Background

Obesity is a condition characterized by excessive fat deposition (BMI > 30) that affects over 36% of adults and 17% of youth in America. In fact, recent estimates suggest that the worldwide prevalence of obesity has doubled since 1980.² In 2008, the estimated medical cost of obesity was roughly \$147 billion.³ Although pharmaceutical, nutritional, and surgical interventions are available for obesity, these treatments are largely underutilized. Consequently, the medical cost of obesity is almost entirely from treating obesity-related diseases, like cardiovascular disease, stroke, type 2 diabetes and certain types of cancer. In 2011, the estimated cost of cardiovascular disease and stroke totaled \$249 billion; and the estimated cost of diabetes (both type 1 and type 2) totaled \$245 billion in 2012.^{4,5} Although these costs are not solely attributable to obesity, excess weight can significantly increase the risk of developing one or more of these chronic conditions.

Causes of Obesity

Unfortunately, obesity is difficult to treat, as there are many factors involved in its development. Some causes include diets high in sugar and processed foods, poor gut health, hormone imbalances, chronic lack of sleep, and genetics. This paper will address two of the most critical: diet and gut health.

1) Diet

Processed, sugary foods have become a major contributor to the growing obesity epidemic. Excessive fructose consumption, in particular, can increase insulin resistance, and may cause leptin resistance in rats. ^{6,7,8} However, reducing sugar consumption can be very difficult for patients, as it is easily accessible, nearly ubiquitous and highly addictive.

2) Gut Health

A healthy gut is an often-overlooked component of a strong immune system and healthy weight maintenance. Studies demonstrate that an imbalance of gut bacteria can actually increase the risk of developing obesity, type 2 diabetes, cardiovascular disease, cancer, and other inflammatory diseases.⁹

Given the many factors involved in the development of obesity, there is a clear medical need for a permanent weight loss solution that can improve diet and gut health.

Sugar and Obesity

One of the principal reasons obesity is so difficult to treat is due to the addictive nature of sugar. Nutrition education is no longer enough to elicit dietary changes because it is difficult to override a biochemical drive with willpower. Foods high in fructose release massive amounts of dopamine into the reward center of the brain.¹⁰ Over time, a constant infusion of dopamine into

the brain can cause dopamine receptors to down-regulate or decrease in number, making it much harder to receive the same number of signals in the brain. As a result, individuals will need greater and greater amounts of sugar and other nonnutritive foods to elicit the same level of reward. Researchers concluded that as common as it is, sugar meets the criteria for a substance of abuse and may be addictive for some individuals when consumed in a binge-like manner.¹¹

The typical solution is to replace sugary foods with artificial sweeteners, but artificial sweeteners only fuel the fire of sugar cravings. Nonnutritive sweeteners like aspartame (Equal), saccharin (Sweet N Low), sucralose (Splenda), and acesulfame potassium (Sweet One) were once considered beneficial since they were not metabolized as sugars. However, current research suggests that artificial sweeteners can actually increase the motivation to eat, disrupt the critical balance of gut bacteria, and increase the risk of type 2 diabetes by 121%. ^{12,13,14}

Surprisingly, the best way to fight sugar cravings is with beneficial gut bacteria. A recent study revealed that unfavorable gut bacteria hijack the vagus nerve and release their own neurotransmitters that can lead to uncontrollable cravings and unhealthy eating. ¹⁵ Furthermore, those same types of gut bacteria appear to alter taste preferences by increasing the number of sweet taste receptors on the tongue. Conversely, beneficial gut bacteria can compete with and overpower unfavorable bacteria, restoring balance and diversity to the microbiome. As a result, the best way to beat sugar cravings is to replace unfavorable gut bacteria with beneficial gut bacteria.

Gut Bacteria and Obesity

In healthy adults, roughly 80% of gut bacteria can be classified into three dominant phyla: *Bacteroidetes, Firmicutes*, and *Actinobacteria*. ¹⁶ In general, the most

important ratio in assessing gut health is that of the *Firmicutes:Bacteroidetes*. An elevated ratio of *Firmicutes:Bacteroidetes* has been associated with obesity, while a decreased ratio is related to weight loss.¹⁷ Some studies suggest that *Firmicutes* bacteria can actually increase the amount of calories extracted from food.¹⁸ Though this area requires more research, these findings suggest that weight loss can be achieved through the manipulation of gut bacteria.

In fact, one animal study already attempted to manipulate gut bacteria through fecal transplantation in mice.¹⁹ Researchers found that the microflora from obese individuals could make bacteria-free mice gain over 60% more fat than the microflora from lean individuals.²⁰ In other words, the composition of gut bacteria appears to have a causal effect on weight status.

Additionally, gut bacteria can also promote low-grade systemic inflammation by producing pro-inflammatory molecules like lipopolysaccharides (LPS), an endotoxin found in the cell walls of Gram-negative bacteria.²¹ If the intestinal epithelium loses integrity, it allows unwanted molecules to enter directly into the bloodstream, where they don't belong. Chronic infusion of molecules like LPS can then exacerbate symptoms of obesity by increasing systemic inflammation and promoting insulin resistance.²² Therefore, an increase in gut permeability and LPSenriched microbiota appears to facilitate LPS absorption and the development of obesity.²³ As a result, there is a need for new therapies to target gut inflammation and permeability in order to treat and reverse obesity.

