Original Research Article

Phytochemical Screening, Nutritional Composition, and Antioxidant Activities of Turmeric (*Curcuma Longa*) Found in Ado- Ekiti, Nigeria

ABSTRACT

Turmeric (*Curcuma longa*) has been used in Indian cooking, likewise in Southern part of Nigeria (majorly Ekiti and Ondo state) and in herbal remedies. Turmeric (*Curcuma longa*) has been a widely used medicinal plant which belongs to *Zingiberaceae family*. This Study is based on the determination of antioxidant properties, proximate, phytochemical compositions, vitamins, minerals and nutritional composition of turmeric found in Ado-Ekiti Nigeria, using various standard methods. From the proximate analysis, it was discovered that turmeric contains 9.29% moisture, 7.4% ash, 12.48% crude fiber, 11.39% fat, 20.62% crude protein, and 38.29% carbohydrate. The phytochemical screening result shows that saponins, tannins, steroid, flavonoid, alkaloid, phlobatanins, and terpenoids are present while anthraquinone is absent in the rhizome. Also, mineral such as Zn, Fe, Cu, Na, K and Mg were present in considerable amount. The presence of glycoside was also determined. The free radical scavenging activities of turmeric was determined. This was carried out by determining free radical scavenging abilities using 1, 1-diphenyl-2-picrylhydrazyl (DPPH), ferric reducing antioxidant power (FRAP). The content of phenols and total flavonoids were determined also. The present report revealed that powdered turmeric rhizome has antioxidant potential, rich in important minerals and thus it can be good supplement in foods.

Keywords: Nutritional, antioxidant, phytochemical, turmeric

INTRODUCTION

Increasing information on the medicinal value of turmeric (*curcuma longa*) found in some other countries such as India, has led researchers to investigate (extract) its broad spectrum of biological actions such as anti-diabetic, anti-inflammatory, anti-ulcer, hypocholesteremic activities etc. Turmeric (*Curcuma longa*) has been used in Indian cooking, likewise in Southern part of Nigeria (majorly Ekiti and Ondo state) and in herbal remedies [1]. In Ekiti State, Nigeria, turmeric is known as "osun" while in some other parts of the country it is called "Ajo". The botanical name of turmeric is *Curcuma longa* Lin. It belongs to *zingiberaceae* or ginger family [2 and 3]. Turmeric is obviously known for its medicinal properties and it is broadly used as a spice and colouring agent [4]. Turmeric has been identified as "golden spice" as well as the spice of life [5]. Turmeric consists of curcuminoids which comprises curcumin, diferuloymethane, demethoxy curcumin and dismethoxy curcumin [6]. Curcumin which is the active constituent of turmeric has several medicinal properties such as anti-diabetic, anti-ulcer, hypocholesteremic, anti-inflammatory, analgesic, anti-bacterial, anti-fungal, anti-protozoa, antiplatelet activities[5,7] . Turmeric is closely related to the socio cultural life of the people of the Indian subcontinent. Turmeric, the earthly herb of the sun with the orange-yellow rhizome was regarded as the "herb of the sun" by the people of the verdict period. As turmeric is probably a native of south East Asia, so it is also found in different parts of Nigeria. Curcumin is $C_{21}H_2OO_6$ with melting point of 184.2^0c. It is not soluble in water but soluble in organic solvent such as ethanol and acetone. Curcumin is a potent antioxidant and it is believed to be the most bioactive and smoothing portion of the herb turmeric [8].

Furthermore, the nutritive value of turmeric is more than just preventing deficiency diseases. The nutritional status of turmeric is high and it can be exploited. Vitamin or vitamin precursor (compound which produces vitamin C), beta-carotene, polyphenol coupled with fatty acid and essential oil are

constituent of curcumin. It has been found that turmeric is a good source of spice compared with other spices such as thyme, nut meg and so on. It is considered to be an under exploited spice though consumed in Africa and part of Sub-Saharan countries. It is probably found to be one of the most underutilized tropical crops [8]. It has been recorded that the introduction of turmeric plant as part of diet has been successful despite the fact that new foods are very often difficult to introduce [9]. Turmeric has been found to be in use traditionally as domestic remedy in curing different disease like yellow fever, anorexia, cough, rheumatism and intestinal disorder [8]. Turmeric needs to be investigated scientifically so that it will not be used traditionally only but industrially in the production of foods and drugs. Thus, this investigation of turmeric will also reveal its medicinal potential to people of this 21st century who depending much on processed food neglecting the ancient plant of great medicinal potential with little or no side effect. This paper is aimed at providing information on the nutritional benefits of turmeric rhizome by investigating the proximate, phytochemical composition and the antioxidant potentials of turmeric rhizome available in Ado Ekiti, Nigeria.

