do you feel?

☐ *3 DigestZyme + 1 PureZyme*
Dinner
☐ *3 GastroZyme* Hunger Scale: 1 2 3
How do you feel?

Bedtime
☐ *3 Plantadophilus + 3 PureZyme*
Notes/Comments:

SNACKS

Guacamole

Prep time: 10 min
Cook time: n/a
Serves: 1-2

- 1 ripe avocado
- ¼ cup diced tomato
- ¼ cup diced onion
- ¼ cup chopped cilantro
- ½ fresh lime (juice)
- Salt, pepper, garlic

Mash the avocado and combine with all ingredients, mix well.

Kale Chips

Prep time: 5 min
Cook time: 15 min
Serves: 2-3

- 1 bunch of kale, washed and dried
- 2 tbsp organic olive oil

Romesco Dip

Prep time: 15 min
Cook time: 15 min
Serves: 10

- 1 cup blanched, toasted almonds
- 2 cloves garlic
- ¼ tsp smoked paprika
- ¼ tsp cayenne pepper (optional)
- 1 cup roasted red bell peppers, patted dry
- ¼ cup green pitted olives, drained
- 2 tbsp fresh lemon juice
- 2 tsp red wine vinegar
- 5 tbsp olive oil
- Salt and pepper to taste

In a food processor, combine almonds, garlic, paprika and cayenne; pulse until coarsely chopped, about 15-20 times.

Add roasted bell peppers, olives, lemon juice and vinegar.

Supplements	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
3 DigestZyme + 1 PureZyme before meal / *3 GastroZyme following meal*	*Breakfast* Raspberry Mint Smoothie	*Breakfast* 2-4 Egg Muffins, 2 tbsp Avocado, ½ cup Mixed Berries	*Breakfast* Kale Shake with Coconut Milk	*Breakfast* 2-4 Egg Muffins, 2 tbsp Avocado, ½ cup Mixed Berries	*Breakfast* Raspberry Mint Smoothie	*Breakfast* Kale Shake with Coconut Milk	*Breakfast* Your Choice (must meet THRIVE guidelines)
	Snack Herbal Tea	*Snack* Herbal Tea	*Snack* Herbal Tea	*Snack* Herbal Tea	*Snack* Herbal Tea	*Snack* Herbal Tea	*Snack* Herbal Tea
3 DigestZyme + 1 PureZyme before meal / *3 GastroZyme following meal*	*Lunch* 3-6 oz. Pork Chops, ½ cup Mashed Yams with Walnuts, 1-2 cups Sautéed Spinach	*Lunch* 3-6 oz. Pistachio Crusted Fish, 5-8 pieces Oven Roasted Asparagus, ½ cup Sautéed Sliced Plantains	*Lunch* Nutty Mixed Up Salad with Chicken	*Lunch* 1½ cups Mexican Chicken Soup, Guacamole, 15-20 Zucchini Slices	*Lunch* 3-6 oz. Pork Chops, ½ cup Mashed Yams with Walnuts, 1-2 cups Sautéed Spinach	*Lunch* 3-6 oz. Pistachio Crusted Fish, 5-8 pieces Oven Roasted Asparagus, ½ cup Sautéed Sliced Plantains	*Lunch* Your Choice (must meet THRIVE guidelines)
2 DigestZyme with snack	*Snack* Small Packet of Mixed Nuts	*Snack* KIND® Bar	*Snack* Small Packet of Mixed Nuts	*Snack* Apple with 2 tbsp Almond Butter	*Snack* Carrot Sticks with Guacamole	*Snack* Thunderbird® Real Food Bar	*Snack* Your Choice (must meet THRIVE guidelines)
3 DigestZyme + 1 PureZyme before meal / *3 GastroZyme following meal*	*Dinner* Nutty Mixed Up Salad with Chicken	*Dinner* 1½ cups Mexican Chicken Soup, Guacamole, 15-20 Zucchini Slices	*Dinner* 3-6 oz. Pork Chops, ½ cup Mashed Yams with Walnuts, 1-2 cups Sautéed Spinach	*Dinner* 3-6 oz. Pistachio Crusted Fish, 5-8 pieces Oven Roasted Asparagus, ½ cup Sautéed Sliced Plantains	*Dinner* Nutty Mixed Up Salad with Chicken	*Dinner* 1½ cups Mexican Chicken Soup, Guacamole, 15-20 Zucchini Slices	*Dinner* Your Choice (must meet THRIVE guidelines)
3 Plantadophilus + 3 PureZyme at bedtime							

