Advantages of Soil Microbes on Immunity and Mental Health

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Abstract

Living in contact with soil improves our mood. Excavating in the dirt exposes people in the present decade to some of those old friends, the so-called soil microbes boosts the immune system and strengthen the health. Spending more time with nature and soil helps people to lead a stress-free life with a higher positive mental state. This review article aims to examine the benefits of interaction with soil microbes to mankind.

Keywords: Dirt microbes, *Mycobacterium vaccae*, emotional health, well-being, immunity, soil bacteria, serotonin, allergy, microbiota

INTRODUCTION

Natural remedies for blues have emerged. Digging in the dirt and breathing in certain soil bacteria may even improve our mental state. A positive link between soil microbes and human health has been recognized by researches.

Mycobacterium vaccae, a bacterium in soil, benefits humans by triggering the release of serotonin, a happy neurotransmitter which in turn improves mental health and possibly even brain function. Hence the contact with soil, through play and gardening and other means advantageous for human beings. Interaction with soil may also enhance immunity and provides good health for people.

Living earthy makes us happier and healthier

It is already proved that childhood exposure to outdoor microbes is allied to a more robust immune system. Olszak *et al*, 2012 explained this scenario with an example of Bavarian farm children who spent plentiful time in family animal stables and drank farm milk was secured from asthma and allergies throughout their lives than other kids who did not have such earthy experience. Though the exposure to germs in childhood is thought to help strengthen the immune system but the pathways by which this occurs have been unclear in the past. Now, researchers have identified mechanisms clearing up the role of early or childhood exposure to microbes in developing immunity against certain diseases like asthma and ulcerative colitis. Olszak clarified that childhood contact with commensal microbes is crucial for developing mucosal iNKT cell (invariant natural killer T cell) tolerance to later environmental exposures. Invariant natural killer T (iNKT) cells play a chief role in causing ulcerative colitis and asthma. Early-life microbial exposure elicits durable tolerance on iNKT cells, and in their absence, later-life exposure to factors that stimulate these cells may induce an autoinflammatory response. Another researcher also suggested that eating trace amounts of the bacteria, from garden vegetables, or breathing it in, maybe too, provide those benefits for humans (O'Brien *et al*, 2004).

But nowadays, people are not raised on farms, may be missing out on such kind of protection. But hopefully some counterbalance, like spending time in a garden, or farms might change that.

O'Brien *et al*, 2004 conducted a study on the effectiveness of the soil bacteria, *Mycobacterium vaccae* in chemotherapy and reported that the non-placebo-controlled trial with (SRL172) killed *Mycobacterium vaccae* suspension when added to standard cancer chemotherapy for lung cancer patients significantly improved patient quality of life without affecting overall survival times. Though this treatment does not help the patients' immune systems beat back the cancer in their lungs but, the patients were happier, expressed more vitality, and better cognitive functioning. From this study it is assumed that the soil microbe has a role in lessening the emotional toll of advanced cancer.

In another study conducted by Stanford *et al*., 2001 in patients with multi-drug-resistant tubercle bacilli (MDRTB) to find out the effectiveness of the soil microbe *Mycobacterium vaccae*, suggests that the addition of immunotherapy with *Mycobacterium vaccae* to chemotherapy improves the rate of cure of MDRTB, most efficiently in patients with short histories of disease and multiple dosing can have beneficial effects in chronic patients in whom chemotherapy has failed.

Lowry *et al*. 2007, measured the behavioral responses of mice with *Mycobacterium vaccae* administration in a forced swim test, to determine the effects of immune activation with *M. vaccae* on stress-related emotional behaviour. They reported that the microbe activates some serotonergic neurons and through which the peripheral immune activation influences physiological, behavioral, or cognitive processes. This suggests that peripheral immune activation may have antidepressant-like behavioral effects *via* actions on the serotonergic neurons which releases serotonin a happy chemical because it contributes to the wellbeing and happiness. The deficiency of serotonin has been linked to depression, anxiety, obsessive-compulsive disorder and bipolar problems. This particular bacterium is found in soil and may stimulate serotonin production, which makes us relaxed and happier. Furthermore, the bacterium appears to be a natural antidepressant in soil and has no adverse health effects. Additionally, these antidepressant microbes in soil may be as easy to use as just playing in the dirt.

The immune system and the brain are intimately connected. Graeff *et al*., 1996 also predicted that *M. vaccae* would have antidepressant-like behavioral effects in mice and this report provides a novel hypothetical framework for investigating the relationships among immune activation, serotonergic systems, and mental health. This microbe may stimulate the rise of cytokine levels which in turn results in the production of increased levels of the neurotransmitter serotonin. Moreover, serotonin, a neurotransmitter that, when impaired, can cause depression. Even more interestingly, the neurons that lit up were also known to be related to immune response, suggesting an intimate connection between the immune system and emotional health. In the past our ancestors lived for centuries with a host of ancient parasites, fungi, and bacteria (including *M. vaccae*) and didn't mind at all. But to the saddest we've forgotten that these were beneficial.