MATERIALS AND METHODS

The source of the sample: The rhizomes of turmeric plant used in this work were purchased from popular market called Oja Oba in Ado-Ekiti, Nigeria.

Preparation of the rhizome material: The rhizomes were carefully washed, sliced into pieces and dried for two weeks. The dried rhizome were separated by handpicking before it was finally grinded into powder using mixer grounder and packaged for analysis.

Determination of proximate composition of turmeric rhizome powder

The percentage of moisture, ash crude fiber, fat, protein and carbohydrate contents were determined using the procedure of Association of Official Analytical chemist [10].

Determination of phytochemical components of turmeric

Saponin was determined by the method described by AOAC[11] while tannin was determined by the method described by Person [12]. Steroids were determined as described by Sofowora [13]. Anthraquinone was determined by the method described by Trease and Evans[14]. Flavonoid was determined as described by Sofowora [13]. Phlobatanin was determined as described by Trease and Evans[[14]. Terpenoid was determined by the method of Sofowora [13].

Qualitative Analysis:

Test for Saponin: 2g of the powdered sample was boiled in 20ml of distilled water in a water bath and filtered.

Then 10ml of the filtrate was mixed with 5ml of distilled water and shake vigorously for a stable persistent froth. This froth was then mixed with 3 drops of olive oil, shaken vigorously, and was observed for the formation of emulsion.

Test for Tannin: 0.5g of the dried powdered sample was boiled in 20ml of water in a test tube and then filtered after which a few drops of 0.1% ferric chloride was added. Brownish green or a blue-black precipitate indicates the presence of tannin.

Test for Steroids: 1ml of the extract was dissolved in 2.0ml of chloroform in a test tube and followed by the addition of concentrated. H_2SO_4. Formation of reddish brown colour at the inter-phase confirms the presence of steroids.

Test for Flavonoid: 1.0ml of the extract was diluted in 1.0ml of diluted NaOH. Formation of precipitate indicates the presence of flavonoid.

Test for Anthraquinone: 5g of the sample extract was mixed with benzene, and filtered. 5ml of 10% ammonia solution was added to the filtrate. The mixture was then shaken and presence of a pink, red or violet colour in the ammonia cal (lower) phase shows the presence of free anthraquinones.

Test for Alkaloid: Aqueous hydrochloric acid (5.0ml of 1%) was added to 2mg of the extract in a test tube. The mixture was heated in a seam bath and filtered and 1ml of the filtrate was treated with 6-10 drops of Dragendoff's reagent. Observation of creamish precipitate or turbidity indicates the presence of alkaloid.

Test for phlobatanin: Red precipitate indicate the presence of phlobatanins when the aqueous extract of the sample was boiled with 1% aqueous hydrochloric acid.

Terpenoids: The extract (5.0ml) was mixed with 2ml of chloroform in a test tube. 3Ml of concentrated H_2SO_4 was carefully added to the mixture to form a lower layer. Formation of an interface with a reddish brown colouration indicates the positive result for the presence of terpenoids.

Cardiac Glycosides test:

a. Kelller-Killani (deoxysugar): The extract (5.0ml) was treated with 2ml of glacial acetic acid containing one drop of ferric chloride solution. This was underplayed with 1.0Ml of concentrated hydrogen tetraoxosulphate (vi) acid. A brown ring at the interface indicates a deoxysugar characteristics of cardenolides
b. Lieberman's test: 2.0ml of acetic anhydride was added to 0.5g of the etract with 2.0Ml H_2SO_4. The colour change from violet to blue indicating the presence of steroids.

Determination of mineral composition of turmeric rhizome (powder)

Calcium, sodium, lead, and potassium contents in the sample were determined using flame photometer by the approach described in [15]. Copper, zinc, iron, and magnesium in the sample were determined by atomic absorption spectrophotometry (AAS) using the direct method described by [5, 6].

