**PHYTOCHEMICAL ANALYSIS AND ANTIOXIDANT ACTIVITY OF PEELS’ EXTRACTS FROM Ipomoea *batatas L*.**

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***Abstract***

***Background****: The danger posed by oxidative stress induced free radicals has caused an increase in the research into the development of new natural antioxidants. Several natural sources including the leaves of Ipomoea batatas lam have been explored for the presence of these bioactive compounds. However, the peels of this important plant have not been examined in this regard. The aim of this work therefore was to carry out phytochemical screening and determine the Antioxidant potential of the peels from Ipomoea batatas lam.*

***Methods:*** *The ethyl acetate and methanolic crude extracts were screened for the presence of phytochemicals. The colour intensity/precipitate formation was used as analytical responses to the tests. The antioxidant activity was determined by employing the DPPH assay. The total phenolic content was also determined.*

***Results:*** *The phytochemical screening showed positive results for tannins/phenolic compounds, terpenoids, reducing sugar, cardiac glycosides, alkaloids and lipids. The antioxidant activity and total phenolic contents of the two extracts are also reported.*

***Conclusion:*** *Sweet potato peels contain important secondary metabolites with explorable medicinal potential.*

**Key words**: Antioxidants, Free radicals, Phenolics, Phytochemicals, Sweet potato.

**Introduction**

Sweet potato (Ipomoea batatas Lam) is a member of the convolvulaceae family which originated from south Mexico and Central America. It is considered to be the seventh most important crop worldwide**1** .It is an important phytochemical source in human and animal nutrition. According to International Potato Center (IPC), Sweet potato is high in carbohydrates and vitamin A. It is also rich in Vitamin B6, Vitamin C, Manganese, Copper, Potassium and Iron**2**. The flesh of this root vegetable range from white to yellow, orange, red or purple depending on the variety **3**. Some parts of sweet potato which are not usually used were rich in nutritive components. For instance, the leaves are rich in protein, minerals and vitamins **4**. Yoshimoto *et al*  reported that sweet potato leaves contained distinctive polyphenolic components with a high content of mono-, di-, and tricaffeoylquinic acid derivatives which could be a source of physiological functions **5**. More specifically, it was reported that the major anthocyanin composition of sweet potato leaves is a cyanidin derivative **6**.

Although sweet potato and potato are not related, the works done on potato peels reveals the potential that could also be found in sweet potato peels. Potato peels have been known to exhibit antioxidant activity. This activity is as a result of the phenolic acids present in the peels. Potato peels also find application as preservatives. An investigation on the carotene bleaching and linoleic acid oxidation revealed that the antioxidant activity of potato peel was also due to the presence of phenolic acids **7**. In the same vein, potato peel extracts have been utilized as antioxidants in soybean oil. It was proposed that potato peel can safely be used as a natural antioxidant to suppress lipid oxidation instead of BHT (Butylated hydroxyl toluene) and BHA (Butylated Hydroxyl Anisol) which are synthetic **8**. Similarly, Rajini employed the free radial scavenging activity of an aqueous extract of potato peel to show that potato peel has great antioxidant potency. In addition to these, potato peels have been used the treatment of burn wounds**9**.

Recently, several research efforts have been directed towards the beneficial secondary metabolites present in the sweet potato tuber. However, the content of the tuber (flesh) is not always the same as that of the peels **10**. The peels of sweet potatoes are believed to contain some chemical compounds with which they fight for survival in the soil. This could be extracted and adopted for use in the treatment of infectious diseases. These peels could also be a reasonable source of phenolic compounds which have could offer certain health benefits. The leaves of this plant have been subjected to phytochemical screening and examined for antimicrobial/ antioxidant activities **11**. However the peels which are usually discarded have not been explored in this direction. We therefore, in this paper, present our findings on the phytochemical analysis and the antioxidant potential of the peels of a white skinned variety of *Ipomoea batatas lam*, a foundation for further studies.

