

Review Article

Elemental analysis of medicinal plants and their impacts on human health

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Abstract

The medicinal plants are the origin of biologically active elements, which are essential for both plants and animals. Trace elements help various biochemical mechanisms in the body of living organisms. The major reason for numerous medical issues in the human being is either a deficiency or toxicity of essential elements. Therefore, investigating the distinct biodynamic elements of medicinal plants and their evaluation is very much important. The therapeutic plants have been utilized in traditional drugs for the treatment of ailments, such as hypertension, minimizing cholesterol level, malignancy, fever, leprosy and eye problems. The most abundant necessary elements found in such plants are Magnesium, Manganese, Copper, Selenium, Iron, Calcium, Sodium and Zinc which are known for their capability to treat different diseases. This review generally discusses the information related to the elemental composition of medicinal plants and their impacts on the living body. The outcomes increase the values of medicinal plants for the preparation of conventional drugs and pharmaceutical factories. This review explores the requirement of further research on therapeutic plants to prepare more effective medicines as different plants have variable values of elements.

Keywords: Essential elements; Human health; Medicinal plants; Prescription; Treatment

Introduction

Background

Therapeutic plants are the most primitive health care items utilized for the treatment of different diseases. They are the wealthy reservoir of antioxidants and other necessary elements [1]. Remedial herbs have reliably been esteemed as a method for the treatment of several diseases in the old era and have imparted a vital role for the preparation of recently advanced drugs with the addition of some chemical constituents. The effectiveness of

medicinal plants for the intention of cure is usually assumed regarding their natural parts like fundamental oils, nutrients, glycosides, vitamins and different components of the living body. It is a known fact that larger quantity or continued intake of restorative plants may prompt a higher collection of various minerals that result in different fitness issues [2]. Necessary metals can likewise deliver poisonous impacts when ingested in larger amounts although non-essential trace metals are lethal even in reduced amount

for human health [3-5]. The quantity of trace minerals in therapeutic herbs on the far side admissible extent is larger anxiety for the people everywhere throughout the world [6]. The shortage of essential elements also results in various disorders [7].

Herbs may assimilate heavy metals from earth, atmosphere or water. The magnitude of necessary minerals in medicinal plants differs from species to species and composition of soil [8]. However, conventional homegrown prescription has been broadly utilized in the progressing as well as in the developed world as an alternate source. Information about the essential elements in curative plants is very important along with organic constituents. Many necessary minerals have important roles in the production of dynamic particles that play a vital function in the treatment of various diseases [9, 10]. Elements play an important role in the medicinal values of plants and treatment and in health and ailment. Likewise, nutrients and biochemical's such as carbohydrates, fats, proteins also play a vital part in satisfying human needs for energy and life processes [11]. Herbs are the vital sources of numerous medications like emetics, hostile to malignancy, antispasmodics, anti-microbes and so on. Therapeutic plants have anti-toxin characteristics and extensively used by the people living in far-off areas around the world [12].

Various scientists exposed the values of trace elements that enhanced the importance of medicinal plants [13]. Rare minerals are the components that are present in fewer amounts but are necessary for the body. It is proved from the latest knowledge that a sufficient measure of trace elements is needed in the maintenance of metabolism and activities of biocatalysts [14, 15]. The familiarity with essential elements is necessary to explain the importance of medicinal herbs to cure various disorders through their medicinal activities and to spread knowledge about the treatment of therapeutic herbs [16].

Flora of Pakistan is rich in medicinal plants, which are therapeutically used. More than 1,000 species possess medicinal properties, which are used by local communities to cure different diseases [17].

The medicinal plants are ordinarily applied because of their easy approach and fewer reactions. According to World Health Organization (WHO 2002), 80% of the people primarily use medicinal plants for their treatment and it is necessary to examine such herbs for their effectiveness, security, and efficiency [18]. The conventional drugs bring improvement in the immune system. Furthermore, they raise chemotherapy that demolishes a wide range of malignant growth [19]. So, various trace elements have been considered as the essential components of the food that repair insulin metabolic process in forbearing of diabetes [20].

Several analysts have likewise reported that necessary minerals usefully influence the complexities of diabetes mellitus [21].

