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Short Communication

Phytochemical Screening, Proximate and Mineral Composition of Sweet Potato Leaves Grown in Tepi Provision, South- west of Ethiopia

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Abstract

Leaves of sweet potato *(Ipomoea batatas)* grown in Tepi area was studied for their class of phytochemicals, mineral and proximate composition using standard analytical methods. The phytochemical screening revealed the presence of alkaloids, flavonoid, terpenoids, saponins, quinones, phenol, tannins, amino acid and proteins in the leaves. The proximate composition revealed the presence of ash (13.74±0.54 % dry weight, DW), crude lipid (3.8±0.52%, DW), crude fiber (12.62±0.39%, DW), crude protein (6.37± 0.13%, DW) and carbohydrate (69.62±0.69%). The minerals composition revealed potassium (3608.854mg/100g), sodium (32.079±0.12mg/100g), calcium (320.125±0.36 mg/100g), magnesium (118.75±0.02mg /100g), copper (1.828±0.11mg/100g), zinc (5.647±0.14mg/100g), iron (73.881±0.03mg/100g) and manganese (9.590±0.06mg/100g). These results revealed that the leaves of sweet potato *(Ipomoea batatas)* contained essential nutrients which compare favorably well with those of wild edible leaves in literatures.

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INTRODUCTION

Vegetables are the fresh and edible portions of herbaceous plants, which can be eaten raw, or cooked (Oyenuga and Fetuga, 1975, Fayemi, 1999, Dhellot *et al*., 2006, Hassan *et al.,* 2007). Vegetables are valuable in maintaining alkaline reserve of the body. They are valued mainly for their high carbohydrate, vitamin and mineral contents. Vegetables may be edible roots, stems, leaves, fruits or seed. Each group contributes to diet in its own way (Robinson, 1990). However, there are some used and inexpensive leafy vegetables whose nutritive and anti-nutritive potentials are yet to be adequately studied and utilized. Among these leafy vegetables are the leaves of sweet potatoes. Sweet potato (*Ipomoea batatas*) is a herbaceous creeping plant with smooth, lightly moderate green leaves sometimes with a considerable amount of purple pigmentation especially along its veins (Longe, 1986). Its starchy tuberous root is the major economic part of the crop.

Occasionally, the leaves are used as vegetable in yam and cocoyam porridges in some parts of Nigeria particularly among the Efik-Ibibio people of South-Eastern Nigeria (Eka and Edijala, 1972). Islam *et al*. (2002) further reported that, Ipomoea *batatas* leaves as an excellent source of antioxidative polyphenolics compared to other commercial vegetables. Though consumed in Asia and some sub-Saharan countries (Duke, 1983), they have generally been regarded as an underexploited green vegetable. Abbiw (1990) listed *Ipomoea batatas* as one of the vegetables consumed by all ethnic groups in Ghana. However, it must be noted that only the storage roots are consumed in large quantities. Yoshimoto *et al.* (2002) considered sweet potato leaf tougher in terms of texture than other leafy vegetables.

Besides being used for human consumption, the leaves serve as fodder and browse for cattle, sheep, goats, pigs and other domestic animals. According to Oyenuga (1968), the young leaves of sweet potatoes serve as a good vegetable source for man. Its wide use as vegetable is however hampered by the fact that it is considered a poor man's vegetable, coupled with the fact that it had always been used traditionally as feeds for domestic animals. Much attention in most literatures has only been paid to the tubers and not the leaves. Since there is very little or no information on the true chemical composition of *Ipomoea batatas* leaves grown in Tepi, Ethiopia, the processing of the leaves for nutritional or therapeutic purposes may be misleading. The population unaware of the high nutritional and nutraceutical values of these vegetables, grow sweet potatoes, wait for the storage roots to mature, harvest and discard the leaves or serve them as animal feed. This work is therefore aimed at finding out the proximate composition, mineral compositions and phytochemical screening of sweet potato leaves in a bid to determining its suitability as an edible vegetable or not.

