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Trace elements deficiency & cancer

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Abstract **:** *With our increasing reliance on chemicals to grow more food, the health of soil is detoriating. Soil is being deprived of essential micro nutrients. Global warming has lead tothe disintegration of humus in soil, which is adversely affecting the availability of nutrients to plants, causing deficiencyof micro nutrient in human body. Metabolismcauses acidosis. Prolonged acidosisleads to development of chronic diarrhea Body becomes deficient in variousmicronutrients like Zinc, Iron etc. System is unable to replenish essential nutrients from dietary sources.Acidosis leads to sharp change in pH;there is change in culture media due to drainage of micronutrients and change in pH which has got mutagenic effect here hydrolysis tends to proceed as pH rises the situation may be accentuated by small divalent ions; "spontaneous mutations" occur due to spontaneous hydrolysis. This ultimately leads to malignancy. Natural products offer a great opportunity to evaluate totally new chemical classes of anticancer agents; Nature is an attractive source of new therapeutic compounds as a tremendous chemical diversity is found in millions of species of plants and microorganisms*

Keywords:*1Antioxidants 2Free radical 3 Hypozincemia4 Micronutrients 5 Stress Hormones*

I. Introduction

Natural dietary agents including fruits, vegetables and spices have drawn a great deal of attention from both the scientific community and the general public owing to their demonstrated ability to suppress cancers. Recent studies suggest that the consumption of food rich in fruits, vegetables and spices have a lower incidence of cancers (stomach, esophagus, lung, oral cavity and pharynx, pancreas and colon) Dietary agents consist of a wide variety of micronutrients& biologically active components that are responsible for the anti-cancer effects which have been used in traditional medicines for thousands of years. These dietary agents are believed to suppress the inflammatory processes that lead to transformation, hyper proliferation and initiation of carcinogenesis. Their inhibitory influences may ultimately suppress the final steps of carcinogenesis i.e. angiogenesis and metastasis

II. Properties of anti cancer medicinal plants.

On perusal of properties of various anti cancer medicinal plantsthe under notedcommon properties have emerged. Anti cancerplants posses (1) Anti oxidant (2) Rejuvenative (3) Detoxifying (4)Boosting body immunity (5) Blood purifying (6) Scavenging (7) Adaptogenic (8) Vigorating (9) Healer and anti bleeding properties. These properties have role in cancer treatment.

2.1. Antioxidants are compounds in foods that scavenge&neutralize chemicals called free radicals (unstable molecules), produced by oxidation in the human body. These chemicals have been linked to diseases such as heart, liver disease and cancer. Plant foods such as fruits, vegetables, nuts and wholegrains are rich source of antioxidants. The process of oxidation in the human body damages cell membranes and other structures, including cellular proteins, lipids and DNA. When oxygen is metabolized, it creates unstable molecules called ‘free radicals’, which steal electrons from other molecules, causing damage to DNA and other cells. Evidence suggests that antioxidant supplements do not work like the naturally occurring antioxidants.

Antioxidants are special class of micronutrients (the term "micronutrient" means that only miniscule amounts are required to provide essential support for vital metabolic functions). Antioxidants block harmful chemical reactions caused by oxidation - the destructive effect of oxygen and other oxidizing agents on the molecular components of cells. Vitamin C, vitamin E, Selenium, and carotenoids are examples of antioxidants found naturally in many fruits and vegetables. Plants are also rich in phytonutrients that act as antioxidants, including catechins, found in green tea; resveratrol found in red wine; and curcumin found in turmeric.

The body’s trillion or so cells face formidable threats, from lack of food to infection with a virus. Another constant threat comes from nasty chemicals called free radicals. They are capable of damaging cells and genetic material.

Free radicals come in many shapes, sizes, and chemical configurations. What they all share is a voracious appetite for electrons, stealing them from any nearby substances that will yield them. This electron theft can radically alter the “loser’s” structure or function. Free radical damage can change the instructions coded in a strand of DNA. It can make a circulating low-density lipoprotein (LDL, sometimes called bad

cholesterol) molecule more likely to get trapped in an artery wall. Or it can alter a cell's membrane, changing the flow of what enters the cell and what leaves it.

Our bodies are battlegrounds against infection and diseases. Normal body functions such as breathing or physical activity and other lifestyle habits such as smoking produce substances called free radicals that attack healthy cells. When these healthy cells are weakened, they are more susceptible to cardiovascular disease and certain types of cancers. Antioxidants, such as vitamins C and E and carotenoids, which include beta-carotene, lycopene and lutein, help, protect healthy cells from damage caused by free radicals.

Examples of dietary antioxidants include beta-carotene, lycopene, and vitamins A, C, and E (alpha-tocopherol). The mineral element selenium is often thought to be a dietary antioxidant, but theantioxidant effects of selenium are most likely due to the antioxidant activity of proteins that have this element as an essential component (i.e.,selenium-containing proteins), and not to selenium itself.

In laboratory and animal studies, the presence of increased levels of exogenous antioxidants has been shown to prevent the types of free radical damage that have been associated with cancer development. Therefore, researchers have investigated whether taking dietary antioxidantsupplements can help lower the risk of developing or dying from cancer in humans.

Oxidative stress occurs when the production of harmful molecules called free radicals is beyond the protective capability of the antioxidant defenses. Free radicals are chemically active atoms or molecular fragments that have a charge due to an excess or deficient number of electrons.

It is impossible to avoid damage by free radicals. Free radicals arise from sources both inside (endogenous) and outside (exogenous) our bodies. Oxidants that develop from processes within our bodies form as a result of normal aerobic respiration, metabolism, and inflammation. Exogenous free radicals from environmental factors such as pollution, sunlight, strenuous exercise, X-rays, smoking and alcohol. Our antioxidant systems are not perfect, so as we age, cell parts damaged by oxidation accumulate.

Antioxidants are chemicals that block the activity of other chemicals known as free radicals. Free radicals are highly reactive and have the potential to cause damage to cells, including damage that may lead to cancer.

