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Determination of Some Minerals in *Salvadora Persica* Stems

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ABSTRACT

Salvadora persica is a well known small tree in the Middle East, Africa and India subcontinent, it one of most important chewing stick use for oral hygiene by people live in this regions. In this study chemicals analysis for some minerals showed *Salvadora Persica* collected from three different regions in Sudan (in center, north and west) named as sample No 1,2,3 respectively. The concentrations of four elements Sodium Na^{+}, Potassium K^{+}, Calcium Ca^{+2}, and Magnesium Mg^{+2} were determined by atomic absorption spectrophotometer using wet digestion method, the results obtained represented presence of four elements with different values. But Sample No 1 showed highest value for Potassium 61.64± 0.025K /ppm, 144.375±0.004 for k/ppm for Sodium and 170.24±0.016 for Calcium, while highest value recorded for Sample No 3 for Magnesium 10.45 K /ppm. The concentrations of fluoride and phosphorus also were determined in the three samples by fluoride selective electrode and UV-visible spectrophotometer. The content of fluoride in samples No 2 and 3 were 3556.56 for both which is higher than sample NO 1, the phosphorus content was found 95 ppm in samples No 1 and 2 higher than sample No 3.

Keywords: *Salvadora Persica*, Minerals

INTRODUCTION

Salvadora Persica; It is also known as Arak tree is chewing stick widely use Middle East, Indian continent and African countries [1], the stems and roots of the plant are commonly use for tooth cleaning, *Salvadora Persica* inhibit dental diseases, reduce the virulence of oral pathogenic bacteria, and it has antiplaque effects [2], thus in 2000 the World Health Organization (WHO) announced using of chewing sticks is effective oral cleaning hygiene [3]. Users of *Salvadora Persica* showed lack of tooth decay when compared to other group use other chewing sticks and those they do not clean their teeth at all. In addition to that the user showed low susceptibility to dental caries [4, 5]. Survey done for dental health in Sudan reported less tooth decay recorded in people chewing sticks than those people use a modern toothbrush [6].

Using chewing sticks such as *Salvadora. Persica* has benefits for oral health and that attributes to the mechanical effects of its fibers beside releasing favorable chemicals from the chewing stick during in use [7].

Phytochemical analysis *Salvadora Persica* bark's and root's showed chemical constitutes as of trimethyl amine, salvadorine, chlorides, high amounts of fluoride and silica, sulphur, vitamin C, small amounts of tannins, saponins, flavonoids and sterols [8,9]. Sodium and Chloride showed accumulation in root, bark and less in immature leaves [10]. The plant contains nearly 1.0 lg/g of fluoride beside calcium and phosphorus in water [11]. Amount (0.07 lg/ml) of fluoride was released when *Salvadora. persica* was soaked in water [12]. Large amounts of sodium chloride and potassium chloride were observed in *Salvadora persica* [13].

Fluoride promote remineralization and reduce demineralization has anticariogenic action by strengthening the apatite of teeth by increasing rate of maturation of the enamel surface also it can inhibit cariogenic microorganisms by suppress their virulence enzymes and reducing enamel solubility [20].

High concentrations of chloride inhibit calculus formationand help in removing stains from the teeth [9]. The sulfur is about 4.73% of total contents of *Salvadora persica* roots' when extracted by ash Sulfur and Salvadorine has a bactericidal effect [14] Vitamin C was help in tissue healing and repair [15]. Silica can remove stains from tooth surfaces [16]. Tannins minimize plaque and gingivitis by inhibiting action of glucosyl transferase enzym [17]. Resins may form a layer on enamel that protects against dental caries [14]. Sofrata (2008) showed *Salvadora. persica* has benzyl isothiocyanate which act as strong bactericidal especially for Gram negative [18]. The mildly bitter taste of the essential oils in *Salvadora persica* stimulates saliva flow's that inhibit the formation of calculus and also aid in removing stains from tooth surfaces [9, 15]. Releasing calcium in saliva due to use of chewing sticks was found to promote enamel remineralization [17].

A mount of the dissolved calcium ion for twenty maxillary first premolars washed by *Salvdora* extract 10% for 2 min daily for 20 days was found less than when use amount 0.05% sodium fluoride [19]. *Salvadorda Persica* represented Strong antimicrobial effect due to presence of thiocyanate agent beside sodium chloride potassium chloride, saponin, tannins [21, 22]

MATERIALS AND METHODS

The samples of stem of *Salvadora persica* were collected from three different center north and west of Sudan which forming different geographical area of Sudan. Atomic absorption UV visible spectrophotometer, Ion selective electrode (Model 3345 – Jenway) pH- meter (Model 3505 – Jenway) were used, concentrated nitric acid (HNO3), Diluted hydrochloric acid (HCl), Concentrated sulphuric acid (H2SO4), Hydrogen peroxide 30% (H2O2), Sodium hydroxide (NaOH). Ferric chloride (FeCl3), DPPH (2, 2 Di (4-tert-octylphenol)-1-picryl hydrazyl)). Ferrous sulphate (FeSO4), Sodium fluoride, Potassium dihydrogen orthophosphate. Ammonium metavanidate, Ammonium molybdate, Citrate buffer and TISAB (II) were used for sample preparation .

