



Forging Wellness: Ayurvedic Insights into Copper's Vital Role in Human Body: A systematic Review

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Abstract

Background: *Ayurveda* has explained Copper in treatment of varied spectrum of diseases. A thorough study was planned to compile the health effects of copper through its role in different bodily systems which is fairly explored.

Aim and Objective: Critical study on copper properties mentioned in texts of *Ayurveda* and related research works to explore its vital role in the body.

Review Methods: Literary method is adopted in this study through *Ayurveda* literatures and contemporary science.

Results: Copper is explained as a special element that has laghu, lekhana and tarpana property along with its indication in various diseases such as agni mandhya, kshaya, amla pitta, kusta, gara visha, etc. Various studies have proved its vital role in physiology of different bodily systems. Shodhana and marana procedures should always be followed before internal administration of elemental copper. It is also recommended for drinking water storage purposes.

Conclusion: Copper is an essential micronutrient, its deficiency is known to cause various health ailments like skin disorders, neurological deficits, respiratory disorders, metabolic disorders, anaemia. Indication of copper in similar kind of ailments are noticed in classics. Storage of drinking water copper vessel serves as easiest way to avail its beneficial method.

Keywords: Copper; Tamra; Health Benefits; Human Physiology; Ayurveda; Copper Deficiency, Drinking Water Stored in Copper Vessel

Key Messages

Copper, plays a vital role in health, aiding in the treatment of various diseases. It is very essential for proper bodily functions; its deficiency can lead to several health issues. Storing drinking water in copper vessels or its internal usage in ash form after proper purification processes is considered as safe and more effective methods.

Introduction

Humans have employed drugs from many different sources to maintain and improve their health. Similarly, Natural sources such as minerals, plants, and animals are the source of Ayurvedic medicines. They've been carefully treated to convert the indigestible harmful metallic form to solely the medicinal form. The phrase "sapta dhatu" refers to the seven

basic metals that are addressed in Ayurvedic scriptures. Tamra, or copper, is one among those. Because of its wide range of medicinal applications, copper has been the subject of several research works; when processed and detoxified appropriately, copper can be helpful for a number of ailments. Various functions of copper at different systemic level are less commonly recognized. To provide a brief outline of the vital role of Copper in maintaining one's health, the current study gathered all the classical references and research studies that have been conducted on this topic.

Background

There are several Sanskrit manuscripts that include unique knowledge on metals and metallurgy, ranging from Vedic literature to medieval and pre-modern texts. This clarifies that copper has been used by Indians for a very long period. There are multiple references to it emerging from the vedic, puranic and samhitha eras. According to the well-known quotations from the scripture rasa kamadhenu, copper symbolizes the traits and essence of the Sun. All living things on this planet are said to receive their vitality and health from the sun. Therefore, the use of this metal is believed to aid in the treatment of several illnesses pertaining to health in our universe. Similarly, using this metal has been shown to be beneficial for a number of illnesses [1].

As per modern science, pure copper is pinkish-orange colour when initially exposed. It is a soft, ductile, malleable metal that has extraordinary electrical and thermal conductivity. It is placed in Group 11 of the periodic chart based on atomic number and valance electronic configuration. Elements in this group are known to be inert and corrosion-resistant hence known by the name coinage metals as they can be minted into coins.

Copper and copper compounds are widely utilized in a variety of medically linked applications these days. For many years, millions of people all around the world have utilized metallic copper in intrauterine devices for reversing contraception and in dental fillings. To encourage the body to cure itself, copper compounds are frequently utilized in anthroposophical medicine as oral, subcutaneous, or topical treatments. Copper ointments are applied topically to treat a variety of conditions, including rheumatism, peripheral venous hypostatic circulation problems, cramping, and swelling brought on by trauma. They also release copper ions that are absorbed via the skin. Copper is an active component included in certain cosmetic face creams as well [2].

Materials and Methods

To obtain the content, a variety of current textbooks, journals, and classical literature were reviewed.

Results

Copper in Ayurveda is known to have a typical pungent, bitter, sweet and sour taste which gets easily distributed throughout the body and is light to get digested. It's hot in potency their by decreases vata and kapha dosha's. After digestion this attains a spicy taste known as pungent taste after digestion (katu vipaka). This metal has a special property known as scrapping action (lekhana). This property is very useful to remove the bodily tissues like fat, phlegm, or any excess tissues aggregations leading to tumour formation. This even helps to remove the piled up, un-eliminated or unprocessed by products in the body like uric acid in joints, cholesterol clogging in blood vessels, etc.

Recent studies suggests that, copper is the third most common trace element in the human body. Due to its vital role in the respiratory enzyme complex cytochrome c oxidase, copper is a trace mineral that is required by every living creature. Studies also suggest that copper is essential in catalysing iron absorption and haemoglobin production in fish and other vertebrates having iron-complexed haemoglobin. Human body stores copper mostly in the liver, muscles, and bones. An adult's body has between 1.4 to 2.1 milligrams of copper per kilogram of body weight [3,4].