Free radicals are formed naturally in the body. In addition, some environmental toxins may contain high levels of free radicals or stimulate the body's cells to produce more free radicals.

Some antioxidants are made naturally by the body. Others can only be obtained from external (exogenous) sources, including the diet and dietary supplements.

Laboratory and animal research has shown that exogenous antioxidants can help prevent the free radical damage associated with the development of cancer.

Free radicals are highly reactive chemicals that have the potential to harm cells. They are created when an atom or a molecule (a chemical that has two or more atoms) either gains or losses an electron (a small negatively charged particle found in atoms). Free radicals are formed naturally in the body and play an important role in many normal cellular processes. At high concentrations, however, free radicals can be hazardous to the body and damage all major components of cells, including DNA, proteins, and cell membranes. The damage to cells caused by free radicals, especially the damage to DNA, may play a role in the development of cancer and other health conditions.

Abnormally high concentrations of free radicals in the body can be caused by exposure toionizing radiation and other environmental toxins. When ionizing radiation hits an atom or a molecule in a cell, an electron may be lost, leading to the formation of a free radical. The production of abnormally high levels of free radicals is the mechanism by which ionizing radiation kills cells. Moreover, some environmental toxins, such as cigarette smoke, some metals, and high-oxygen atmospheres, may contain large amounts of free radicals or stimulate the body's cells to produce more free radicals.

Free radicals are a natural byproduct of energy metabolism and are also generated by ultraviolet rays, tobacco smoke, and air pollution. They lack a full complement of electrons, which makes them unstable, so they steal electrons from other molecules, damaging those molecules in the process.

Free radicals have a well-deserved reputation for causing cellular damage. But they can be helpful, too. When immune system cells muster to fight intruders, the oxygen they use spins off an army of free radicals that destroys viruses, bacteria, and damaged body cells in an oxidative burst. Vitamin C can then disarm the free radicals.

Antioxidant is a catchall term for any compound that can counteract unstable molecules such as free radicals that damage DNA, cell membranes, and other parts of cells.

Antioxidants are able to neutralize marauders such as free radicals by giving up some of their own electrons. When a vitamin C or E molecule makes this sacrifice, it may allow a crucial protein, gene, or cell membrane to escape damage. This helps break a chain reaction that can affect many other cells.

It is important to recognize that the term "antioxidant" reflects a chemical property rather than a specific nutritional property. Each of the nutrients that have antioxidant properties also has numerous other

aspects and should be considered individually. The context is also important—in some settings, for example, vitamin C is an antioxidant, and in others it can be a pro-oxidant

Some phytochemicals have either antioxidant or hormone-like actions. Findings from laboratory studies have shown that phytochemicals have the potential to stimulate the immune system.Block substances we eat, drink and breathe from becoming carcinogensReduce the kind of inflammation that makes cancer growth more likelyPrevent DNA damage and help with DNA repairReduce the kind of oxidative damage to cells that can spark cancerSlow the growth rate of cancer cellsTrigger damaged cells to commit suicide before they can reproduceHelp to regulate hormones

It has been observedthat fruits and vegetable phytochemical extracts exhibit strong antioxidant and anti proliferative activities and that the major part of total antioxidant activity is from the combination of phytochemicals. It has been proposed that the additive and synergistic effects of phytochemicals in fruits and vegetables are responsible for those potent antioxidant and anticancer activities and that the benefit of a diet rich in fruits and vegetables is attributed to the complex mixture of phytochemicals present in whole foods. This explains why no single antioxidant can replace the combination of natural phytochemicals in fruits and vegetables to achieve the health benefits.A group of phytochemicals, called *allyl sulfid*es, are found in garlic and onions. These compounds may stimulate enzymes that help the body get rid of harmful chemicals. They may also help strengthen the immune system.

The phytonutrients appear to serve three major functions in the human body, they act as antioxidants; they regulate hormone levels; and they eliminate toxins. The antioxidant properties of the phytonutrients make phytofood a powerful antioxidant. It helps to protect our bodies against free radical damage that has been associated with degenerative diseases, such as from hardening of the arteries, setting the stage for heart disease, to cancer and premature aging. Phytonutrients also help maintain healthful levels of various hormones, which in turn help keep disease at bay. For example, isoflavones (a type of phytonutrients) which are very similar to natural estrogen may help reduce breast cancer risk by supplanting excess estrogen in the body and thus restoring estrogen levels to the safe zone. Another function of phytonutrients is to detoxify carcinogens which are cancer-causing chemicals and flush them out of the body by attacking "bad" enzymes that activate toxins and increasing production of "good" enzymes that find and detoxify the carcinogens

2.2.Detoxification.Basicallydetoxification means cleaning the blood. This is done by removing impurities from the blood in the liver, where toxins are processed for elimination. The body also eliminates toxins through the kidneys, intestines, lungs, lymph and skin. However, when this system is compromised, impurities aren't properly filtered and every cell in the body is adversely affected.

Detoxification helps in following ways. Resting the organs through fasting.Stimulating the liver to drive toxins from the body.Promoting elimination through the intestines, kidneys and skin.Improving circulation of the blood and refueling the body with healthy nutrients.

One of the benefits of detoxification is that liver, kidney and blood purification can take place - which wouldn't occur during regular eating patterns. Other advantages include: the immune system is stimulated & the hormonal system is enhanced.

Detoxification refers mainly to the removal of toxic substances and cleansing of the kidneys and colon, as these are organs involved in the detoxification of chemicals and toxins from the body. Detoxification is performed in a variety of ways including nutritional supplements, herbal mixtures, oral chelating agents, safe mercury removal, intravenous injections, colonics, etc. Once heavy metal burden is relieved, other parasite, yeast and organic detoxification proceeds easier

2.3 Adaptogens or adaptogenic plants or, herbs refer to the pharmacological concept whereby administration results in stabilization of physiological processesand promotion of homeostasis. The concept of adaptogens as "medicine for the healthy or in helping the body cope with stress is a great deal similar to many remedies common inChinese herbology, as well as other forms of traditional medicine.