Method of preparation of the samples for analysis Na, K, P Ca, and Mg

Wet digestion involves the destruction of organic matter through the use of both heat and acids. Acids that have been used in these procedures include H2SO4, HNO3, and HClO4, either alone or in combination. Hydrogen peroxide (H2O2) is also used to enhance reaction speed and complete digestion in temperatures of 80 to 125ºC. After digestion is complete and the sample is cooled and dilutions are made to meet analytical requirements.1000 g of dried (80ºC) plant material was weighed then 10 mL of concentrated HNO3 was added and allowed to stand overnight, sample placed on hot plate or and heated carefully until the production of red NO2 fumes has ceased after that cooled and added small amount (2:4 ml) of 70% percholoric acid (HCLO4),The sample was transferred to 50 ml volumetric flask and diluted with deionized water. To reveal Na^{+}, K^{+}, Ca^{+2}, Mg^{+2} elements from samples, sample must be form into solution to destruct organic matter. The solution was aspirated, atomized and subsequently introduced into an energy source as acetylene/air to and generate temperature about 2.300ºC, The burner design and adjustment of the fuel/oxidant mixture provides conditions in which the sample are converted to a nonexcited, nonionized, ground

state, In this energy status, the light source was provided by a hollow in cathode lamp, the electron atoms are capable of absorbing light energy, the elements of samples under investigation act as the cathode when current passed to lamp and this light was directed into the flame where it was absorbed proportional to the concentration of the element in the flame. Absorption was calculated based upon the measured difference in light intensity passing around the flame and that passing through the flame.

Method of preparation of the samples for determination fluoride by selective electrode

About 5.000 g of dry plant material was weighed in a nickel crucible after dried at 100-120°C. 10 ml of sodium hydroxide solution (400g/L) was added, and mixed thoroughly. The mixture was fused in a muffle furnace for 18 hours (overnight). After that the ash was collected, and dissolved in 18 ml diluted hydrochloric acid and 10 ml of citrate buffer was added, this mixture was diluted to 50ml with deionized water in volumetric flask. 50 ml of TISAB II was added to 50 ml of sample. Potential of the resulted solution was reading by ion selective electrode.

Method of determination fluoride by selective electrode

50 ml TISAB II was added to 50 ml sample and 50 ml TISAB II was added to 50 ml for each fluoride standard. The potential of the samples was recorded by fluoride selective electrode after the standards were red.

Method of determination phosphorus by Spectrophotometer

10 ml of sample was taken in 100 ml volumetric flask, 50 ml water was added. 10 ml ammonium metavanidate solution and 10 ml ammonium molybdate solution diluted to the mark with distilled water. The absorbance of this solution was determined at 465 nm against a blank prepared in the same procedure by using spectrophotometer which measure the intensity of light beam pass through solution using different wavelength.

RESULTS AND DISCUSSION

The elemental composition (Na^{+}, K^{+}, Ca^{+2}, and Mg^{+2} of all samples of *Salvadora persica* stems were given in table (1), and comparison between three samples are shown in figure (1). From the results obtained it was found that Calcium exists as a major component in all samples, 170.24±0.016/ppm, 123.08±0.013pmm, 122.72±0.048pmm for Sample No 1,2 and 3 respectively, For Sodium sample No1 showed highest amount 144.375±0.004 /ppm . Potassium found in moderate amount ranging from 61.64± 0.025ppm to 12.12±0.004 pmm. Magnesium was found as lowest mineral amount in all samples vary between 9.15/ppm and 10.45/ ppm.

The concentration of above elements was found less than the amounts in study performed in India by Sanjay 2010 *et al* , he detected Ca 1323 mg/ml, K 199 mg/ml, and Mg 180 mg/ml, these differences in the results may refer to region where sample or method of preparation and analysis of the samples [23].

The results reported the concentration of elements vary from sample to sample in and that may attribute variation in geographical regions and types of soil and weather in Sudan; desert in North sub-Sahara in center and Savanna in west

Ramoliya *et al* 2003 performed study by adding a mixture of chlorides and sulphates of Na^{+}, K^{+}, Ca^{+2} and Mg^{+2} to soil to detect minerals accumulation in *Salvadora persica* the result showed when sodium deposited in roots assist in transfer of Na^{+} ions to leaves [24].