Determination of antioxidant properties of the sample

A total flavonoid content of the extract was determined using a colorimeter assay developed by the [16]. The total phenol of the rhizome extract was determined using the method described in [17]. In addition, the ferric reducing property of the extract was determined following the approach in [18]. Furthermore, the ability of the extract to chelate Fe^{2+} was determined using a modified method of [19].

Evaluation of free radical scavenging ability of the sample

The free radical scavenging ability of the extract against DPPH (1, 1- diphenyl-2picrylhydrazyl) free radical was evaluated by the method in [20]. Free radical scavenging ability of rhizome extract against NO was evaluated the approach described in [21].

RESULTS AND DISCUSSION
RESULTS

PROXIMATE COMPOSITION OF TUMERIC RHIZOME

Table 1 shows that turmeric rhizome contains 9.29% moisture, 12.48% crude fibre, 20.62% crude protein, 7.94% ash, 11.39% fat & oil and 38.29% carbohydrate.

Table 1: Proximate composition of turmeric rhizome

Parameter	%composition
Moisture content	9.29±0.08
Ash content	7.94±0.14
Crude fiber	12.48± 0.34
Fat	11.39±0.16
Protein	20.62±0.54
Carbohydrate	38.29± 0.59

PHYTOCHEMICAL COMPOSITION OF TURMERIC RHIZOME

Table 2 below shows that there is presence of saponin, tannin, steroid, flavonoid, alkanoid, phlobatanin and terpenoid. However, anthraquinone was absent.

Table 2.0: Qualitative test on phytochemical composition of turmeric rhizome

Parameters	Results
Saponin	+
Tannin	+
Steroid	+
Flavonoid	+
Anthraquinone	-
Alkaloid	+
Phlobatanin	+
Terpenoid	+

Table 3 shows mineral composition of turmeric rhizome. It contained iron (283.72ppm), Zn (120.63ppm), copper (22.09ppm), sodium (10.02ppm), calcium (5.35ppm), potassium (356.78ppm) and magnesium (99.44ppm) respectively.

Table 3: Mineral composition of turmeric (Curcuma Longa) rhizomes

Minerals	Concentration (ppm)
Pb	-
Fe	283.72
Zn	120.63
Cu	22.09
Na	10.02
Ca	5.35
K	356.78
Mg	99.44

Antioxidant composition and free radical scavenging ability of turmeric rhizome

The result in table 3 shows that the turmeric rhizome contains 1.86mg/g flavonoid, 4.87 mg/g total phenol, 28.99mg/g Frap, 83.90mg/g ability to scavenge DPPH which is in line with [28] result, 20.65mg/g NO, 13.8mg/g Fe^{2}+ chelation, 7.06mg/g tannin and 12.10mg/g vitamin c.

Table 4: Free radical scavenging ability of turmeric (*Curcuma longa*) rhizome

Parameters	% composition (mg/g)
FLAVONOID	1.86± 0.07
TOTAL PHENOL	4.87± 0.31
FRAP	28.99± 0.43
DPPH %	83.90 ± 0.14
NO %	20.65± 0.07
Fe2+ CHELATION %	13.8± 0.0
TANNIN	7.06 ± 0.02
VIT C	12.10 ± 0

DISCUSSION

From the percentages presented above (Table 1), it could imply that turmeric rhizome is a good source of fibre and carbohydrate. Studies show that turmeric (38.29%) was rich in carbohydrate than some plants like *Acalypha marginata* [8]. However, it was observed from the result of analysis that the carbohydrate content of turmeric found in Ado is lower compare to the content reported by [8]. This may be as a result of climatic condition. There are variations in moisture contents of foods and water is a major constituent of most food product as reported by [22]. The moisture content of turmeric in this study is shown above (Table 1) and studies show that moisture is an essential factor in food quality, resistance to deterioration and preservation. Calculation of the content of other food constituents on a uniform basis (i.e. dry weight basis) depends on the determination of moisture contents [22]. The ash content (7.29%) is an indication that turmeric rhizome contains some amounts of mineral. Fiber content which is 12.48% of turmeric rhizome is substantial and is known to aid cleansing the digestive tract of its consumer and hinders the absorption of excess cholesterol. Fiber has been reported to add bulkiness to the stomach (food) and prevents the intake of too much starchy food which can thus guide against metabolic conditions like diabetics mellitus and hypercholesterolemic [23]. This result is different from the result reported by [8] peradventure due to difference in climatic conditions and the fact that the chemical composition of most herbs changes with geographical location which may be due to climatic conditions and biochemical variations.