Ayurveda traditional medicine operates with the concept of rasayana. Various substances are classified in this tradition as rasayanas, meaning that they are believed to promote physical and mental health, improve defense mechanisms of the body and enhance longevity. Rasayanas are referred to as adaptogens by some researchers.

Tulasi (Sanskrit:-Surasa) (Ocimum *sanctum* Linn) has been used for thousands of years in Ayurveda for its diverse healing properties. It is mentioned in the Charaka Samhita, an ancient Ayurvedic text. *Tulsi* is considered to be an adaptogen, balancing different processes in the body and helpful for adapting to stress Marked by its strong aroma and astringent taste, it is regarded in Ayurveda as a kind of "elixir of life" and believed to promote longevity.

Tulasi extracts are used in ayurvedic remedies for a variety of ailments. Traditionally, *tulasi* is taken in many forms: as herbal tea, dried powder, fresh leaf etc. Essential oil extracted from Karpoora *tulasi* is mostly used for medicinal purposes and in herbal cosmetics and is widely used in skin preparations and for fever, colds and infections.

The mechanism of action of adaptogens has been hard to rationalize. However, by 1965 it had been demonstrated that the adaptogenic effect is dependent on transcription. By 1980, it was clear that the effect operates on the sympathetic nervous system.

A series of recent pharmacological studies have provided rationale for the effects at the molecular level. The stress-protective activity of adaptogens has been found to be associated with activation of molecular chaperonin Hsp70 and other key mediators of the stress response such as cortisol, nitric oxide, stress-activated protein kinase JNK and DAF-16 Studies have demonstrated that heat-shock factor 1 (HSF1) and Neuropeptide Y might be primary upstream molecular targets of adaptogens in neuroglia cells but the results were only suggestive not conclusive. One recent analysis revealed that claimed adaptogen extract *ADAPT-232* and some of its components individuallyregulate the transcription of genes involved in cellular signaling pathways, the most notable ones being those of G protein-coupled receptors

3.Wheat sprout juice has drawn our attention because of its properties in treatment of cancer. The fresh juice of young wheat grass is a rich source of natural vitamins, minerals, stress hormone; enzymes and vital energy. Wheat grass helps to provide more energy, strengthens the immune system, prolong life, protects against environmental pollution, purifies the blood, stimulates circulation, regenerates DNA , protects against free radicals, provides nutrients and rejuvenates, deodorizes and cleanses the body releasing toxins.The benefits are as under.

It increases hemoglobin. It is rich in iron, improves circulation and helps to lower blood pressure. Great source of vitamins A, B and C. Excellent source of Calcium, Iron, Magnesium, Phosphorus, Potassium, Sodium, Sulphur, Cobalt and ZincIt removes drugs deposit from the body.It purifies the liver and pancreas. It detoxifies the colon. It acts against the body's metabolic toxins. It is the most effective therapy of chlorophyll. Having high protein concentrationit is stimulant for circulation.Blocks the process by which the nitrites used as preservatives in foods form tumors.The molecular structure of wheat grass is very similar to that of the red blood cells, which increases the ability of blood to carry oxygen to every cell in the body.

Micronutrients are nature's wonder drug yet ample attention has not been paid towards it. However in plant physiology it is being investigated. We have only limited data available.

Data regarding micronutrient availability in anti cancer plants

Turmeric Na K Ca Cu Mg Zn Fe
Spinach Mg Mn Ca K Cu P Zn Se
Sun FlowerCu Mg Mn P Se
Indian Mulberry P Mg Zn Cu Cr Mn Mo Na K
Barley Mo Mn Se Cu Cr P Mg
Sesame Fe Mg Mn Cu C
Wheat sprouts Ca Fe Mg P K Na S Co Zn Se

The wheat grass juice contains 103 elements known to man among them are 13 essential It is a powerful natural healer because it creates an unfavorable climate for the growth of bacteria. Chlorophyll contains hormone i.e. stress hormone Abscisic acid is considered the "stress" hormone. It inhibits the effects of other hormones to reduce growth during times of plant stress.

It is synthesized in plastids from carotenoids and diffuses in all directions through vascular tissues and parenchyma. Its principal effect is inhibition of cell growth. Plant stress hormones suppress the proliferation and induce apoptosis in human cancer cells

4.Micronutrients are nutrients required by humans and other organisms throughout life in small quantities to orchestrate a range of physiological functions. For people, they include dietary trace minerals in amounts generally less than 100 milligrams/day - as opposed to macro minerals which are required in larger quantities. The micro minerals or trace elements include iron, cobalt, chromium, copper, iodine, manganese, selenium, zinc and molybdenum. Micronutrients also include vitamins, which are organic compounds required as nutrients in tiny amounts by an organism.

Micronutrients are found naturally in a variety of plant- and animal-based foods. Although they can now be synthesized in the laboratory, a varied diet typically provides all of the vitamins and minerals necessary for human health. In many settings, however, such foods are not available and provide a major threat to the health and development of populations around the globe. These are also the places where micronutrient deficiencies cause the greatest harm.

Lack of these important vitamins and minerals also has a profound impact on the body's immune system. Immune system weakened by a lack of micronutrients putsus at increased health risk

It also represents a human physiological disorder which occurs when a person's diet does not contain required nutrients and/or when illnesses (such as diarrhea) cause rapid loss of nutrients through feces or vomit untreated sub-clinical deficiencies can manifest as serious physical disabilities or life-threatening disorders.

