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Study of Major and Trace elemental Concentration of Some Commonly used Indigenous Medicinal Plants of Illu Aba Bor, South West Ethiopia

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Abstract

Kota Hare, Burii and Godere has exhibited many therapeutic activities. Trace elements are required by human body and any deviation from its optimal limits affects the general well-being of any individual. They may be responsible for therapeutic activity attributed to medicinal plants. In the present paper work has been carried out to determine the elemental profile of those plants. Analysis was carried out for individual plant part Roots of *Kota Hare, Burii and Godere*. Elements were analyzed by High purity Germanium detector. The elements analyzed were Copper, Iron, Zinc, Potassium, Magnesium, Manganese, Aluminum, Boron and Calcium. The analysis has shown that the metal content of the plants are less than prescribed permissible limits. The elemental concentration of different types of medicinal plants and their biological effects on human beings are discussed. The obtained data will be helpful for making medicinal formulation and deciding dosage of the medicine made from those plants.

INTRODUCTION

Medicinal plants are plants, either growing wild or cultivated and used for medicinal purposes. Traditional medicines includes herbal medicines composed of herbs, herbal materials, herbal preparations, and finished herbal products, that contain as active ingredients parts of plants, or other plant materials, or combinations of all. Traditional medicines may also use animal parts and/or minerals [1]. Medicinal plants play an important role in traditional medicine and are widely consumed as home remedies. Recent study by the World Health Organization (WHO) has shown that about 80 - 85% of the world‟s population still relies on traditional medicine for their primary healthcare needs. Thus it can safely be presumed that a major part of traditional therapy involves the use of plant extracts or their active principles [2,3]. The past decade has seen a significant increase in the use of herbal medicine due to their minimal side effects, availability and acceptability to the majority of the populace especially in third world countries. Consumption of these plants contributes to the intake of minerals -essential and non-essential by the people including infants and the elderly [2]. Many metabolic disorders resulting in human ailments have experimentally been shown to be managed by traditionally used medicinal plants. Among the factors attributing to the healing potential of these medicinal plants, are the trace elements present in them. The study of such elements with respect to traditional medicinal plants reveal that major and trace elements have significant roles in combating a variety of human ailments and diseases [3]. Therefore, scientific studies of medicinal plants are required to test their potentials and characterize the medicinal properties. Moreover, medicinal plants contain several bio-chemical substances that produce definite physiological actions in the metabolism of the human body. Inorganic elemental levels present in medicinal plants are of great importance due to their pharmacological actions [2]. Quantification of essential and toxic inorganic elements is an important task in determining the effectiveness of the medicinal plants in treating certain diseases [2,4].

Ethiopian medicinal plant

Ethiopia is endowed with a diverse biological resources including about 6, 500 species of higher plants, with approximately 12% endemic, hence making it one of the six plant biodiversity rich regions [3]. The diversity is also considerable in the lower plants but exact estimate of these have to be made. The genetic diversity contained in the various biotic make up is also high thus making the country a critical diversity hot spot for plants [5]. Of these, more than 62.5% of the forest area is found in southwest region of Ethiopia where most of the medicinal plants are confined and have been used as a source of traditional medicine to treat different human and livestock ailments. Experts agree that this definition applies to the practice of traditional medicine in Ethiopia and common with its implementation in many other regions of the developing world.

Most Ethiopian traditional medicinal knowledge is kept in strict secrecy; however, it is dynamic in that the practitioners make every effort to widen their scope by reciprocal exchange of limited information with each other or through reading the traditional pharmacopeias. There are three treatment features of Ethiopian traditional medicines i.e. curative, prophylactic and preventive. Sometimes, the treatment could have a curative as well as a prophylactic effect and it is occasionally claimed that the prophylaxis could even be genetically fixed and can protect the offspring. Preventive remedies are usually prepared as ornamental, to be borne by the patients against evil spirits or psychosomatic disorders. Other therapies of preventive nature are employed against snake bites, intestinal worms, and miscarriages. Regulatory drugs are also commonly used to correct the time and the amount of flow of the menstruation cycle of women. Rejuvinative and restorative remedies are also employed to counter the effect of aging, and to overcome impotence, malnutrition, infertility etc. Traditional medicine is an integral part of the local culture and is a major public health system; what we call modern medicine is an offshoot of traditional medicine [5]. Up to 80% of the Ethiopian population has been reported to rely on traditional medicine as a major provider of health care [2,3]. Of the different forms of specialized areas, herbal therapy appears to play a prominent role in Ethiopian traditional medicine. Ethiopia is considered the home of some of the most diverse plant species in Africa that serve as sources of many traditional medicinal plants [6].