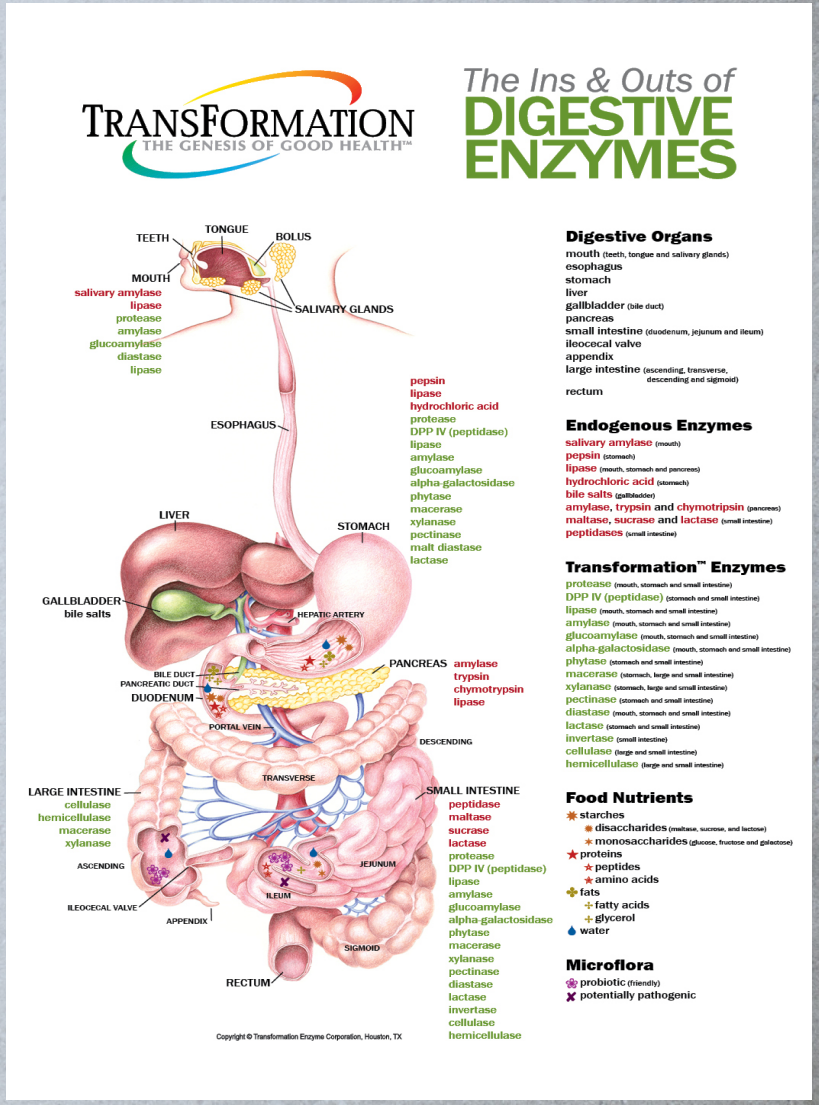
Thrive in 63: Week One

MYTHS & FAQs:
Enzymes & Weight Loss

FAQs: Enzymes & Microbiome Changes

- The presence of microbial enzymes in the gut can improve the efficiency of food digestion, especially for compounds that the host cannot effectively metabolize on its own, such as certain fibers or resistant starches which supports short chain fatty acid production.

- Moreover, microbial-generated enzymes can influence the pH within the gut, thereby promoting or inhibiting the growth of other microorganisms indirectly and thus regulating the community structure of the microbiome.



FAQ: Digestive Supplements with DPP-IV & GLP-1 Efficacy

- DPP-IV inhibition drugs target the DPP-IV in the body (CD26) and is not the same as what we supplement.
- CD26 is a membrane bound protease that cleaves off GLP-1 (this is why it has such a short half life in your body).
- While it has similarity to the DPP-IV family, it is a metabolic enzyme, not a mycelial digestive.
- Simply put, this is not the same DPP-IV used in our digestive formulas, which is safe and effective for those on GLP-1's.

FAQ: Do Enzymes Raise Blood Sugar?

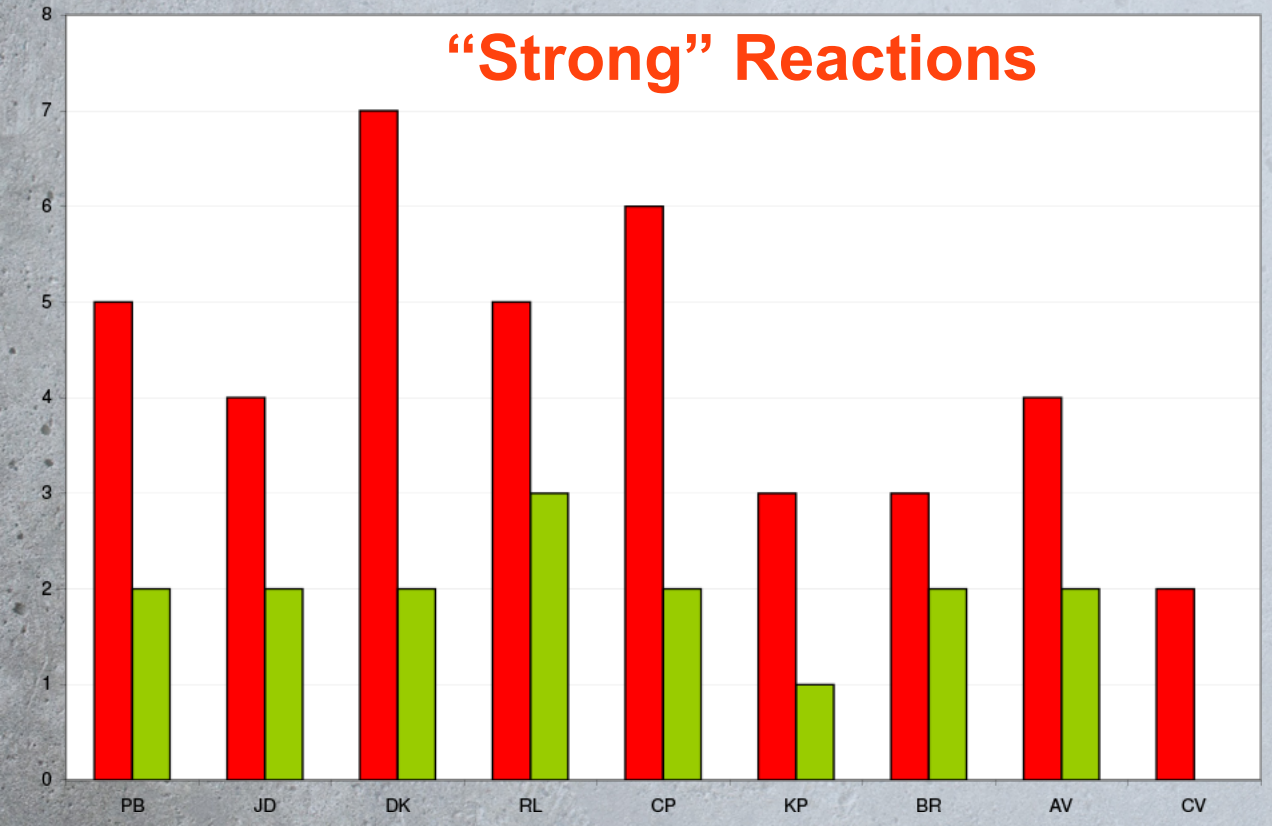
- The body's response to the sugars released into the bloodstream depends on several factors, including: insulin sensitivity; meal composition; overall health
- Digestive enzymes increase nutrient absorption, not blood sugar levels.
- They facilitate the body's ability to process carbohydrates, influencing how blood sugar levels respond.
- Enzymes support utilization of various nutrients needed for proper glucose metabolism.
- You can view our case study's on this at mycliniciantoolbox.com