The abundant inorganic elements act as ionic electrolytes. The most important ions are sodium, potassium, calcium,magnesium, chloride, phosphate and the organic ion bicarbonate. The maintenance of precise ion gradients across cell membranes maintains osmotic pressure and pH. Ions are also critical for nerve and muscle function, as action potentials in these tissues are produced by the exchange of electrolytes between the extracellular fluid and the cell's fluid.Electrolytesenter and leave cells through proteins in the cell membrane called channels Transition are usually present as trace elements in organisms, with zinc and iron being most abundant of those. These metals are used in some proteins as cofactors and are essential for the activity of enzymes such as catalase and oxygen-carrier proteins such as hemoglobin Metal cofactors are bound tightly to specific sites in proteins; although enzyme cofactors can be modified during catalysis. Metal micronutrients are taken up into organisms by specific transporters and bind to storage proteins such asferritin or metallothionein when not in use. Extrinsic control involves a cell in a multicellular organism changing its metabolism in response to signals from other cells. These signals are usually in the form of soluble messengers such as hormones and growth factorsand are detected by specific receptors on the cell surface These signals are then transmitted inside the cell by second messenger systems that often involved the phosphorylation of proteins.

Following DNA damage, the cell cycle can be transiently arrested to allow for DNA repair or activation of pathways leading to cell death (apoptosis) if the damage is irreparable. Defective cell cycle regulation may result in the propagation of mutations that contribute to the development of cancer.

4.1 Selenium is a trace mineral needed by the body in small amounts for good health.Accumulated evidence from prospective studies, intervention trials and studies on animal models of cancer has suggested a strong inverse correlation between selenium intake and cancer incidence. Selenium has been shown to induce DNA repair and synthesis in damaged cells, to inhibit the proliferation of cancer cells, and to induce their apoptosis, the self-destruct sequence the body uses to eliminate worn out or abnormal cellsIn addition, selenium is incorporated at the active site of many proteins, including *glutathione peroxidase*, which is particularly important for cancer protection. One of the body's most powerful antioxidant enzymes, glutathione peroxidase is used in the liver to detoxify a wide range of potentially harmful molecules. When levels of glutathione peroxidase are too low, these toxic molecules are not disarmed and wreak havoc on any cells with which they come in contact, damaging their cellular DNA and promoting the development of cancer cells.

4.2 Zinc is vital for healthy growth.Good stomach acid, vitamin A, E and B6, magnesium, calcium and phosphorus will all help with the absorption of zinc

Zinc is an essential mineral with over 300 enzymes reliant on it to help heal wounds, maintain fertility in adults, protect against free radicals, promote healthy growth in children, boost immunity, synthesise protein, preserve good vision and help cells reproduce

Hypozincemia is a condition where insufficient zinc is available for metabolic needs.

Signs of zinc deficiency include diarrhea, and wasting of body tissues. A deficiency in zinc can cause malfunctions of these organs and functions. Congenital abnormalities causing zinc deficiency may lead to a disease called acrodermatitis enteropathica Zinc deficiency is also implicated in the pathogenesis of Esophageal Squamous Cell Carcinoma (ESCC) in many populations including persons with chronic alcohol consumption In a rat model, chronic zinc deficiency induces an inflammatory gene signature that fuels Esophageal Squamous Cell Carcinoma development.

Zinc deficiency contributes to an increased incidence and severity of diarrhea and pneumonia.Studies have shown that zinc treatment results in a 25 percent reduction in duration of acute diarrhea and a 40 percent reduction in treatment failure or death in persistent diarrhea. Hypozincemia is usually a nutritional deficiency, but can also be associated with malabsorption, diarrhea, acrodermatitis enteropathica, chronic liver disease, chronic disease, sickle, diabetes, malignancy, pyroluria, and other chronic illnesses. It can also occur after bariatric surgery, heavy metal exposure and tartrazine.

Zinc is an essential micronutrient needed not only by people but also by crops. Almost half of the world's cereal crops are deficient in zinc, leading to poor crop yields. Many agricultural countries around the world are affected by zinc deficiencies. In China, zinc deficiency occurs on around half of the agricultural soils, affecting mainly rice and maize.

In India, zinc-deficient soils occupy almost 48% of the agricultural areaand are a critical constrainton yield, but crops are highly responsive to zinc fertilization.

Research has shown that areas with zinc-deficient soils are often regions with widespread zinc deficiency in humans.

Zinc is an important chemical essential for human functioning. Zinc nutrition deficiency is insufficient availability of zinc in the diet or can be caused due to the malabsorption of zinc by the body. Zinc plays a vital role in many aspects of the immune system. It helps in cell division, clotting, healing wounds, DNA synthesis, growth and development of the fetus, and protein synthesisZinc helps blood clot, is essential for taste and smell, and bolsters the immune response.

Deficiency is very common (especially in the Third World) and can cause major health complaints, zinc deficiency can be overcome by consuming the right diet full of foods that are high in zinc and by supplementing the diet with chelated zinc.

Trace minerals interact with one another, sometimes in ways that can trigger imbalances. Too much of one can cause or contribute to a deficiency of another.

The difference between "just enough" and "too much" of the trace minerals is often tiny. Generally, food is a safe source of trace minerals but if you take supplements, it's important to make sure you're not exceeding safe levelsA minor overload of manganese can exacerbate iron deficiency. Having too little can alsocause problems

4.3 Copper helps to form several enzymes, one of which assists with iron metabolism and the creation of hemoglobin, which carries oxygen in the blood.

The other trace minerals perform equally vital jobs, such as helping to block damage to body cells and forming parts of key enzymes or enhancing their activity.

4.4 Cobalt is a chemical element with symbol CoCobalt is the active center of coenzymes called cobalamins, the most common example of which is vitamin B_{12}. As such it is an essential trace dietary mineral for all animals

Cobalt is essential to all animals. It is a key constituent of cobalamin, also known as vitamin B_{12}, which is the primary biological reservoir of cobalt as an "ultra trace" element.

Although far less common than other metalloproteins (e.g. those of zinc and iron), cobaltoproteins are known aside from B_{12}. These proteins include methionine amino peptidase 2an enzyme that occurs in humans and other mammals which does not use the corrin ring of B_{12}, but binds cobalt directly. Another non-corrin cobalt enzyme is nitrile hydratase, an enzyme in bacteria that are able to metabolize nitriles.

