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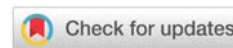
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Review Article

Usage of human diatomaceous earth

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Abstract

Diatomaceous earth is naturally formed sedimentary mineral rock resulting from the remains of diatoms, or oceanic unicellular algae. It is extracted from diatoms mined from deposits of diatomite and manufactured into a powder that is diatomaceous earth for human use, as a natural compound. It is gaining popularity as having an outstanding list of health benefits and non-toxic, no-known side effect origins. In this paper, a comprehensive review is presented to highlight the availability, benefits, mechanism of operation, and effects on the use of Human Diatomaceous Earth. The review revealed that diatomaceous earth has an outstanding list of health benefits and non-toxic, no-known side effects. It has the ability to lower the concentration of cholesterol in the blood. It is a very essential mineral for tendons, cartilage, blood vessels, and bones. Diatomaceous Earth is also considered to greatly help the body in getting rid of toxic substances such as heavy metals. It improves body joints bones, and ligaments through silica, which is the highest-occurring compound in diatomaceous earth that aids in the metabolism and formation of the joints.

Introduction

Diatomaceous earth also referred to as diatomite, is the remnants of siliceous diatom frustules; a composition of amorphous hydrated silica ($\text{SiO}_2 \cdot n\text{H}_2\text{O}$) [1]. It is naturally formed sedimentary mineral rock resulting from the remains of diatoms, or oceanic unicellular algae [2]. Diatoms are way over thirty million years of age and made from the cementation of microscopic algae-like plant remains on the surface of the earth, they are clay-like, chalky remains commonly found in the form of thick, white, siliceous powder that is referred to as a diatomaceous earth [3]. It is one of the minerals that is mined in Kenya as diatomite in the Kariandusi area in the form of mineral clay.

According to Earthworks Health [4] diatomaceous earth for human use is extracted from diatoms mined from deposits of diatomite and manufactured into a powder that is diatomaceous earth for human use, as a natural compound. Diatomaceous earth is largely silica, it is composed of up to 85% silica along with added organic silica [5]. Silica in diatomaceous earth

is the form of opal, which is an amorphous form of hydrous silica containing up to 10% water [6]. Diatomaceous earth for human consumption is gaining popularity as having an outstanding list of health benefits and non-toxic, no-known side effect origins [7]. Charles and Joshua, [8] also stated that silicon has no evidence of oral toxicity in humans. This article reviews the use of food-grade diatomaceous earth in humans and its benefits on blood cholesterol concentrations, body detoxification, body joints, bones and ligaments, and skin, nail, and teeth protection. There is a growing interest in human food supplements that help the human body stay healthy and fight diseases. This article helps highlight the benefits of using food-grade diatomaceous earth, which can help prevent diseases and support a healthy lifestyle. Advancing the use of diatomaceous earth supports the use of organic supplements which are less toxic and minimize or avoid processed food supplements.

Diatomaceous earth lowers blood cholesterol concentrations

According to a study by Wachter, et al. [9] to investigate the potential of diatomaceous earth in lowering blood cholesterol.

It was established that diatomaceous earth has the ability to decrease blood cholesterol and positively influence lipid metabolism in humans. In their study Wachter, et al. [9] did an experiment of one year monitoring serum lipid concentration in 19 subjects that had cases of high blood cholesterol. The subjects were orally administered with 0.25 grams of diatomaceous earth 3 times a day for 2 months where they were being observed. The study measured the subjects' serum concentrations of cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, and triglyceride levels prior to the experiment and every second week when the patients were taking diatomaceous earth. This measurement was also taken on week four after the subjects had stopped taking diatomaceous earth. When comparing to the baseline the consumption of diatomaceous earth was associated with a significant decrease of serum cholesterol at any time point, getting to a minimum on week 6 from baseline. Additionally, low-density lipoprotein cholesterol and triglyceride levels are reduced. After four weeks of diatomaceous earth intake stoppage serum cholesterol, low-density lipoprotein cholesterol, and triglycerides still stayed low and the rise of high-density lipoprotein cholesterol became significant. It was thus seen that diatomaceous earth reduces blood cholesterol and positively influences lipid metabolism [9].

