

Soil Science Vs Science for Medicine

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Abstract

Soil is the truthful soul of infinite lives on the earth. The call of UN for food safety is on way of accomplishment, but the medically victimized community is looking for cure. Medical science is aimed at symptomatic or diagnostic or preventive medicines, but perhaps no protective medicine. Yoga is simply a way of life to keep the human health sustained, while soil or clay or both opens a new door in medical science for protective treatment, since food supply chain begins from soil and through various stages after excretion, undergo for recycling in soil. It is the soil that filters the underground as well as rain water for drinking and supports the plantation to sustain a friendly eco-system and air to breathe. Not only a variety of ailments are cured, but more importantly, type specific clays have powerful potential to detoxify the toxic substances in the body. Today's global health problems like blood pressure, blood sugar, constipation, gastric, weight gain, mental strain etc. are all responsible to imbalance the life styles. However, on the eve of the International year of soil 2015, let's introduce soil or clay or both as the integral part of medical sciences even. If human body intakes safe and quality food for survival, nourishment and energy, let the same body be ready to use the type specific soil or clay for medical treatments too. Both indigenous as well as researchable knowledge supports the myth of truth.

Keywords: Soil; Clays; Protective medicine; Medical treatment

Introduction

Human health is virtually a finger print of soil health [1]. Soil health through physical, chemical, biological and interactive radiation as well as magnetic manipulation, productivity evaluation, conservation agriculture, land use identification, integrated farming system, agro forestry induced ecosystem, intercropping, biodiversity enrichment, manurial and composting operation is the key to keep the land sustained. Soil works in its critical zones covering surface ecosystem, rhizosphere and aquifer in such a way that sustains not only its outcome as food materials (grain, milk or flesh), but also the quality of water and air even (Figure1). With a simple and straightway question in mind as what not soil is for humans, the following remarks are of immediate concern:

1. About 95% of our food comes from soils.
2. Almost 99% of drinking water passes through and get filtered through soils.
3. Eco-system around humans is dictated by soil and its vegetation.
4. Being reservoir of carbon, soil controls the climate change even.
5. Lowest boundary of the earth's atmosphere and subject to interaction with incoming radiation and magnetism.
6. About 70 percent of poor people in rural areas depend on agriculture for their livelihoods.
7. Soil is the huge reservoir and the ultimate frontier of biodiversity. Most known antibiotics come from organisms that were isolated from the soil. The soil biosphere controls the cycling of most major plant nutrients like nitrogen, phosphorus, sulphur and many others.
8. Soil is non-renewable natural resource. Soil takes thousands of years to develop just a few inches.

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9. Soil erosion is a curse. It is both natural and man-made. A rich and deep soil that may have taken more than 100,000 years to form can be lost over night due to soil erosion.
10. Soil or clay has been an integral part of medical science and needs to have been popularized globally.
11. Human, humanity, harmony and humus are all interlinked in a big way to the soil and so to the land.
12. Non-farming uses of soil following the construction of buildings and roads (soil sealing/shrinkage) lead drastically as well as irreversibly to undesirable climate change.
13. Soil sickness through contamination and pollution is an emerging problem that needs to be critically evaluated.

Thus, the ultimate target to insure maximum potential yields per unit of land at highest profit by lowering the unit production costs is possible by building, restoring and maintaining the overall soil health that includes fertility and safety of soils in relation to pedology and edaphology. Besides, there is ample scope of taking shelter on type specific soils and clays for protective medical treatments. Importantly, the imbalanced, undesirable and unsustainable approaches with soil and land have made our food unsafe, water toxic and polluted besides air being impure [1]. The accumulated impacts are reflected on human health considerably across the globe. The existing situation of human health problems necessitates for rethinking on a soil being the building block of food supply chain issues with safety.

The human body suffers from ailments that are caused mostly by nutritionally poor, imbalanced or toxic food and chemically contaminated unsafe water or dust loaded with impure air. Such patients immediately visit a medical clinic for quick relief. The practitioner after diagnosis prescribes some medicines just to suppress the ailment identified often without knowing or giving the importance of root cause. In fact, food chain in true sense starts from soil, which controls all plants, grains, animals including their products, water and even air. On doctor's advice, the patients spend a lot on quality food without testing for undesirable constituents in foodstuff being used. The patients used to follow yoga even. But, no one wish to check the soils that control food, water and air. A healthy soil is one that gives healthy food, pure water and clean air. As such, soil science is the integral part of medical science [1]. Apart from this, the significant role played by soil and clay as medicines deserves appreciation to address such vital issue by policy makers as well as medical council of respective countries.