Cobalt is required in small amounts for life and is the only metal found in vitamins (cobalt is the critical component of vitamin B_{12}.)

Cobalt is beneficial for humans because it is a part of vitamin B_{12}, which is essential for human health. Cobalt is used to treat anaemia with pregnant women, because it stimulates the production of red blood cells

4.5 Sulfur can damage the internal enzyme systems of animals. Sulphuric substances have the following effects on human health: - Neurological effects and behavioral changes- Disturbance of blood circulation- Heart damage- Effects on eyes and eyesight- Reproductive failure Damage to immune systems- Stomach and gastrointestinal disorder- Damage to liver and kidney functions- Disturbance of the hormonal metabolism-

4.6 Sodium- In humans, sodium is an essential nutrient that regulates blood volume, blood pressure, osmotic equilibrium and pH;

The renin-angiotensin system regulates the amount of fluids and sodium in the body. Reduction of blood pressure and sodium concentration in the kidney result in the production of renin, which in turn produces aldosterone and angiotensin, retaining sodium in the urine. Because of the increase in sodium concentration, the production of renin decreases, and the sodium concentration returns to normal Sodium is also important in neuron function and osmoregulation between cells and the extracellular fluid, their distribution mediated in all animals by Na^+/K^+-ATPase; hence, sodium is the most prominent cation in extracellular fluid.

In animals, sodium ions are used against potassium ions to build up charges on cell membranes

The consequent need of animals for sodium causes it to be classified as a dietary inorganic macro-mineral.Our body needs some sodium to work properly. It helps with the function of nerves and muscles. It also helps to keep the right balance of fluids in ourbody. Kidneys control how much sodium is in our body. If we have too much and our kidneys can't get rid it, sodium builds up in our blood. This can lead to high blood pressure. High blood pressure can lead to other health problems.Low blood sodium (hyponatremia) occurs atan abnormally low amount of sodium in blood due to severe vomiting or diarrhea.Having high levels of anti-diuretic hormone, which causes us to retain water

Hyponatremia (American English) or hyponatraemia (British English) is an electrolyte disturbance in which the sodium ion concentration in the plasma is lower than normal. Sodium is the dominant extracellular cation (positive ion) and cannot freely cross from the interstitial space into the cell, because charged sodium ions attract up to 25 water molecules around them, creating a large polarstructure that is too large to pass through the cell membrane. Its homeostasis (stability of concentration) inside the cell is vital to the normal function of any cell. In particular, sodium loss can lead to a state of volume depletion (loss of blood volume in the body), with volume depletion serving as a signal for the release of ADH (anti-diuretic hormone). As a result of ADH-stimulated water retention (too much water in the body), blood sodium becomes diluted and hyponatremia results.

The severity of symptoms depends on how fast and how severe the drop in blood salt level. A gradual drop, even to very low levels may be tolerated well if it occurs over several days or weeks because of neuronal adaptation. The presence of underlying neurological disease like a seizuredisorder or non-neurological metabolic abnormalities also affects the severity of neurologic symptoms.

4.7 Potassium A shortage of potassium in body fluids may cause a potentially fatal condition known as hypokalemia, typically resulting from vomiting, diarrhea, and/or increased diuresisDeficiency symptoms include muscle weakness, paralytic ileus, ECG abnormalities, decreased reflex response and in severe cases respiratory paralysis, alkalosis and cardiac arrhythmia.

Low potassium is associated with a risk of high blood pressure, heart disease, stroke, arthritis, cancer, digestive disorders, and infertility. For people with low potassium, doctors sometimes recommend improved diets -- or potassium supplements -- to prevent or treat some of these conditions.Potassium is associated with control the acid-base balance.

Having too much or too little potassium in the body can have very serious consequences

A low blood level of potassium is called hypokalemia. It can cause weak muscles, abnormal heart rhythms, and a slight rise in blood pressure. You may have hypokalemia if you have

Severe or prolonged vomiting and diarrhea, certain kidney or adrenal gland disorders cause hypokalemia.

Too much potassium in the blood is known as hyperkalemia. It may cause abnormal and dangerous heart rhythms.

Potassium is a mineral that the body needs to work normally. It helps nerves and muscles communicate. It also helps move nutrients into cells and waste products out of cells. A diet rich in potassium helps to offset some of sodium's harmful effects on blood pressure.

4.8 Phosphorus is essential for life. As phosphate, it is a component of DNA, RNA, ATP, and also the phospholipids that form all cell membranes

Inorganic phosphorus in the form of the phosphate $PO3{-}4$ is required for all known forms of life, playing a major role in biological molecules such as DNA and RNA where it forms part of the structural framework of these molecules. Living cells also use phosphate to transport cellular energy in the form of adenosine triphosphate (ATP). Nearly every cellular process that uses energy obtains it in the form of ATP. ATP is also important for phosphorylation, a key regulatory event in cells.

Living cells are defined by a membrane that separates it from its surroundings. Biological membranes are made from a phospholipids matrix and proteins, typically in the form of a bilayer. Phospholipids are derived from glycerol.

Phosphorus is an essential mineral that is required by every cell in the body for normal function. The majority of the phosphorus in the body is found as phosphate (PO_4).

Phosphorus is a major structural component of bone in the form of a calcium phosphate salt called hydroxyapatite. Phospholipids (e.g., phosphatidylcholine) are major structural components of cell membranes. All energy production and storage are dependent on phosphorylatedcompounds, such as adenosine triphosphate (ATP) and creatine phosphate.Nucleic acids (DNA and RNA), which are responsible for the storage and transmission of genetic information, are long chains of phosphate-containing molecules. A number of enzymes, hormones, and cell-signaling molecules depend on phosphorylation for their activation. Phosphorus also helps to maintain normal acid-base balance (pH) by acting as one of the body's most important buffers. Additionally, the phosphorus-containing molecule 2, 3-diphosphoglycerate (2, 3-DPG) binds to hemoglobin in red blood cells and affects oxygen delivery to the tissues of the body

Inadequate phosphorus intake results in abnormally low serum phosphate levels (hypophosphatemia). The effects of hypophosphatemia may include loss of appetite, anemia, muscle weakness, bone pain, rickets (in children), osteomalacia (in adults), increased susceptibility to infection, numbness andtingling of the extremities, and difficulty walking. Severe hypophosphatemia may result in death. Because phosphorus is so widespread in food, dietary phosphorus deficiency is usually seen only in cases of near-total starvation. Other individuals at risk of hypophosphatemia include alcoholics, diabetics recovering from an episode of diabetic ketoacidosis, and starving or anorexic patients on refeeding regimens that are high in calories but too low in phosphorus.