MATERIALS AND METHODS

Sample Collection

The leaves of *Ipomoea batatas* was collected from Tepi area farm land, Ethiopia. The leaves were destalked,

washed with deionized water to remove the impurities and sunlight dried. After drying, the leaves were ground into a fine powder using a mortar and pestle, and then sieved and stored in a well labeled air-tight container for analysis.

Qualitative Phytochemical Screening

Phytochemical tests on the leaves of *Ipomoea batatas* were carried out using standard analytical procedures as described by Sofowora (1993), Harborn (1973) and Evans (2002).

Proximate Analysis

The *Ipomoea batatas* leaves was analyzed for proximate constituents; moisture, total ash, crude fat and crude fiber using the methods of Association of Official Analytical Chemists (AOAC, 1990) in JIJE Analytical Testing Service Laboratory in Addis Ababa, Ethiopia**.** While nitrogen was determined by micro-Kjeldahl method as described by Pearson (1976) and the percentage nitrogen was converted to crude protein by multiplying the value with 6.25. To determine the total carbohydrate, the method of James (1995) based on the difference was employed.

Mineral Analysis

Test for the presence of minerals was carried out after acid digestion. The supernatant was decanted and the liquid was analyzed for the levels of Ca, Na, K, Cu, Fe, Zn, Mg and Mn. Sodium and Potassium levels were analyzed using flame photometer. Calcium, Magnesium, Iron, Zinc, Copper and Manganese were determined using atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

The qualitative phytochemical screening of *Ipomoea batatas* leaves (Table 1) reveals the presence of Tannins, Saponins, Flavonoids, Terpenoids, Quinones, Phenol, Amino acid and Protein. The reported health benefits of *Ipomoea batatas* leaves may be attributed to these phytoconstituents that might be of medicinal value (Figure 1).

Table 1: Results of the qualitative phytochemical screening of *Ipomoea batatas* leaves

Phytochemical constituents	Solvents Used for Extraction		
	Water (H_2O)	Methanol (CH_3OH)	Cyclohexane
Alkaloids	+	+	-
Flavonoids	+	+	-
Terpenoid	+	+	-
Saponins	+	+	-
Quinones	+	+	-
Phenol	+	+	-
Tannin	+	+	-
Amino acid and proteins	+	+	-

+ Present, - Absent, assay were carried out in triplicates

The proximate analysis of *Ipomoea batatas* leaves revealed that it contain an appreciable amount of carbohydrate (69.62%). This value is higher than the values reported for pterocarpus soyansii 46.66% and pterocarpus santalinoides 51.37% Ndukwe, (2013). This means that every 100g of *Ipomoea batatas* leaves should contain 69.62g of carbohydrate. Carbohydrate also serves as stored forms of energy as glycogen in liver and muscles. It also provides major source of energy and responsible for breaking-down of fatty acids and preventing ketosis (Hassan and Umar, 2006).