**Materials and Methods**

**Collection of Samples:**

A bag of white skinned variety of sweet potato (*Ipomoea* *batatas* Lam) was obtained from a local market in Ilorin, Nigeria and identified by a taxonomist at the herbarium of Biological Department of the University of Ilorin, Ilorin, Nigeria. The peels were carefully removed, air-dried at room temperature. The peels unavoidably contained a little of the sweet potato tissue.

**Extraction**

About 1.2 Kg of the pulverized peels was exhaustively extracted successively by maceration at room temperature with ethyl acetate and methanol. The extracts which were afterward concentrated were coded IBLPE and IBLPM respectively.

**Phytochemical Screening**

The determination of the presence or absence of certain secondary metabolites in the peels’ extract was made by using established procedures**12, 13**. The colour intensity or the precipitate formation was used as analytical responses to these tests.

**Tests for carbohydrates:**

**Fehling’s Test:** 1 ml of Fehling’s solution A and 1ml of Fehling’s solution B were mixed and added to about 2 ml of the solutions of the extracts. The mixture was heated for for a few minutes in a heating mantle. A yellow /brick red precipitate indicated the presence of reducing sugar.

**Molisch Test:** To about 2cm3 of solutions of the extracts 2-3 drops of a 1 % alcoholic solution of 1-naphthol were added and then 2 cm3 of conc. H2SO4 was carefully poured down the side of the test-tube so that it forms a heavy layer at the bottom. A deep violet coloration produced at the junction where the liquids meet indicated the presence of carbohydrate.

**Tests for glycosides:**

**Keller-Killiani Test:** Glacial acetic acid which had been treated with one drop 3% FeCl3 was added to 2 ml of each of the extracts. Conc. H2SO4 was added down the side of a slanting test tube. Reddish brown colour at the junction of two liquid layers and upper layer turned bluish green indicating the presence of glycosides.

**Test for steroids:**

**Salkowski Test:** 2 ml of chloroform was added to 2 ml of each of the solution of the extract and 1 ml of conc. H2SO4 was added by the side of the test tube. The solution was shaken well. A red coloration in the upper layer and a greenish yellow fluorescence in the acid layer indicate the presence of steroids.

**Leibermann-Buchard’s Test:** 2ml of the solution of each extract was mixed with 1ml of acetic anhydride. The mixture was then heated and cooled. A few drops of conc. H2SO4 were added to the mixture by the side of the test tube. An appearance of blue colour confirms the presence of sterols.

**Tests for alkaloids:** The ethanolic extract was evaporated in a test tube. To the residue dilute HCl was added, shaken well and filtered. With the filtrate, the following tests were performed.

**Hager’s Test:** To the 2-3 ml of filtrate Hager’s reagent was added. The formation of yellow precipitate showed the presence of alkaloids.

**Mayer’s Test:** To the 2-3 ml of filtrate Mayer’s reagent was added. Formation of yellow precipitate or observation of turbidity showed the presence of alkaloids.

**Tests for flavonoids:**

**With Lead Acetate:** To 1ml of a solution of the extract, lead acetate solution was added. The formation of yellow precipitate indicated the presence of flavonoid.

**With Sodium Hydroxide:** To 1ml of a solution of the extract, few drops of sodium hydroxide was added. A yellow coloration which is decolorized after addition of acid indicated the presence of flavanoids.

**Tests for Tannins and Phenolic compounds:**

**FeCl3 Solution Test:** To 1ml of a solution of the extract, few drops of 1% FeCl3 solution was added. A deep blue black colouration was taken as a positive test result.

**Test for saponins:**

**Froth Test:** A little portion of the solution of the extract was shaken vigorously with water. The formation of a stable froth indicated the presence of saponins.

**Test for triterpenes:** To 1ml of a solution of the extract, chloroform and conc. H2SO4 were added. Appearance of red colour indicated the presence of triterpenes.

**Determination of Total Phenolics**

To 1ml of sample solution (1mg/ml) and the standard (gallic acid) solutions, 1ml of Folin-Ciocalteau reagent was added. After 5minutes, 10ml of 7%Na2CO3 was added followed by 13ml of deionized water. The mixture was then shaken and kept in the dark for 90 min at 23oC and the absorbance was read at 750nm using a UV-VIS spectrophotometer **14, 15**. The amount of total phenolics was expressed as gallic acid equivalent (GAE) in mg/100g dry plant extract using the expression

C=c x V/m

Where; C=Total content of phenolic compounds in mg/g, in GAE (gallic acid equivalent); c=The concentration of Gallic acid established from the calibration curve in mg/ml; V=The volume of extract in ml; M=The weight of plant extract in g.