Impacts of elements on human health

Importance of some of the elements found in medicinal plants are given as:

Copper and human health

Copper is found in several parts of human body parts and various enzymes and is thought to be a significant necessary trace element. However, too much ingestion of copper results in hepatic destruction and Wilson's disease. Wilson's disease is caused due to the addition of free copper in the liver, kidney, and brain [22]. The shortage of Cu has bad fitness issues, including aneurysms, harm the circulatory system, hernias, hemorrhages and may affect the passage of nutrients through cell walls [23].

Copper is necessary to the whole living creatures as a trace nutritional constituent as it is a main component of the respirational enzyme systems. Cu is a part of the bloodstain hemocyanin that is substituted by hemoglobin complexed with iron. However, copper is an important trace element required in a small amount for the suitable working of tissues and

organizations but the higher quantity may be poisonous and fatal [24]. The site of storage of copper in the human body is muscles, bones and liver. Cu mixes are utilized as a bacteriostatic agent, fungi killer and preservation of wood [25]. The shortage of copper in humans occurs very rarely as it is commonly found in ordinary food items such as legumes, nuts, grains, etc. Copper is an obligatory trace element in some vegetations and animals but not for all [26]. Scarcity of copper results in anomalies of bones, reduced development, defects in the metabolism of sugar and fats. Copper assistances the body for the utilization of iron. It plays a vital role in the nervous system, development of bones, maintenance of glucose and protects the plasma membrane from the effects of free radicals. A lot of cardiac problems and blood irregularities may be caused due to the insufficiency of copper [27, 28].

Iron and human health

Iron is an essential element, which is the main constituent of hemoglobin and is present in numerous human enzymes. Its concentration in red blood cells and muscle tissue is very high. Larger intake of iron results in hepatotoxicity. Severe hepatic failure has been observed due to overdose of ferrous sulphate in an earlier age of adulthood [29]. Anemia, a nutritional disease that is caused due to a shortage of iron [30].

Iron plays a significant role in oxygen and electron transference in the human body. Its deficit reasons in gastric issues, bleeding from the nose and cardiovascular diseases [31]. Mixes of iron and protein have a dynamic function in the metabolic process of all living things [32].

Manganese and human health

Manganese is an essential element that is the main constituent of metalloenzymes, which plays an important role in the oxidation of fats and cholesterol [33]. Shortage of manganese may result in bleeding issues but high quantity causes talking problems, limb spasms, and encephalitis [34].

Manganese is necessary for the normal working of reproduction and the central nervous system. Its insufficiency results in heart problems and bone issues in youngsters and young [35].

It has been investigated that Manganese is tangled in normal immune activities, maintenance of blood glucose and cellular vitality and the resistance against free radicals [36]. It stimulates specific enzymes, which show vital roles in the breakdown of starches, protein, and cholesterol. It is also necessary for regular insulin production, its discharge and a variation in its metabolic rate has been involved in diabetes growth [37]. Shortage of manganese can cause weakened glucose forbearance, transformed starch and fat metabolism, decreased insulin emission and skeletal irregularities [38]. Mn is a very significant element while maintaining the glucose of body fluid. It has strong estrogenic characteristics and it is very important for the treatment of menopausal indications, bone issues and post-delivery depression. Insufficient Manganese consumption has been linked with a parenteral diet, causing dermatitis, alters hair coloration and decelerated hair growing. Steady displacement of joints (mainly knee junctions) is also related to a deficiency of Manganese. Similarly, an excess amount of Mn causes rupture of tendon/ligament and pneumonia. Moreover, damage to sex drive and sperm destruction has been investigated in males. Excessive manganese affects the assimilation of dietetic iron. It has outstanding antioxidant characters which are important during oxidative pressure. For example, Manganese superoxide dismutase is the prime antioxidant enzyme in mitochondria that takes almost totally the oxygen used by cells. The investigation has exposed that numerous Mn-activated enzymes play significant functions in the breakdown of carbohydrates, proteins and fats [39]. Mn is the best co-factor of enzymes (glycosyl transferases) needed for the production of proteoglycans necessary

for the growth of solid bones and cartilage. It is also accountable for the excretion of prolinase which is responsible for amino acid, the main constituent of collagen manufacture and repairing of injuries that use closely all the oxygen consumed by cells [40].