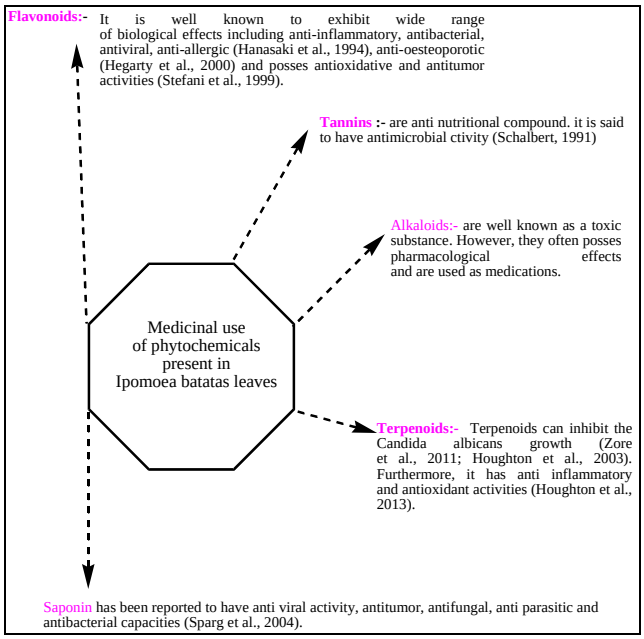

Figure 1: Medicinal uses of *Ipomoea batatas* leaves

Protein is used for building and repairing of body tissues, regulation of body processes and formation of enzymes and hormones. Proteins also aid in the formation of antibodies that enable the body to fight infection. Proteins serve as a major energy supplier (Brosnan, 2003). Proteins are responsible for the formation of bones, teeth, hair and the outer layer of skin and they help maintain the structure of blood vessels and other tissues. The protein content of *Ipomoea batatas* leaves (6.37%). The concentration is relatively lower compared to the 35.9% reported by Ekuagbere (2007) for calabash seed, 43.1% for luffa cylindrical kernel (Olaofe *et al*., 2008) and the 23.7-30.8% for gourd seed (Olaofe *et al*., 1994). The result revealed that the leaves *Ipomoea batatas* leaves are a source of protein.

The cured fat content of *Ipomoea batatas* leaves is 3.80%, which was low in amount when compared to those of groundnut (43%) (Apata and Ologhobo, 1994), alinum *triangulare (*5.09%), Amarantus *hybridus* (4.80%) (Akindahunsi and Salawu 2005) and calabash seed (43%) (Ekuagbere, 2007), the findings of this study showed that, the *Ipomoea batatas* leaves is a poor source of plant fat (lipid), which is in agreement with general observation that leafy vegetables are low lipid containing food, thus, advantages health use in avoiding obesity (Lintas, 1992). The crude fiber content of *Ipomoea batatas* leaves is 12.62%. This value is higher than that of *Gnetum africanum (*4.60), M*. ureans* (4.00) and *Parinari polyandra* (Ekpo, 2007). The substantial amount of fiber in all the vegetables shows that they can help in keeping the digestive system healthy and functioning properly. Fiber aids and speeds up the excretion of waste and toxins from the body, preventing them from sitting in the intestine or bowel for too long, which could cause a build-up and lead to several diseases, reduce serum cholesterol level, hypertension, diabetes, breast cancer and constipation (Hunt *et al*., 1980, Ishida *et al*., 2000). Thus, the *Ipomoea batatas* leaves could be valuable sources of dietary fiber.

The ash content 13.74±0.013% indicates that the leaves are rich in mineral elements. The value obtained is higher compared to 1.8% reported in sweet potato leaves (Asibey-Berko and Tayie, 1999), 10.83% in water spinach leaves and 5% in *Tribulus terrestris* leaves , but lower than 19.61% in *Amaranthus hybridus* leaves (Nwaogu *et al.,* 2000) and 18.00% Balsam apple leaves (Hassan and Umar, 2006). The ash content is a reflection of the amount of mineral elements present in the samples; therefore, the *Ipomoea batatas* leaves contained a good amount of minerals.

Mineral Content

The mineral composition of *Ipomoea batatas* leaves was evaluated in the present study. Potassium is necessary for the function of all living cells and is thus present in all plant and animal tissues. Epidemiological studies and studies in animals subject to hypertension indicate that, diets high in potassium can reduce the risk of hypertension and possibly stroke. The present study revealed that the potassium content of *Ipomoea batatas* leaves (3608.854mg/100g). Thus, the *Ipomoea batatas* leaves could serve as a good source of potassium for the hypertensive patient especially pregnant women that are prone to high blood pressure toward the period of delivery. Sodium is an essential element that is necessary for humans to maintain the balance of the physical fluids system. It is also required for nerve and muscle functioning. Sodium content of *Ipomoea batatas* leaves was (32.079mg/100g).which shows a close agreement with the values reported for bitter leaf 26.05mg/100g and soybean 35.85mg/100g (Chuku and Ugorji, 2012). The obtained value is lower than 805.60±0.01mg/100g and 196.80±0.02 mg/100g reported for the leaves and stems of *Balanites aegyptiaca* (Idris *et al*., 2010).