Evidences available often indicate certain actual benefits of eating soil, dirt or even clay. It removes toxins from human body and often helps to lose weight. However, its uses can make the body anaemic and that too because of a lack of iron in the blood. In true sense, medical science hardly supports such practice and recommends that eating soil would reduce the hunger and often causes infection. Contrary to this, few people eat red clay soil after lunch as a measure of iron deficiency. Some African tribes use clay against diarrhoea. However, soil eating is dangerous issue, if anthrax bacteria and other undesirable organics resist for years in the soil. Besides, soil eating may pose hazards like (a) chemical contamination, especially heavy metals and (b) harmful bacteria through sewage or manure especially roundworms. Besides, eating soil or dirt may lead to some gastrointestinal problems like constipation, vomiting, abdominal pain, loss of appetite as well as diarrhoea. Normal children will rarely eat enough soil to get into this kind of trouble. It is often advocated that eating a pinch of 500 mg clean soil clay may benefit the immune system, though the quantity may be increased beyond the age more than three years. The experience of Dr. Jeremy Friedman, the Division of Paediatric Medicine in Toronto is remarkable.

The most serious health concerns caused by contaminated soil are due to lead and arsenic. Lead is a potent toxin that can damage the nervous systems of embryos, breastfed infants and young children. Long-term exposure to arsenic increases the risk of cancers of the skin, lungs, bladder, kidneys and liver. Even small amounts of lead delay mental development, lower intelligence, impair hearing, and even affect balance. This damage to the nervous system may be irreversible. A child having high level of lead in blood is often pale and irritable. He may feel sleeplessness, constipation, loss of appetite, abdominal pain and headache. Symptoms caused by poisoning with other heavy metals are similar. When children have consumed arsenic from contaminated soil, they may have: upset stomach or vomiting, stomach cramps, diarrhoea, swelling of the face and headaches.

Clay eating is associated historically with treatment for cholera and bacterial infections. Clay tablets were used widely across the Mediterranean as well as European territories in certain religious cause besides in curing the poisoning and the plague. However, the clay tablet was used by Roman Catholic Church and was listed in pharmacopeia as late as 1848. The use of eating clay has been studied in America, Sweden, Africa, Indonesia and Australia. In India and many other countries, however, knowledge on soil and clay eating is scanty. By and large, the practice is being revolutionized as a means of medical treatment. The rates of pregnant women eating soil or clay in African countries range approximately from 28% in Tanzania to 65% in Kenya, where clay is selectively identified and sold in markets. They collect it from termite mounds being rich in minerals and eat at an average of 30g daily. Commendable contributions as recorded herein include the reports of Callahan. (2007), Cieslak, *et al.* (1993), Dominy. (2004) [2], Geissler. (2000) [3], Hunter. (1973) [4], Hunter and Kleine. (1984) [5], Trevor Stokes. (2006), Vermeer, *et al.* (1985) [6], Wiley and Solomon. (1998) [7] and Wilson. (2003) [8], though many indigenous knowledge is yet to be tested and documented. The present paper, thus, aims at sensitizing the professionals of both medical as well as soil science to authenticate the type specific soils and clays for their successful use as protective medical treatments through collaborative research projects.