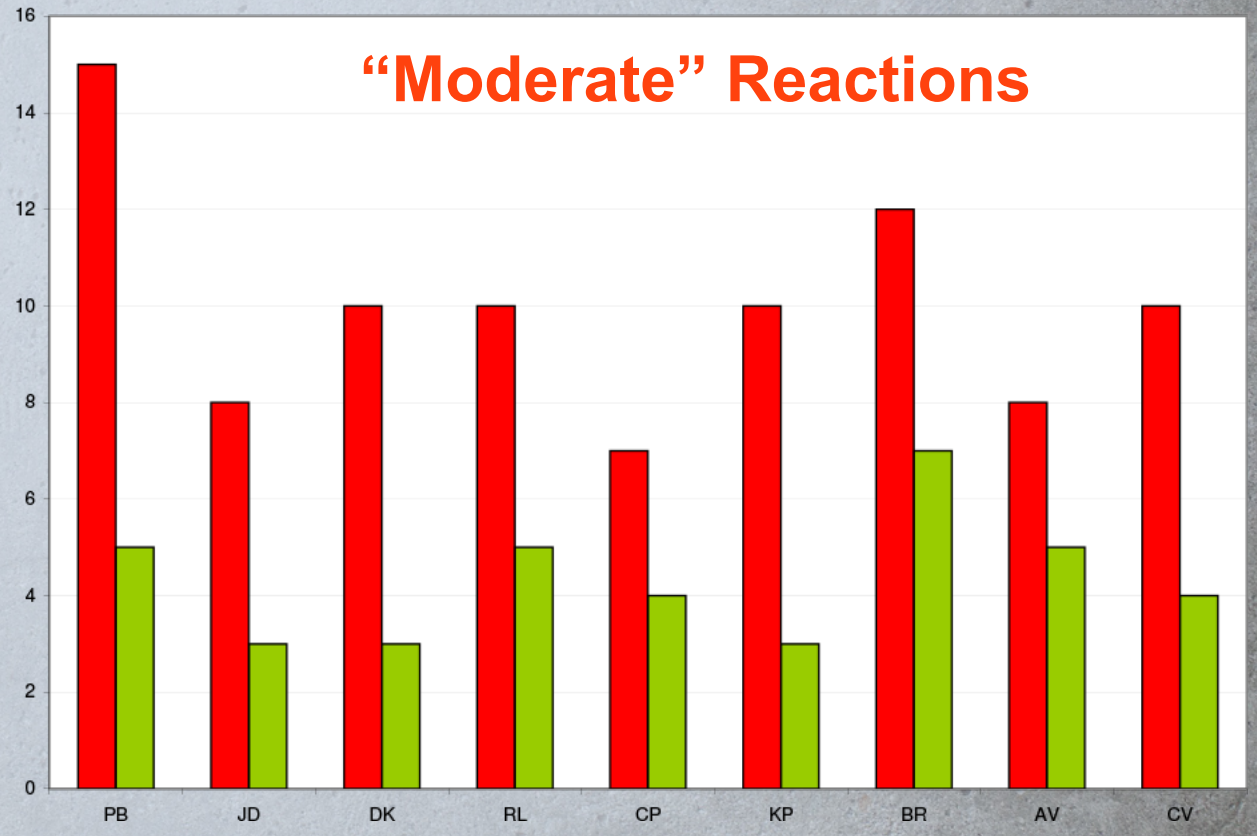
How Enzymes Support a Healthy Weight

- Digestive enzymes don't directly cause hunger, but they indirectly influence hunger and satiety by impacting digestion and nutrient absorption.
- When the body can absorb more nutrients from REAL food, it results to a more balanced energy supply.
- Improved digestion can reduce feelings of bloating and discomfort after meals, allowing underweight individuals to eat more without discomfort.
- Enzymes can indirectly influence the release of hormones like leptin and ghrelin, which regulate hunger and satiety.
  - Improved nutrient absorption signals more leptin (satiety hormone).
  - If enzyme activity is insufficient resulting in malabsorption, ghrelin levels remain elevated, stimulating appetite even when energy stores are sufficient.