4.9 Magnesium is an alkaline earth metal. In human biology, magnesium is the eleventh-most-abundant element by mass in the human body. Its ions are essential to all livingcells, where they play a major role in manipulating important biological polyphosphate compounds like ATP, DNAand RNA. Hundreds of enzymes, thus, require magnesium ions to function.

Because of the important interaction between phosphate and magnesium ions, magnesium ions are essential to the basic nucleic acid chemistry of life and thus are essential to all cells of all known living organisms. Over 300 enzymes require the presence of magnesium ions for their catalytic action, including all enzymes utilizing or synthesizing ATP or those that useother nucleotides to synthesize DNA and RNA. ATP exists in cells normally as a chelate of ATP and a magnesium ion.

Plants have an additional use for magnesium in that chlorophylls are magnesium-centered porphyrins. Magnesium deficiency in plants causes late-season yellowing between leaf veins, especially in older leaves, and can be corrected by applying Epsom salts (which is rapidly leached) or else crushed dolomitic limestone to the soil.

Intracellular magnesium is correlated with intracellular potassium. Magnesium is absorbed in the gastrointestinal tract with more absorbed when status is lower. Magnesium competes with calcium in the human body in this way it actually keeps calcium in check. However, this can cause a calcium deficiency if calcium levels are already low. Low and high protein intake inhibit magnesium absorption and other factors such asphosphate, phytate and fat affect absorption

Magnesium is also required for the proper function of nerves, muscles and many other parts of the body. In the stomach, magnesium helps neutralize stomach acid and moves stools through the intestine.
Magnesium also plays a role in the active transport of calcium and potassium ions across cell membranes.

It helps to maintain normal nerve and muscle function, supports a healthy immune system, keeps the heart beat steady and helps bones remain strong. It also helps regulate blood glucose levels and aid in the production of energy and protein. There is ongoing research into the role of magnesium in preventing and managing disorders such as high blood pressure, heart disease, and diabetes.

4.10 Iron plays an important role in biology, forming complexes with molecular oxygen in hemoglobin and myoglobin; these two compounds are common oxygen transport proteins in vertebrates. Iron is also the metal used at the active site of many important redox enzymesdealing with cellular respiration and oxidation and reduction in plants and animals.

Iron-proteins are found in all living organisms, ranging from the evolutionarily primitive archaea to humans. The color of blood is due to the hemoglobin, an iron-containing protein.Iron is a necessary trace element found in nearly all living organisms. Iron-containing enzymes and proteins, often containing hemeprosthetic groups, participate in many biological oxidations and in transport. Examples of proteins found in higher organisms include hemoglobin, cytochrome and catalase

The human body stores some iron to replace any that is lost. However, low iron levels over a long period of time can lead to iron deficiency anemia. Symptoms include lack of energy, shortness of breath, headache, irritability, dizziness, or weight loss

4.11Copper is essential to all living organisms as a trace dietary mineral because it is a key constituent of the respiratory enzyme complexcytochrome coxidase. Copper works with iron to help the body form red blood cells. It also helps keep the blood vessels, nerves, immune system, and bones healthy. Lack of copper may lead to anemia and osteoporosis

4.12 ChromiumTrivalent chromium (Cr (III)) ion is possibly required in trace amounts for sugar and lipid metabolism, although the issue remains in debate. In larger amounts and in different forms, chromium can be toxic and carcinogenic.Chromium is a mineral that humans require in trace amounts, although its mechanism of action in the body is not well defined.

4.13 ManganeseIn biology, manganese (II) ions function as cofactors for a large variety of enzymes with many functions. Manganese enzymes are particularly essential in detoxification of superoxide free radicals in organisms that must deal with elemental oxygen. Manganese also functions in the oxygen-evolving complex of photosynthetic plants. The element is a required trace mineral for all known living organisms

Regulation of the body's metabolism is one of the vital functions of manganese. Manganese-activated enzymes help in the metabolism of cholesterol, amino acids, and carbohydrates. It is also important for the metabolism of Vitamins like Vitamin E and Vitamin B-1. Furthermore, it helps the liver properly function and run smoothly Manganese helps absorb vital vitamins like vitamin B and E and minerals like magnesium. This is due to the role of manganese in the enzymatic reactions that are required to absorb and utilize vitamins taken in from food. Manganese is one of the most versatile co-factors for enzymatic reactions and if there is a risk of having a deficiency in certain vitamins, then be sure to increase levels of manganese, as long as they are still within safe and non-toxic levels

4.14 Molybdenum is a necessary soil component for preventing the growth of cancer-producing agents, known as nitrosamines, in plant foods. An article published in "Cancer Research" in August 1980 noted that research conducted in the Taihang Mountain Range area in northern China concerning cancer-causing agents responsible for numerous cases of esophageal cancer determined that deficiencies of trace elements, such as molybdenum, in the soil play a possible role in the high incidence of cancer. It's thought that when there's a deficiency of molybdenum uptake in plants, nitrosamines are produced because nitrate reductase -- an enzyme -- can't perform properly without its molybdenum co-factor. Proponents claim molybdenum is an antioxidant that prevents cancer by protecting cells from free radicals, destructive molecules that may damage cells.