Emerging Issues and Challenges

The serious health concerns caused by contaminated soil are due to lead and arsenic. Lead is a potent toxin that can damage the nervous systems. Long-term exposure to arsenic increases the risk of cancers in skin, lungs, bladder, kidneys and liver. Children are poisoned with lead through eating dust or soil contaminated with lead. Even micro-quantity of lead delays mental development, lowers intelligence impairs hearing. The damage to the nervous system may be irreversible. Children with chronically elevated lead concentration in blood are often pale and irritable. They may experience sleeplessness, constipation, loss of appetite, abdominal pain and even headache. When children have consumed arsenic from contaminated soil, they may have stomach problems and diarrhoea or vomiting including swelling of the face and headaches. However, soil eating may be dangerous if anthrax bacteria and others resist for years in the soil. Medical science believes that eating soil would reduce their hunger and sometimes causes infection. Soil is considered to pose hazard because of:

- a. Chemical contamination, especially heavy metals
- b. Harmful bacteria, mostly from sewage or manure
- c. Parasites, especially roundworms from pet or wildlife faeces

Clay may be credited with healing of a wide range of ailments or illness like constipation, diarrhoea, anaemia, chronic infections, skin ailments such as eczema and acne, heavy-metal poisoning, exposure to pesticides and other toxins, arthritis and specific stress. Clay is often known to adhere to the gastric and intestinal mucous membrane and protect them on way of absorbing toxins, bacteria and even viruses. It helps to lose weight. Clay may sometimes make you Anaemic. Anaemia is associated with a deficiency of iron in the blood. Clays (type dependant) have an ability to absorb chemicals, water and complex with organics, pesticides, insecticides and cations even.

The pregnant women in Bangladesh are consuming charred soil, which is known to improve their appetite and health and helps in delivery with a healthy child. But, clays are often known to cause the removal of enzymes and decline in nutrition even probably due to their ability for detoxification.

However, a group of people in Uganda (Ugandan chimps) are known to eat soil that appears to improve their antimalarial fighting ability. The soil activates chemicals from the leaves of *Trichilia rubescens*, a plant representing one of the preferred food items of the Ugandan chimps. Some African tribes use clay against diarrhoea. Other animals often eat soil/dirt under stress or as a source of minerals.

However, there are some reasons to think that taking a pinch of well-tested clay or soil may be a benefit to the immune system. Even in USA, normal children of one and three years of age often eat soil on different occasions. Aged children may continue to eat soil if there is delay in their growth. A dose of 500 mg a day of soil or clay consumption is considered normal in children up to 3 years old.

Soil or dirt or clay-eating is seldom used for practice known as geophagy or geophagia, but appears as a puzzling medical issue, which makes such practice medically abused because of certain abnormal behaviour as affected by psychological disorders. Pica refers to the abnormal ingestion of non-food substances like soil, clay and dirt. Clay eating is known to be associated with treatments for cholera and bacterial infection. In a practice dating back to Greek and Roman times and later witnessed by Christianity, holy clay tablets were widely distributed and traded throughout the Mediterranean region and Western Europe for use in religious customs and as cures for poison and the plague. These clay tablets, blessed by the Roman Catholic Church, were listed in pharmacopeia as late as 1848.

Opportunities Vs Medical Treatment of Clays

Tony de Morais (2009)[9] reported the wide spectrum of clays entitled “The medical properties of clay” published in *Amazing Discoveries* that outlined the following tips.

Clay may be used externally as well as internally in different forms. It is antiseptic to prevent decay or putrefaction, promotes wound healing, relieves and prevents inflammation, cleans cancer cells (anti-carcinogenic), softens and soothes the skin (emollient), refrigerant cools and reduces body temperature (refrigerant) and improves skin texture (cosmetic). When used internally, clay like bentonite acts as an effective detoxifier, which can absorb heavy metals such as mercury, arsenic, lead, and tin. Besides, it provides minerals and trace elements. Being colloidal in nature, it reduces or even eliminates toxins and harmful ingredients from body.

Clay may be of different colours depending on the chemical composition of the soil viz. gray, white, red, black, green, yellow, blue and pink even. Normally, white bentonite clay is used for heavy metal detoxification, while red clay for facial purifying mask. Such clays are usually mixed with herbs, fruit or vegetable juice or olive oil to improve the performance of clay. Normally, green clays are used externally as well as internally.

