The Gut Microbiota and Long Term Health

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Introduction

Understanding the human gut microbiota is one of the most exciting advancements in biomedicine in the last 20 years. Research on the human microbiome reveals how the microbiome plays a significant role in digestion, inflammation, chronic disease, and mental health. The gut microbiota is influenced by dietary practices. The standard American diet (SAD) "includes excess consumption of calories from refined carbohydrates, fatty meats, and added fats…that lacks many nutrients found in whole grains, fruits and vegetables" (Grotto & Zied, 2010, p. 603). Foods high in fiber, minerals, vitamins, as well as fermented foods, have a positive impact on the microbiota composition. Furthermore, the composition and diversity of the microbiota in prenatal and postnatal life influences the development and maturation of the gastrointestinal tract. Maternal microbes may play a profound role in establishing life-long immunity. Additional research is required to fully understand how important the development and maintenance of diverse gut microbiota will be for the creation of targeted interventions for disease prevention.

Personal Statement

I believe it is critical to educate the world about the link between rising chronic diseases and the imbalances of our gut microbiota. The gut microbiota refers specifically to the beneficial microorganisms that work symbiotically within our bodies to bolster immunity, process nutrients, and manage waste. Gut dysbiosis refers to a condition of microbial imbalances within our digestive tract which lead to a growing number of chronic health conditions.

Serious memory loss, as with Alzheimer's disease, has also been associated with gut bacterial imbalances. Inflammation develops when the microorganisms living in the gut become

unbalanced. Chronic inflammation spreads throughout the body and leads to the etiology of chronic diseases. My 85-year-old father is suffering from late stage Alzheimer's as I write this, and that has propelled me to research gut health to better educate the world about its impact on total wellbeing.

Lack of wellbeing begins with our lifestyle choices. For many of us, poor lifestyle choices begin each day after a restless night's sleep and a bowl of sugar-laden breakfast cereal with fat-free milk. Next, we jump into the car, stop for a cup of coffee, and hustle through our commute to get to a climate-controlled office building. We work much of the day sitting down for long stretches of time. Then, we rush through lunch prepared with more processed foods high in fats and sugars, low in vital nutrients. Now back to our climate-controlled office where we sit for more hours each day. At the end of the workday, we settle into a nice homemade dinner, if we are lucky, or fast foods prepared for us if we do not have time or energy to do it ourselves. Finally, we end the day in front of the television or surfing the Internet. We might possibly consume a carbonated or alcoholic beverage, maybe a dessert. Then, off we go for another restless night's sleep before repeating the cycle of poor lifestyle choices all over again the next day.

This cycle of poor habits and eating patterns needs to stop if individuals are ever going to grow and flourish and reach a greater state of longevity without morbidity. Extending life expectancy is not enough without improving quality of life. We can do better than living long lives burdened with chronic diseases. We can open our minds to healing ourselves with awareness and mindful intention. It is my purpose and meaning to help us find our way back to personal well-being which the research has shown starts in the gut.

"The doctor of the future will give no medicine, but will instruct his patient in the care of the human frame, in diet and in the cause and prevention of disease."

– Thomas Alva Edison.

Problem Statement

The standard American diet SAD, the major determinant of whether microbes flourish in the gut microbiota, is not fiber rich enough to support a diverse gut which contributes to decades of inflammation, along with other factors, leading to a pandemic level of chronic disease both physical and mental negatively impacting quality of life.

Literature review

What is the gut microbiota?

The gut microbiota plays a highly-significant role in the maintenance of a healthy body and lifestyle, which is just beginning to gain more recognition. According to Dore, Simren, Buttle, and Guarner (2013), "the human gut microbiota is a complex community" consisting of "10^{14} bacteria" which is 10 times the number of cells in the human body (p. 311). The gut microbiota is also "increasingly described as another organ of man…a super organism" (p. 311). The microbiota plays a central role in immunity, digestion, inflammation, cell proliferation, and is capable of communication with the gut and also with distant organs and bodily systems, like the brain and central nervous system (Cerda, Perez, Perez-Santiago, Tornero-Aguilera, Gonzalez-soltero, & Larrosa, 2016; Cho & Blaser, 2012; Deehan & Walter, 2016; Dore, Simren, Buttle, & Guarner, 2013; Kweon & Yang, 2016; Schnorr & Bachner, 2016; Selhub, Logan, & Bested, 2014; Sonnenburg & Sonnenburg, 2014; and Thum, et al., 2012). The crucial relationship between the gut microbiota and health is increasingly evident and should be further studied and investigated to maximize its potential to revolutionize global health standards and knowledge.

Along those lines, the "gut microbiota is crucial for the development of the immune system… the bidirectional interaction between microbiota and the host immune system begins at birth and both evolve throughout the life of the host" (Cerda, et al., 2016, p. 2) Science has confirmed the centrality of the gut microbiome for individual physical and mental well-being. In exploring further, it has been found that "gut microbiota is influenced by several factors, including host genetics, age, pregnancy, and some environmental factors such as diet, the type of birth, stress, and antibiotic intake" (p. 2). Essentially, "the balance between the immune system

and commensal microbiota is essential for maintaining health" (p. 2). As the research confirms, "the breaking of this equilibrium can trigger many diseases, not only related to the gastrointestinal system, such as ulcerative colitis, Crohn's disease, and colon and gastric cancer, but also other diseases, such as metabolic syndrome, diabetes type I and type II, allergic diseases…, rheumatoid arthritis, and autism" (p. 2). Clearly, the health of our gut microbiota represents an integral aspect of complete and proper body functions free of debilitating diseases and afflictions.

What is a healthy gut microbiota?