Identifying the presence of all these phytochemicals in turmeric rhizomes, may be responsible for its medicinal properties. Tannins have been reported as antimicrobial agents and they are water soluble plant polyphenols that precipitate protein [24]. It was found also that tannins can hinder the growth of microorganisms by precipitating microbial proteins and making nutritional proteins unavailable for the microorganisms

The development of many viruses, yeast, fungi and bacteria was inhibited by tannins [8]. They reported also that tannins have different physiological effects such as antiparasitic, antimicrobial, antiphlogistic, anti-irritant effects and so on. Tannins containing plants like turmeric rhizomes, *Acalypha racemosa* and *Acalypha marginata* have been found useful in the treatment of nonspecific diarrhoea, inflammations of mouth (and throat) and slightly injured skins phytotherapeutically [24-25]. The most important function of flavonoids may be its potent antioxidant activity, their ability to scavenge lipid peroxy radicals, hydroxyl radicals and superoxide anions [25].

Inclusion of turmeric rhizome in daily diet could be essential in maintaining strong bones, reducing blood pressure, blood clotting, muscle contraction & relaxation, and help in haemoglobin formation [8]. Potassium and magnesium have been found to reduce blood pressure, potassium also functions in controlling skeletal muscle contraction and nerve impulse transmission. Calcium has been found to be the major element sustaining strong bones and plays a strong role in absorption of vitamin B_{12}, muscle contraction and relaxation, and blood clotting [26]. High calcium and potassium are usually recommended for patient with strong bone problems [26]. In [27], it was reported that the content of iron in a plant extract can assist in haemoglobin formation, and thus it can be recommended for iron

deficiency anaemia. Also, it plays a role in cell division, cell growth, wound healing, and the breaking down of carbohydrates. Plants are very important in metabolic reactions because various minerals present in these plants are also co-enzymes in certain biochemical reactions.
From the result, the sample has ability (20.65±0.07 and 83.90mg/g in Table 4) to scavenge NO and DPPH respectively. This implies it could be a very good source of antioxidant which plays a crucial role in preventing diseases that could result from oxidative damage. DPPH radical was used as a stable free radical to determine antioxidant activity of natural compounds [29]. As reported by [30], plant extracts containing polyphenol components possess antioxidant activity due to their capacity to be donors of hydrogen atoms or electrons and to capture the free radicals. Therefore, the purple colour of 2, 2-diphenyl-1- picryl hydrazyl (DPPH) will reduce to α, α-diphenyl- β-picrylhydrazine (yellow coloured) [31]. Scavenging of the stable radical (DPPH) is considered a valid and easy assay to evaluate scavenging activity of antioxidants as reported in [32].
In addition, the antioxidant activity is also determined on the basis of the ability of antioxidant in this plant extracts to reduce ferric (III) iron to ferrous (II) iron using FRAP reagent [33-34]. According to [35] FRAP assay was used generally due to its simplicity and reproducibility. The result (mean value28.99± 0.43) of FRAP in this study is different from the report of [34]. This may be due to difference in climatic region. Several studies [34, 36-37] reported that phenolic compounds in spices and herbs significantly contributed to their antioxidant properties. According to [34], phenolic compounds are major contributors to antioxidant activity.

Vitamin C content of powdered turmeric rhizome extracts is 12.10 ± 0.0 (mg/g) as shown in table 4 though different from result reported by [38] which is 0.66mg/g, this can be as a result of using different plants. As a water-soluble antioxidant (cannot be stored in the body), vitamin C is in unique position to "scavenge" aqueous peroxyl radicals before these destructive substances have a chance to damage the lipids [38]. Hence, the present investigation suggests that powdered turmeric rhizome shows good antioxidant activity, reducing power and free radical scavenging activity.

CONCLUSION

Phytochemical screening of turmeric rhizome found in Ado Ekiti reveals the presence of flavonoids, saponins, tannins and steroids. Thus these in vitro antioxidant potential of sample may be due to the presence of these phytoconstituents and vitamin C. The obtained data implied that turmeric rhizome has antioxidant potential which is very important in the prevention of some oxidative stress induced diseases. The results of the study show that turmeric rhizome is a good nutriceutical.