Importance of Storing Water in Copper Vessel

Acharya's have stressed the need of keeping boiled and cooled water in copper containers before using it for drinking purposes, which infuses micro-particles of copper required for the physiological funtions in the body [5]. Recent research works have also suggested their importance, by showing that water kept in copper vessels eliminates bacteria that can bring about diarrhoea and renders the water safe to drink. Another study has demonstrated that water drawn from different sources kept in copper vessel changes its pH and TDS levels within the potable standards indicating that it is safe to drink.

Copper Quality Ideal for Medicinal Use

As per classical description, copper that is smooth, glossy, that can withstand heavy weight, free of lead or iron impurities, with its colour similar to a red hibiscus blossom should be utilized for therapeutic purposes [6]. Modern studies also suggest that copper differs from other metals because copper isn't naturally silver or grey like other metallic elements. The orange-red colour of pure copper turns reddish-brown when it comes into contact with air. This is due to the metal's low plasma frequency, which allows it to absorb colours of higher frequencies, including blue and green, and its location in the visible spectrum's red area [4].

Copper Quality Non-Ideal for Medicinal Use

Any of the following qualities indicate that the copper is not

acceptable for use in any of the processes: it should not be black, dry, slippery, white, or that cannot bear the weight. It also shouldn't have a lot of lines in it or include traces of iron or lead [6,7].

Causes of Copper Deficiency

High oral intakes of zinc and iron decrease copper absorption and may predispose to copper deficiency. Copper deficiency also has been documented in subjects receiving penicillamine, or other cation-chelating agents, or high doses of oral alkalis, which enhance copper losses [5].

Pharmacodynamics of Copper

On entry into the liver and kidney, newly absorbed copper is incorporated into several different compartments. These include endogenous copper enzymes, copper-requiring proteins that are secreted, and, in the case of liver, bile. Depending on the dose of copper delivered, a greater or lesser portion will go directly to bile: more at higher doses and less at lower doses. This is important in the maintenance of copper homeostasis. Incorporation of copper into ceruloplasmin is constant at higher intakes but reduced at intakes that result in copper deficiency [8].

Preparing Copper for Medicinal Use: Essential Processing Steps

Processing of copper is most important due to its inherent toxic properties. Acharya Charak has addressed eight toxic properties of copper as *tamra doshas*. These *doshas* are generally present in every unprocessed copper metal. Hence, administering this metal without processing, or by improper processing leads to various problems in the person consuming the medication containing copper. Illnesses caused due to their consumption causes increased burning sensation, sweating, anorexia, aguesia, unconsciousness, vomiting, diarrhoea, and giddiness. Classical references suggest that, though copper is being indicated in many of the diseases, there are strict methods that should be adopted before availing its therapeutic benefits. These procedures includes purificatory procedures (*samanya shodhana and vishesha shodhana*) and incineration methods (*marana*). Which includes the use of specific drugs during various stages of procedures. These procedures finally makes copper loose its metallic form and nullifies its toxic properties. This kind of copper is advised to be used as a best medicine in different forms along with different medicinal substances based on various illnesses. Adopting these strict measures retains only the therapeutic benefits of copper nullifying its toxicity.

Classical Indications of Copper

It has a special combination of qualities that include (*lekhana*) scraping and (*tarpana*) nourishing that helps in removal of

over clogged cholesterol and deeply adhered toxins from the body and by subsequently nourishing the body. It is a very good carminative (*deepana dravya*) along with its specific activity on cleansing the clogged channels. Due to these properties it is also indicated in poisoning condition (*gara visha chikitsa*) to eliminate *gara visha* i.e, concoctant poison from the body. It acts as wormicidal, fungicidal, bactericidal (*krimighna*) along with wound healing properties (*vrana ropana*). It improves vision (*chakshushya*) hence aids in eye replenishment. It is also indicated to cure various ailments like anaemia (*pandu*), disorders of gastro intestinal tract (*udara*), (*arsha*), haemorrhoids, abdominal distensions (*gulma*), splenic and hepatic disorders (*pleeha and yakrith vikara*), swelling (*shotha*), piercing pain (*shola*), abdominal colics (*udara shola*), sour belching (*amlodgara*), fever (*jwara*), breathing difficulties (*shwasa*), cough (*kasa*), emaciation (*kshaya*), skin ailments (*kusta*), rhinitis (*peenasa*), reduced appetite (*mandagni*), uterine disorders (*gabhashaya vikara*), Irritable bowel disorders (*grahani*), difficulty in micturition (*mutrakrichra*), fever with long term origin (*jeerna jwara*), tastelessness (*aruchi*), fainting (*murcha*), rheumatoid arthritis (*ama vata*), obesity (*sthoulya*), geriatric disorders (*jara vyadhi*). Their by it is stated that Copper is capable of reducing cholesterol and eye disorders also prevents death by removal of toxins from the body [9-11]. *Charaka Samhita* mentions the use of Copper for medical purposes. In treatment of concoctant poison (*Gara Visha Chikitsa*), it is said that powdered Copper aids in removal of *gara visha* from the body by provoking vomitus [12]. *Shaligrama nighantu* also specifies its advantage in the treatment of cancer (*arbudha*) [6].