Food Sensitivities & Their Connection to Natural GLP-1 Output

Leaky Gut Study LRA Elisa/ACT results after Thrive in 63



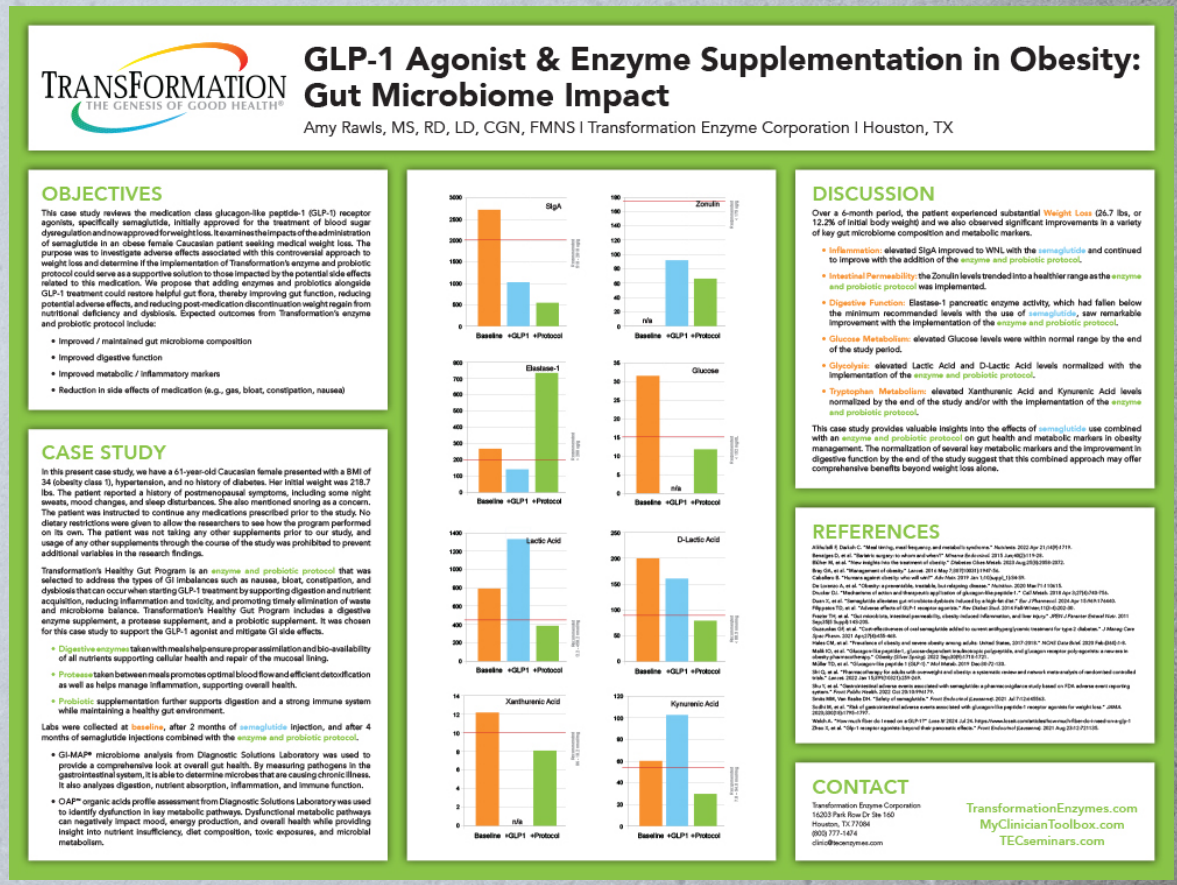


Case Study

Case Study: Impact of GLP-1 Receptor Agonist & Digestive Enzyme Supplementation on Gut Microbiome & Metabolic Markers in Obesity Management

To minimize the severity and duration of potential side effects of GLP1 drugs, providers and patients must be aware of appropriate support needed to prevent and/or lessen side effects while undergoing treatment.

This case study will investigate semaglutide, the impact Transformation's Healthy Gut Program has on common side effects associated with GLP-1 receptor agonists, and the ability of enzyme and probiotic supplementation to help mitigate microbiome and metabolic pathway imbalances that can occur while on this drug.



TRANSFORMATION
THE GENESIS OF GOOD HEALTH®

GLP-1 Agonist & Enzyme Supplementation in Obesity: Gut Microbiome Impact

Amy Rawls, MS, RD, LD, CGN, FMNS I Transformation Enzyme Corporation I Houston, TX

OBJECTIVES

This case study reviews the medication class glucagon-like peptide-1 (GLP-1) receptor agonists, specifically semaglutide, initially approved for the treatment of blood sugar dysregulation and now approved for weight loss. It examines the impacts of the administration of semaglutide in an obese female Caucasian patient seeking medical weight loss. The purpose was to investigate adverse effects associated with this controversial approach to weight loss and determine if the implementation of Transformation's enzyme and probiotic protocol could serve as a supportive solution to those impacted by the potential side effects related to this medication. We propose that adding enzymes and probiotics alongside GLP-1 treatment could restore helpful gut flora, thereby improving gut function, reducing potential adverse effects, and reducing post-medication discontinuation weight regain from nutritional deficiency and dysbiosis. Expected outcomes from Transformation's enzyme and probiotic protocol include:

- Improved / maintained gut microbiome composition
- Improved digestive function
- Improved metabolic / inflammatory markers
- Reduction in side effects of medication (e.g., gas, bloat, constipation, nausea)

CASE STUDY

In this present case study, we have a 61-year-old Caucasian female presented with a BMI of 34 (obesity class 1), hypertension, and no history of diabetes. Her initial weight was 218.7 lbs. The patient reported a history of postmenopausal symptoms, including some night sweats, mood changes, and sleep disturbances. She also mentioned snoring as a concern. The patient was instructed to continue any medications prescribed prior to the study. No dietary restrictions were given to allow the researchers to see how the program performed on its own. The patient was not taking any other supplements prior to our study, and usage of any other supplements through the course of the study was prohibited to prevent additional variables in the research findings.

