

Research Article

Evaluation of inorganic elements in herbal preparations by FAAS and FES

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ABSTRACT

In this study four inorganic elements i.e. sodium, potassium, calcium and magnesium were estimated in eleven locally available herbal preparations used as sex stimulants using Flame Atomic Absorption Spectrometry and Flame Emission Spectroscopy. Samples names were Ginseng, Nan-bao, Choe, Safoof-e-Mughallis (Powder), Imsaki (Jawahar) capsules, Zarjam (capsules), Shahi (capsules), Mumsik sultani (Jawahar) capsules, Laboob-e-Kabeer, Laboob Bard (Jawahar wala), Laboob Khas (Jawahar wala). Results indicate the presence of variable amounts of metals in these samples. Order of concentration of metals in different samples has been found to be Ca > Mg > K > Na. Shahi capsules exhibited highest amount of sodium (3100±1825 µg/g) and other three minerals were in higher quantities. Choe contained highest amount of calcium (54175±4898 µg/g) and magnesium (53223±3205 µg/g) while Mumsik showed highest quantity of potassium (12070±882 µg/g). Ginseng, Nan-bao and Zarjam contained moderate amounts of all minerals and Laboob Khas exhibited lowest amounts of calcium (922±338µg/g), magnesium (463±106 µg/g), potassium (2968±735 µg/g) and small quantity of sodium (476±246 µg/g). It is evident that these herbal preparations can replenish the deficiency of minerals but excessive use of such herbal preparations may cause health hazards.

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INTRODUCTION:

Many commonly used herbal medicines are toxic. The toxic effects of common herbal products have been reported (Stickel *et al*, 2003). Toxic effects of herbal medicines range from allergic reaction to cardiovascular, hepatic, renal, neurologic, and dermatologic (Perez and Holmes, 2005). Although ginseng is considered safe, the toxicity of ginseng has also been reported in the literature. In 1979, the term ginseng abuse syndrome was coined as a result of a study of 133 people who took ginseng for 1 month. Most subjects experienced central nervous system stimulation. The effect of ginseng

on mood seems to be dose-dependent. At a dose of less than 15 g/d, subjects experienced depersonalization and confusion. At a dose of more than 15 g/d, some subjects experienced depression. Fourteen patients experienced ginseng abuse syndrome, which is characterized by symptoms of hypertension, nervousness, sleeplessness, skin eruption, and morning diarrhoea (Klepser and Klepser., 1999).

Herbal medicines can alter physiology, and these changes can be reflected in abnormal test results. For example, kava-kava can cause drug-induced hepatitis, leading to unexpected high concentrations of liver enzymes. Use of toxic herbal products such as ma huang (an ephedra-containing herbal product), Chan Su, and comfrey may cause death. Other toxic effects of herbal medicines include cardiovascular, hematologic, neurotoxic effects, nephrotoxic effects,

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carcinogenic effects, and allergic reactions (Stickel *et al*, 2003).

Toxicity from excessive dietary intake of major minerals rarely occurs in healthy individuals. Kidneys that are functioning normal can regulate mineral concentrations in the body by excreting the excess amounts in urine. Toxic symptoms from excess intakes are more likely to appear with acute or chronic kidney failure. Sodium and chloride toxicity can develop due to low intake or excess loss of water (Dasgupta, 2007).

Calcium and magnesium are essential minerals for the maintenance of good health. Most people obtain enough magnesium by eating a balanced diet, and deficiency is rare. In contrast, calcium deficiency is more common. If you do not consume sufficient amounts of calcium through diet alone, your Physician may recommend a calcium supplement. Some calcium supplements contain calcium in combination with magnesium.

A deficiency of biologically available calcium and magnesium can cause the same symptoms as a calcium and/or magnesium deficiency. Certain herbs such as ginseng and eluthero are also somewhat stimulatory and can cause anxiety.