References

1. Tilak J.C.1., Banerjee M., Mohan H. and Devasagayam T.P. (2004). Antioxidant availability of turmeric in relation to its medicinal and culinary uses. Phytother Res.; 18(10):798-804.
2. Pawar H, Karde M, Mundle N, Jadhav P and Mehra K (2014) Phytochemical Evaluation and Curcumin Content Determination of Turmeric Rhizomes Collected From Bhandara District of Maharashtra (India). Med chem 4: 588-591.
3. Chattopadhyay I.,Biswas K., Uday B., and Ranajit K. B.(2004). Turmeric and curcumin: Biological actions and medicinal applications. Current Science, Vol. 87(1).
4. Kulkarni S.J., Maske K.N., Budre M.P. and Mahajan R.P. "Extraction and purification of curcuminoids from Turmeric (curcuma longa L.)" *International Journal of Pharmacology and Pharmaceutical Technology (IJPPT)*, ISSN: 2277 – 3436, Volume-1, Issue- 2, 2012. PP. 81-84

5. Duggi Shrishail, Handral Harish, Handral Ravichandra, Tulsiand G. and Shruthi S.D. (2013) Turmeric: Nature's Precious Medicine, *Asian Journal of Pharmaceutical and Clinical Research*, vol.6, issue 3, 10-16.
6. Chainani-Wu, N. (2003). Safety and anti-inflammatory activity of curcumin: a component of turmeric (Curcuma longa). *Journal of Alternative and Complement medicine* 9: 161- 168.
7. Peter, K. V. (2000). Informatics on Turmeric and Ginger. India Spices 36 (2 and 3): 12 - 14.
8. Ikpeama, Ahamefula, Onwuka, G. I. and Nwankwo, Chibuzo.(2014). Nutritional Composition of Tumeric (Curcuma longa) and its Antimicrobial Properties. Int. J. of Scientific & Engineering Research, Volume 5, Issue 10.
9. Henry, B. (1998). Use of capsicum and turmeric as natural colours, India Spices 35 (3): 7 - 14.
10. AOAC. (1990) Official Method of Analysis 15th Edition, Association of Official Analytical Chemists Washington, D. U.S.A.
11. AOAC. (2000).Official methods of analysis of AOAC. *International 17th edition; Gaithersburg, MD, USA Association of Analytical Communities.*
12. Person, D. (1976). Chemical analysis of foods. 7th edition. Edinburgh churchil living stone.
13. Sofowora A (2006). Medicinal Plants and Traditional Medicine in Africa. 2nd Edn. Spectrum Books Ltd., Ibadan, Nigeria, pp. 151-153, 209- 214.
14. Trease, G.E. and Evans, W.C (1989). Pharmacolognosy. 13th (ed). ELBS/ Bailliare Tindall, London. Pp. 345-6,535-6, 772-3.
15. Tel DA, Rao R (1982). Automated and semi-automated method for soil plant analysis, Manual Series No.7, IITA, Ibadan.
16. Bao J. Y., Cai M., Sun G., Wang and H. Corke, (2005). Anthocyanins, Flavonoid and Free Radical Scavenging Activity of thines Baybery (Myrial rubia) extracts and their colour properties and stability. Journal of Agric Food Chem. 53: 2327-2332.
17. Singleton V. L., Orthofer R. and Lamuela-Raventos R. M. (1999). Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Cioalteau Reagents. Meyhods in Enzymol. 299: 152-178.
18. Oyaizu M. (1986). Studies on products of browning reactions: antioxidant activities of products of browning reaction prepared from glucosamine. *J. Nutrit*., 44 pp. 307–315
19. Puntel, R.L., C.W. Nogueira and J.B.T. Rocha, 2005. Krebs cycle intermediates modulate Thiobarbituric Acid Reactive Species (TBARS) production in rat brain *in vitro*. Neurochem. Res., 30: 225-235.
20. Lin J-K. (2007). Molecular targets of curcumin. In: The Molecular Targets and Therapeutic Uses of Curcumin in Health and Disease. Springer; p. 227–43. ISBN 978-0-387-46401-5