Different studies show that the use of plants as sources of both preventive and curative traditional medicine preparations for human beings and livestock was dated beyond recorded history perhaps as old as the history of mankind. Historical accounts confirm that traditional medicinal plants were in use as early as 5000 to 4000 B.C. in China, and 1600 B.C. by Syrians, Babylonians, Hebrews and Egyptians. Considerable indigenous knowledge, from the earliest times, is linked to the use of traditional medicine in different countries.

Plants in general and medicinal plants can easily be contaminated by metals in the course of cultivation or later during the processing stage and therefore determining the content of the metals accumulated is of high importance. The human body requires both the metallic and the non-metallic elements within certain permissible limits for growth and good health. Therefore, the determination of element compositions in food and related products is essential for understanding their nutritive importance [8]. On other hand, the presence of some heavy metals in large quantities in the body may have a toxic effect [8-10], concentration of essential and non- essential heavy metals in medicinal plants beyond permissible limit is a matter of great concern to public safety all over the world [11]. The problem is rather more series in Ethiopia, because in medicinal products used by the society are neither controlled nor properly regulated by quality assurance parameters. World Health Organization recommends that medicinal plants which form the raw materials for the finished products may be checked for the presence of heavy metals, further it regulates maximum permissible limits of toxic metals like arsenic, cadmium and lead, which amount to 1.0, 0.3 and 10 ppm, respectively [12]. Thus, many scholars in the world have been studied on different analytical techniques with different objectives but in the current study we are going to focused few literature reviews related to nuclear analytical techniques.

C.I. Yamashita et al., studied on "Characterization of trace elements in Casearia medicinal plant by neutron activation analysis" Leaves of Casearia sylvestris, Casearia decandra and Casearia obliqua plant species, collected at the Atlantic Forest in Brazil, were analyzed by using instrumental neutron activation analysis (INAA). Short and long irradiations using thermal neutron flux of the IEA-R1 nuclear reactor were carried out for these analyses. Concentrations of Ca, K and Mg were found in these samples at the percentage levels, Br, Cl, Fe, Mn, Na, Rb and Zn at the mg/g levels and Co, Cr, Cs, La, and Sc at the mg/kg levels. Comparisons were made among the element concentrations obtained in these three Casearia species and significant differences were found for the elements Cl, Co, Cs, Cr, La, Mn, Na and Sc. The precision and the accuracy of the results were evaluated by analyzing the certified reference materials NIST-1515 Apple Leaves and NIST-1573a Tomato Leaves [13].

S. Bhuloka Reddy et al., studied on "Estimation of trace elements in some anti-diabetic medicinal plants using PIXE technique" Trace elemental analysis was carried out in various parts of some anti-diabetic medicinal plants using PIXE technique. A 3MeV proton beam was used to excite the samples. The elements Cl, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Zn, Br, Rb and Sr were identified and their concentrations were estimated. The results of the this study provide justification for the usage of these medicinal plants in the treatment of diabetes mellitus (DM) since they are found to contain appreciable amounts of the elements K, Ca, Cr, Mn, Cu, and Zn, which are responsible for potentiating insulin action. Our results show that the analyzed medicinal plants can be considered as potential sources for providing a reasonable amount of the required elements other than diet to the patients of DM. Moreover, these results can be used to set new standards for prescribing the dosage of the herbal drugs prepared from these plant materials [14].

K. Nomita Devi et al., studied on „Estimation of essential and trace elements in some medicinal plants by PIXE and PIGE techniques" in some commonly used medicinal plants of north east India. The researchers was found Light elements such as Na, Mg, Al and P are determined by PIGE while medium Z elements such as K, Ca, Mn, Fe, Cu, Zn, Rb and Sr are determined by PIXE. Analysis is performed on pellets (thick targets) prepared using powders of the specimens which, in turn, are obtained following a series of processing steps. Plant based biological certified reference materials (CRMs) served as standards for quantification. These elements are found to be present in varying concentrations in the studied plants, with the contents of Mn and Zn being notably large in certain specimens. Medicinal properties possessed by these plants have been correlated with their elemental distribution [15].

Donatella Desideri et al., studied on "Determination of essential and non-essential elements in some medicinal plants by polarized X ray fluorescence spectrometer (EDPXRF)" Polarised X ray fluorescence spectrometer (EDPXRF) is employed for the determination of essential and nonessential elements in the parts (leaves, fruits, seeds, roots, flowers, barks, berries, and thallus) of thirty-five medicinal plants used in Italy generally as remedies. The quality of data was assured by calibrating the instrument with certified reference materials. The elements are found to be present in different plants in various proportions depending on soil composition and the climate in which the plant grows [16].