It should be stated that simply being healthy according to conventional definitions does not automatically translate to having a healthy gut microbiota or gut microbiome that contains all the diversity in composition required to facilitate digestion and promote total well-being (Sonnenburg & Sonnenburg, 2014). It is possible that the post-industrial microbiota is dysbiotic and predisposes individuals to a variety of diseases, regardless of their perceived health status (Sonnenburg & Sonnenburg, 2014). The post-industrial lifestyle, which includes a diet low in microbiota-accessible carbohydrates (MAC), has much less microbe diversity than those of groups living more traditional lifestyles (Sonnenburg & Sonnenburg, 2014). However, descriptions of the postindustrial diet and lifestyle should be tempered with caution because "use of the term 'dysbiotic' must be accompanied by the recognition that the definition of a healthy microbiota that should serve as a frame of reference is still poorly defined" (p. 779). Even the leading researchers on intestinal homeostasis are still studying gut microbiomes and trying to determine what constitutes a healthy one versus an unhealthy one.

Historically, human beings have been equipped with the ability to develop healthy gut microbiomes in ideal, natural environments. For example, "hunting and gathering was the

lifestyle that dominated for the longest time span in human existence" (Sonnenburg & Sonnenburg, 2014, p. 781). In modern times, the "Hadza, a group of 1,000 people in Tanzania, are the last full-time hunter-gathers in Africa and represent one of the best modern approximations of pre-agricultural humans" (p. 782). As reported by Sonnenburg and Sonnenburg (2014), a "study comparing the microbiota of 27 Hadza to 16 Italians" showed a "much larger extent of bacterial diversity in the foraging microbiota compared to the industrialized group" (p. 782). Additionally, the study of the Hadza and Italian subjects showed that "the gut microbiota has been unable to keep pace with the recent profound changes brought on by our modern lifestyle," specifically related to diets low in microbiota-accessible carbohydrates (p. 783). Also, the research results emphasized that "traditional societies typically have much lower rates of Western diseases" indicating that the gut microbiome of these more traditional societies has a significant advantage in reducing incidence of common diseases and disorders over those of people from more industrialized societies (p. 783). The researchers further concluded "it is possible that the new microbiota configuration resulting from modern diet and lifestyle presents incompatibilities with our human biology, the ill effects of which contribute to modern diseases" (p. 783). As a result, the human microbiota will continue to suffer the ill-effects of poor diets and lifestyles without drastic changes being made in collective consciousness regarding the way people eat and the way they live.

Antibiotics and the gut microbiome

As social and medical advancements among humans have increased, antibiotics have been used to treat severe and highly contagious diseases that once ended in fatalities (Langdon, Crook, & Dantas, 2016). However, over time, human pathogens have developed increasing antibiotic resistance due to the widespread and excessive use of antibiotics (Langdon, Crook, &

Dantas, 2016). At the same time, discovery of new antibiotics to treat the same bacterial infections has declined (Langdon, Crook, & Dantas, 2016). Currently, it is estimated that antibiotic-resistant pathogens will cause 10 million deaths worldwide by 2050 (p. 1). The use of antibiotics also contributes to the development of a dysbiotic human microbiome by disrupting the ecology of the cells, genes, and metabolites of bacteria as they perform their essential functions of nutrient supply, vitamin production, and immunological protection (Langdon, Crook, & Dantas, 2016). Antibiotics can alter gene expression, protein activity, overall metabolic activity, and physiological state of the gut microbiota creating an environment like those present under diseased conditions (Francino, 2016). The administration of broad-spectrum antibiotics destroys an estimated 30 percent of the abundance of bacteria in the gut community and has been associated with obesity, diabetes, and asthma development (Francino, 2016). These antibiotic-induced microbiota changes can last for a few months up to several years (Francino, 2016).

The hygiene hypothesis has been proposed to explain why individuals in less-developed countries have a more complex gut microbiome composition than individuals from post-industrial societies (Langdon, Crook, & Dantas, 2016). The hygiene hypothesis argues that the use of antibiotics to promote cleanliness and the eradication of bacterial diseases has resulted in the overuse of these medications, which lead to reduced microbiome diversity (Langdon, Crook, & Dantas, 2016). The instances of antibiotic resistant genes are highest with antibiotics that have been on the pharmaceuticals market for the longest, as well as those that have been approved for use in animals (Francino, 2016). The prevailing rationale suggests that antibiotics interfere with the production of good bacteria in contrast to allowing the proliferation of bad bacteria, which thus increases the hosts' susceptibility to harmful pathogens (Langdon, Crook, & Dantas, 2016).

Some of these harmful pathogens that proliferate during antibiotic treatments include *Clostridium difficile* and *Salmonella typhimurium* (Langdon, Crook, & Dantas, 2016).

In response to the harm caused using antibiotics and antibiotic resistance, probiotics, live microorganisms, have been proposed as one approach to restore or improve the gut microbiome (Langdon, Crook, & Dantas, 2016). Thus, probiotics offer potential treatment modalities, which may enhance the functionality of the existing gut microbiome while also impacting its composition to improve a variety of immunologic responses throughout the human body (Hemarajata & Versalovic, 2013). For example, probiotics derived from the Lactobacillus strains have been shown to improve the intestinal barrier resulting in increased immune toleration, decreased translocation of bacteria across the intestinal mucosa, and decreased production of pro-inflammatory cytokines (Hemarajata & Versalovic, 2013, pp. 44, 46). The future of improving the gut microbiome depends on further development of probiotics as a possible treatment for increasing diversity within gut microbial communities.