**Determination of antioxidant activity**

The 2,2-Diphenyl-1-picryl hydrazyl radical assay described by Ayoola *et al* **16** with slight modification was used to evaluate the free radical scavenging activity of the extracts. The following concentrations of the extracts were prepared: 0.002, 0.05, 0.1, 0.2, and 0.5 mg/ml in methanol. Vitamins C was used as the

antioxidant standard at the same concentrations. 1 ml of the extract was placed in a test tube, 3 ml of 1 mM DPPH in methanol was added and the mixture was incubated in the dark for 30 minutes after which the absorbance of each solution was taken by using a UV spectrophotometer at 517nm. A blank solution was prepared containing only DPPH in methanol. The free radical scavenging activity was calculated using the formula:

% inhibition = {[Ab-Aa]/Ab} x 100

where Ab is the absorption of the blank solution and Aa is the absorption of the solutions containing the extracts. The readings were done in triplicates.

**Results and Discussion**

**Phytochemical studies**

Plant extracts have been employed in the treatment of diseases from pre-historic times. This preliminary phytochemical investigation reveals the presence of terpenoids, lipids, tannins/ phenolics, lipids, cardiac glycosides and carbohydrates while saponins and anthraquinones were absent. These phytochemicals have been shown to possess an interesting array of biological activities by various researchers. The result of the preliminary phytochemical screening carried on IBLPE and IBLPM extracts is shown in table 1.

Table 1: Preliminary Phytochemical screening of IBLPE and IBPLM extracts

(-) negative (+) slightly present (++) moderately present (+++) significantly present

This result shows that the usually discarded sweet potato peels obviously contains some phytochemicals which could be studied for the development of new antimicrobial agents.

**Total Phenolic Content**

The spectroscopic determination of the total phenolic content from sweet potato peels’ extract was carried out using Folin-Ciocalteu method (Table 2) and the gallic acid standard curve shown in figure 1.

Table 2: Determination of total phenolics in IBLPE and IBPLM extracts

The absorbance for various dilutions of gallic acid with Folin-Ciocalteu reagent and sodium carbonate were determined as described in Table 2. The standard curve equation was; y= 0.109 + 0.5281; R2 = 0.9829 (Figure 1). The total phenolic contents was calculated for IBLPE and IBLPM as 108.2mg and 437.5mg/100g GAE. This compares well with previous study which reported that tuberous roots of five sweet potato varieties showed phenolic content ranging from 192.7 to 1159.0 mg GAE/100 g dry sample **17**.

Figure 1: Callibration curve of gallic acid

**Antioxidant Activity**

The free radical scavenging activities of IBLPE and IBLPM are shown in figure 2. In the order of free radical scavenging effectiveness, the IC50 values were calculated as 0.077mg/ml for ascorbic acid (the standard) followed by IBLPM with 0.223mg/ml, and at the base of the ladder, IBLPE with 0.353mg/ml. The ability of the extracts to scavenge free radicals increased with increase in polarity just as the phenolic content was more in IBLPM.

Figure 2: Antioxidant activities of IBLPE and IBLPM

This further confirms the findings of Habila *et al* and several other related articles already observed that there is a positive correlation between the phenolic content of medicinal plants and antioxidant activity **18**. It shows that sweet potato peels could also be a rich source of phenolic compounds which are useful as antioxidants. Hence, we can safely predict that the consumption of sweet potato peels provides considerable antioxidant activity and could help in averting the danger posed by oxidative stress induced free radicals.

These preliminary studies show that sweet potato peels which is usually discarded contain several beneficial phytochemicals. The peels which are generally regarded as waste could be a rich source of bioactive compounds such as inexpensive antioxidant phenolics. These findings provide a credible foundation for further studies on sweet potato peels. Hence the constituents of this crude extract will consequently be isolated, examined and derivatized for possible improved biological activities.