Transformation's Healthy Gut Program is an enzyme and probiotic protocol that was selected to address the types of GI imbalances such as nausea, bloat, constipation, and dysbiosis that can occur when starting GLP-1 treatment by supporting digestion and nutrient acquisition, reducing inflammation and toxicity, and promoting timely elimination of waste and microbiome balance. Transformation's Healthy Gut Program includes a digestive enzyme supplement, a protease supplement, and a probiotic supplement. It was chosen for this case study to support the GLP-1 agonist and mitigate GI side effects.

- Digestive enzymes taken with meal help ensure proper assimilation and bio-availability of all nutrients supporting cellular health and repair of the mucosal lining.
- Protease taken between meals promotes optimal blood flow and efficient detoxification as well as helps manage inflammation, supporting overall health.
- Probiotic supplementation further supports digestion and a strong immune system while maintaining a healthy gut environment.

Labs were collected at baseline, after 2 months of semaglutide injection, and after 4 months of semaglutide injections combined with the enzyme and probiotic protocol.

- GI-MAP® microbiome analysis from Diagnostic Solutions Laboratory was used to provide a comprehensive look at overall gut health. By measuring pathogens in the gastrointestinal system, it is able to determine microbes that are causing chronic illness. It also analyzes digestion, nutrient absorption, inflammation, and immune function.
- OAP® organic acids profile assessment from Diagnostic Solutions Laboratory was used to identify dysfunction in key metabolic pathways. Dysfunctional metabolic pathways can negatively impact mood, energy production, and overall health while providing insight into nutrient insufficiency, diet composition, toxic exposures, and microbial metabolism.

DISCUSSION

Over a 6-month period, the patient experienced substantial Weight Loss (26.7 lbs, or 12.2% of initial body weight) and we also observed significant improvements in a variety of key gut microbiome composition and metabolic markers.

- Inflammation: elevated SIgA improved to WNL with the semaglutide and continued to improve with the addition of the enzyme and probiotic protocol.
- Intestinal Permeability: the Zonulin levels trended into a healthier range as the enzyme and probiotic protocol was implemented.
- Digestive Function: Elastase-1 pancreatic enzyme activity, which had fallen below the minimum recommended levels with the use of semaglutide, saw remarkable improvement with the implementation of the enzyme and probiotic protocol.
- Glucose Metabolism: elevated Glucose levels were within normal range by the end of the study period.
- Glycolysis: elevated Lactic Acid and D-Lactic Acid levels normalized with the implementation of the enzyme and probiotic protocol.
- Tryptophan Metabolism: elevated Xanthurenic Acid and Kynurenic Acid levels normalized by the end of the study and/or with the implementation of the enzyme and probiotic protocol.

This case study provides valuable insights into the effects of semaglutide use combined with an enzyme and probiotic protocol on gut health and metabolic markers in obesity management. The normalization of several key metabolic markers and the improvement in digestive function by the end of the study suggest that this combined approach may offer comprehensive benefits beyond weight loss alone.

REFERENCES

Alfadda A, Darch C. "Meal timing, meal frequency, and metabolic syndrome." Nutrients. 2022 Apr 21;14(9):1719.
Bloomgarden D, et al. "Bariatric surgery: to whom and when?" Mt Sinai J Med. 2010 Jan;48(1):119-26.
Bülow M, et al. "New insights into the treatment of obesity." Diabetes Obes Metab. 2023 Aug;25(8):2059-2072.
Bray GA, et al. "Management of obesity." Lancet. 2011 May 7;377(9818):1549-56.
Caballero B. "Humans against obesity: who will win?" Adv Nutr. 2019 Jan 1;10(suppl_1):S4-S9.
De Lorenzo A, et al. "Obesity: a preventable, treatable, but relapsing disease." Nutrition. 2020 Mar;71:110615.
Drucker DJ. "Mechanisms of action and therapeutic application of glucagon-like peptide-1." Cell Metab. 2018 Apr 3;27(4):740-756.
Duan Y, et al. "Semaglutide alleviates gut microbiota dysbiosis induced by a high-fat diet." Eur J Pharmacol. 2024 Apr 15;969:176460.
Filippatos TD, et al. "Adverse effects of GLP-1 receptor agonists." Rev Diabet Stud. 2014 Fall-Winter;11(3-4):202-30.
Foster TH, et al. "Gut microbiota, intestinal permeability, obesity-induced inflammation, and liver injury." JRSM J Parenter Enteral Nutr. 2011 Sep;35(5 Suppl):14S-20S.
Gudzune KA, et al. "Cost-effectiveness of oral semaglutide added to current antihyperglycemic treatment for type 2 diabetes." J Manag Care Spec Pharm. 2021 Apr;27(4):459-469.
Hales CM, et al. "Prevalence of obesity and severe obesity among adults: United States, 2017-2018." NCHS Data Brief. 2020 Feb;(360):1-8.
Malik VS, et al. "Glucagon-like peptide-1 receptor agonists in the treatment of obesity." Diabetes Obes Metab. 2022 Jan;24(1):3-13.
Müller TD, et al. "Glucagon-like peptide 1 (GLP-1)." Mol Metab. 2019 Dec;30:72-130.
Shi Q, et al. "Efficacy and safety of liraglutide for overweight and obesity in adolescents and adults: a systematic review and meta-analysis." Int J Obes (Lond). 2022 Jan;46(1):1-11.
Shu Y, et al. "Gastrointestinal adverse events associated with semaglutide: a pharmacovigilance study based on FDA adverse event reporting system." Front Public Health. 2022 Oct 28;10:996179.
Smits MM, Van Raalte DH. "Safety of semaglutide." Front Endocrinol (Lausanne). 2021 Jul 7;12:645563.
Sodhi M, et al. "Risk of gastrointestinal adverse events associated with glucagon-like peptide-1 receptor agonists for weight loss." JAMA. 2023;330(18):1795-1797.
Walsh A. "How much flow do I need on a GLP-1?" Loss It! 2024 Jul 24. https://www.lossit.com/articles/how-much-flow-do-i-need-on-a-glp-1
Zhao S, et al. "Glp-1 receptor agonists beyond their pancreatic effects." Front Endocrinol (Lausanne). 2021 Aug 23;12:721135.