Calcium

Calcium is needed for strong bones and teeth and for healthy gums. It is also needed to maintain a normal heartbeat, for the transmission of nerve impulses and for the proper functioning of muscles. The recommended dose for a calcium supplement is 800 to 1,500 mg per day.

Magnesium

Magnesium intake from foods has no adverse effects, but a high intake from supplements cause toxicity. Risk of toxicity increases when kidney function is limited. The most serious complication of potassium or magnesium toxicity causes cardiac arrest. Normal dose of magnesium in males (19 - 30 years of age): 400 mg daily. Females 19 - 30 years of age: 310 mg daily.

Potassium

Potassium, a mineral, is important to the proper functions of kidney, heart and muscles. It is a major electrolyte involved in protein synthesis, fluid balance, muscle contraction, nerve transmission. It is used by the body for proper functioning of the muscles, nerves, digestive and circulation systems. It is particularly essential for the heart and is regulated by the kidneys. A potassium level greater than 5 meq/L is considered high. If left untreated hyperkalemia can have a 67 percent mortality rate.

Sodium

Principal electrolyte, acid-base balance, fluid retention and muscle contraction are involved in nerve impulse transmission.

Potassium works hand-in-hand with sodium. In fact they are both necessary to perform optimal cell and nerve functions within the body. Our bodies want to hold tight to what little potassium we have and in the process hold on to sodium, as well. The simplest way to release the excessive sodium is to consume much more potassium than sodium. Luckily potassium is readily available in foods such as bananas and potatoes. If consuming potassium-rich foods is not possible, take a potassium supplement.

The best way to restore your sodium balance is to flush excess sodium from the body and to use preventative measures to ensure you don't fall victim to water retention or worse, heart attack or stroke. The American Dietetic Association recommends that individuals should limit their sodium intake to 2,300 mg per day

MATERIALS AND METHODS

Chemicals

Nitric acid, Hydrogen peroxide, Hydrochloric acid, Sodium chloride, Potassium chloride, Calcium carbonate and Magnesium chloride. All chemicals were of Analytical Grades.

Preparation of sample

To a weighed quantity (0.25-1.0g) of sample, 10 ml

Table 1: Detail of samples studied

Brand name	Form	Manufacturer/Supplier	Aqua Regia or HNO ₃ & H ₂ O ₂
Ginseng	Capsule	Qarshi, Hattar, Pakistan	Aqua Regia
Nan-bao	Tablet	Harbal Healthcare Foods, Karachi	Aqua Regia
Choe	Tablet	Natural Lovers, Lahore	Aqua Regia
Safoof-e-Mughallis	Powder	Rehan Unani Dawakhana, Lahore	HNO ₃ & H ₂ O ₂
Imsaki (Jawahar)	Capsules	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂
Zarjam capsules	Capsules	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂
Shahi capsules	Capsules	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂
Mumsaki Sultani (Jawahar)	Capsules	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂
Laboo-e-kabeer	Semi-solid	Ashraf Laboratories, Faisalabad	HNO ₃ & H ₂ O ₂
Khas-ul-Khas	Semi-solid	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂
Laboobard (Jawahar wala)	Semi-solid	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂
Laboob-e-Khas (Jawahar wala)	Semi-solid	Qarshi Industries, Hattar	HNO ₃ & H ₂ O ₂

of aqua-regia or 8ml of mixture of nitric acid and hydrogen peroxide was mixed. The solution was refluxed for 30 minutes and then cooled down to room temperature. 20 ml of deionized water was added and this solution was filtered using Whatman No 42 filter paper and the final volume was made upto 50ml. Sample solution were stored in clean polyethylene bottles for metal analysis, selected formulation with their dosage form are shown in Table 1.

Atomic absorption and Flame emission spectrometric analysis

Atomic Absorption Spectrometrer (Hitachi-A-1800, Japan) was used with absorption and emission mode. Calcium, potassium and magnesium were determined using an absorption mode while sodium was estimated by flame emission mode.