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**REFERENCES**

1. Woolfe JA “Sweet Potato: An untapped Food resource”. Cambridge University Press, Cambridge, 1992

2. CIP “About Sweet potato” .Centro International de la papa (International Potato Centre). www. Cipotato org, 2005

3. Wood R “The Whole Foods Encyclopedia”. New York, NY: Prentice-Hall Press, 1988.

4. Hiroshi I, Hiroko S, Noriko S, Satoshi I, Jadahiro T, Akio M “Nutritive evaluation on chemical components of leaves, stalls and stems of sweet potatoes”. Food Chemistry 2000; 68, 359 - 367

5. Yoshimoto M, Yahara S, Okuno S, Islam MS, Ishiguro K, Yamakawa O Antimutagenicity of mono - , di – and tricaffeoylguinic acid derivatives isolated from sweet potato (Ipomoea batatas L.) leaf. Bioscience, Biotechnology and Biochemistry, 2002; 66(11): 2336 – 2341

6. Islam MS, Yoshinoto M, Teraara N, Yamakawa O Authocyanin compositions in sweet potato (Ipomoea batatas L.) Leaves. Bioscience, Biotechnology and Biochemistry 2002:Vol.66 (11): 2483 -2486.

7. Onyeneho SN and Hettiarachchy NS “Antioxidant activity, fatty acids and phenolic acid compositions of potato peels”. Journal of Science of Food and Agriculture, 1993; 62: 345 - 350.

8. Ziar-ur R, Ferzana H and Shah WH Utilization of potato peels extract as a natural antioxidant in soy bean oil. Food chemistry 2004; 84 (2): 215 – 220.

9. Aakanksha R, and Keswani MH Bandages of Boiled Potato Peels. Burns 1985; 2(6): 444 – 445.

10. Ogundana SK, Coxin DT, Dennis C “Natural antifungal compounds from the peel of yam tubers”. 2. Triennial Root Crops Symposium of the International Society for Tropical Root Crops, Douala (Cameroon), 14-19 Aug 1983.

11. Pochapski MT, Fosquiera EC, Esmerino LA, Dos Santos EB, Farago PV, Fábio AS, and Carlos F Phytochemical screening, antioxidant, and antimicrobial activities of the crude leaves’ extract from *Ipomoea batatas* Lam. Pharmacogn Mag, 2011;7(26): 165-170.

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12. Harborne JB. Phytochemistry. Academic Press, London 1993; 89-131

13 Thamaraiselvi PL and Jayanthi P. Preliminary studies on phytochemicals and antimicrobial activity of solvent extracts of *Eichhornia crassipes* (Mart.)Solms. Asian Journal of Plant Science and Research. 2012; 2 (2):115-122

14. Kujala TS, Loponen JM, Klika KD, Pihlaja K. Phenolics and betacyanins in red beetroot (Beta vulgaris) root: Distribution and effect of cold storage on the content of total phenolics and three individual Compounds. J. Agric. Food Chem 2000; 48: 5388-5342.

15 Naima S, Muhammad R and Maria S. Antioxidant activity, total phenolic and total flavanoid content of whole plant extracts *Torilis* *leptophylla* L. Complementary and Alternative Medicine 2012

16 Ayoola GA, Coker HAB, Adesegun SA, Adepoju-Bello AA, Obaweya K, Ezennia EC, Atangbayila TO. Phytochemical screening and antioxidant activities of some selected medicinal plants used for malaria therapy in southwestern Nigeria. Tropical Journal of Pharmaceutical Research, September 2008; 7 (3): 1019-1024

17. Rumbaoa RG, Cornago DF, Geronimo IM. Phenolic content and antioxidant capacity of Philippine sweet potato (*Ipomoea batatas*) varieties. Food Chem 2009; 113:1133–8.

18. Habila1 JD, Bello IA, Dzikwi AA, Musa H and Abubakar N. Total phenolics

and antioxidant activity of *Tridax procumbens* Linn. African Journal of Pharm and Pharmacol 2012; 4(3): 123-126

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