Mental health and the gut microbiome

Traditional diets and mental health. The central role of the gut microbiome in holistic health and well-being is reflected in the negative impact dysbiosis has on mental health. In the post-industrial world, the most frequently diagnosed disorders are anxiety and depression (Schnorr & Bachner, 2016). In the past ten years, research into the gut microbiome has shown definitively that poor diet and gut health causes symptoms related to diagnosis with stress related disorders, depression, and anxiety (Schnorr & Bachner, 2016). As human beings have moved away from traditional lifestyles and into more modern lifestyles with poor, post-industrialized SAD diets, the rates of depression, anxiety, and other mental health disorders have drastically increased, supporting this relationship between the gut microbiome and mental well-being (Selhub, Logan, & Bested, 2014). Besides the gut brain connection, the linkage between gut health and psychological well-being has also been termed the gut-brain axis (GBA), which is further defined as:

> a bi-directional communicative and regulatory system involving the brain and central nervous system (CNS) and the enteric environment of the gut, inclusive of human and microbial cells. The gut and the brain send and receive messages via the enteric nervous system (ENS) through neural pathways such as the sympathetic system and the vagal nerve, as well as through the blood stream. Thus the gut and its microbiota affect immunity, endocrine function, and the nervous system, as well as regulation of behavior (Schnorr & Bachner, 2016, n.p.).

The potential to disrupt the etiology of mental health disorders through diet is patently clear in this relationship between the composition of the gut microbiome and mental health status. Specifically, Selhub, Logan, and Bested (2014) propose “among the variables that might afford

protective or resiliency effects against mental health and depression disorders, diet has emerged as at least one strong candidate" (p. 2). This growing area of research into the GBA is known as nutritional psychiatry with robust research being developed as more and more is understood about gut microbiota and the brain (Selhub, Logan, & Bested, 2014). In research that has engaged in population studies, adherence to more traditional diets have been linked to lowered risks of anxiety and depression (Selhub, Logan, & Bested, 2014). The most convincing evidence from these studies has shown that strong adherence to healthy dietary patterns can lower the risk of developing depression by 25 to 30 percent (p. 2).

Unfortunately, the reality of mental health care in the post-industrial world involves the continued consumption of overly-processed foods high in sugar. These foods work against the development of the human genome from the evolutionary past, further undermining the gut microbiome, and ultimately, the brain (Selhub, Logan, & Bested, 2014). Despite the novelty of the post industrialized SAD diet and its reliance on processed foods for nutrition, an intuitive understanding about the centrality of nutrition in maintaining good health is an age-old knowledge. Hippocrates said, "all health begins in the gut," and this can be further translated to mean "we are what we absorb" (Schnorr & Bachner, 2016). Because nutrition, especially nutrition that sustains the gut microbiome's diversity, plays a central role in preventing and alleviating symptoms associated with mental health disorders, the medical and mental health systems "need to radically shift away from reliance on prescribing psychotropic medications and move to providing dietary information and prioritizing dietary interventions as an important initial step in biopsychosocial treatment approaches" (Schnorr & Bachner, 2016, n.p.) The link between mental health and dysbiosis in the gut microbiome reveals an immediate need for health

care practitioners to prioritize nutrition in their treatment plans, especially for populations most vulnerable and at risk of developing mental disorders.

Fermented foods and mental health. In terms of developing a balanced gut microbiome to enhance and improve mental health, fermented foods present a unique chance to practice nutritional psychiatry with marked results. In ancient human history, without the benefit of scientific research, human populations understood "the palatability, preservation, analgesic, and mentally stimulating or sedating qualities of fermented foods and beverages" (Selhub, Logan, & Bested, 2014, p. 1). The study of human anthropology has revealed "the purposeful application of fermentation to provide value in the areas of human nutrition, traditional medicine, and culture. Sophisticated measurements of the chemical content within ancient Neolithic vessels suggest intentional fermentation of fruit, rice, or honey beverages as a common practice for close to 10,000 years" (p. 1). Through the study of ancient human populations, it has become clear that fermented foods were a significant part of ancestral nutritional practices (Selhub, Logan, & Bested, 2014). Even further, Selhub, Logan, and Bested (2014) reveal that fermentation may increase the known benefits of a wide variety of foods and herbs, directly influencing the bioavailability and activity of the chemical components. Specifically, fermentation impacts the gut microbiome "to influence brain health by virtue of the microbial action that has been applied to the food or beverage" (pp. 2-3). As a result, fermented foods may play a direct role in the GBA by enabling enhanced communication between the intestines and the brain (Selhub, Logan, & Bested, 2014). The present research helps to confirm the necessity of developing and maintaining a balanced gut microbiome, which directly translates into resiliency against depression and other mental disorders.

Maternal microbiota and infant health

Scientific research has uncovered the impact of the gut microbiome on pregnancy and childbirth. It is commonly understood that pregnancy is a time during which the mother requires a diet that supports the healthy growth and development of the fetus, while also providing nutrients for the proper functioning of their own metabolism (Thum, et al., 2012). This is also true of lactation after the baby is born as the nutrients taken in by a mother directly affect milk production and thus the infant's nutritional intake (Thum, et al., 2012). Because of the close relationship between a mother, her developing fetus, and the growing infant, a failure to sustain the correct amounts and types of nutrition are central factors in miscarriages, abnormal fetal development, and malnutrition (Thum, et al., 2012). Subsequently, Thum and their colleagues (2012) definitively documented how the microbiota of the maternal GIT has important functions for the infant's GIT, including development of the immune system, protection against pathogens and carcinogens, and efficient nutrient processing (Thum, et al., 2012). As a result, maintaining a healthy gut microbiome has realistic implications for the health of mothers and their children, from conception to long after delivery.