Magnesium is an important mineral element in connection with circulatory diseases such as ischemic heart disease and calcium metabolism in bone (Ishida *et al*., 2000, Hassan and Umar, 2006). The magnesium content of the leaves is 118.750±0.02mg/100g which is high compared with 2.56mg/100g in *Diospyros mespiliformis* (Hassan *et al*., 2004), 23.18±0.4 of *Amaranthus hybridus* leaves (Nwaogu *et al*., 2000) and lower than 400.00±00.00 mg/100g in *Cassia siamea* leaves (Ngaski, 2006).

Calcium is an important component of a healthy diet and a mineral necessary for life. It plays an important role in building strong and dense as well as in the keeping of healthy bones and teeth both early and later in life. Calcium content of *Ipomoea batatas* leaves was (320.125 mg/100g). It is higher than the values obtained for spinach 14.55mg/100g, bitter leaf 150mg/100g, okra 50.8mg/100g but less than soybean 480mg/100g (Chuku and Ugorji, 2012). Thus, the *Ipomoea batatas* leaves could serve as a good source of calcium for building strong and dense as well as in the keeping of healthy bones and teeth.

Copper has a number of important functions in the human body. It helps to produce red and white blood cells and triggers the release of iron to form hemoglobin (the substance that carries oxygen around the body). Copper content of *Ipomoea batatas* leaves was 1.828 mg/100g. The result of the present study shows that, the *Ipomoea batatas* leave is a good sources of copper relative to its recommended dietary allowance (RDA) of 1.5-3 mg/day for adult male and female, pregnant and lactating mothers and 1-3 mg/day for children (7-10 years) (NRC, 1989).

Iron is required for haemoglobin formation and its deficiency leads to anaemia (Turan *et al*., 2003). The iron content of *Ipomoea batatas* leaf was found to be 73.881±0.03 mg/100g which is higher than 2.80±0.7 mg/100g in *T. terrestris* in some cultivated vegetables such as spinach (1.6mg/100g) lettuce (0.7mg/100g) and cabbage (0.3mg/100g) (Turan *et al*., 2003) but lower than 84.4mg/100g in *Helminthostachys sp*. The leaves of *Ipomoea batatas* are rich sources of iron, and could be of good use to pregnant women, lactating mothers. Generally for women since they loss some quantity of blood during monthly menstruation, it could help in the nourishing of their bodies.

Manganese plays an important role in number of physiologic processes as a constituent of some enzymes and an activator of other enzymes. Concentration of manganese in *Ipomoea batatas* leave was found to be 9.59±0.06 mg/100g. When compared to the RDA for manganese which are 2-5 mg/day for adult male and female, pregnant and lactating mothers and 2-3mg/day for children (7-10 years) (NRC, 1989), the *Ipomoea batatas* leave of this plant cannot serve as a manganese supplement because of excessive manganese it contain which exceeded the RDA.

Different enzyme systems in the body require mineral zinc as cofactor. These enzyme systems are responsible for every major physiological function that necessitates catalytic activity from enzyme at the molecular level. Zinc concentration was found in the *Ipomoea batatas* leave was found to be 5.647±0.14 mg/100g, which is high compared to garcinia kola 3.67± 0.01mg/100g (Adesuyi *et al*., 2012). Zinc content of the leaves of this plant cannot serve as a zinc supplement when compared to the zinc RDA of 10 mg/day for children (7-10 years), 12 mg/day for adult female, 15 mg/day for adult and 19 mg/day for pregnant and lactating mothers (NRC, 1989), and to be able to meet the daily requirements, it should be taken in large quantities.

CONCLUSIONS

In conclusion, *Ipomoea batatas* leaves are an important plant not only as food but also as medicine, due to the presence of various phytochemical constituents. The result of the mineral composition also reveals its high content of minerals such as Mn, Ca, Na, Zn, K, Mg and Fe indicating its relevance and indispensable roles in solving many mineral related problems in the consumers. Some of these minerals are useful in patient suffering from bone thinning, adult rickets, bone fraction, bone leaching or bone weakening. The high carbohydrate content provides major source of energy and responsible for breaking down of fatty acids and preventing ketosis.

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