Table 2: Instrumental conditions

Parameters	Na	K	Ca	Mg
Measurement mode	Emission	Absorbance	Absorbance	Absorbance
Wavelength (nm)	589.0	766.5	422.7	285.2
Slit (nm)	0.4	2.6	0.4	2.6
Calibration range (ppm)	1-10	1-5	1-10	0.5-2
Detection limit (mg/L)	0.001	0.03	0.89	0.003

RESULTS AND DISCUSSION

Results

Results indicate variable amounts of inorganic elements in studied herbal preparations. Order of concentration of these elements were found to be as Ca > Mg > K > Na values are shown in Table 2. When individually studied, sodium was found highest in shahi capsules followed by Laboobard, Nan-bao, Mumsik sultani and ginseng respectively. Potassium was found highest in Mumsik sultani followed by Zarjam capsules, Shahi capsules, Safoof-e-Mughallis, Imsaki (Jawahar) respectively. Calcium was found highest in Choe tablets followed by Shahi, Mumsik sultani, Zarjam, Ginseng capsules. Magnesium was highest in Choe tablets followed by Ginseng, Shahi, Mumsik sultani and Zarjam capsules respectively. Concentration of four inorganic elements are given in Table 3.

Table 3: All metal concentrations are expressed in $\mu\text{g/g} \pm \text{SD}$ of sample

Sr.No	Herbal Preparation	Na	K	Ca	Mg
1	Ginseng	672 \pm 125	6028 \pm 1271	3533 \pm 869	50107 \pm 6783
2	Nan-bao	1167 \pm 101	5926 \pm 448	1277 \pm 99	482 \pm 53
3	Choe	345 \pm 195	6207 \pm 806	54175\pm3898	53223\pm3205
4	Safoof-e-Mughallis	204 \pm 18	8389 \pm 311	3036 \pm 671	2251 \pm 96
5	Imsaki Jawahar	297 \pm 2(9)	6777 \pm 649	3043 \pm 230	2414 \pm 93
6	Zarjam capsules	469 \pm 102	9992 \pm 332	4957 \pm 586	3197 \pm 98
7	Shahi capsules	3100\pm1825	9376 \pm 1095	21493 \pm 2391	4541 \pm 52
8	Mumsik Sultani	737 \pm 87	12070\pm882	10145 \pm 2199	3931 \pm 77
9	Laboob-e-Kabeer	208 \pm 61	4313 \pm 2798	1394 \pm 719	582 \pm 485
10	Laboob bard	1432 \pm 726	4016 \pm 1026	1627 \pm 377	2174 \pm 1082
11	Laboob Khas	476 \pm 246	2968 \pm 735	922 \pm 338	463 \pm 106

Table 4: Concentration of various chemical components in extracellular and intracellular fluids

Chemical Components	Concentration in Extracellular Fluid (ECF)	Concentration in Intracellular Fluid (ICF)
Sodium mmolL^{-1}	140	10
Potassium mmolL^{-1}	4	140
Magnesium mmolL^{-1}	2	30
Calcium mmolL^{-1}	2.5	0.1
PO_4^{3-} mmolL^{-1}	2	60
HCO_3^{-1} mmolL^{-1}	27	10
Glucose mg/dl	5.5	0-1
Protein g/dl	2	30

DISCUSSION

It has been studied that internal environment (ICF) of cell is rich in K and Mg while phosphate is major ion. Extracellular fluid (ECF) is characterized by high Na, Ca while Cl is major anion. Concentration of glucose is high in ECF while protein is high in ICF. Other are given in

Table 4. It is thought that primordial sea in which life originated was rich in K and Mg. It therefore

follows that enzymatic reactions and other biological processes evolved to function best in that environment. Hence higher concentrations of these ions were developed within cells.

Cells were faced with strong selection pressure on the sea gradually changed to a composition rich in Na and Ca. Vast changes would have required for evolution of completely new set of biochemical and physiological machinery instead as it happened cells developed barriers called "membranes". Membranes with associated "pumps" such as Na-K-ATPase to maintain internal environment. Other members are Ca-ATPase of sarcoplasmic reticulum. In addition ligand or voltage-gated ion channels are often employed to move charged molecules (Na, K, Ca etc.) across membranes.