As the diversity in the mother's gut microbiome determines the infants' gut microbiota as well, early colonization of the infant GIT is undoubtedly an important factor for the infant health and may have additional health benefits later in life (Cho & Blaser, 2012; and Thum, et al., 2012). The reasearch of Cho and Blaser (2012) and Thum and their fellow researchers (2012) confirmed the mechanisms through which infant gut microbiomes are established prior to their delivery and further developed during vaginal delivery (Cho & Blaser, 2012; and Thum, et al., 2012). Specifically, Thum and their colleagues (2012) attest that "during vaginal delivery, contact with maternal vaginal and intestinal microbiota is an important source of microbiota for

the colonization of the infant GIT" (p. 1922). Cho and Blaser (2012) corroborate these findings and establish that "immediately after vaginal delivery, founding microbial populations in the baby closely resemble that of their mother's vagina…and in mother's milk" (p. 5). Because of the intimate relationship between the mother's microbiome and the infants, there are multiple opportunities of transference, except in the case where modern medical advances disrupt natural vaginal birthing (Cho & Blaser, 2012). Having a Caesarian section instead of a naturally-occurring vaginal delivery is an example of those medical practices which disrupt the developing microbiota of the infant (Cho & Blaser, 2012).

For infants, healthy microbiota development occurs through breastfeeding: "human milk provides nutrients and non-nutritive components to the offspring that facilitate the adaptive, functional changes required for optimal transition from intrauterine to extra uterine life. It also stimulates the immune system, encourages cognitive development, protects from toxins and pathogenic diseases, and colonizes and supports protective microbiota in the infant" (p. 1922). Clearly, maternal and infant health are directly impacted by the state of the mother's gut microbiome, and working to develop and maintain healthy gut microbiota diversity has significant implications for the health of mothers and infants long-term.

The future of the gut microbiota

In looking at the future of developing healthy gut microbiomes, research has identified the globalization of the post-industrialized diet as a continuing obstacle. To that end, Sonnenburg and Sonnenburg (2014) elaborate that the

> ongoing dissemination of the industrialized lifestyle and processed foods to the most remote areas of the globe will be accompanied by a series of microbial extinction events similar to that which has left the biodiversity of the Western microbiota decimated. While

> imposing poorer health on populations as they modernize, the global eradication of critical microbiota members will likely have far-reaching importance. These remaining untouched populations may represent valuable repositories of important taxa that have been lost from Western populations (pp. 783-784).

Sonnenburg and Sonnenburg (2014) propose that "collection and preservation of these microbes followed by their deliberate reintroduction supported by a diet rich in the MACs that sustain them might be the best hope of rewilding the Western microbiota" (p. 784). The current research on gut microbiomes remains a vastly unexplored terrain ripe for further research in identifying the specific components of a healthy microbiome, the processes of achieving and developing a healthy microbiome, and facilitating the continuation of a millennia of healthy human existence.

What can be done to restore the human microbiome?

With the future of healthy human existence at stake, it is likely that a combination of factors may have caused the decline in gut microbiome diversity.

Fiber. The factor that has been empirically shown to have a direct linkage to microbiota diversity is the insufficiency of fiber in the SAD diet (Deehan and Walter, 2016). Fiber is considered the nutrient most accessible for the development and maintenance of a healthy gut microbiome, and the absence of sufficient fiber intake leads "not only to the loss of species reliant on these substrates, but also the reduction of fermentation end products with important physiological and immunological functions" (p. 239). The lack of appropriate fiber intake in the SAD diet upholds the "notion that this process might have contributed to the rise of chronic diseases and a substantial degree of morbidity and mortality" which "provides a strong incentive to consider attempts to conserve and potentially restore the gut microbiome" (p. 239).

Holistic Lifestyle. The research supports the present project through its focus on diet and lifestyle to improve the gut microbiome, which will have a significant impact holistically, from physical health and curing disease to mental health and promoting wellness.

Integrated Effort. Considering how to apply the current research to a real-world application of improving the gut microbiome, the question becomes one of how best to go about improving intestinal homeostasis. To date, all nutritional organizations propose increased consumption of dietary fiber as means of improving gut microbiota diversity (Deehan & Walter, 2016). Despite this industry-wide understanding of the importance of fiber intake and its benefits, people's consumption of foods high in fiber remains low on average (Deehan & Walter, 2016). The continued lack of high fiber intake and additional changes in dietary recommendations are not likely to produce the desired changes in consumer behavior nor the composition of the gut microbiome (Deehan & Walter, 2016). To combat the stagnancy of response even in the face of such beneficial information, Deehan and Walter (2016) specifically propose "an integrated effort that involves academics, the food industry, economics, nutritional policy makers, and regulatory organizations with the goal to systematically enhance the fiber content and availability of the food supply" (p. 241) However, the researchers also warn that

> although a strategy to boost the consumption of MAC's alone would likely be beneficial and could be immediately implemented, this might not restore microbiome diversity completely without parallel efforts to reintroduce microbes that were lost during industrialization….a successful implementation will require a society-wide effort and essentially a transformation of human nutrition away from a discipline that focuses merely on meeting nutritional needs of the human host to one that is concerned with also nourishing the symbiotic microbial communities that are so essential (p. 241)

in our collective human health. If the gut microbiome of individual and collective populations steeped in an unhealthy post-industrial SAD diet is to change and improve to result in lasting health and well-being, diets and lifestyles must first change. Individuals must take charge of their diets and lifestyles, but the food industry must also support these changes with deliberate efforts to improve the quality and types of food sold. The key to eliminating dysbiosis and its resulting diseases is in the foods eaten. Failing to improve the gut microbiome will continue to have deleterious effects on wellness, even negatively impacting mental health, maternal and infant health as well.

Discussion

The growing volumes of research on the gut microbiota is very useful in the world of health coaching. In my experience as an integrative health and wellness coach, most of my clients are challenged by the many food choices and conflicting information on food and diets. In addition to insufficient fiber intake there are many other factors to understand and traverse through which include food additives and preservatives, soil depletion, pesticides and GMOs. My professional experience with clients has shown to start with the basics of becoming aware of individual food consumption. This awareness of food is the first step. Research shows that most diets feel restrictive and do not work for the long term. This leads to lack of motivation and a sense of failure to adhere to strict diets. Most of us do not understand how we can stay fit and healthy and at our desired weight without great sacrifice and deprivation.