Discussion

Around 110 mg of copper is present in the body of a healthy 70 kg person; of this, 50% is located in the bones and muscles, 15% in the skin, 15% in the bone marrow, 10% in the liver, and 8% in the brain [2]. Different systems control this micronutrient's intake, transit via various tissues, metabolism, and excretion. It is a highly coordinated micronutrient, which makes it essential for the proper functioning of the organism.

Role of Copper in Respiratory System

Copper has been recommended by Ayurveda for the treatment of cough (*Kasa*), Breathing difficulties (*Shwasa*), rhinitis (*Peenasa*), and emaciation (*Kshaya*) [6,11]. Recent research has shown that copper deficiency is associated with respiratory distress syndrome [3]. Research suggests restoring of lung Cu status as a possible therapeutic and prophylactic approach for long-term lung inflammation and associated conditions [13].

Role of Copper in Gastrointestinal System

Copper indications are given for reduced appetite (*Agni mandhya*), abdominal distension (*gulma*), irritable bowel

syndrome (*Grahani*), sour belching (*amlapitta*), rheumatism (*amavata*), peptic and deodinal ulcers (*parinama shola*, *udara shola*), mass like appearance in trunk regions (*gulma*), haemorrhoids (*arshas*), liver and spleen disorders (*yakruth*, *and pleeha roga*) [6,11]. Alcohol-induced liver and intestinal damage has been demonstrated to respond favourably to supplemental dietary copper, but same parameters are adversely affected by minimal dietary copper [14].

Role of Copper in Musculoskeletal System

In treating emaciation (*kshaya*), which is an umbrella term for the depletion of body tissues, Ayurveda has provided a description for the usage of copper [6,10]. *Lysyl oxigenase* of collagen and elastin is known to require copper ions as a cofactor. Its absence might contribute to the improper production of elastin and collagen [15]. It is thought that a severe copper deficit leads to a multi-copper oxidase deficient condition; hence, the absence of ferroxidase activity fails to meet bone marrow requirements. Osteoporosis, fractures, and epiphyseal separation are examples of frequent bone disorders associated with copper deficiency [16].

Role of Copper in Integumentary System

The role of copper in the integumentary system has been addressed by Ayurveda, which suggests using it to cure skin conditions designated as *Kusta* and *Shwitra* [4,5,9]. Studies have confirmed this as well, stating that it is essential for maintaining the health of the skin. It is known to play a function in the formation and stability of the extracellular matrix of skin proteins, as well as in angiogenesis. Transforming growth factor- β (TGF- β) activation has been linked to increased cutaneous fibroblast proliferation and production of collagen (types I, II, and V) and elastin fibres. Moreover, copper stimulates Heat Shock protein-47 (HSp-47), crucial for collagen fibril formation, and acts as a cofactor for *Lysyl oxidase*, essential for extracellular matrix protein cross-linking. This mineral also increases collagen and elastin matrix cross-linking in a dose-dependent manner once formed. Furthermore, as a cofactor for superoxide dismutase, copper serves as a potent antioxidant in the skin, safeguarding against free radicals. Additionally, it supports tyrosinase activity, pivotal in melanin production for skin and hair coloration, while also mitigating cellular oxidative damage like membrane harm and lipid peroxidation. Cu-GHK, a peptide found in human blood and cerebrospinal fluid, stimulates collagen and elastin protein production. Furthermore, Cu-GHK promotes the survival and proliferation of epidermal basal stem cells, which is connected to increased integrin expression. Consequently, this peptide has been found to improve wound healing. Role of copper in wound healing is also justified by its role to stimulate angiogenesis and promote the formation and the maintenance of the skin's extracellular matrix. LOX activity and collagen production is

observed to be minimal in those with Menke's syndrome, a disorder in which the body is unable to metabolize copper [2]. Based on the evidence presented above, copper may be viewed as a multifaceted promoter of skin health and endurance.