Zinc and human health

Zinc is a necessary element, and cellular Zn stimulates the homeostatic mechanism to evade the storage of extra zinc. Excess zinc causes a shortage of Cu and cell apoptosis. Moreover, zinc deficit has been connected to a repressed immune system [41]. Zn and Cu both are considered significant for breakdown sugar and depressing cholesterol [42].

The part of Zn in the creation of insulin and catalysis of several enzymes catalytic reactions has been investigated [43]. The low level of Zn in plasma unfavorably distresses the capability of islet cells to secrete and produce insulin [44]. Furthermore, it may exaggerate the insulin confrontation in type 2 diabetes and so reasons further problems [45].

Zinc is a nutritional constituent for humans and animals. The human body has about two gm to three gm. It has an important function in DNA duplication, prenatal period, adolescence and menopause. The greater amount of Zinc protects people from cadmium harming although the side effects of Zn over dosage include vomiting, dizziness, sicknesses and motions [46].

Calcium and human health

Inadequacy can prompt low bone mass (osteopenia), bone breaks, deadness and shivering in the fingers and unusual heart rhythms. Some of the plants show the satisfactory dimension of Ca collection [47, 48].

Chromium and human health

It maintains insulin and blood sugar levels by activating insulin signing and metabolic path and consequently it might improve insulin affectability. The balance of lipid digestion by Cr in marginal tissues may signify an extra novel system of activity [49]. Insufficiency of Cr or its biodynamic

type has been entangled in the pathogenesis of insulin obstruction and diabetes [50].

Magnesium and human health

Magnesium is a cofactor of numerous enzymes in the starch oxidative breakdown and has a vital function in glucose carrying process of the plasma membrane. It has also a role in insulin production, combination and working [51]. It takes part in the phosphorylation reactions of sugar and its breakdown and it may affect the secretion and function of the hormones that aid to regulate blood sugar stages [52]. It was also investigated that a lack of Magnesium might reduce insulin facilitated glucose take in and have been linked with the increase of insulin conflict [53].

Mg is broadly dispersed in animals and plants, diets and drinks. Green leafy herbs, for example, spinach, beans, nuts, seeds and whole grains are good sources. Magnesium, a plentiful element in the body, is part of various foods items, added to further nutrition, available as a dietetic component and present in drugs [54, 55]. A sufficient dose of Mg from food does not cause a health problem in fit people since the kidneys remove extra amounts in the urine. Though, high dosages of Mg from diet or medicines usually cause diarrhea, nausea and stomach hampering [56].

Analytical Techniques

The most extensively and generally used methods of elemental investigation, providing standard ranks of accuracy and precision, comprise flame atomic absorption spectrometry (FAAS), UV/Vis spectrophotometer, flame photometry, graphite furnace atomic absorption spectrometry (GFAAS), inductively coupled plasma atomic emission spectrometry (ICP-AES), and inductively coupled plasma mass spectrometry (ICP-MS) [57].

Conclusion

It is concluded from the above review/study to examine the specific quantity of those elements from their permissible limits that were set up by the world health organization (WHO). If the amount of these elements in medicinal plants is high than the standard level, it may cause severe

health-related issues, particularly in human beings. The majority of the general population believes that herbal prescriptions are safe and nontoxic. Even current chemotherapeutics are unaware of metals available in therapeutic plants. Moreover, the accumulation of toxic metals in the soil causes different types of contaminations that transfer through roots and arial parts of plants by the food chain.

Therefore, it is necessary to investigate the medicinal plants properly before the manufacturing of the medicines and further, such kind of investigation on the plant will help in choosing different dynamic constituents and in dealing with the helping of a specific formulation.

Authors' contributions

Conceived and designed the experiments: A Sattar, Attiq-Ur-Rehman & A Baqi Performed the experiments: A Sattar, Samiullah & A Baqi, Analyzed the data: Samiullah, N Khan & M Suleman, Contributed materials/ analysis/ tools: Samiullah, N Khan & Muhammad Tahir Shah, Wrote the paper: A Sattar, A Baqi & Samiullah.

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