Probiotics and Weight Loss

Interestingly, studies show that gut bacteria, such as Bacillus-strain probiotics, can contribute to the integrity of the intestinal wall by maintaining cell-to-cell junctions and repairing cellular damage after injury.²⁴

The latest research has shown that the type of bacteria in the gut controls the number of calories extracted from the food consumed, the types of food craved by the patient, and also what that food converts to in the digestion process.^{25,26} Foods consumed (especially carbohydrates) can be converted to compounds that lead to insulin resistance, fat storage, gas production and metabolites that cause inflammation. Conversely, the right bacteria can convert those same foods to very important compounds that increase insulin sensitivity, increase fat burn, prevent fat storage, reduce inflammation, reduce gas production and actually improve satiety. These effects are realized by turning on crucial genes in the digestive tract that control metabolic rate. People are either programmed to easily gain and retain weight or to be lean. The good news is that this programming can be changed by using the right probiotic bacteria and feeding those good bacteria with the right types of nutrients.

Silver Fern™ Brand probiotics contain a unique blend of powerful Bacillus strains, including *B. subtilis HU58, B. coagulans,* and *B. clausii*.

Silver Fern™ Brand Probiotics		
Bacillus subtilis	Reduces gut inflammation ²⁷	
HU58	Decreases gut permeability ²⁸	
Bacillus coagulans	Strengthens immunity by	
	enhancing T-cell response ²⁹	
Bacillus clausii	Strengthens intestinal lining with	
	protective mucous ³⁰	
Saccharomyces	Reduces gut inflammation by	
boulardii	interfering with inflammatory cellular	
	pathways ³¹	
Pediococcus	Secretes natural antibacterial32	
acidilacti	Strengthens intestinal lining by	
	adhering to epithelial cells ³³	

This unique probiotic formula pairs perfectly with prebiotic fiber to beat sugar cravings, reduce gut inflammation, and repair intestinal damage. It is formulated with a unique combination of probiotic bacteria that have been shown to convert fibers in the diet to the much-desired short chain fatty acids (SCFAs). This formulation is built with unique endospore-forming gut bacteria called Bacillus species. Studies completed at Ghent University's ProDigest research firm found that the pairing of Bacillus strains with fiber increased the production of SCFAs by 40% and decreased the production of gas by 50%.³⁴ No other probiotic strains have shown this type of metabolic response to fiber thus far.

Additionally, SCFAs have been shown to increase the AMP-activated protein kinase (AMPK) activity in liver and muscle tissue.³⁵ AMPK is a critical keystone enzyme found in the liver and muscle tissues that plays a major role in the control of metabolism. Activation of AMPK triggers peroxisome proliferator-activated receptor gamma coactivator (PGC)-1a expression, which is known to control the transcriptional activity of several transcription factors important in the regulation of cholesterol, lipid and glucose metabolism. Activated AMPK then enhances β-oxidation in both liver and muscle tissues while decreasing fatty acid synthesis in the liver. In addition, SCFAs have been shown to increase protein expression of PGC-1a and uncoupling protein (UCP)-1 in brown adipose tissue, thereby increasing thermogenesis and β-oxidation.

A diet rich in healthy fibers and reduced sugars, paired with these key Bacillus endospores, reprograms the body through modification of gene activation to reduce fat deposition and increase β -oxidation, energy metabolism, thermogenesis, satiety, and insulin sensitivity. This metabolic reprogramming is crucial for permanent and powerful weight loss.

Fiber and Weight Loss

Dietary fiber is a popular topic in the world of nutrition, but the human body cannot actually digest it. Instead, dietary fiber aids in bowel movements and some serve as food for naturally occurring gut bacteria. There are many different types of fiber that the body needs, but this paper will focus primarily on soluble and insoluble fiber.

When soluble fiber forms a gel, it has the ability to slow down the absorption of fat and sugar, thereby resulting in prolonged satiety and steadier levels of glucose and cholesterol. In fact, numerous controlled clinical trials have found that high-fiber diets (>20g/1000 kcal) reduced postprandial blood glucose concentrations by 13-21%, serum LDL cholesterol levels by 8-16%, and serum triglycerides by 8-13%. Some evidence suggests that viscous, soluble fiber can specifically target abdominal fat. Viscous, soluble fibers include: pectins, β -glucans, psyllium, glucomannan and guar gum. Fiber recommendations for adults are as indicated in the following table.

Fiber Recommendations

Age	Men	Women
< 50 years old	38g/day	25g/day
> 50 years old	30g/day	21g/day

Source: Institute of Medicine.

Benefits of a high fiber diet:

- Prevent constipation
- Slow digestion
- Improve satiety
- Normalize insulin responses
- Reduce serum LDL cholesterol levels
- Feed healthy gut bacteria
- Reduce risk of obesity-related complications

like cardiovascular disease and type 2 diabetes

Some fibers can be fermented by naturally-occurring gut bacteria, resulting in the formation of gases and short-chain fatty acids (SCFAs) like acetate, propionate, and butyrate.³⁹ Fermentable fiber, also known as prebiotic fiber, can be found in plants like: whole grains, onions, garlic, bananas, Jerusalem artichoke, and chicory root. In addition to improving bowel movements, prebiotic fiber can also have a positive impact on gut bacteria, which can actually strengthen the intestinal wall, improve nutrient absorption, improve appetite and anxiety, enhance metabolism, and more.

Summary

Obesity is an inflammatory disease that originates in the gut. Though there are multiple causes of obesity, the majority can be tied back to increased gut inflammation and permeability. Bacillus-strain probiotics paired with soluble, viscous fiber enhance the production of SCFAs that can burn fat, reduce inflammation and repair the epithelial lining of the gut.

The functional products from Silver Fern™ Brand have the ability to improve satiety, reduce inflammation, reduce sugar cravings, encourage fat loss, and even promote insulin sensitivity – creating the perfect weight loss solution for health professionals and consumers alike.

For more information on how to achieve the best results with Silver FernTM Brand products, check out the 7-Step ELEVATED Program at www.silverfernbrand.com/pages/silver-fern-elevated. These simple steps will enable patients to treat or prevent the negative effects of obesity through proper nutrition and gut health.

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