In order to prepare clays for medical use, select a bowl shaped container preferably made of glass, porcelain, or wood, but never metal. Then, fill the bowl with fresh water and sprinkle the clay powder until a homogeneous paste is ready that may not be very concentrated. Let the clay then rest for two hours without much disturbance. Now, spread an even half-inch layer of clay over the affected area with a wooden spoon, but avoid smoothening to enable clay settled naturally on affected area. Then use a clean cloth bandage for wrapping. In case of an abscess or inflamed organ or any pus-forming sore, then prepared clay is covered with a cabbage leaf in order to slow down its drying process. However, if the affected patch to be treated is on both sides of the body like the kidneys, spread the clay first on a clean cloth and then place on the affected for two hours, but at least for three times a day with separate applications. If there is an ulcer or an open sore, the prepared clay should be applied directly on the affected area or flesh. Tony de Morais. (2009)[9] reported that applications should only occur at least two hours before or two hours after meals. When treating an abscess or purulent ulcer, change the application every hour. However, if the clays dry in half an hour, then take it off without waiting the entire hour. Preferably avoid clay application when menstruating and during pregnancy.

Historical accounts of humans using ‘healing clay’ began with Aristotle in 384-322 BC [10] and Pliny the Elder (23-79 AD) later recounted the cure of intestinal ailments by ingestion of volcanic muds [11]. However, the scientific evidence of clays, mud or soil for treating and healing ulcers, tumors, cysts, cancers, osteoporosis, etc, is lacking. Certain uses of clays are based on the physical characteristics of clay minerals that benefit digestion or protect and cleanse the skin [12]. The adsorptive and absorptive properties of clay minerals have historically been the driving force behind the traditional use of healing and therapeutic clays. Initially, negatively-charged interlayer sites of clays will absorb positively-charged substances to their extensive surface area. Over time, many clay minerals may absorb substances in between the stacked silicate layers of the mineral, allowing for expansion and swelling or contraction. While the physical adsorption of water and organic matter is the most common attribute of healing clays, the geochemical mechanisms controlling antibacterial properties of clays have received significantly less attention.

It is well known that metallic ions, such as silver, copper, and zinc, have strong inhibitory and bactericidal effects on a broad spectrum of bacteria [13]. Various forms of silver ions have been used to treat burn wound infections, osteomyelitis, urinary tract infections,

and central venous catheter infections [14]. In low concentrations (4 µg/ml), silver ions produced inhibitory and bactericidal effects with no obvious toxic effect on human blood cells [15]. Although required by most living organisms at low concentrations, elevated levels of copper can inhibit the growth of some microorganisms and exhibit bactericidal activity [13]. The use of copper-coated products or copper alloys has been proposed for surfaces exposed to human contact to reduce the transmission of infectious microbial agents. Other metallic oxides, including zinc oxide, magnesium oxide, and calcium oxide, have antibacterial activity with demonstrated effectiveness against *E. coli* and *S. aureus* [16]. The nanometer particle size of these oxides, as well as titanium and silicon dioxide [17,18], have proven to be important for antibacterial activity. Zinc oxide has been used in a variety of dental composites to treat or prevent dental caries and as an endodontic sealer [19]. Nonetheless, the antibacterial mechanism has not been identified.

The high cation exchange capacity of certain clay minerals is the basis for creation of inorganic antibacterial materials and synthetic antibacterial clay minerals are prepared by exchanging their native ions with known antibacterial ions such as Ag-ions [20]. Thus silver-loaded clays are pursued more aggressively than other antibacterial chemical ions. Nevertheless, copper-loaded mineral substrates are recently discovered [21].



Figure 1: White cavity of zeolite in basalt (Hirna watershed, Ethiopia).

The zeolites (Figure 1) with their immense power of absorption as well as adsorption indicate strong affinity for oxidized silver ions and thus form silver exchanged zeolites, which have shown antibacterial potential against aerobic and anaerobic Gram-negative and Gram-positive bacteria pathogens including *Pseudomonas aeruginosa*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Staphylococcus aureus*, *Streptococcus mutans*, and *Streptococcus sanguis* and could be used in dental applications [22-24]. Copper-loaded vermiculite is reported to have better antifungal activity besides inhibiting the growth of *E. coli* [25].

Clay for Detoxification

Clay or soil eating by and large has revealed some potential for digestive and nutritional benefits. However, the most remarkable evidence is its relevance in detoxification. It is known that ingestion of clays by animal species like rats, birds, parrots etc enables a wide variety of foods free of suffering from any toxic effect. Today, human beings are suffering from variety of ailments caused mainly by some types of toxicity/contamination. There is need to look for substances that can scavenge for variety of food material used and soil and clay may be a choice to be tested under the supervision of medical experts.