The soil bacterium *Mycobacterium vaccae* was first discovered on the shores of Lake Kyoga in Uganda in the 1970s by John Stanford (immunologist) after identifying that people who lived in the area responded better to certain leprosy vaccines. They later understood that the bacterium found in the lakeshore soil had some immune-modulating properties that we're enhancing the vaccine's efficacy.

Moreover, soil microbes can be used as an alternative therapeutic agent for certain more diseases. The Mycobacterium antidepressant microbes in soil are also being investigated for the betterment of cognitive functions, Crohn's disease and even rheumatoid arthritis. The present-day lifestyles have disrupted the well-known traditional relationships during prenatal, neonatal and adulthood with coevolved organisms such as helminths, soil and water microbes, farm animals and pets that are typically documented as harmless by the innate immune system and induce an anti-inflammatory response.

The transformation from traditional lifestyles has been linked to increased rates of depression and other mental health disorders. A variety of studies have associated adherence to traditional dietary patterns with a lowered risk of anxiety or depression. [6] Before this, Hunt *et al*., 2005 disclosed that heat-killed *M. vaccae* could influence immunocompetence through gastro-intestinal tract interaction in mice after administration by gavage.

Another study reported that the saprophytic mycobacteria are common in the environment and though they do not replicate in the gut, but were probably to be present in the gastrointestinal tract of our ancestors due to contact with mud and water (Kazda, *et al*., 2009) Along with this, the scientists suggest that the recent rise in chronic inflammatory disorders is at least partially due to immune-dysfunction resulting from the lack of exposure to environment and microorganisms, that have an indispensable role in the establishment of the immune system (Rook, 2010).

Moreover, the scientists, also explained the importance of the microbial flora of skin, lung and breast in immunoregulation. Before the invention of modern soaps and detergents, the skin was abundantly colonized by ammonia-oxidizing bacteria (AOB), ubiquitous in soil. The peculiarity of these bacteria is that they are extremely sensitive to alkylbenzene sulphonate detergents. These microbes convert the high concentrations of urea and ammonia found in human sweat into nitrite and nitric oxide (NO) which are absorbed quickly and competently via the skin. Hence this source of nitrite has a biological significance because it supplements the blood-saliva-stomach-blood cycle of nitrate/nitrite/NO. Researchers trust that without AOB in the skin flora, modern man is nitropenic, because NO is vital to immunoregulation and this might be another way in which modern hygiene is distressing our immune systems. (Whitlock and Feelisch, 2009)

Viewed firmly from the nutritional viewpoint, experimental studies have examined the potential influence of ambient bacteria, such as *Mycobacterium vaccae* on the gut-brain-microbiota axis. Moreover, oral *Mycobacterium vaccae* can easily find its way onto edible plants, is acknowledged for its role in improving cognitive functions and reducing anxiety-like behaviour among animals (Matthews and Jenks, 2013). According to Grenham *et al*., 2011, such relationships involve bidirectional signalling between the gastrointestinal tract and the brain *via* neural, hormonal and immune interactions.

Urbanization has frantically devastated soil microbiota vital to plant health by the use of chemical fertilizers, fungicides, herbicides and pesticides. These soil microorganisms predominantly the bacteria and fungi cycle provide nutrients and water to plants and crops, and provides the source of our food, and eventually benefits our health. Hence it is high time to reintroduce the right bacteria and fungi to facilitate the dark fermentation process in depleted and sterile soils which is analogous to taking probiotic drugs of the future to restore the right microbiota deep in our digestive tract. Many researchers believe that the frightening surge in autoimmune diseases may owe to a disruption in the ancient relationship between our bodies and the old friends, the microbial symbionts with whom we coevolved. Soil microorganisms nourish and protect plants, but at the same time, they also play a central role in providing many ecosystem services that are essential to human survival. By the time many researches proved that the living soil is the Earth's most valuable ecosystem that provides a wide range of ecological services such as water filtration, climate regulation, mitigation of drought and floods and preventing soil erosion, etc. By stabilizing the climate, the soil microbes have been sequestering carbon for hundreds of millions of years through the mycorrhizal filaments, which are coated in a sticky protein called glomalin and about 30 to 40 percent of the glomalin molecule is carbon. Glomalin may account for as much as one-third of the world's soil carbon and the soil contains more carbon than all plants and the atmosphere combined (Mike and Bruce, 2013)

Conclusion

From the above reviews we can assume that for the sustenance of a happier and healthier life it is crucial to reintroduce microorganisms into the soil, together with the organic matter they feed upon. Because soil microbes have the potential to be a significant part of the next revolution in human health. It is beneficial to live earthy to lead a stress-free life.

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