Copper, zinc, selenium, and molybdenum are involved in many biochemical processes supporting life. The most important of these processes are cellular respiration, cellular utilization of oxygen, DNA and RNA reproduction, maintenance of cell membrane integrity and sequestration of free radicals. Copper, zinc, and selenium are involved in destruction of free radicals through cascading enzyme systems. Superoxide radicals are reduced to hydrogen peroxide by superoxide dismutases in the presence of copper and zinc cofactors. Hydrogen peroxide is then reduced to water by the selenium-glutathione peroxidase couple. Efficient removal of these

superoxide free radicals maintains the integrity of membranes, reduces the risk of cancer, and slows the aging process.

The human diet requires both macronutrients (protein, fats & carbohydrates) and micronutrients (vitamins, minerals, etc,) to grow, develop and function. Of the micronutrients, there are ~40 essential vitamins, minerals and other bio-chemicals which are responsible for virtually all metabolic and developmental processes that take place in the body. This includes energy production, cell division, replication, the growth, maintenance and function of our brains, heart, immune system, lung, skin, bone, muscle, etc. So obviously if you are even marginally short on your overall daily needs for extended periods, some part of the body will get less than it's' need to function optimally. The body now must decide where the nutrients should go based on immediate rather than long-term needs. Human bodies have been programmed to favor short-term survival, including reproduction, over long-term health when there are shortages of essential nutrients. In other words, when there are less than optimal amounts of vitamins or minerals entering our bodies, they will be routed to the areas that are needed to keep us alive, such as energy production, blood formation, etc., at the expense of other areas of metabolism whose lack of optimal nutrition has only long-term consequences such as the age-related diseases. Since vitamins and minerals (micronutrients) are involved in all functions, it's not hard to understand that chronic insufficiencies are a primary cause of diseases and may be preventable or certainly lessened.

Micronutrients as opposed to macronutrients (protein, carbohydrates and fat) are comprised of vitamins and min erals which are required in small quantities to ensure normal metabolism and growth .No single food contains all of the vitamins and minerals we need and, therefore, a balanced and varied d iet is necessary for an adequate intake.

The interplay of micronutrients isn't always cooperative, however. For example, vitamin C blocks your body's ability to assimilate the essential mineral copper. And even a minor overload of the mineral manganese can worsen iron deficiency.

5Metabolism is the set of life-sustaining chemical transformations within the cells of living organisms. Inorganic elements play critical roles in metabolism; some are abundant (e.g. sodium and potassium) while others function at minute concentrations. About 99% of a mammal's mass is made up of the elements carbon, nitrogen, calcium, sodium,chlorine, potassium, hydrogen, phosphorus, oxygen and sulfur Orga nic compounds (proteins, lipids and carbohydrates) contain the majority of the carbon and nitrogen; most of the oxygen and hydrogen is present as water.

Transition metals are usually present as trace elements in organisms, with zinc and iron being most abundant of those.These metals are used in some proteins as cofactors and are essential for the activity of enzymes such as catalase and oxygen-carrier proteins such as hemoglobin.

There are multiple levels of metabolic regulation. In intrinsic regulation, the metabolic pathway self-regulates to respond to changes in the levels of substrates or products; for example, a decrease in the amount of product can increase the fluxthrough the pathway to compensate This type of regulation often involves allosteric regulation of the activities of multiple enzymes in the pathway. Extrinsic control involves a cell in a multicellular organism changing its metabolism in response to signals from other cells. These signals are usually in the form of soluble messengers such as hormones and growth factorsand are detected by specific receptors on the cell surface These signals are then transmitted inside the cell by second messenger systems that often involved the phosphorylation of proteins

Metabolism produces acidic products that lower the pH of the body fluids. For example, carbon dioxide is a by-product of metabolism, and carbon dioxide combines with water to form carbonic acid. Also, lactic acid is a product of anaerobic metabolism, protein metabolism produces phosphoric and sulfuric acids, and lipid metabolism produces fatty acids. These acidic substances must continuously be eliminated from the body to maintain pH homeostasis. Rapid elimination of acidic products of metabolism results in alkalosis, and the failure to eliminate acidic products of metabolism results in acidosis.

Ordinarily, chemical and physiological buffer systems maintain the hydrogen ion concentration of body fluids within very narrow pH ranges. Abnormal conditions may disturb the acid-base balance. For example, the pH of arterial blood is normally 7.35-7.45. A value below 7.35 produces acidosis. A pH above 7.45 produces alkalosis. Such shifts in the pH of body fluids may be life threatening. In fact, a person usually cannot survive if the pH drops to 6.8 or rises to 8.0 for more than a few hours.

Acidosis results from an accumulation of acids or a loss of bases, both of which cause abnormal increases in the hydrogen ion concentrations of body fluids. Conversely, alkalosis results from a loss of acids or an accumulation of bases accompanied by a decrease in hydrogen ion concentrations.

Acid-base disturbances cause potassium to shift into and out of cells, a phenomenon called "internal potassium balance". Metabolic acidosis is an abnormally low blood pH caused by overproduction of acids or failure of your kidneys to rid the body of acids normally. With metabolic acidosis, blood has an abnormally high level of positively charged hydrogen atoms, or hydrogen ions. To reduce the acidity of your blood, hydrogen ions move from your circulation into your cells in exchange for potassium. The exchange of hydrogen for

potassium ions helps relieve the severity of acidosis but may cause an abnormally high level of blood potassium, or hyperkalemia

Metabolic acidosis is a clinical disturbance characterized by an increase in plasma acidity.It is defined as an arterial blood pH <7.35 with plasma bicarbonate <22 mmol/L. Respiratory compensation occurs normally immediately, unless there is respiratory pathology. Pure metabolic acidosis is a term used to describe when there is not another primary acid-base derangement - i.e. there is not a mixed acid-base disorder. Compensation may be partial (very early in time course, limited by other acid-base derangements, or the acidosis exceeds the maximum compensation possible) or full.