My proposal is to teach, inform, and empower my clients with my six-week program titled, *Follow Your Gut: Your Guide to Long Term Health*. This six-week program provides knowledge about attaining a proper mindset and adequate resources to learn to heal and trust their guts as they move toward personal wellbeing. The power of healing begins within each of

us. Learning to tap into our own wisdom and knowledge will support the shift from prescriptive medicine to personal choices and an informed lifestyle. This six week program will offer tools and resources to discover the intuition that resides in all of us to help us move toward a level of personal well-being that will be rewarding, and most importantly, sustainable. This on-line program will be webinar-based with teaching videos, downloadable resources, and live group coaching sessions, along with a private group discussion page.

Interview with John Douillard DC, CAP February 21, 2017

John Douillard, DC, CAP, is a recognized leader in the fields of natural health, Ayurveda, and sports medicine. He is the inventor of Life Spa and the Colorado Cleanse through which he has been educating about well-being for over thirty years. Our conversation covered the urgent need to balance the immune system and the gut microbiota, which is essential for optimal health. Douillard states that the dysbiotic gut predisposes people to disease. The gut has not kept pace with the rapidly changing lifestyle choices that have occurred since the 1940's. Douillard is passionate about us understanding our lymphatic system. Inside the intestinal tract, the lymphatic system starts within the villi, which are the tiny, finger-like projections that absorb nutrients in our gut. Particles that are too large to be absorbed into the blood can enter the lymphatic system, which can then become overwhelmed by a lifetime of processed foods and poor digestion. Once the intestinal wall becomes inflamed, the intestinal lymphatic system is exposed to a variety of environmental toxins. According to Douillard, when the lymphatic tissue become congested with toxins and hard to digest proteins and fats, the lymphatic system can overflow into the fat layers around the gut and predispose the body to various forms of obesity and health concerns. When your lymphatic system is congested, you tend to get belly fat. Douillard calls the lymphatic system the drains of the body. Keeping those drains open is one of the key markers to good

health. Douillard believes eliminating gluten is not fixing the problem. Instead, John states that we must start with getting in tune with our circadian rhythms, eating seasonally, and eating our largest meal in the middle of the day. He also suggests practicing mindfulness in all we do to create action from a centered place (Doulliard, 2017).

Interview with Akil Palanisamy, M.D. March 24, 2017

Akil Palanisamy, M.D., is a Harvard-trained physician who practices integrative medicine at the Center for Health and Healing in San Francisco. He is the author of *The Paleovedic diet: A Complete Program to Burn Fat, Increase Energy, and Reverse Disease*. Palanisamy states that fiber intake in the average American diet today has had a 90 percent drop from the era of hunter gathering. To improve the health of the gut microbiota, daily fiber intake needs to increase from the current 10 to 15 grams per day to 30 to 40 grams per day with an ideal intake of 50 grams per day. He also states that the Paleo diet is mostly a plant-based diet high in fiber and not a low carb diet. He emphasized that it is not a meat-heavy diet as it is commonly perceived in popular culture. Palanisamy promotes the "Science of Life" approach to health which is a personal approach to health and well-being. He stated that the Paleo diet must be customized and personalized to the individual and their specific needs. Plant diversity in the diet is also a must as we currently eat eight to ten types of plants in our diet, and we need to increase that to twenty different types. He said this could be easily achieved by seasonal eating. In addition, the more brightly colored the vegetable, the higher the phytol chemicals that help fight disease (Palanisamy, 2017). Palanisamy provided insightful information on how to improve the SAD diet to better feed the microbiota.

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Appendix A. Follow Your Gut program storyboard

Follow Your Gut:

Your Guide to Long Term Health

6 Week On-line Webinar

Landing Page

Follow Your Gut is a program designed to help you start your journey to vibrant health and longevity by informing you on how to change the way you feel in your body by changing the way you eat in your diet.

Quiz taken with the following questions:

Do you want to be more vibrant and healthy in just six weeks?

Does your day start with as much energy as you would like?

Does your day end with exhaustion?

Would you like less body fat?

Do you feel bloated and gassy on a regular basis?

Would you like a stronger immune system?

Do mood swings and cravings overwhelm you?

Have you changed your diet because you can no longer digest certain foods?

Do you rely on stimulants like coffee, alcohol, or medication to get through the day?

Are you concerned about the environmental toxins you are exposed to?

What is possible?

Would you like to be in control of your own health by your daily choices?

Would you like to get healthy naturally and gently, without extreme fasting or discomfort?

The latest research shows that a diverse gut is equated to a healthy lifestyle and diet. Eating properly is the fastest and most direct route to increasing gut diversity, which is the foundation of your long-term health. You have 100 trillion microbes that live in your gut. The microbes that run the human body have been starving due to the abundance of simple, processed carbohydrates in the modern diet of convenience that has been wreaking havoc for decades on the human gut. We have been living unknowingly with decades of inflammation caused by our daily food choices. Inflammation is the precursor to most chronic health conditions. Simply adjusting our lifestyle, starting with diet, can change this trend toward disease and illness.

In this six-week program, you will be given the tools to start the healing process of improving your gut health by taking control through your daily, informed dietary choices.

All these concerns can be addressed by properly feeding the 100 trillion microbes that live in your gut. Ninety percent of your immune system resides in your gut. What you put into your mouth effects almost every aspect of your health. You are the one in control of your choices each moment of the day.