Diatomaceous earth detoxifies the body

Silica the highest percentage occurring content in diatomaceous earth is effective in getting rid of aluminum which is one of the heavy metals that the human body is exposed to [10]. Heavy metals are considered systemic toxicants well known to bring about multiple human organ damage, even at lower levels of exposure [11]. Barabasz, et al. [12] noted that aluminum exposed to humans can lead to infections.

Silica works like other antioxidants by retaining its qualities as a stable particle even when in a liquid suspension, this allows it to fight free radical damage. It is broken into a colloidal form, which then acts like a detoxifier for the blood as it possesses electrical charges that attach to harmful toxins. Silica particles can then neutralize the charge of the toxins and eliminate them from the body through sweat, urine, and feces, which slows oxidative damage and has anti-aging effects [13].

Jugdaohsingh, et al. [10] in their study to investigate the effects of silica, a highly occurring mineral in diatomaceous earth, on the absorption and effects of aluminum on the human body found that high-aluminum-affinity form of soluble silica reduces aluminum availability from the human gastrointestinal tract. This study was done through a controlled experiment. In the first experiment they had 3 subjects who were healthy, each taking aluminum alone, this was the controlled experiment that tried to examine the availability of silicon from oligomeric, a soluble silica polymer that has a much higher affinity for aluminum and monomeric silica (has a less affinity for aluminum than oligomeric silica) in the human gastrointestinal tract. In the second experiment 5 subjects who were healthy, took both the oligomeric and monomeric forms of silica.

When samples of urine taken from the subjects were evaluated it was established that oligomeric silica reduced the availability of aluminum by 67% compared with the control, whereas monomeric silica had no effect. Monomeric silica was readily taken up from the gastrointestinal tract and then excreted in urine, whereas oligomeric silica was not detectably absorbed or excreted. This led to the conclusion that oligomeric, which has a high-aluminum-affinity form of soluble silica reduces aluminum availability in the human gastrointestinal tract [10].

Another study was done by Exley, et al. [14] to experiment with whether the absence of aluminum in the body would lead to the prevention of Alzheimer's disease that is caused by body exposure to aluminum. The study reduced the aluminum concentration in the body to a level that was corresponding with Alzheimer's disease-free people. To eliminate and prevent the entry of aluminum in the body silicic acid that contains silicon elements is used as a geochemical control of the biological availability of aluminium in the body. The study then asked Alzheimer's disease patients to take one and a half liters of silicic acid-rich mineral water every day for 5 days, they then compared the patients' urinary secretion of aluminum before and after the procedure, and the influence upon their body burden of aluminum was determined.

The result showed drinking the silicic acid-rich mineral water increased significantly the patient's urinary secretion of silicic acid and consequently reduced significantly their urinary secretion of aluminium. The latter was achieved without any significant influence on the urinary secretion of iron. This study hence concluded that the observed reduction in urinary aluminum supported the future longer-term use of silicic acid as a non-invasive therapy for reducing the body burden of aluminum Exley, et al. [14].

Marín-Alzate, et al. [15] studied the behavior of diatomite and its use for the removal of heavy metals in contaminated effluents. The absolute removal and removal efficiency of Zinc (Zn), lead (Pb), and copper (Cu) were examined by stirring the diatomite in solutions for a known concentration of the contaminant and then assessed the solution by atomic absorption spectroscopy. Findings revealed that diatomite has the potential used for the decontamination of heavy metals from contaminated effluents even with their low SiO₂ content. The affinity for the heavy metals included in the study was Zn > Pb > Cu, with removal percentages higher than 98% for Zn.

ElSayed [16] examined natural diatomite as an adsorbent for heavy metals and wastewater treatment. The study included diatomite samples ground to 0.25 mm – 0.5 mm size and metals stock standard of multi-element (Aluminium, Barium, Cadmium, Chromium, Copper, iron, Lead, Manganese, Nickel, and Zinc). The study results showed the creation of metal hydroxide and silicone dioxide due to the presence of calcite and quartz respectively leads to increased metal absorption properties of diatomite. The presence of calcite offers an advantage to diatomite as an adsorbent since it is largely used as a sorbent material through the formation of metal hydroxide or metal carbonate.