Md. Lokman Hossen et al., studied on "Pixe for Elemental Analysis of Domestic Medicinal Plants in Bangladesh" The medicinal plants are a source of biologically important elements which are necessary both for animals and plants. From this investigates the concentration of elemental constituents of seven selected medicinally important plants of Bangladesh, namely Terminalia bellirica, Centella asiatica, Pleurotus ostreatus, Curcuma longa, Bombax ceiba and Trigonella foenum-graecum. Appropriately desiccated samples (pellets) of these medicinal plants were bombarded with accelerated proton beam with the help of 3 MV Van de Graff accelerators at accelerator Facilities Division, Atomic Energy Center, Dhaka. The results of this studies has Eleven different elements- P, S, K, Ca, Sc, Ti, V, Mn, Fe, Cd and I were detected by collecting the harvested X- rays with [Si(Li)] detector. Data collection and analysis were performed using Maestro-32 and GUPIX software [17].

Alemayehu Hailemariam et al., studied on "Determination of Levels of Some Metals in Selected Traditional Medicinal Plants in Wolaita Zone, Southern Ethiopia" The purpose of the current study was to determine the concentration of selected essential and nonessential metals; Na, Ca, Cu, Fe, Zn, Mn, Cr, Ni, Cd, and Pb in traditional medicinal plants; Artemisia afra (ariti), Hagenia abyssinica (kosso enchet), Foenic kebericho (qeberecho) grown in Wolaita Zone, southern Ethiopia. A wet digestion procedure involving the use of mixtures of (69-72%) HNO3 and (70%) HClO4 at an optimum temperature and time duration were used to isolate metal from the medicinal plants by using FAAS. Based on the results, the concentration of Ca ranged from 1.75 mg/kg to 4.98 mg/kg, the concentration of Mg ranged from 1.35 mg/kg to 2.22 mg/kg, the concentration of Na ranged from 1.29 mg/kg to1.80mg/kg, Mn ranged from 0.09mg/kg to 1.21 mg/kg and that of Fe lied in range of 0.23 mg/kg to 0.78 mg/kg in the plants studied. Among the toxic heavy metals, the concentration of Pb was in the least range (0.08 mg/kg to 0.11 mg/kg) and the levels of remaining trace metal 0.54-0.97 mg/kg, 0.25- 0.29 mg/kg and 0.20-0.33 in Zn, Cd and Cu respectively [18].

Finally The aims of this study is determining the level of the essential, non-essential and toxic elements that can be accumulated in the stated plant species which were grown in different localities of Ilu babor zone in order to ensure individuals health status. Furthermore, the result of this study may help to propose the maximum dosage of the plant for normal body function in terms of trace metal content. Based on this finding the local expertise will try to manage the normal dosage by integrating their experience with the optimum quantity whichis going to be reported by this study.

Importance of Elements in Human Body

More than 40 elements have been considered essential to life systems for the survival of both mammals and plants. An element is considered essential when reduction of its exposure below a certain limit results consistently in a reduction in a physiologically important function, or when the element is an integral part of an organic structure performing a vital function in that organism. Two main criteria are considered when elements are said to be essential. The first one is absence from diet results in departures from normal growth and metabolism, and development of pathological symptoms, while the second dist heat pathological symptoms can be relieved by replacing the element. To be pharmacologically effective or essential, the trace element may need to be combining or cheated with some ligand, in order to be physiologically absorbed to prevent or cure impairment caused by deficiency of the element [7].

Objective of the study

The aim of this study is determination of elemental concentration in some commonly used indigenous medicinal plants of sample which growing in ILU ABA BOR zone using High purity Germanium detector.

METHODOLOGY

Ethiopia is considered the home of some of the most diverse plant species in Africa that serve as sources of many traditional medicinal plants [1]. Traditional medicine is an integral part of the local culture and is a major public health system; what we call modern medicine is an offshoot of traditional medicine [2], Up to 80% of the Ethiopian population has been reported to rely on traditional medicine as a major provider of health care [3,4]. Of the different forms of specialized areas, herbal therapy appears to play a prominent role in Ethiopian traditional medicine. In the present study, High purity Germanium detector was employed for the determination of elemental concentration in Medicinal plant Samples, such as Kota-Harea, Burri and Godere sample and Soil samples analysis. In the context of huge amounts of natural resource founds, Of these, more than 62.5% of the forest area is found in southwest region of Ethiopia where most of the medicinal plants are confined and have been used as a source of traditional medicine to treat different human and livestock ailments [2].

Sample Collection and Preparation

There are several species of medicinal plants in different parts of ILLU ABABORA. In the present study, there are three medicinal plants and its soil samples had been collected from three study areas. Some of the medicinal plants are namely Kota-Harea, Burri and Godere sample and Soil samples. These all-medicinal plants, name given by the farmers and local doctors.

The medicinal plants samples were purchased from the local markets and harvested from the trees.