Scientists once thought human beings were solely a product of the genetic material contained in our DNA, but as it turns out, we are a part of the microbial world and just 10 percent human DNA. These are exciting times, and this information will make you the master of your health. It does not matter what age you are; your current state of health can be improved. Join me in becoming the master of your health and longevity. This six-week course will provide information on how to take control of your life through your eating patterns by developing a growth mindset that encourages you to look forward to a life that offers you choice on your own terms and at your own pace.

What you will get when you take the six week Follow Your Gut program:

- Six Videos: 1 teaching video each week to be viewed at your convenience
- Live Group Coaching Sessions each week
- Handouts and worksheets weekly
- 3-week fiber enriched diet
- Private Facebook Group to share your experience, ask questions, and get support

Follow Your Gut

Your Guide to Long Term Health

The Follow Your Gut program will start off with a introduction video which will outline the six weeks and how each week will build on the following week. The goal of the program is to understand and create diet and lifestyle change that will end in better understanding of your own personal dietary and lifestyle needs bringing more energy and vitality to your life.

Week 1

Learning objectives: Participants will explore growth versus fixed mindsets, judger versus learner paths, deliberate practice, curiosity, and goal setting. Action item will be tracking water intake for week one.

Week 1 Video Training: 4 Steps to Changing Mindsets

1. Learn to hear your fixed mindset voices
2. Recognize you have a choice
3. Talking back to your fixed mindset voices with a growth mindset
4. Take growth mindset action

   Growth Mindset: learns from experience, embraces challenges, persist in the face of setbacks, see effort as the path to mastery, learns from feedback, inspired and learns from other successes, reaches ever-higher levels of achievement.

   Growth Mindset: Focuses on Lessons & Learning

   Fixed Mindset: out to prove themselves, avoids challenges, gives up easily, sees effort as pointless, ignores feedback, feels threatened by other successes, plateaus early and achieves less than their full potential.

   Fixed Mindset: Focuses on Labels & Judgments

5. **Choice Map**: Judger vs. Learner Path

   Catch your Judger and Shift Gears: Ask a Switching Question

   - How else can I think about this?
   - What do I want to learn?

6. **Deliberate Practice**: Building momentum, effort over time.
7. **Curiosity** is the antidote to a Fixed Mindset.

   Curiosity: recognizing, embracing, and seeking out knowledge and new experiences. Embracing curiosity is linked with life satisfaction.

8. **Goal Setting for "Follow Your Gut"**

   - Start by setting your goal Be specific "My goal is to follow this program with intention and deliberate action to become more in tune with my body and how diet effects it."
   - Develop your action plan "I will participate fully in this program to reap the most benefit for my health."
   - Act out your plan "I am participating in all the resources and materials I have been given in the program."
   - Monitor the plan "How am I feeling in my body about my daily choices?"
   - Evaluate Progress "I feel lighter and clearer when I act with mindful intention in my daily choices."

Week 1: Action

Become aware of how much water you are drinking this week:

- Keep a daily log of how much water you drink this week

Week 1 Texted Messages

1. "Water is the driving force of all nature" Leonardo da Vinci
2. "Drinking water is like taking a shower for the inside of your body"
3. "Pure water is the world's first and foremost medicine" Slovakian Proverb
4. Water "this has only two aspects, when mixed with anything is need and when not, it is life"
5. "We forget that water cycles and the life cycle are one" Jacques Cousteau

Week 1 PDF downloads:

1. Choice map
2. Expand your Perspectives list
3. Growth mind set
4. Inquiring mindset
5. Daily log sheets for Core Behavior tracking
6. Goal setting Sheet

Week 1: I hour Group Coaching for discussion and support

Week 2

Learning objective: Participants will learn about the theory of change. Action item will be recording movement for week two.

Week 2 Teaching Video: Understanding the Change Process

If you **Focus on Results,** You'll **Never Change.**

If you **Focus on Change**, You'll **Get Results.**

Change is non-linear

Change is…Getting from where you are to where you want to be.

Prochaska's Stages of Change Theory

- **Pre-contemplation**

  Understanding you want to feel and look better but not even thinking about changing behavior.

- **Contemplation**

  Identifying how your current state of health is not working. “What will happen if I keep things the same and don’t make changes?”

  Considering making change but feeling ambivalent.

  The end of contemplation stage is marked by anticipation, activity, anxiety and excitement. Considering the program “Follow Your Gut.”

- **Preparation**

  Gathering information, assembling resources and checking the possibilities. What do I need to help me meet this goal?

  Prepare for pitfalls.

  Celebrating your move from contemplation to preparation by signing up for “Follow Your Gut Your Guide to Long Term Health” program.

- **Action**

  Committing to “Follow Your Gut” program and making mindful dietary changes in small steps that will lead to your improved long term health.

  Making daily choices that create health and vitality. Understanding this is a re-committing to the goal process with deliberate practice.

- **Maintenance**

New dietary habits have been created and incorporated. You feel better and look better. Your health and vitality have become an intrinsic and intuitive part of you and you are the master of your own health.

- **Relapse/Terminate**

  Plan for a relapse. Return to your preparation phase and use the resources for mind set and deliberate practice. Re-visit your goal of long term health with vitality and longevity.

  You will know when you are ready to terminate when your food choices are so in line with your current and future well-being that you no longer need a pragmatic approach to change, you have embodied lasting dietary change.

Behavioral Immune System

Four Core Behaviors:

i. Water
ii. Exercise
iii. Diet
iv. Breath

Week 2: Action

1. Become Aware of how much you move. Movement should be something you love to do. Walking, hiking, dancing, yoga, tai chi, playing your favorite sport, moving your body in any fashion that makes you feel alive. Our bodies are meant to move, the key to movement is uniquely yours, find your movement passion and feel the spark it lights in your body.
2. Keep a daily log of how much you move this week.