Clays belong to a crystalline shape with hexagonal networks of silicon-oxygen tetrahedron that provides a large surface area with charged sites that cause bonds to capture charged ions or certain toxins. The well known colloidal properties following the existence of hydroxyl ions within the clay structure may promote its ability to bind and exchange other metals, adsorb water and organic compounds too. The use of clays to reduce bioavailability of plant toxins from foods is of current interest in order to make the food more edible. In countries like Peru and Arizona, wild varieties of potato has bitterness in taste and cause abdominal pain and vomiting due possibly to the presence of glycoalkaloids in potato, but clays have shown ability to absorb glycoalkaloids. Eating soil as well as clay

thus seems to be an ancient example of solving most of medical problems. However, recent evidence reveals its continued use in lowering food toxicity and promoting digestive health. Let's look for truth based on evidences and transform such ancient practice to some modern shape through teaching and learning as science of medicine for protective treatment.

Clay crystals carry a negative electrical charge as hydroxyl and oxide ions, while impurities or toxins or even bacteria carry a positive electrical charge and during exchange with clay, the positively charged ions are attracted to the negatively charged colloidal surfaces of the clays. The clay colloids thus get electrically satisfied and hold the positive ions until our body could remove the both through excreta in toilet and accordingly, clay could maintain its colloidal integrity within the human body without any assimilation or break down. The clay may expand in case of montmorillonite or bentonite and the substance could be absorbed by filling the space between the stacked silicate layers. Thus, clay minerals possess an inner layer charge that behaves and acts like an absorbent and may absorb and bond even with elements showing toxic nature.

An Evidence That Witnesses the Truth

As a mark of the first celebration of the Soil Day of UN on 5th December, 2014, the Department of Soil Science of Bihar Agricultural University, Sabour has hopefully identified Karu Paswan of 100 years living at a village of Babupur (Bakharpur) in Pirpainti Block of Bhagapur District in Bihar (India), who has been daily eating a type specific soil of Ganga flood plain for the last 60 years. He is non-vegetarian with normal food diet, but daily eats almost 500g of soil additionally. He has two daughters (house wife) and two sons (farmer and treasury officer, respectively). At the age of 100 years, he has black hairs and walks on foot for 10 to 12 km daily to local market (Figure 2). However, sample of soil collected was analysed (Table 1), though further analysis along with medical reports are still awaited [26-29].



Figure 2: Karu Paswan.

Parameters	Values	Rating
pH	7.01	Neutral
EC	0.036	Normal
Org. C. (%)	0.37	Low
P ₂ O ₅ (Kgha ⁻¹)	10.34	Low
K ₂ O (Kgha ⁻¹)	371.25	High
Avail. - N (Kgha ⁻¹)	112.89	Low
Avail.-S (Mg/Kg)	61.71	High
Zn (Mg/ Kg)	7.62	High
Cu (Mg/Kg)	0.78	Medium
Fe (Mg/Kg)	38.16	High
Mn (Mg/Kg)	24.04	High
Boron (Mg/Kg)	1.10	High

Table 1: Chemical analysis of the soil eaten by Karu Paswan.

Conclusion

Necessity is the mother of invention and challenges open the door of opportunities. Let's not forget that the soils across the globe suffer from crucial management risks, even though they possess in their type specific forms like clays certain unique potential for medical uses. Soil as a natural resource helps in getting food, water and even air. However, the truth of evidence as recorded is enough to trust on a bare fact that soil or clay may be uniquely suitable medically to cure a number of ailments, which are becoming common to everyone now-a-days across the world. This is now time for researchers in different facets of medical sciences to come forward to establish the truth in a big way in close association with soil science professionals, who could specify the suitability of soil and clay for medical uses. Soil is thus not only meant for survival and nourishment of human beings, but for protective medical treatment even.

If "Yoga" has been accepted as a symbol to sustain the human health, soil or clay as medical tool will surely restore and regain after ailment as protective medical treatment. The UN Soil Day on 5th December may thus be a mark of humanity in a big way, wherein soil as a protective medical treatment must be well taken during the International year of soil 2015.

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