Description of the Study area

Metu is a market town and separated woreda in south-western Ethiopia. Located in the Illubabor Zone of the Oromia Region (or kilil) along the Sor River, this town has a latitude and longitude of 8°18′N 35°35′E and an altitude of 1605 meters. Metu has been an important market of the coffee trade, with several foreigners residing in the town as early as the 1930s to buy the crops from local farmers. Distance from Addis Abeba to Metu 541.5 km. the annual rainfall 1800ml, temperature 20 and altitude 1600m-1710m and its soil type loamy. There are two distinct agro-ecological zones; 17% kola (lowland) and 83% Weyenadega (middle land) [5].

Yayu is one of the woredas in the Oromia Region of Ethiopia. Part of the Illubabor Zone, Yayu is bordered on the south by the Southern Nationalities and Peoples Region, on the west by Metu, on the north by Supena Sodo, on the east by Chora, and on the southeast by the Jimma Zone. Towns in Yayu include Elemo and Yayu. Doreni and Hurumu woredas were part of Yayu woreda.

Coffee is an important cash crop in Yayu; over 50 square kilometers are planted with this crop. The largest share of the proposed Yayu Biosphere Reservation, a project of the Ethiopian Coffee Forest Forum, lies in this woreda. Latitude: 8° 09’ 60.00” N Longitude: 36° 00’ 0.00” E. the annual rainfall 1960.7ml, temperature 29 and altitude 1200m-2580m and its soil types Clay loamy(75%), Sandy loam(10%) and Clay soil (15%). There are three distinct agro ecological zones; 9.62% Lowland, 46.76% Middle land and 43.62% Highland [6].

Becho is one of the woredas in Illubabor zone coffee growing areas the major production systems are forest coffee, semi-forest coffee and plantation coffee. The annual rainfall 1400-2200 ml, temperature 12 – 27°C and altitude 1970-2200 m and its soil type Red. There are two distinct agro-ecological zones; 73% Midle land and 27% Highland.

Good sample preparation is by far the most important step in any analytical technique. Whatever samples you‟re working with–loose or pressed powders, fused beads, solid or liquid samples. How well the sample is prepared and presented will affect the ability to yield accurate data from the instrument.

Preparation of medicinal plants and soil samples

The medicinal plant samples and its soil samples were collected from three different parts of Illu Babor zone. First of all in a laboratory the collected medicinal plants were removed the outer layers of the samples (Pulp, Skin and Mucilage) and the soil samples were cleaned from stones, a piece of roots and sediments by using stainless steel forceps and next the removed outer layer can be washed with tap water and followed by de-ionized water to decrease contamination. Later both samples can be dried in ovens at temperatures within 60-103°C in order to avoid water contents.

Grinding is an effective way of eliminating large and/or inconsistent grain sizes to produce homogeneous samples from loose powders. Grinding can minimize scatter affects due to particle size. Additionally, grinding insures that the measurement is more representative of the entire sample, vs. the surface of the sample. Pressing (hydraulically or manually) compacts more of the sample into the analysis area, and ensures uniform density and better reproducibility. The powders can also be pressed into pellets, either hydraulically or manually. With pressing, compacts more of the sample into the analysis area and ensures uniform density and better reproducibility. In the present study, I had been grinded three types of medicinal samples and its soils. All these samples were powdered; homogenized using a mortar and pestle [7].

Having all the samples properly powdered; homogenized using a mortar and pestle were weighed should be takes place in order to prepare pellet. In this investigation 200mg of each powdered sample weighed and Triplicates of each sample were done.

The preferred method for analyzing powders or samples that are usually ground to a powder to make them more homogeneous is the hydraulic pressed pellet. Several manufacturers make hydraulic presses that are capable of pressures ranging from 10 to 50 tons or more but in this study I were used 100kg/cm^2 to 150 kg/cm^2 . The press uses a die set to contain and form the sample during pressing. There are a few types of indie sets and a lot of variations to the methods incorporating a lot of individual creativity, but one basic outline follows. The samples is first dried and ground to a fine consistency, 400 meshes or better is recommended. In some other materials the samples blended with binder that help hold the pellet together although in this study don‟t require it. To prepare the press, the die set must first be cleaned with methanol or other solvent. A specific weight of sample is then poured into the **s**et, i.e 200 mg. It is important to keep the mass constant because the sample may not be infinitely thick at high x-ray energies. Next a polished pellet is placed over the sample to produce a smooth finish. The plunger goes in after that, and then the die set is positioned in the press. Follow the press instructions for pressing the sample to 100kg/cm^2 to 150 kg/cm^2, and holding it for a period of time usually from 30-60 seconds. Different materials produce better pellets at different pressures, so finding the best pressure may require some experimentation. Once the best pressure is determined however all samples of that type must be compacted to the same pressure and hold time to achieve optimal analytical results. The pellet is then removed from the die set, taking care not to crack in the process. The pellet is then removed from the die set, taking care not to crack it in the process. The finished pellet is uniform in composition, density, and mass per unit area, and has a smooth finish. Compressed using a 150 ton hydraulic press for medicinal plants but 100 ton for soil and both made into pellets of 13mm diameter and 1- 2mm thickness. Triplicates of each sample were done [7].