Week 2 Texted Messages

1. "To enjoy the glow of good health, you must exercise." Gene Tunney
2. "Lack of activity destroys the good condition of every human being, while movement and methodical exercise save it and preserve it." Plato
3. "If you could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health." Hippocrates
4. "It is exercise alone that supports the spirits, and keeps the mind in vigor." Cicero "A thirty-minute workout is 2% of your day"

Week 2: PDF Downloads:

1. Stages of Change Theory Chart
2. Change Process Chart
3. Log sheet for movement

Week 2: 1 hour Group Coaching for discussion and support

Week 3

Learning objective: Participants will understand how diet effects the gut microbiota. Action item will be cleaning out their pantries and refrigerator and restocking with a *Follow Your Gut* grocery list for week three.

Week 3 Teaching Video: Understanding Your Gut Microbiota

Research has uncovered a complex web connecting our gut microbiota to every organ in our body. Imbalances in our microbial communities have been linked to chronic health conditions, immune health, and psychological well-being.

100 trillion microbes live in your gut.

1. Your Gut microbiota is your control center.

2. Our modern life-style has dramatically impacted our gut microbiota.
3. There are ways to modify the damage to our guts.
4. Diet is the fastest route to re-establishing gut diversity.

One of the common denominators of the many chronic Western diseases is inflammation. It is decades of inflammation that set us up to get one of the many current chronic diseases and then it's inflammation that drives the condition. Diseases like arthritis or inflammatory bowel disease are two examples. The developing research shows that the gut microbiota, if it is fed dietary fiber, something that is greatly deficient in the Western diet, ferments that fiber and creates chemicals known as short-chain fatty acids. These short-chain fatty acids which are the fermentation end products of what the microbiota is doing to fiber, get absorbed into our circulation and have anti-inflammatory effects. This means if we are not eating fiber rich diets, our microbiota is not producing as many short-chain fatty acids, and we don't have the same level of anti-inflammatory compounds floating around in our bloodstream. Modifying life-style practices such as diet can protect and restore this endangered microbial community to 80%. The Follow Your Gut Program is designed to restore your microbiotas health by increasing fiber which is complex carbohydrates in your diet. Let's begin the journey of gut restoration.

Week 3 Action

Clean out pantry and refrigerator of all processes foods. This is a necessary process when making dietary changes.

Week 3 Texted Messages

1. "If we don't change, we don't grow. If we don't grow, we aren't really living." -*Gail Sheehy*

2. "The price of doing the same old thing is far higher than the price of change." -*Bill Clinton*
3. "Those who cannot change their minds cannot change anything." -*George Bernard Shaw*
4. "The first step toward change is awareness. The second step is acceptance." -*Nathaniel Branden*
5. "Be the change that you wish to see in the world." -*Mahatma Gandhi*

Week 3 PDF Downloads:

1. Cleaning out your Pantry and Fridge Guide
2. Grocery List
3. Recipe sources

Week 3: 1 hour group coaching for discussion and support

Week 4

Learning objective: Participants will understand habits and how to create or transform them.

Week 4 Teaching Video: Transforming a Habit

1. **Power of Habit**

Research shows more than **40% of the actions** we take **are governed by habit**, not actual decisions. (Neal et al 2006).

2. **How Habits Emerge**

Cue is a trigger that tells your brain to go to automatic mode and which habit to use. Ex: Mouth feels unclean after waking

Routine is a physical, emotional or mental activity that comes from the cue. Ex: Brush teeth

Reward helps your brain decide whether the loop is worth remembering. Ex: Mouth feels clean

3. **How Habits Emerge**

   Neural networks get created from the repetition of that behavior. Ex: Learned from child hood how to care for teeth and mouth.

   Long Term Potentiation (LTP): "Neurons that fire together, wire together."

4. **How Habits Change**

   Long Term Potentiation (LTP): "Neurons that fire together, wire together."

   New pathways get created. Ex: Add oil pulling into mouth cleaning habit.

5. **Evolutionary Neuroscience**

   Automating behaviors

Week 4 Action

1. Begin the three-week fiber rich eating plan.
2. Transforming a habit exercise. Identify the old habit, the craving and the cue, the new habit and routine, and the reward.

Week 4 Texted Messages

1. "It's not a short-term diet, it's a long-term lifestyle change." Anonymous
2. "We are what we repeatedly do. Excellence then is not an act, but a habit." Aristotle

3. “The secret to permanently breaking any bad habit is to love something greater than the habit.” Anonymous
4. “Create healthy habits, not restrictions.” Anonymous
5. “There is no diet that will do what healthy eating does.” Anonymous

Week 4 PDF downloads

1. Habits map
2. Your habit transformation list

Week 4: 1 hour group coaching for discussion and support

Week 5

Learning Objectives: Participants will explore basic nutritional principles for vitality, embody basic “food rules,” and understand mindful eating.

Teaching Video: How increasing fiber in your diet can be easy and rewarding.

Week 5 Action: Cook one of the fiber rich recipes included in your PDF.

Week 5 Texted Messages

1. “If you keep good food in your fridge, you will eat good food.”
2. “Yes! I am eating healthy and not on a diet.”
3. Eating healthy gets easier when you turn “I can’t have that” into “I choose not to have that.”
4. “When you truly understand that your food choices are powerful, and life affirming, you can exercise control and restraint without deprivation.”

5. "The doctor of the future will no longer treat the human frame with drugs, but rather will cure and prevent disease with nutrition." Thomas Edison
6. "Remember when your body is hungry, it wants nutrients, not calories."

Week 5 PDF downloads

1. List of Anti-angiogenic Substances
2. Follow your Gut Recipes

Week 6

Learning objective: Understanding what "GRIT" is and fostering it to reach your goals for continued success in your health and longevity.

