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Phytochemical screening, proximate and elemental analysis of *Citrus sinensis* peels (l.) Osbeck.

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ABSTRACT: *Citrus sinensis* was screened for its phytochemical composition and was evaluated for the proximate and elemental analysis. The phytochemical analysis indicated the presence of reducing sugar, saponins, cardiac glycosides, tannins and flavonoids. The elemental analysis indicated the presence of the following mineral elements in various concentrations: Zn, Cu, Mg, and Mn, while Cd and Ni were less than 0.001 and 0.05 respectively, while Cr was about 0.01 in concentration. Proximate analysis also shows that it has a high nutritional value such as carbohydrate, fibre, Ash, fat and protein. These results recommended the consumption of these peels of desired physiochemical properties as sources of food fibres or low-calorie bulk ingredients in food applications requiring oil and moisture retention. © JASEM

The orange is a hybrid of ancient cultivated origin, possibly between pomelo (*Citrus maxima*) and mandarin (*Citrus reticulata*) (Nicolosi et al., 2000). It is an evergreen flowering tree generally growing to 9-10m in height (although very old specimens have reached 15m) (Webber et al., 1903). The leaves are arrange alternately, are ovate in shape with crenulated margins and are 4-10cm long. The orange fruit is hespiridium, a type of berry (Bailey et al., 1976).

The sweet orange does not occur in the wild. It is believed to have been first cultivated in southeastern Asia (formerly Indochina) (Miami, 1987). Sweet orange oil is a byproduct of the juice industry produced by pressing the peel. It is used as a flavoring of food and drink and for its fragrance in perfume and aromatherapy (Wilson, 2008).

Various parts of the orange, from the orange fruit extract to the orange peel are useful; essential oil can be used in cosmetic in a variety of ways. Hesperidins, extracted from the peel of the sweet orange are used in Rejuvenating Eye Treatment Cream. Hesperidin methyl Chalcone is an organic compound and is classed as both a ketone as well as a polyols and is used as an antioxidant. It is a bioflavonoid, which is found in *Citrus sinensis* peel and specifically in the peel of sweet oranges and has lately been the subject of much research, specifically its application in pharmaceuticals as well as in cosmetic use. It is useful in preventing and halting capillary leakiness. To obtain Hesperidin methyl Chalcone, the hesperidin extract is made alkaline, to become Hesperidin Chalcone. This result is then methylated by another process, to produce Hesperidin methyl Chalcone which is an extremely pure product and is water soluble. It is this form of Hesperidin, which is a constituent of one of the potential ingredients that is included in Rejuvenating Eye Treatment Cream (Dermaxime, 2009).

The aim of this study was to analyses the extract of *Citrus sinensis* peels for the phytochemical, proximate and elemental composition.

MATERIALS AND METHODS

Plant materials Fresh peels of C*itrus sinensis* were collected from Uselu market in Benin City, Edo State, Nigeria. It was identified and authenticated by Dr. J.F Bamidele of the Department of Plant Biology and Biotechnology, Faculty of Life Science, University of Benin, Benin City, where a voucher specimen have been deposited with number 4563 The peels were initially rinsed with distilled

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water, air dried in the laboratory under shade and pulverized in a mixed-grinder, filtered and the coarsed powder stored in a non-toxic polyethylene bag.

Preparation of plant extract: The powdered mass of 1000g of *Citrus sinensis* was extracted by Soxhlet apparatus (Quickfit, England) using methanol (2.8 L). The extract was filtered through filter paper and filtrate was concentrated under reduced pressure in a rotary vacuum evaporator. Phytochemical screening was carried out on the extract.

Phytochemical screening: Qualitative assay, for the presence of plant secondary metabolites such as reducing sugar, saponnins, anthracene glycosides, deoxysugar cardiac glycosides, tannins, flavonoids and alkaloids were carried out on the extract of the *Citrus sinensis* peels following standard procedure (Harbone, 1973; Trease and Evans, 2003).

Mineralization of samples: For the conversion of solid to liquid, a wet digestion technique was used. 0.5g of the fine powdered samples was placed in beakers for digestion. The content of the beakers were treated with a mixture of HNO_3 and H_2O_2 in the ratio of 1:1. The beakers with their contents were placed on hot plates in a fume cupboard, leaving behind a colourless liquid. After mineralization, samples were transferred quantitatively to 50 mls volumetric flask and made to mark with de-ionzed distil water (Person, 1976).

Elemental Analysis.: The aliquots of the digested samples were analysed for metals of interest using bulk Scientific VGP 210 model Atomic Absorption Spectrophotometer (AAS). (Alloway, et al, 1993, Homat, 1990). Qualitative analysis of the samples was achieved by interpolating the relevant calibration curves prepared from standard metal solution of the aqueous standards.