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CASE STUDY

- Non-diabetic, 61-year-old Caucasian female, 218.7 lbs, BMI 34
- Hx: HTN, night sweats, mood changes, sleep disturbances; & snoring
- No consistent GI issues or events constituting gut dysregulation
- Stress: work-related stress (7/10) health-related stress (8/10)
- Sleep: average 6 hours per night, not feeling rested upon awakening
- Exercise: daily walking (couple miles a day), some gardening
- Diet: following a low-carb diet with no dairy (has dairy sensitivity)
- No sig family hx of DM, Obesity, CVD

Hypothesis

- The implementation of Transformation's Healthy Gut Program would mitigate common GI side effects and risks for those taking this drug while still facilitating healthy weight loss.
- Case Study Protocol
  - 1 capsule **Digest** with each meal
  - 1 capsule **Protease** at rise and bedtime (away from food)
  - 1 capsule **Probiotic** at bedtime

Methods

- The patient was monitored weekly to evaluate side effects, weight changes, and medication adjustments by the primary care provider prescribing the medication.
- Weekly calls were scheduled with Transformation's research team to monitor tolerance of Healthy Gut Program, once implemented, so adjustments could be made as needed.
- No dietary restrictions were given to allow researchers to see how the program performed on its own.
- The patient was not taking any other supplements prior to our study, and usage of any other supplements through the course of the study was prohibited to prevent additional variables in the research findings.

Methods

- Labs were collected at baseline, two months of GLP-1 only, and two months of GLP-1 &Transformation's Healthy Gut Program.
- The researchers were focused on evaluating shifts in microbiome composition, digestive function, and metabolic pathways; this drove the decision to use GI Map and OMX testing from Diagnostic Solutions Laboratory.
- Symptoms and adverse events/changes were measured through symptom questionnaires completed at weekly follow-ups with her primary care provider and Transformation's researchers.

Results(Microbiome analysis)

GI-MAP®	Baseline	Second	Final	Reference
Microbiome Analysis	12/6/2023	1/26/2024	5/22/2024	
Inflammatory Markers				
Secretory IgA	2720	1026	549	510 - 2010 ug/g
Eosinophil Activation Protein	2.64	0.63	0.86	< 2.34 ug/g
Calprotectin	<dl	0	106	< 173 ug/g
Intestinal Permeability				
Zonulin	n/a	91.9	66.1	< 175 ug/g
Digestive Function				
Elastase-1	269	142	735	> 200 ug/g
Streatocrit	6	11	<dl	< 15 %
Commensal/Keystone Bacteria				
Bacteroides fragilis	2.67e10	4.78e9	3.67e9	1.6e9 - 2.5e11
Bifidobacterium spp.	1.17e9	6.21e9	5.23e9	> 6.7e7
Enterococcus spp.	2.64e7	9.40e8	8.01e8	1.9e5 - 2.0e8
Escherichia spp.	5.80e6	3.88e7	5.77e8	3.7e6 - 3.8e9
Lactobacillus spp.	1.47e7	6.49e6	8.37e6	8.6e5 - 6.2e8
Enterobacter spp.	1.57e7	5.19e6	1.93e6	1.0e6 - 5.0e7
Akkermansia muciniphila	<dl	<dl	<dl	1.0e1 - 8.2e6
Faecalibacterium prausnitzii	1.17e6	3.67e5	5.57e5	10.e3 - 5.0e8
Roseburia spp.	5.57e8	1.63e9	6.90e8	5.0e7 - 2.0e10
Bacterial Phyla				
Bacteroidetes	1.29e12	7.01e11	5.24e11	8.6e11 - 3.3e12
Firmicutes	1.12e11	2.41e11	9.43e10	5.7e10 - 3.0e11
Firmicutes:Bacteroidetes Ratio	0.09	0.34	0.18	< 1.0
Dysbiotic & Overgrowth Bacteria				
Bacillus spp.	<dl	2.23e7	2.74e6	< 1.76e6
Enterococcus faecalis	<dl	2.55e4	<dl	< 1.00e4
Enterococcus faecium	<dl	1.42e6	1.05e5	< 1.00e4
Morganella spp.	<dl	<dl	<dl	< 1.00e3
Pseudomonas spp.	<dl	<dl	<dl	< 1.00e4
Pseudomonas aeruginosa	<dl	<dl	<dl	< 5.00e2
Staphylococcus spp.	<dl	2.54e2	<dl	< 1.00e4
Staphylococcus aureus	2.15e2	1.03e2	<dl	< 5.00e2
Streptococcus spp.	4.76e3	4.20e3	4.84e3	< 1.00e3