Validation of the Present High Detector with the standard Reference Materials

Standards or reference materials contain elements with known concentration for comparison with the elements of unknown concentration related to the present sample for analysis of experimental results. These are useful to calibrate analytical instruments too. The accuracy of an analytical instrument or measurements made by it indicates how best the obtained result exhibit nearer to the exact or true value of the specimen(s). Accuracy determination of a measurement usually requires calibration of the analytical instrument with a known standard or reference material. This is often carried out with the standards that have elements of known concentrations to make a calibration or working curve.

1. Standards (such as certified reference materials) are required for Quantitative Analysis.
2. Concentrations of the elements present in the reference material should be known to a better degree of precision and higher accuracy is required for the analysis.
3. Standards must belong to the same matrix to which samples to be analyzed same category [1].

Internationally certified Standard Reference Material (SRM) related to a plant is an important tool for the quality control process. This material has known concentrations of the elements that concerned to the present investigation; therefore, it is used to test the reliability.

As tabulated in Table 1 the standard deviation of the measured values are mostly with in ± 5-10 %, which may represent a good agreement between the measured and certified values.

Plots drawn between certified elemental concentrations against experimentally obtained elemental concentrations for SRM-1515 and CTA-OTL-1 is shown in Figure 1 and 2 respectively. The slope of the curves related to apple leaves is 1.005 and for Tobacco leaves 0.941. The average value of the two slopes were calculated and found to be 0.973; which taken as a corrections‟ factor R^2 as a statistical parameter that gives information about the fitness of the model.

The observed deviation of measured values from the certified values of the elements related to both the reference materials varied based on the quality of certified materials and uncertainty of the element present in the sample.

Figure 3 and 4 shows the ratio of the certified values of elemental concentrations over Experimental concentrations as a function of atomic number Z of the elements for Apple and Tobacco Leaves respectively. The plots of the two reference materials followed the same trend and their ratios are comparable with less than 10% difference. The error bars represent the error of the resulting ratio, which is the root mean square combination of certified uncertainties of the elements in the standard and the uncertainty in the experimental values.

Table 1: Concentrations of elements obtained from NIST (SRM 1515) Apple leaves and Tobacco leaves (CTA-OTL-1) with the present experimental set-up. (*Italic (percent), normal text (ppm))

Elements	NIST (SRM1515)		(CTA-OTL-1)	
	Certified value[5]	Measured values	Certified value	Measured values
P	15900.00	15278.01	2892 ±134	4723.83
S	18000.00	18780.64	*0.732±0.081**	*0.684 **
K	16100.00	15878.04	*1.56±0.05**	*1.36 **
Ca	15260.00	15581.52	*3.17±0.12 **	*3.038 **
Mn	54.00	47.98	412±14	421.12
Fe	83.00	71.70	989	1000.34
Cu	5.64	7.08	14.1±0.5	12.57
Zn	12.5	14.5	49.9±2.4	46.69
Se	0.05	0.11	0.153±0.018	0.11
Br	1.80	4.26	9.28±1.06	11.78
Rb	10.20	9.85	9.79±1.27	10.61
Sr	25.00	29.29	201±20	205.27

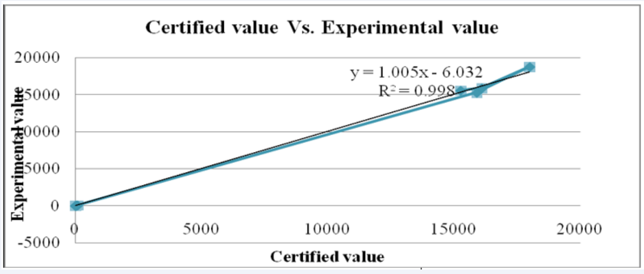

Figure 1 Certified values against the experimental values of Apple Leaves (SRM 1515).

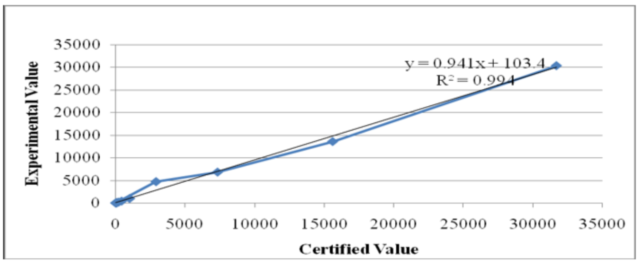

Figure 2 Certified values against the experimental values of Tobacco Leaves (CTA-OTL-1).