Proximate Analysis.: *Crude Protein, Moisture Content and Crude Fibre.*
These were determined by method described by Food and Feed Analysis Laboratory Manual-Hach (Subrahmanyan, et. al, 1938).

Ash Content and Carbohydrate: Ash Content and Carbohydrate contents were done according to Association of Official Analytical Chemist and Dreywood (AOAC, 1999 and Dreywood, 1930).

Statistical Analysis.: The results of the proximate and elemental analysis were expressed as mean± Standard Error. The paired sample test using SPSS version 17 was used for the evaluation of data and $p<0.05$ accepted as significant.

RESULTS AND DISCUSSION

The phytochemical screening of *Citrus sinensis* peels revealed the presence of reducing sugars, saponins, deoxysugars cardiac glycosides, tannins and flavonoids. The presence of these constitute gives an indication of the medicinal value of the *Citrus sinensis* peels, for example, flavonoids have been found to have antioxidant properties, antibacterial and antimicrobial properties (Qian and Nihorimbere, 2004).

TABLE 1: Phytochemical Screening of *Citrus sinensis* peel**.**

Secondary metabolites	Extract
Reducing sugarss	+
Saponins	+
Anthracene glycosides	-
Deoxysugar cardiac glycosides	+
Tannins	+
Flavonoids	+
Alkaloids	-

Key: (+) present
(-) absent

TABLE 2: Result of Proximate Analysis of *Citrus sinenesis* peels in Percentage(%)

	Mean ± SE.
Moisture Content.	2.20 ± 0.20.
Ash.	14.35 ± 0.35.
Fibre.	26.50 ± 0.20.
Carbohydrate.	42.90 ± 1.00.
Protein.	4.05 ± 0.25.
Fat.	10.00 ± 0.00.

Correlation is significant at the 0.01 level (2-tailed).

The proximate analysis shows that it has a high nutritive value such as Moisture content (2.20 ± 0.20), Ash (14.35 ± 0.35), fibre (26.50 ± 0.20), carbohydrate (42.90 + 1.00), protein (4.05 ± 0.25), and fat (10.00 ± 0.00). The elemental analysis indicated the presence of some trace elements in large amount, Zn (14.04 ± 0.96) and Mg (15.55 ± 1.45). Some heavy metals were also detected in a very lower concentrations compared to the WHO standard, Cd (0.001 ± 0.00), Pd (0.08 ± 0.005) and Ni (0.05 ± 0.00). The elemental analysis has shown high concentration of trace elements: Zn and Mg. These elements are required by plants in small quantities for their normal growth. Zn is also essential in enzyme metabolism. The various concentrations of these elements in plants are very important for their normal function (Korc, 1998).

Heavy elements like; Pb and Cd were also detected in a very low concentration. These concentrations are low when compared with the acceptable daily intake of 10mg/kg (WHO, 1996). The *Citrus sinensis* peels can serve as source of valuable nutrients required for normal functioning of the body system. The utilization of these peels will enhance conversion of waste to wealth. It will also contribute positively towards solid waste management and a cleaner environment.

TABLE 3: Result of Elemental Analysis of *Citrus sinenesis* peels in mg/L.

Metal	Mean $\pm$ SE.
Zn	14.04 $\pm$ 0.96.
Cu	0.01 $\pm$ 0.001.
Cr	0.01 $\pm$ 0.001
Pd	0.02 $\pm$ 0.005.
Cd	< 0.001 $\pm$ 0.00.
Mg	15.55 $\pm$ 1.45.
Ni	< 0.05 $\pm$ 0.00.
Mn	0.04 $\pm$ 0.05.

Correlation is significant at the 0.01 level (2-tailed).

Previous work revealed that the methanolic extract is highly active against Gram positive, Gram negative micro-organism and fungi at concentrations of 100mg/ml, 150mg/ml and 200mg/ml respectively. At lower concentrations of 50mg/ml, the extract shows no activity except against *Candida albicans*. (Osarumwense, *et al.,* 2011).

TABLE 4: World Health Organization Permissible Limits For Some Heavy Metal in ppm.

Metal	Highest desirable level.	Maximum permissible level.
Fe	0.1	0.3
Pb	0.05	0.1
Zn	5.0	15.0
Mn	0.05	0.2
Cu	0.05	1.5
Cr	0.02	0.05
Cd	0.005	0.01
Ni	0.5	6.5

Conclusion: In conclusion, the evaluation of the proximate composition of *Citrus sinensis* peels (L.) Osbeck showed that this peel is high in valuable nutrients. The elemental analysis shows that it contains some micro nutrients required for normal functioning of the body system. Previous work revealed that this extract has activity against Gram positive, Gram negative micro-organism and fungi in a dose dependent manner. However, further studies on the identification, isolation, characterization and elucidation of the structure of the bioactive compounds are in progress.

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