Teaching Video: You Gotta Have GRIT

1. Grit: Perseverance and passion for long term goals.
2. Building Grit: Don't be a quitter; Be around gritty people; work on optimism; Pursue something with passion; don't shrink from challenges; don't allow criticism or failure to define you.

Week 6 Action:

1. Take the Grit Scale test. You can sign up for a free account at www.authentichappiness.com and get your score.
2. Breathing exercise
3. Find a story about someone whose grittiness impresses you, keep this role model as inspiration whenever you are tempted to revert to old habits and cravings that do not meet your long-term health and longevity goals.

Week 6 Texted Messages:

1. “Grit is perseverance and passion for long term goals”.
2. “Grit is living life like it’s a marathon not a sprint.”
3. “Don’t be afraid to be amazing.”
4. “Yes, you can!”
5. “You need grit to succeed.”

Week 6 PDF downloads

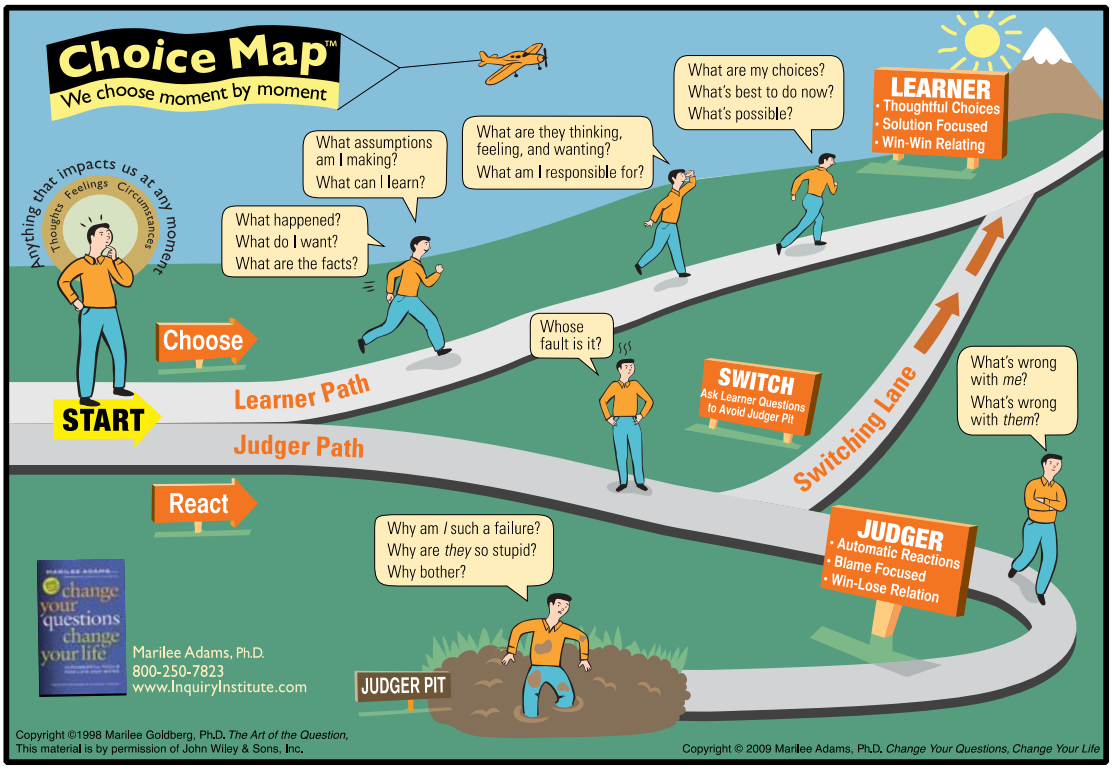
1. Goal Checklists

Week 6: 1 Hour group coaching session for discussion and support

Appendix B. Examples of weekly PDFs

Week 1.

Choice map



Inquiring Mindset

• Blame	• Responsibility
• Personal perspective only	• Considers others' perspectives
• Either/or thinking	• Both/and thinking
• Self-righteous	• Inquisitive
• Doesn't notice or defends assumptions	• Looks for and questions assumptions
• Assumes scarcity	• Assumes sufficiency
• Possibilities seen as limited	• Possibilities seen as unlimited
• Primary mood: closed and protective	• Primary mood: open and curious

* We all have both mindsets. We also have the capacity to choose where we operate from in any moment.

Judger Relating*

- Win-lose relating
- Dismissive and criticizing
- Debate (to win)
- Separate from others/self
- Fears differences
- Feedback considered rejection
- **Listens for:**
  - Right/wrong
  - Agree/disagree
  - Differences
- Seeks to attack or defend (defensive)

Learner Relating*

- Win-win relating
- Discerning and critiquing
- Dialogue (to understand and create)
- Connected with self/others
- Values differences
- Feedback considered worthwhile
- **Listens for:**
  - Facts
  - Understanding
  - Commonalities
- Seeks to understand, resolve, and create

* We all relate from both mindsets. We also have the capacity to choose which mindset to relate with in any moment.

Judger Questions*

- What's wrong (with me/others)?
- Whose fault is it?
- How can I prove I'm right?
- Why is that person so stupid and frustrating?
- Haven't we already been there, done that?
- How will this make things worse?
- How can I be in control?
- Why bother?

Learner Questions*

- What works (about me/others)?
- What am I responsible for?
- What can I learn?
- What's useful/valuable?
- What is the other person thinking, feeling, and wanting?
- What am I assuming? What are the facts?
- What's the big picture?
- What's the best first step?
- What's possible?

* We all ask ourselves both kinds of questions. We also have the capacity to choose, at any moment, which questions will frame our thinking, listening, behaving, and relating.

Switching Questions*

Growth pyramid