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Yoga Influences Gut Microbiome: A Conceptual Study

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Abstract
A diverse environment of microorganisms in the gut, holding most of our bacterial microorganisms. The gut environment has a symbiotic association with the surrounding organism, and an equilibrium and variety of bacteria support health of an individual. When variety of gut bacteria reduces, results in gastrointestinal and mental distress. This path of interaction is identified as the microbiome–gut–brain axis. Strategies such as probiotic supplementation that influence microbiome also improve both gut and mind illnesses. Current evidence recommends that Yogic practices like Dhauti, Vasti improves the variety of microbiome, which may be positively affects both the gut and mind. The purpose of this article is to elucidate the pathway of the microbiome–gut–brain axis and suggests the role of specific Yogic practice on gut microbiome.

Keywords: Yoga, gut, brain, probiotics, microbiome, Dhauti, Vasti.

Introduction

The microbiome in the gut is a diverse environment, having majority of bacterial microbes. Containing of above thousand genera and closely 40 trillion microbes in the human body (Cheng et al., 2018; Sender et al., 2016). The gut microorganisms encourages digestion and absorption of food for energy making, improves the functioning of immune system (Mach & Fuster-Botella, 2017; Peters et al., 2001), and seems to have an influence on brain and endocrine function (Braniste et al., 2014; Burokas et al., 2017). Gut microorganisms facilitate their function through manufacture of numerous molecules of fatty acids which are nutrients for colon and brain cells, regulates cholesterol breakdown, and balance numerous hormones of digestion (Lin et al., 2012). Gut micro-bacteria are also accomplished of manufacturing proteins or enzymes that control inflammatory markers and oxidative stress (Tang et al., 2013). The bacterial community of gut is sustained by the symbiotic association among infective and non-infective bacteria and their balanced ratio. Considerable shifts to the bacterial communities due to nutritional changes, and antibiotics may disturb equilibrium, or generate oxidative stress and has health issues (Lozupone et al., 2012). Gut microbiome disturbance may result in the growth of numerous ailments or disorders like type 2 diabetes (Proctor et al., 2017;Li et al., 2015), irritable bowel syndrome (Dinan & Cryan, 2013), cardiac diseases (Li et al., 2015), allergies, temper ailments (Burokas et al., 2017), and intestinal inflammation (Peters et al., 2001).
Developing research has demonstrated that an imbalanced regime like extremely saturated fats, low fiber, and high sugar foof consumption has a huge impact on the variety and quantity of gut microorganisms (Proctor et al., 2017). Imbalanced nutritional intake pays to gut disorders and

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inflammatory illnesses (Cani et al., 2012). Additionally, inflammatory disorders like IBS and obesity leads to intellectual dysfunction (Kennedy, Clarke, et al., 2014) like stress and anxiety (Kennedy, Cryan, et al., 2014). In accordance, strategies that precisely cure nervous illnesses like drugs and hormonal supplements have been shown to recover GI function (Thorkelson et al., 2016).
Because of these results, researchers are becoming more curious, which has increased their efforts to learn more about the association among the GI tract and the brain (Burokas et al., 2017). More curiosity has increased in determining the function of the microorganisms in facilitating the association among the gut and brain. Consuming probiotics has improved psychological conditions (stress and unease) which improves GI function (Ringel et al., 2012). It has been demonstrated that regular Yogic practices specifically pranayama can stop age-related brain deterioration and increases grey matter of the brain in the frontal and temporal lobe leads to improve memory, concentration, attention and control behavior (Colcombe et al., 2003, 2006; Gomez-Pinilla & Hillman, 2013).
Recent studies have indicated that aerobic exercise has a beneficial effect on the gut microbiome in adults by boosting its number and quality. Yoga may have the potential to balancing the gut bacterial diversity and their by-products by reversing the symptoms linked to imbalanced diet, obesity, metabolic diseases, and behavioural and neurological issues (Clarke et al., 2014; Monda et al., 2017).

Yoga influences the microbiome-gut-brain axis

The junction of the gut-brain-microbiome axis is the vagus nerve. It is common for patients with both gastrointestinal and psychological illnesses to have defective vagus nerve activation. (Gershon, 2005; Rottenberg, 2007). Exercise in many forms, such as Yoga and aerobic training, has been demonstrated to increase parasympathetic tone (Vempati & Telles, 2002). Yoga has been shown in meta-analytical research to be an effective way to enhance GI and psychological health (Cramer et al., 2013; Schumann et al., 2016). Changes in the gut microbiome impact vagal transmission from the gut to the brain (Perez-Burgos et al., 2013). Consequently, it makes sense to speculate that whatever effects Yoga might have on the variety of gut microbes might be established by influencing vagal communication between the gut and brain. Regretfully, there isn't any empirical data available at this time to support this conclusion.
Mind structure and function are enhanced by yogic breathing exercises (S. Colcombe & Kramer, 2003; Kramer et al., 2005) and stops age-related brain deterioration (S. J. Colcombe et al., 2006) by controlling BDNF (Brain-derived neurotrophic factor). Apart from regulating mood disorders, learning, and memory, BDNF is also responsible for the existence of striatal neurons in the brain (Molteni et al., 2004; Rasmussen et al., 2009). According to Linnarsson et al.,(Linnarsson et al., 1997) BDNF is well known for its protective function in the adult brain because cells die when this protein is deleted genetically. Reduced levels of BDNF in the hippocampus have also been connected to gut inflammatory diseases like IBS (irritable bowel syndrome) and IBD as well as anxiety and sadness (Proctor et al., 2017; Sarkar et al., 2016).
It has been demonstrated that Bifidobacterium-containing oral medications or tablets raise BDNF expression in rodent brains, While Bifidobacterium in the gut has also been demonstrated to grow with aerobic exercise (Smith et al., 2010). Antibiotic use also delayed neurogenesis, or the proliferation of brain cells, in the mouse hippocampus areas (Möhle et al., 2016). Yogic practices may, however, prevent this. However, the exact mechanism by which Yoga practices affect neurogenesis and cognition through Bifidobacterium remains unknown (Cerdá et al., 2016). Aerobic exercise or high oxygen consumption (VO2max) is associated with altered gut microbiota and elevated HPA (hypothalamic-pituitary-adrenal) axis activation. Because of the lack of gut bacteria, psychological stress led to high HPA activation, suggesting that the variety of the gut microbiota has