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GI-MAP®	Baseline	Second	Final	Reference
Microbiome Analysis	12/6/2023	1/26/2024	5/22/2024	
Commensal Overgrowth Microbes				
Desulfovibrio spp.	4.76e7	3.50e7	1.10e7	< 7.98e8
Methanobacteriaceae (family)	1.69e7	6.30e7	9.11e7	< 3.38e8
Inflammatory & Autoimmune-Related Bacteria				
Citrobacter spp.	<dl	<dl	<dl	< 5.00e6
Citrobacter freundii	<dl	<dl	<dl	< 5.00e5
Klebsiella spp.	<dl	<dl	<dl	< 5.00e3
Klebsiella pneumoniae	<dl	5.02e3	1.33e4	< 5.00e4
M. avium subsp. paratuberculosis	<dl	<dl	<dl	< 5.00e3
Proteus spp.	<dl	<dl	<dl	< 5.00e4
Proteus mirabilis	<dl	<dl	<dl	< 1.00e3
Commensal Inflammatory & Autoimmune-Related Bacteria				
Enterobacter spp.	1.57e7	5.19e6	1.93e6	< 5.00e7
Escherichia spp.	5.80e6	3.88e7	5.77e8	< 3.80e9
Fusobacterium spp.	2.23e6	1.79e6	1.31e6	< 1.00e8
Prevotella spp.	1.17e7	2.20e6	1.39e6	< 1.00e8
Pathogens				
Norovirus GI/II	<dl	<dl	6.60e2	< 1.00e10
Helicobacter pylori	<dl	2.41e2	3.61e2	< 1.00e7

Results (Metabolic pathways)

OAP™ Organic Acids Profile	Baseline 12/8/2023	Second 1/30/2024	Final 5/22/2024	Reference
Glucose Metabolism				
Glucose	31.6	<dl	11.8	< 15.2 mg/dL
Glycolysis				
Pyruvic Acid	28.2	39.5	30.4	< 67.4 nmol/mg
Lactic Acid	792.1	1330.7	385.7	12.2 - 458.2 nmol/mg
D-Lactic Acid	>200.0	160.8	79.1	< 88.3 nmol/mg
Tryptophan Metabolism				
Xanthurenic Acid	12.2	<dl	8.1	0.6 - 10.2 nmol/mg
Kynurenic Acid	60.2	102.7	29.8	7.8 – 54.0 nmol/mg
Quinolinic Acid	152.4	97.3	98.1	29.4 - 178.5 nmol/mg
Krebs Cycle Intermediates				
Citric Acid	776.4	2165.8	2237.1	203.0 - 3208.6 nmol/mg
Isocitric Acid	518.0	525.9	1119.8	137.1 - 794.9 nmol/mg
Succinic Acid	35.5	9.4	59	12.3 - 260.4 nmol/mg
Metabolic Processing				
β-Hydroxybutyric Acid	15.7	39.4	17.8	3.2-116.4 nmol/mg
Toxic Impact				
Glucaric acid	14.6	12.7	65.7	< 31.5 nmol/mg
Orotic acid	6.1	5.6	12.9	1.2 - 13.1 nmol/mg
pH	5.6	6.5	5.5	5.5 - 7.7
Oxalic acid	163.1	189.8	204.2	144.9 - 1749.5 nmol/mg
Microbial Metabolites				
Hippuric Acid	874.4	650.0	1343.2	198.7 - 3104.6 nmol/mg

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Discussion

GI MAP™ FINDINGS

- Immune + Inflammation markers improved
- GI lining + Digestive function improved
- Positive shifts in commensal bacteria
- Trend of improvement in most opportunistic bacteria
  - The rise in opportunistic bacteria could be due to *H Pylori* suppressing stomach acid allowing bacteria to grow and possible side effect of the GLP-1 medication's gastric stagnation which gives opportunistic bacteria more food to eat.

Discussion

Organic Acid Profile (OAP™)

- Improved glucose metabolism and glycolysis
- Improved Tryptophan metabolism and b vitamin status
- Toxic Impacts: Toxic impact scores were more prevalent on final OAP™ draw, which points to a possible higher efficiency of toxic excretion from the enzymes and probiotics consumed.

Discussion

SYMPTOM SURVEY

- Initial low energy and queasy stomach with semaglutide injection.
- Ongoing need to be careful with food choices to avoid heartburn and bloat, which ceased once enzyme protocol started.
- Initial diarrhea, some heart burn and nausea with TPP Protease enzyme. Switched to Purezyme, gentler protease blend, which was tolerated well.
- Temporary interruption in treatment due to foot surgery.

As the patient reported on March 28, 2024:

"Starting weight 218.7 now 198. Start date December 15, 2023. Now on .2 ml or . 6mg. Shot 1 times a week. You have to be very careful what you eat so you do not have heartburn and sometimes I have heartburn anyway. The Digest did help with my heartburn.