Hypercalcemia

Adverse effects from excess calcium have been reported only with consumption of large quantities of supplements. Excessive amounts of calcium supplements, particularly calcium

carbonate, can lead to chromium deficiency. Taking large amounts of calcium supplements can also cause constipation (this can be alleviated with concurrent supplementation of magnesium).

Hypercalcemia is a condition marked by elevated calcium levels in the blood. Signs of hypercalcemia may include numbness or tingling in the fingers, convulsions, nausea, vomiting, mental/mood changes, headache, weakness, constipation, muscle cramps, an abnormal heart rhythm, lethargy, poor appetite, persistent thirst and fatigue. Severe cases may cause kidney failure. There are no documented cases of hypercalcemia from dietary intake of calcium, and the condition seems to occur only in response to the high levels of calcium in supplements.

Magnesium Overdose

A magnesium overdose, also called magnesium toxicity or hypermagnesemia. Magnesium overdose has not been observed from dietary sources but supplemental magnesium (a pill or a liquid) may cause this serious side effect. An early sign of magnesium toxicity is diarrhoea. As the condition progresses, other symptoms may include changes in mental state, confusion or loss of consciousness for even a brief moment, nausea, poor appetite, severe abdominal, pelvic, or lower back pain, chest pain or pressure, weakness, difficulty breathing, abdominal cramping, low blood pressure and heart arrhythmias. Seek emergency medical attention if you suspect a magnesium overdose.

Potassium overdose

Common side effects of excessive intake of potassium supplements include diarrhoea and nausea. Other side effects are muscle weakness, confusion, tingling sensation in the limbs, low blood pressure, irregular heartbeat, weakness, coma and abnormal heart rhythm. High potassium levels can cause irregular and dangerous heartbeats, possible vomiting and sometimes death.

Accumulation of excess potassium in plasma may result increase in urine production, excreting sodium but not potassium), insufficient aldosterone secretion (a hormone that acts on the kidney to decrease sodium secretion and increase potassium secretion), or tissue damage (e.g., from severe burns).

Basic Symptoms of sodium overdose

Too much salt intake is characterized by several symptoms. Basic signs may be mistaken as common respiratory ailments such as flu. You may experience abdominal pain, coughing, diarrhoea, shortness of breath and vomiting. This may also be accompanied by high fever. Other symptoms that are not common are shock seizures and metallic taste.

Increased Blood Volume and Pressure

Salt overdose is characterized by severe headaches, which could be mistaken as migraine because of high fluid retention. You may experience an increase in blood pressure, which should be addressed by a doctor immediately. If the kidney fails to get rid of the excessive salt coming from the food you eat, there will be internal sodium build up, which can lead to chronic heart and kidney problems.

Early symptoms of sodium salt overdose can also be painful in the throat because of dryness. You will feel thirsty most of the time due to increased iodine, which is a main component of salt. Often, these symptoms are mistaken to be just a simple sore throat, but you need to take it seriously because it may lead to serious ailments. Excessive presence of iodine in the system can lead to thyroid enlargement and may even develop into hyperthyroidism or thyroid papillary cancer.

Sodium helps to regulate body fluids. In addition, it also maintains a balanced acid-base level. Excessive salt intake disrupts the normal fluid concentration in the body, affecting the circulatory system. It also increases water in the veins, capillaries and arteries of the heart,

including other internal organs such as kidney and pituitary glands. Some of the early symptoms of increased body fluid are chest pain and breathing difficulty because of improper nerve and cell conduction. If not immediately treated, this can lead to heart failure.