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an effect on the hyperresponsive HPA axis (Sudo et al., 2004). By taking supplements containing Bifidobacterium species, human anxiety and pain were decreased and HPA overactivation was reversed (Messaoudi et al., 2011). A number of microbial species seem to be impacted by both forced and voluntary exercise. In summary, it seems that mind-body treatment like Yoga affects the microbiome, and these modifications could have an even greater effect on the control of the HPA axis. It has also been demonstrated that Yoga affects serotonin regulation. It has been discovered that a number of bacteria in the gut microbiome create serotonin (Özoğul, 2004; Özoğul et al., 2012) . Regrettably, no prior research has looked closely at whether exercise affects any particular microbiome. The gut microbiome may benefit from Yoga. Consequently, it is possible that the Yoga-adapted gut microbiome's ability to produce serotonin explains why participants' mental problems appear to be less severe after practicing Yoga. However, these are only conjectures, and further study is required to validate this idea.

The Shatkarma have been known in India for over 4,000 years, described in the *Hatha Yogic* texts such as Hatha Yoga Pradipika, Gheranda Samhita and Hatharatnavali. The Hatha Yoga tradition of Yoga describes six purifying techniques that are known to balance a person's constitution. In the twenty-first century, there is once more a need to bring the original meaning and experience of the Shatkarma practices into common language, but most practitioners still don't explore the depth and spirit of the practices. A thorough literature regarding the scientific evidence for Shatkriya does not exist. The scant data on Shatkriya implies that practices are understudied. However, these methods are beneficial in a number of physiological and therapeutic areas. Research has shown that the practice of dhauti can improve digestive issues and respiratory functioning. The first Shatkarma practice is 'Dhauti'. "Dhauti" extracts poisonous substances from the body and purifies the gastrointestinal tract. The second Shatkarma practice is 'Vasti'. Vasti is of two type Jal Vasti or Sushak/Sthal vasti as described in Hatha yogic text. But Sushak/Sthal vasti is unexplored or not in practice due to its difficult procedure. Both 'Dhauti' Vatsara and Bahiskrit as well 'Vasti' play vital role in maintaining homeostasis in the body through maintaining the ecosystem of GI.

Anaerobes make up the majority of the microbiota and lower the O2 levels in the intestinal environment, and as a result, the gut is severely hypoxic. According to recent research, intestinal homeostasis is primarily regulated by oxygen dynamics and many intestinal illnesses, such as colorectal cancer (CRC) and inflammatory bowel disease (IBD), are brought on by alteration of the oxygen gradient. Targeting oxygen sensing pathways, a number of novel medications are either undergoing clinical trials or have received approval. *The intestinal tracts of newborns have a higher oxygen content than those of adults.* High oxidative stress is known to be present in many GI disorders, which might affect luminal oxygen levels. High oxidative stress is known to be present in many GI disorders, which might affect luminal oxygen levels. The modulation of epithelial transport functions in the body is evidently influenced by the oxygen supply to the intestine. The stomach's blood capillaries absorb a portion of the oxygen that is consumed, enhances intestinal metabolism, microorganisms, and the gut microbiota. Swallowing oxygen-rich fresh air triggers digestion by preserving homeostasis and intensifying the gastric fire through an increase in chemical processes within the stomach and eliminates the tainted gas that the stomach produces while it undergoes several metabolic processes, such as the carbon dioxide, nitrogen and prevent excess bile production. Eliminates the burning feeling that comes from stomach and chest acid. The appropriate amount of digestive juice begins to release, faeces are eliminated on schedule, and prevent gastric problems, by absorbing oxygen directly to GI. By keeping the gut's healthy and harmful microbiota in balance, like air in gut can inhibit the anaerobic organisms like helicobacter pylori in pyloric region of the stomach which is responsible for acid -peptic diseases, and other bacterial, amoebic infections.

It reduces or prevents digestive system disorders such as dyspepsia, dysentery, boils in the stomach, hernias, ulcers, bloated or swollen belly, belly pain, biliousness, chronic gastritis, reflux acts, obesity, constipation, and diseases caused by anaerobic bacteria and germs. There are two forms of *Basti* described in *Hatha Yoga*, *jala* (water) and *sthala* (dry). Both *vasti* practices involve the cleansing of the colon. Vasti is a technique that Swami Swatmarama believes is good for clearing the mind and senses and harmonising the tridosha and dhatus. Sage Gherenda claims that vasti is good for digestive and urinary issues and that it reduces vata disorders.

Conclusion

All of the studies outlined above indicate that Yoga may regulate a two-way relationship between the gut and the brain by balancing the diversity of gut microbiota. Yoga can be used as a therapy method for GI and psychiatric conditions. It is unknown at this time how Yoga affects the connection between the gut and the brain. This article's goals are to provide a quick overview of the many interactions that exist between the gut, brain, and microbiota as well as to elaborate on how Yoga may affect these connections and stablish equilibrium among gut microbiome and supports individuals' health.

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