Diatomaceous earth advances body joint, bones and the ligaments

Diatomaceous Earth (Silicon Dioxide) is listed as one of the food supplements for silicon and is an element considered important for bone formation and the overall health of the bone [10]. Schiano, et al. [17] in their study of the activity of soluble salt silicium on the evolution of the trabecular bone volume, observed that silicon supplementation occasioned an increase in bone volume. Charles and Joshua, [8] acknowledged the increasing body of scientific works that identifies silicon as important in the formation and maintenance of bones. Silicon develops bone matrix quality and helps in bone mineralization. Better intake of silicon has been linked with improved bone mineral density [8].

Eisinger and Clairet, [18] carried out two comparison studies one a retrospective study of bone mineral density changes was carried out in 53 osteoporotic (low bone mass) women before carrying out a prospective study. An evaluation was done between the bone mineral density of controls and treated groups in a period of 14 to 22 months, the results indicated that fluoride induced a significant increase in vertebral and a slight decrease in femoral bone mineral density, whereas silicon induced a significant increase in femoral bone mineral density. Etidronate and, to a lesser extent, magnesium, induced a slight although statistically non-significant increase in vertebral bone mineral density.

Diatomaceous Earth is involved in bone formation and the overall health of the bone through its element silicon which is involved in the formation of the bone through the synthesis and/or stabilization of collagen [10]. Collagen helps in the building and resilience of the bones and connective tissue. It is the most occurring protein in bone matrix conferring flexibility and, with elastin, is a major element in connective tissues found in skin, cartilage, tendons, and arteries [19].

Helps clean and protect skin, nails and teeth

Human skin is susceptible to a lot of toxic substances in the environment, and with diatomaceous earth, these risks are reduced due to the nature of diatomaceous earth drying out toxins and helping maintain a clean and smooth skin and it doesn't carry any unwanted effects. diatomaceous earth carries natural abrasive features and is effective in parasite elimination it's thus included in toothpaste for effective cleaning of the teeth, and also in skin exfoliators and skin scrub for healthier skin cleaning, it's also applied in nail polishes and as noted by Jurkić, et al. [20] appearance of hair and nails can be affected by lower silicon levels in the body since hair and nails are essentially made of keratin proteins.

Additionally, diatomaceous earth appears to have anti-aging effects by helping with the use of calcium in the formation of strong bones, nails, and teeth. Jurkić, et al. [20] observed that silicon found in diatomaceous earth is associated with bone mineralization, collagen synthesis, skin, hair, and nails health atherosclerosis. The reduction in silicon and hyaluronic acid amounts in connective tissues is a sign of aging skin, as a

result of moisture loss and elasticity of the skin. Jurkić, et al. [20] also noted that nail and hair appearance can be affected by low levels of silicon in the body which is a compound of keratin proteins. Silicon stimulates the production of collagen and connective tissue function and repair.

Barel, et al. [21] carried out a placebo-controlled experiment to study the effect of oral intake of choline-stabilized orthosilicic acid on skin, nails, and hair in women with photo-damaged skin. Choline-stabilized orthosilicic acid is a bioavailable form of silicon the most occurring element in diatomaceous earth. In their study, Barel, et al. [21] administered 10 mg silicon per day to 48 women of fine hair for nine months and assessed the hair morphology and its tensile properties prior to treatment and thereafter. The result revealed a significantly smaller decrease (-4.52%) in elastic gradient in the women's group placed under the silicon supplement than in the placebo group (-11.9%). They also observed the break load in the two women group hairs, and there was a significant change in the break load in the placebo group (-10.8%) while the change was significant in the silicon-supplemented group (-2.20%). Also observed were the beak stress and elastic modulus that were found to have reduced in the two groups but this change was observed to be small in the silicon-supplemented group. The hair cross-section was also noted to have significantly increased after 9 months as related to the baseline, this was in the supplemented group while in the placebo group, this was not the case. The study concluded that silicon had a positive influence on the tensile strength of hair and led to thicker hair [21].

Conclusion

Diatomaceous earth has an outstanding list of health benefits and non-toxic, no-known side effects. It has the ability to lower the concentration of cholesterol in the blood. It is a very essential mineral for tendons, cartilage, blood vessels, and bones. Diatomaceous Earth is also considered to greatly help the body in getting rid of toxic substances such as heavy metals. It improves body joints bones, and ligaments through silica, which is the highest-occurring compound in diatomaceous earth that aids in the metabolism and formation of the joints. Diatomaceous earth consumed by humans is considered to have an outstanding health benefit.

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