RESULTS AND DISCUSSION

In the present study, determination of major and minor (essential) elemental concentrations those present in the medicinal plants sample. Based on these spectra; the elements like K, Ca, Mn, Fe, Cu, Zn, Mg, Al and B are identified and determined their concentrations also. The sources of these elements origination along with their contribution during accumulation of these elements in human physiology with reference to environmental conditions are presented in this section.

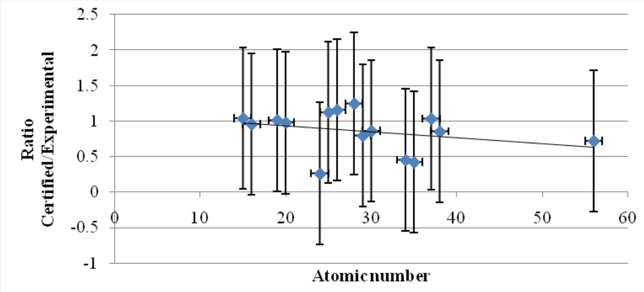

Figure 3 The ratio of certified over experimental values for Apple Leaves (SRM 1515).

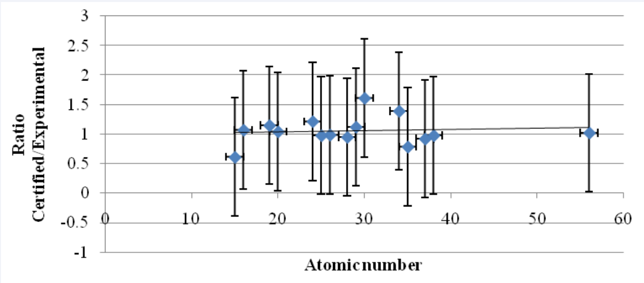

Figure 4 ratio of certified over experimental values for Tobacco Leaves (CTA-OTL-1).

Copper (Cu)

Copper is essential for human body to function properly that come under category of trace element. Copper presents in all tissues of human body playing an important role in the formation of connective tissue; and in the normal functioning of muscles; the immune and nervous systems. The human body requires copper for normal growth and good health. Copper along with iron is a critical component in the formation of red blood cells. It also influences the functioning of the heart and arteries; it helps to prevent bone defects such as osteoporosis and osteoarthritis, and promotes healthy connective tissues (hair, skin, nails, tendons, ligaments and blood vessels).

Copper deficiency is characterized by anemia, fatigue, poor wound healing, chronic diarrhea, and elevated cholesterol levels with poor immune function. Signs of deficiency include bleeding under the skin, damaged blood vessels, hair loss, pale skin and an enlarged heart.

Symptoms include fatigue because copper plays a role in immunity, imbalances can make more susceptible to infections.

The concentration of copper in the present study samples is ranging from 6.48 – 14.79 ppm with an average value of 10.635 ppm as given in the Table 2. The observed lowest value in the sample namely “Kota Hare” belong to Mattu (Illubabor) site while the highest value observed in the sample “Burii” related to Yayu location. The obtained copper concentration values have higher than with the earlier reported values 0.504 – 0.785 ppm and also the permissible limit set by WHO for copper in edible plants is 3.00 ppm [2,3]. But The permissible limits for copper set by China and Singapore for medicinal plants were20 ppm and 150 ppm respectively [4,] from this ours result are lower therefore, the obtained copper concentration values have fair agreement with the permissible limits.

Zinc (Zn)

Zinc is also a mineral that need to be absorbed in small quantities only to keep health of human beings and belongs to trace minerals. The zinc is essential for body growth, maturation and development, tissue repair and immune to disease. Zinc is an important mineral for children and the elderly people. It is involved in numerous aspects of cellular metabolism. It is required for the catalytic activity of approximately 100 enzymes and it plays a role in immune function, protein synthesis, wound healing, DNA synthesis and cell division. Zinc also supports normal growth and development during pregnancy, childhood and adolescence periods and also required for proper sense of taste and smell.

Zinc deficiency is characterized by growth retardation, loss of appetite, and impaired immune function. In more severe cases, zinc deficiency causes hair loss, diarrhea, delayed sexual maturation, impotence, hypogonadism in males and eye and skin lesions. Weight loss, delayed healing of wounds, taste abnormalities and mental lethargy can also occur. Many of these symptoms are non-specific and often associated with other health conditions; therefore, a medical examination is necessary to ascertain whether a zinc deficiency is present or not.

In the present study the concentration of Zinc in the medicinal samples varies from 15.0–43.0 ppm having an average of 29.0 ppm as given in the Table 2. The lowest concentration values are observed in the sample namely “Godere” which belong to Mattu locations. The highest concentration is found to be in sample “Burii” related to Yayu site. These values are found to be higher relative to the earlier results 1.622 – 2.844 ppm [2], but the permissible limit for zinc in edible plants was 27.4ppm and for medicinal plants permissible limit is not yet decided. The obtained Zinc concentration values have fair agreement with the permissible limits

Manganese

Manganese is a trace element and it is vital to human life. Human body contains about 15 to 20 milligrams of manganese. Most of Mn is found in the bones while the remaining distributed throughout tissues in the body such as pancreas, kidneys, liver, adrenal glands and pituitary glands. Its key role is in the activation of enzymes that needed for the digestion and utilization of foods and nutrients. It also plays a role in reproduction and growth of the bones. Itis sometimes called the „brain‟ mineral as it is important to the function of brain. Manganese deficiency is very rare and hard to determine.