So obviously if you are even marginally short on your overall daily needs for extended periods, some part of the body will get less than it needs to function optimally. The body now must decide where the nutrients should go based on immediate rather than long-term needs. Human bodies have been programmed to favor short-term survival, including reproduction, over long-term health when there are shortages of essential nutrients. Here due to prolonged acidosis and non replenishment of essential nutrients from dietary source leads to a significant acid-base disturbance.

Severe diarrhea can cause either a metabolic acidosis or a metabolic alkalosis. Development of a significant acid-base disturbance requires a significant increase in stool water loss above its normal value of 100 to 200 mls/day. The more fluid and anions lost, the more marked the problem.

The acid-base situation with severe diarrhoea can be complicated by other factors and it may not be possible to completely sort out all the factors in the acid-base disturbance in an individual case.

The body's natural protective defence system is put under a huge strain as these toxins build until eventually it is unable to cope. Therefore, in order to maintain the body's ability to self heal it must be regularly detoxified of all harmful chemicals, toxins and heavy metals

Free radicals are a natural by-product of the body turning food into energy (ATP). The body has mechanisms to deal with these free radicals, because they are highly dangerous left to their own devices. Excess free radicals are a problem because they attack the body itself, damaging key cellular molecules such as DNA. Cells with damaged DNA may be more prone to developing cancer

When cell membranes are attacked by free radicals they either become hardened so that nutrients cannot get into the cells, or they may be punctured so that the cell collapses as the cell fluid drains out. In cells it may damage the DNA causing cell division of cells that would normally be instructed to eliminate themselves which is what culture conditions vary widely for each cell type, and variation of conditions for a particular cell type can result in different phenotypes. Aside from temperature and gas mixture, the most commonly varied factor in culture systems is the cell growth medium. Recipes for growth media can vary in pH, glucose concentration, growth factors, and the presence of other nutrients.

III. Other technical issues

As cells generally continue to divide in culture; they generally grow to fill the available area or volume. This can generate several issues:

Nutrient depletion in the growth media

Changes in pH of the growth media

Accumulation of apoptotic/necrotic (dead) cells

Cell-to-cell contact can stimulate cell cycle arrest, causing cells to stop dividing, known as contact inhibition.

Cell-to-cell contact can stimulate cellular differentiation.

Genetic and epigenetic alterations with a natural selection of the altered cells potentially leading to overgrowth of abnormal, culture-adapted cells with decreased differentiation and increased proliferative capacity.

In genetics, a mutagen is a physical or chemical agent that changes the genetic material, usually DNA, of an organism and thus increases the frequency of mutations above the natural background level. As many mutations cause cancer, mutagens are therefore also likely to be carcinogens. Not all mutations are caused by mutagens: so-called "spontaneous mutations" occur due to spontaneous hydrolysis, errors in DNA replication, repair and recombinationInterestingly, DNA repair pathway genes are often mutated in cancers and other genetic disorders.

Base analog, which can substitute for DNA bases during replication and cause transition mutations.

Hydrolysis is related to energy metabolism and storage. All living cells require a continual supply of energy for two main purposes: for the biosynthesis of micro and macromolecules, and for the active transport of ions and molecules across cell membranes.

Chemo preventive drugs are still to gain a major breakthrough. Traditionally plants which were used as wound healers, bleeding treatment and blood related diseases have proven to be potential source of anti cancer agent. Turmeric, Periwinkle, Andrographis paniculata, Tenospora Purpurea, Curcuma Augustifolia and Saraca indica are few examples. Other potent source of anti cancer agent may be colostrums and certain fishes which are known for their healing qualities.

IV. Stress Hormones

Abscisic acid is considered stress hormone. ABA is an essential mediator in triggering plant responses to adverse environmental stimuli. This is known to occur in a number of crop plants which include rice, barley, soybean, tomato, cotton, and alfalfa. Leaf ABA content in wild plants increases with water stress.

Cellular stressors induce various outcomes including inhibition of cell proliferation and cell death. Sodium salicylate (SA), a plant stress hormone, can suppress the proliferation or cause apoptosis in certain mammalian cancer cells. Plant stress hormones are activators of cellular responses, including cell death, to diverse stress situations in plants. Thus, it is hypothesized that plant stress hormones share the ability to adversely affect cancer cells. It was found that the plant stress hormone SA suppressed proliferation of lymphoblastic leukemia, prostate, breast and melanoma human cancer cells. Jasmonic acid (JA), a plant stress hormone belonging to the Jasmonate family, induced death in lymphoblastic leukemia cells and caused suppression of cell proliferation in the other human cancer cells mentioned above. Another member of the Jasmonate family, methyl jasmonate (MJ), induced death in each of the cell lines. Plant stress hormones did not affect normal human lymphocytes, in contrast to their strong effect on lymphoblastic leukemia cells. These findings suggest that plant stress hormones may potentially be a novel class of anti-cancer drugs.

V. Conclusion

Micronutrients and hormones have vital role in cancer prevention. This includes energy production, cell division, replication, the growth, maintenance and function of immune system, lung, skin, brain, heart etc. So obviously, if one is even marginally short on once overall daily needs for extended periods, some part of the body will get less than it needs to function optimally. The body decides where the nutrients should go based on immediate rather than long-term needs. Human bodies have been programmed to favor short-term survival, including reproduction; over long-term health when there are shortages of essential nutrients Research has shown that areas with zinc-deficient soils are often regions with widespread zinc deficiency in human body.

With increase in population demand of food crops have increased many folds. High yielding variety crops, use of chemical fertilizers has put heavy drag on micronutrients (which are normally supplemented by nature only). 48% soil in India is deficient in Zn, 12% in Fe, 5% in Mn, 4% in Cu, 33% in B, 13%in Mo& 41% in S. Each essential element has a specific role in the metabolism as a co-factor in several enzymatic reactions or as a necessary constituent of important structural proteins that can't be partly or wholly replaced by any other element.Disintegration of humus has made it very difficult to be available to plants .Naturally its' availability to human being has been reduced. Lack of replenishmentof micro nutrients by natural sources leads to imbalance of micronutrients in human body which ultimately contributes to the cause of malignancy.

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