Steroid Hormones (Adrenal gland) and Sex

Adrenal hormones are related with

- 1) Fluid and electrolyte metabolism
- 2) Renal function
- 3) Carbohydrate and protein metabolism
- 4) Resistance to stress
- 5) Control of blood pressure
- 6) Muscle response

Evaluating activity of steroid to maintain life is

- 1) Recovery of muscle fatigue
- 2) K, Na and Cl retention
- 3) Work performance
- 4) Glycogen deposition activity
- 5) Diabetogenic activity

Two classes of steroid hormones are synthesized in cortex of adrenal gland:

- 1) Mineralocorticoids (Aldosterone)-which control reabsorption of inorganic ions (Na, Cl HCO_3) by kidney.
- 2) Glucocorticoids (Cortisol)-help to regulate gluconeogenesis and reduce inflammatory response. Sex hormones are produced in male and female gonads and placenta.

Glucocorticoids, mineralocorticoids, androgens (Testosterone) and estrogens (estradiol) affect sexual development, sexual behaviour and variety of other reproductive and non-reproductive systems.

All steroid hormones act through nuclear receptors to change level of expression of specific

genes. Recent evidence indicates that they also have rapid effects mediated by receptors localized in plasma membrane.

It is difficult to assign specific role to many corticoids and it is likely that this role as a "Conditioner" of cellular and tissue response to stress in their function.

Relation of these sex hormones of adrenal to normal sex function has not been completely understood but since tumors of male adrenal may have profound feminizing effects and certain tumors of female have masculinization. Since it is possible that adrenal may play a role in normal sex function such as that cortical substances do not modify agent but tissue response to agents.

Possible mechanism of corticoids in sex

Plasma β -globulin that binds testosterone with specificity, relatively high affinity and limited capacity called Sex-hormone binding globulin (SHBG) and corticosteroid-binding globulin (CBG). Their affinities with steroid hormones are given in Table 5.

CBG binds most of hormone when plasma cortisol level are within normal range. Cortisol binds tightly with CBG and half life is 1.5-2 hours while corticosterone bind loosely and half life is <math><1.0</math> hour. Unbound cortisol constitutes 8% of total and represents biologically active fraction.

Table 5. Affinity expressed as K_d (nmol/L)

Hormone	SHBG	CBG
Testosterone	2	>100
Estradiol	5	>10
Progesterone	>100	~2
Cortisol	>100	~3
Corticosterone	>100	~5

Impotence, Low libido and sexual dysfunction

Sexual dysfunctions are extremely common today, and usually are the result of biochemical imbalances.

CAUSES FOR LOW LIBIDO

The most common cause of reduced sexual desire in both men and women, is low energy production and in particular women, is an overall lowered energy level. Sex is not a necessary function, and if the body's energy level decreases, often one will have less interest in sex. This shows up on hair mineral analysis (Calcium shell pattern) often as a sluggish oxidation rate (This means that the thyroid and adrenal glands are underactive, Most often, the levels of male and female sex hormones are also low, in part as a result, a low sodium/potassium ratio, the presence to excessive toxic metals or other indicators of lowered energy production in the body cells.

Slow oxidation and sexual desire

The body's energy level is always reduced, at least to some degree and often to an enormous degree. The person is more prone to general fatigue, apathy, and symptoms such as vaginal dryness that can cause pain or discomfort with intercourse. In many cases, there is a tendency for depression and some psychological withdrawal, as well.

Remedy of this phenomenon

Most often, low libido goes away quickly on a nutritional balancing program (including minerals). Hormone levels begin to normalize, the body's energy level increases, often drastically, and if a calcium shell pattern was present, it will often begin to go away within a few months to no more than 1 year. Thus, in most cases, low libido is easy to correct without drugs or hormones using these program.

One should not be tempted to take hormone replacement therapy for this problem. It corrects itself, often rapidly, using nutritional balancing

science without the need for hormones. Even natural or bio-identical hormone therapy is often extremely harmful in subtle ways.

Americans consume around between 2,500 and 7,500 mg of sodium per day. With those statistics, it is no wonder sickness is rampant across the nation. Read food labels and limit sodium intake by eating more fruits and vegetables and less packaged, canned and processed foods, as they are usually high in sodium.

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