Role of Copper in Circulatory System

The Ayurvedic classics go into additional detailing on the use of copper in poisoning cases (*visha*), anaemia (*pandu*), and emaciation (*kshaya*) situations [6,10,11]. According to current research, ferrous iron is converted to ferric form by *ceruloplasmin*, a major copper-carrying protein in the blood, enabling iron to circulate and bind to transferrin. *Hephaestine*, a copper-dependent *ferroxidase*, is another important factor in the copper-iron interaction. This transport protein helps enterocytes absorb iron, which might be the reason that some people develop *microcytic hypochromic anaemia*. Because copper is an essential component for enzymatic processes like protein synthesis and cell division, it is associated with both *macrocytosis* and *neutropenia* [17].

Role of Copper in Digestive System

Classical medical treatments has always recommended copper for the treatment of *Jara* (geriatric disorders), *Medo Roga* (disorders of lipid metabolism), and *Sthoulya* (obesity). All types of metabolic diseases are included in these above terms. According to recent studies, obesity, a rise in insulin resistance, and the accumulation of fat outside of adipose cells are symptoms of the syndrome known as *lipotoxicity*. Decades of research in humans and animal models have shown that inadequate copper levels exacerbate oxidative stress and cause *dyslipidaemia* [18]. Animals fed an experimental diet deficient in copper showed higher concentrations of total and LDL cholesterol and decreased concentrations of HDL cholesterol [19]. The copper-deficient group gained much more weight and used more calories than the copper-sufficient group, shortly after supplementation [19].

Role of Copper in Nervous System

Ayurveda recommends using copper to treat shooting or piercing pains and in degenerative conditions [6]. According to recent research, copper deficiency has been linked to myelopathy and peripheral neuropathy, which mimic subacute combined degeneration which falls under *jara vyadhi* [20]. It is also known to act as a cofactor in various enzymes that are essential for the formation and function of the central nervous system. These enzymes include *cytochrome-c-oxidase* in the mitochondrial electron transport chain and oxidative phosphorylation, superoxide dismutase for oxidative protection, lysyl oxidase for collagen and elastin crosslinking, dopamine beta-hydroxylase for catecholamine biosynthesis, and peptidyl glycine alpha-amidating mono-oxygenase for peptide neurotransmitter and hormone

processing [20]. It has been proposed that there is a prenatal crucial period in central nervous system development during which copper deficiency might induce central nervous system damage. This might explain the profound mental inadequacy associated with prenatal copper molecular deficit in Menkes syndrome. The high copper concentration of the brain, particularly in the basal ganglia, has led to speculation about the role of copper deficiency in abnormal neurodevelopment [19].

Role of Copper in Sensory Nervous System

Ayurveda has discussed copper's role in *netra roga* [10]. Recent investigations have shown that copper deficiency leads to neuropathy. Nerves develop slowly, and remyelination may take longer time [21].

Role of Copper in Genotoxicity

Copper has special features such as *lekhaana*, *ropana*, and *deepana*, as well as indications in *arbudha* conditions. This metal is also indicated to neutralize all kinds of poisons present within the body [9,22,23]. Recent research has revealed that tumours are caused by genetic alteration of a normal gene. This might be caused by a variety of toxins capable of inducing gene alterations, resulting in decreased cell proliferation. According to studies, malfunction of copper-responsive transcription factors have a significant impact on cellular activities such as proliferation, growth, and metabolic activity, suggesting that this metal plays an important role in eukaryotic cellular physiology [19]. Menkes syndrome, an x-linked disorder, is associated with copper insufficiency caused by decreased gastrointestinal copper absorption [7].

Role of Copper in Immune System

According to recent studies, when antigens are encountered, toxins can cause insufficient immune responses by reducing the amount of necessary cytokines produced. They kill or impair immune cells and bone marrow cells, making it difficult for the body to recognize antigens and create novel immunological responses. This can be measured by lowering levels of the immune-suppressive antibodies IgM and IgG. Certain toxins also appear to disrupt T regulatory cells, which are necessary for maintaining an appropriate level of immune response [24]. Studies have indicated that polymorphonuclear leukocytes' phagocytic activity rose by 30% after getting copper supplementation, though immunoglobulin levels remained constant [24]. This might result in reduced immunity making an individual more prone to infections such as fever, asthma, cough, skin ailments, rhinitis, swelling. Hence, these are the ailments that are indicated in classical texts while explaining the therapeutic effects of copper [9,22].

Conclusion

Indians have known about copper for around 10,000 years and have used it medicinally for more than 3,000 years. Metals and minerals are both necessary components to provide effective therapeutic benefits. Literatures suggests established rules such as *Shodhana* and *Marana* to be followed while preparing metals for medicinal purposes. *Tamara* is one such metal that has been prescribed for a wide spectrum of diseases. Appropriate use of this metal has the potential to be one of the best therapeutic drug. Easiest method to avail the benefits of copper is by inculcating the cultural wisdom of storing water in copper vessel for 12 hrs before consumption. To completely comprehend this amazing component in addition to offering therapeutic benefits with a deeper understanding, further scientific studies on copper in particular with its individual indications are very necessary.

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