In the present study concentration of manganese in the

Table 2: Element Concentration of Medicinal Plant Samples collected from 2 different study site (*Mean ± S D*, *n* = 3, ppm dry weight)

Plants name	Site of study	Cu	Zn	Mn	Fe	K	Ca	Mg	Al
Kota Hare	Mattu	6.48 ± 0.31	21.4 ± 0.5	25 ± 1	285 ± 3	2380 ± 0.1	1060 ± 0.04	109 ± 0.17	198 ± 21
	Yayu	10.94 ± 0.6	25.7 ± 0.6	29 ± 3	390 ± 3	2450 ± 0.14	1330 ± 0.01	280 ± 0.03	139 ± 4
Buri	Mattu	9.14 ± 0.63	35.7 ± 0.8	52 ± 1	331 ± 3	3480 ± 0.07	1320 ± 0.21	340 ± 0.02	370 ± 14
	Yayu	14.79 ± 0.33	43 ± 0.7	68 ± 7	405 ± 3	6240 ± 0.70	1430 ± 0.14	530 ± 0.02	360 ± 7
Godere	Mattu	7.27 ± 0.60	15 ± 0.8	35 ± 1	74 ± 4	1800 ± 0.14	950 ± 0.02	230 ± 0.05	49 ± 1
	Yayu	8.37 ± 0.32	24.4 ± 1.0	38 ± 1	152 ± 13	2160 ± 0.30	1100 ± 0.30	170 ± 0.02	225 ± 8

samples ranged from 25–68 ppm with an average value of 46.5 ppm. The variations of the manganese concentration in the medicinal samples are given in Table 2. The lowest concentration is observed in the Sample namely “Kota Hare”; which belong to Mattu location while the highest concentration obtained in the sample “Burii” related to Yayu location.

The obtained Mn concentrations values are higher than the earlier results reported data such results 1.741–5.235 ppm [2], and the permissible limit set by FAO/WHO for Mn was 2ppm in edible plants [3]. In some other researchers (Shad and Sheded) have fairly agree with the earlier reported results 52.94 and 44.6 to 339 ppm. However, studied by Amare in 2010 was reported between 157 ± 7.5 pmm to 421 ± 9.0 pmm, therefore our results somewhat lower [2].

Iron (Fe)

Iron is essential to human life, it plays an important role in the hemoglobin molecule of human beings red blood cells (RBC), where it functions in transporting oxygen from the lungs to the body tissues and also transports carbon dioxide from the tissues to the lungs. In addition, iron also functions in several key enzymes for energy production and metabolism including DNA synthesis.

Iron is a mineral that present naturally in several food items such as red meat, Beef liver, Cereal, soya bean, white beans and flour products, sea food, sun flower seeds and so on. By adding it to some of the food products, it is available as a dietary supplement. 6 to 12 grams of elemental iron content present in adults‟ hemoglobin; which is in the compound form that transmits oxygen from the blood to the cells of different organs.

The concentration of iron in the present study is given in Table 2. The obtained values of iron concentration in the present Medicinal plant samples are between 74 to 405 ppm with an average of 239.5 ppm. The lowest value is observed in the sample namely “Godere” that belong Mattu and the highest value observed in the sample such as “Burii” related to Yayu place. The present results are slightly lower than the earlier reported values 17.372 ppm to 80.073 ppm and the Permissible limit set by WHO for edible plants is 20 ppm [2,5].

Potassium

The third most abundant mineral in the human body is potassium. It is an electrolyte, a chemical that dissolves in water and turns into charged particles called ions. These circulate in the blood, in and out of the fluid of the cells and also help for proper functioning of nerve and muscles. The beating of the heart is based on impulses that require electrolytes. Potassium is largely available in the cells of all living plants and animals. Fresh fruits and vegetables are the richest sources of potassium namely broccoli, carrots, strawberries, bananas and artichokes are excellent sources of potassium. Adults require 4700 milligrams of potassium per day [7].

The obtained potassium concentration in the present study is ranged from 1800 ppm to 6240 ppm with an average of 4020 ppm as shown in the Table 2. The observed lower values 1800 ppm in the sample namely Godere, Burii sample belong to Yayu locations.