“I was doing very well but ended up with a cyst on the bottom of my foot that had to be operated on and removed. I did only miss 1 shot of semaglutide. I received an injection of local anesthetic to numb the plantar surface of the foot. “

“My eating has gone well 2 meals a day. Protein, veggie, small carb. Meals are 1/2 or less of what I ate before. It does seem harder to drink the water I need each day, but I do concentrate on meeting my goal. My exercise has been stopped with not being able to walk well.

“I chose to do this study because I have always been interested in natural vitamins and I felt if I could get extra help with balancing my system maintaining the weight loss would be obtainable. I really like the Probiotic and Digest, I do not like Protease and felt better with Purezyme.”

ADDITIONAL PATIENT TESTIMONY'S

Patient 1: Stated after 2 weeks on the Healthy Gut program she began to have regular bowel movements daily. By week 4 she was going twice daily. Before being on the program, she was only going once a week. And it has helped with her blood sugar problems as well she is currently holding at 110 before it was 185. It took 3 weeks to get to 110.

Patient 2: She is currently on GLP-1 traziptide. She is on the Healthy Gut program
And now has daily bowel movements twice daily. Before she would go days without going.
The Gut program has also helped her lose the weight effectively without muscle wasting.
Her energy has been good and has notice a difference in her skin and how shiny it is .
She has lost 60lbs. She has been on the program for 6 months.

Patient 3: She started GLP-1 3 months ago. Her lab work has improved tremendously She also has issues with going to the bathroom only once a week. She now goes daily at least once. She now isn't afraid to eat she breaking down food better. Before the food would run right through her so she was afraid to eat . Now she able to eat like normal. She mentioned that she definitely can tell a difference when she doesn't stay on track with the program. Her Liver and Kidney function are back to normal and all of her other labs are prefect since incorporating the Healthy Gut Program.

Conclusion

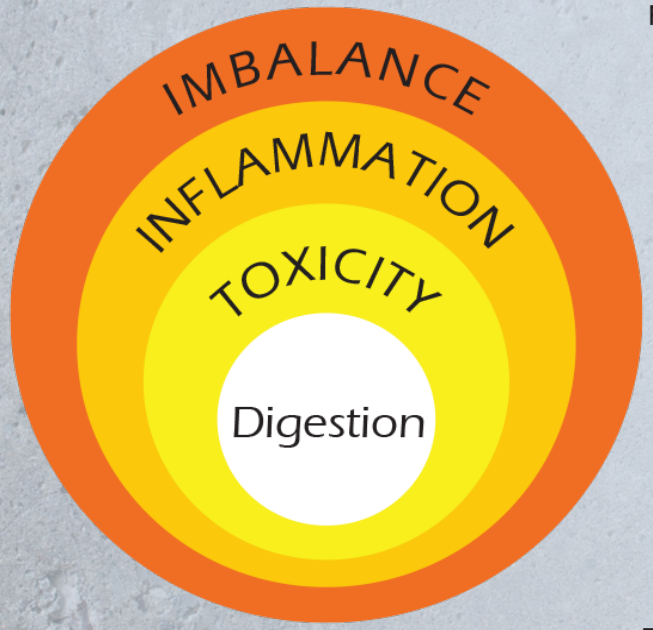
- The patient achieved significant weight loss (26.7 lbs, or 12.2% of initial body weight) and improvements in several metabolic parameters despite facing challenges such as foot surgery and temporary difficulties with semaglutide and protease supplementation.
- We propose that adding probiotics, digestive and systemic enzymes alongside GLP-1 treatment could support pancreatic elastase, restore/maintain helpful gut flora, thereby improving gut function, reducing potential AE's, and reducing post-medication discontinuation weight regain from nutritional deficiency and dysbiosis.
- The normalization of several key metabolic markers and the improvement in digestive function by the end of the study suggest that this combined approach may offer comprehensive benefits beyond weight loss alone.

Final Thoughts

- GLP-1 drugs offer benefits like improved blood sugar control, weight loss, and potential cardiovascular benefits, but also come with potential side effects like nausea, vomiting, and diarrhea.
- By integrating GLP-1 therapies with gut health strategies and holistic lifestyle interventions, physicians can tackle metabolic dysfunction comprehensively.
- Ozempic can be a valuable **tool** for weight loss, it's not a magic bullet.
- Long-term weight maintenance requires continued commitment to healthy lifestyle changes, including regular exercise and a balanced diet. Stopping Ozempic without these changes in place can lead to weight regain.

System Disruption
Starts in the Gut

Cardiovascular System
Circulation
Blood pressure
Cholesterol
Inflammation
Digestive System
Allergies
Candida
IBS/IBD
Leaky gut
Endocrine System
PMS
Menopause
Adrenal
Thyroid
Lymphatic System
Auto-immune
Allergies
Cancer
Infections
Lymphedema
Muscular System
Stress, injury
Repair – improved recovery
Nervous System
Anxiety
ADD
Autism
Alzheimer's



Parkinson's
Fibromyalgia
Eye health
Headaches
Multiple Sclerosis
Reproductive System
Infertility
Healthy pregnancy
Endometriosis
Fibrocystic breasts
Uterine fibroids
Benign Prostate Hyperplasia (BPH)
Respiratory System
Asthma
Allergies
Sinus congestion
Skeletal System
Scoliosis
Osteoarthritis
Osteoporosis
Skin
Acne
Eczema
Psoriasis
Rosacea
Urinary System
Gout
Renal insufficiency
Urinary Tract Infections (UTI)

IF YOU GOT PROBLEMS, WE HAVE THE ANSWER!