Potassium increased in leaf, but decreased in root tissues with increased in salinization. Phosphorus content significantly decreased, while Calcium increased in leaf as soil salinity increased, the result indicated the mineral content in plant parts were influence by amount of minerals in the soil. Hardikar *et al* 2011added Sodium chloride with different concentration to soil, the result showed high selectivity for potassium , lacking in transferring Sodium but Phosphorus, calcium and magnesium content in tissues significantly decreased [25].

Table 1 Table No 1: Concentration of elements by atomic absorption in three samples (ppm) =

No	K^+ /ppm	Na^+ /ppm	Ca^{+2} /ppm	Mg^{+2}/ppm
1	**61.64± 0.025**	**144.375±0.004**	**170.24±0.016**	**9.15±0.0**
Mg/ml	**0.06164**	**0.14437**	**0.17024**	**00.00915**
2	**42.44±0.0026**	**36.5±0.008**	**123.08±0.013**	**10.45**
Mg/ml	**0.04244**	**0.0365**	**0.12308**	**0.45010**
3	**12.12±0.004**	**34.7±0.003**	**122.72±0.048**	**9.15**
Mg/ml	**0.01212**	**0.0347**	**0.12272**	**0.00915**

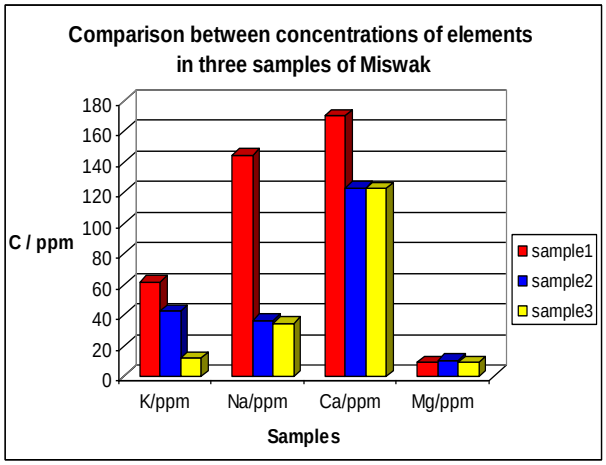

Figure 1: four elements concentration of three samples

The concentration of fluoride in *Salvadora persica* was determined by potentiometric method, by using ion selective electrode. The concentration of fluoride for three samples of *Salvadora persica* stems was shown in table (2), and figure (2). The concentration of fluoride for sample (2) and sample (3) is higher than sample (1), and both were rich with fluoride.

Table 2: concentration of fluoride and percentage in each Samples

Sample	Fluoride /ppm	Mg/ml
1	2825.08	2.82508
2	3556.56	3.5565
3	3556.56	3.55656

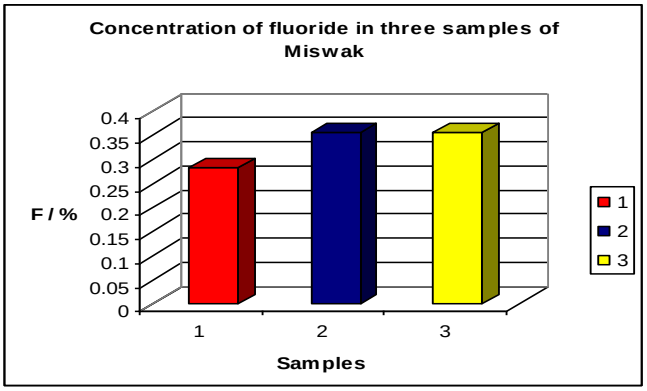

Figure2: Concentration of fluoride in three samples

The concentration of phosphorus for three sample of *Salvadora persica* was shown in table (3). And the comparison between three samples was shown in figure (3). The concentration of phosphorus for sample (1) and sample (2) was found higher than sample (3). And there is no difference between amount of phosphorus in sample (1) and sample (2)

Table 3: Concentration of phosphorus by ppm and percentage in the samples

Sample	Phosphorus / ppm	Mg/ml
1	95	0.09
2	95	0.09
3	90	0.095

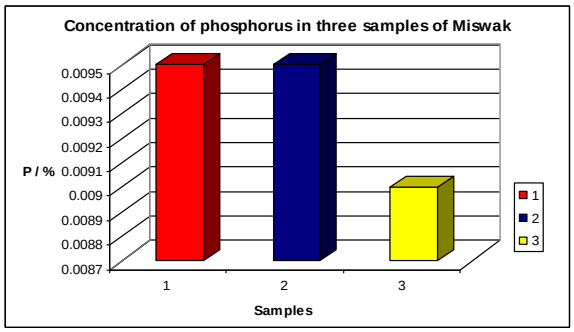

Figure 3: Concentration of phosphorus in three samples (ppm)

CONCLUSION

Salvadora persica was found to contain some elements that may play an important role in oral health. The stems of *Salvadora persica* were found rich with minerals for all samples from different regions in Sudan beside thus teeth cleaning by *Salvadora persica* may have benefits over tooth brush due to containing chemicals contents that improve oral health.

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