Calcium

Calcium is the human body‟s most abundant mineral having about 2% of body weight locating particularly in bones and teeth. A little is scattered in soft tissues like muscles and organs. It is very important for optimal bone health throughout the life of human beings. Human body needs Calcium to build and maintain strong bones. Heart, muscles and nerves also need calcium to function properly. If one doesn‟t get enough Calcium, he/she could face health problems related to bones and muscles due to their deterioration.

Although diet is the best way to get enough calcium, calcium supplements may be an option if the said mineral falls short in the diet. Calcium comes largely in the diet from dairy foods like milk, cheese and yogurt. However; those who don‟t like dairy products can get calcium from bokchoy, broccoli, kale and spinach. The amount of calcium required to the human body depends on age and gender. In general required or needed calcium to the adults is a minimum of 1000 mg/day.

Excessive or higher levels of calcium in the blood known as hypocalcaemia; which can cause renal insufficiency, vascular and soft tissue calcification, hypercalciuria (high levels of calcium in the urine) and kidney stones. Intake of high calcium can lead to constipation. Due to these effects and absorption of iron and zinc might be interfere [7,8].

The concentration of calcium in the present study ranged from 950 to 1430 ppm with an average of 1190 ppm is given in Table 2. Higher values of calcium 1430 ppm were observed in the sample namely Burii area of Yayu location. Lower values of calcium 950 ppm were observed in the sample of Godere; which belongs to Mattu (Illubabor) sites. These values are relatively fair agreement to the earlier results 790.171 – 935.427 ppm [2].

Magnesium

Magnesium content in the 3 selected medicinal plant range from 109 ppm – 530 ppm. *Burii* with 530 ppm of Mg contained the highest amount of Mg among the plants analyzed in Yayu site. Whereas Mg content of 109 ppm in *Kota Hare* was reported in the present study, a plant that is traditionally used in treating diabetes. Magnesium functions as a cofactor of many enzymes involved in energy metabolism, protein synthesis, RNA and DNA synthesis, and maintenance of the electrical potential of nervous tissues and cell membranes [9]. In addition, low serum and dietary Mg maybe related to the etiologies of cardiovascular problems, hypertension, diabetes, and atherosclerosis in humans [10].

The obtained Mg concentrations values are higher than the earlier results reported data such results 1.35 – 2.22 ppm [11]. In some other researchers (Chizzola and Shazia) in Pakistan the content of Mg between 2241.88 ppm – 6350.63 ppm in different medicinal plant therefore our results very low as compared to it [11].

Boron

The finding that boron may be nutritionally important for human is so recent that there has been no opportunity to investigate possible indicators of an inadequate boron status. The daily intake of boron by human can vary widely depending on the proportions of various food groups in the diet. Foods of plant origin, especially fruits, leafy vegetables, nuts, and legumes are rich sources. Meat, fish, and dairy products are poor sources. The functions of boron in mammalian tissues are unknown and its physiological roles and the pathological effects of boron deficiency should be investigated more fully with a view to assessing the nutritional significance of dietary boron [12].

The concentration of Boron in the present study is given in Table 2. The obtained values of Boron concentration in the present Medicinal plant samples are between 36.2 to 55.6 ppm with an average of 45.9 ppm. The lowest value is observed in the sample namely “Godere” that belong Mattu and the highest value observed in the sample such as “Kota Hare” related to Mattu place.

Aluminum

There are no substantiated evidence that aluminum has any essential function in animals or humans. The only main point is its potential toxicity if exposure is excessive. Dialysis encephalopathy in a large number of patients with renal failure undergoing chronic dialysis was shown to attribute to the high aluminum content of some water used for the preparation of dialysates [4]. Aluminum levels in the brain and in other tissues of affected subjects were consistently elevated. Excess aluminum also affects the skeleton by markedly reducing bone formation, resulting in osteomalacia. A further pathological manifestation of aluminum toxicity is a microcytic hypochromic anemia not associated with iron deficiency. Such problems have practically disappeared since the use of aluminum-free deionized water for dialysis became routine. The toxicological aspects of orally consumed aluminum are less well defined. It is poorly absorbed from the intestines; the small amounts absorbed from normal diets are excreted by healthy kidneys, so that no accumulation occurs.

Aluminum interacts with a number of other elements, including calcium, fluorine, iron, magnesium, phosphorus and strontium and when ingested in excess, can reduce their absorption [13]. Because of this property, it has been used therapeutically to treat fluorosis and to reduce phosphorus absorption in uremic patients. Furthermore, there is no known risk to healthy people from typical dietary intakes of aluminum. Risks arise only in persons with impaired kidney function.

The concentration of Aluminum in the present study is given in Table 2. The obtained values of Aluminum concentration in the present Medicinal plant samples are between 49 to 370 ppm with an average of 209.5 ppm. The lowest value is observed in the sample namely “Godere” that belong Mattu and the highest value observed in the sample such as “Burii” related to Mattu place.

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