21. Jagetia G.C. and Baliga M.S. (2004). The evaluation of nitric oxide scavenging activity of certain Indian medicinal plants in vitro: a preliminary study. *J Med Food.* 2004 Fall; 7(3):343-8.
22. Nielsen S.S. (2010).Food Analysis. Food Science Texts Series, DOI 10.1007/978-1-4419-1478-1_6.Springer Science+Business Media, LLC.
23. Bamishaiye, E. I., Olayemi, F. F., Awagu, E. F. and Bamshaiye, O. M. (2011). Proximate and phytochemical composition of Moringa oleifera leaves at three stages of maturation. Advance Journal of Food Science and Technology 3(4): 233 - 237.
24. Prasad, N. R., Viswanathan, S., Devi, J. R., Nayak, V, Swetha, V. C., Archana, B. R., Parathasarathy, N. and Rajkumar, J. (2008). Preliminary phytochemical screening and antimicrobial activity of Samanea saman. Journal of Medicinal Plants Research 2(10): 268 - 270.
25. Iniaghe, O. M., Malomo S.O. and Adebayo, J.O. (2009). Proximate composition and phytochemical constituents of leaves of some acalypha species. Pakistan Journal of Nutrition 8: 256 - 258.
26. Kubinarawa, D., Ajoku, G. A., Enwerem, N. M. and Okorie, D. A. (2007). Preliminary phytochemical and anti-microbial screening of 50 medicinal plants from Nigeria, African Journal of Biotechnology 6(14):1690 - 1696.
27. Latunde – Dada, G. O., (1980). Effect of processing on iron levels and availability on Nigeria vegetables. Journal Science of Food and Agriculture 53:355 - 361.
28. Virendra V. P., Shalini T., Nirmala K., Chetan N. and Kalpagam P.(2013). In vitro evaluation on antioxidant and antimicrobial activity of spice extracts of ginger, turmeric and garlic.J. of Pharmacognosy and Phytochemistry .2 (3): 143-148
29. Ozturk, M., Ozturk, F.A., Duru, M.E. and Topcu, G. (2007). Antioxidant activity of stem and root extracts of Rhubarb (Rheum ribes): An edible medicinal plant. Food Chemistry 103: 623-630.
30. Stoilova, I., Krastanov, A., Stoyanova, A., Denev, P. and Gargova, S. 2007. Antioxidant activity of a ginger extract (Zingiber officinale). Food Chemistry 102: 764-770.
31. Akowuah, G.A., Ismail, Z., Norhayati, I. and Sadikun, A. 2005. The effects of different extraction solvents of varying polarities of polyphenols of Orthosiphon stamineus and evaluation of the free radical-scavenging activity. Food Chemistry 93: 311-317
32. Suhaj, M. (2006). Spice antioxidants isolation and their antiradical activity: a review. Journal of Food Composition and Analysis 19: 531-537.
33. Alothman M., Bhat R. and Karim A.A. (2009). Antioxidant capacity and phenolic content of selected tropical fruits from Malaysia, extracted with different solvents. Food Chemistry 115: 785-788.

34. Wong C., Li H., Cheng K. and Chen F. (2006). A systematic survey of antioxidant activity of 30 Chinese medicinal plants using the ferric reducing antioxidant power assay. Food Chemistry 97: 705-711.
35. Maizura M., Aminah, A. and Wan Aida, W. M. (2011). Total Phenolic Content and Antioxidant Activity of Kesum (Polygonum Minus), Ginger (Zingiber Officinale) and Turmeric (Curcuma Longa) Extract. *International Food Research Journal* 18: 529-534
36. Shan B., Cai Y. Z., Sun, M. and Corke, H. 2005. Antioxidant capacity of 26 spice extracts and characterization of their phenolic constituents. Journal of the Agricultural and Food Chemistry 53: 7749–7759.
37. Wu C.Q., Chen, F. Wang, X., Kim, H.J., He, G.Q., Haley- Zitlin, V. and Huang, G. (2006). Antioxidant constituents in feverfew (Tanacetum parthenium) extract and their chromatographic quantification. Food Chemistry 96: 220–227
38. Naskar S., Islam A., Mazumder U. K., Saha P., Haldar P. K., and Gupta M.(2010). *In Vitro* and *In Vivo* Antioxidant Potential of Hydromethanolic Extract of Phoenix dactylifera Fruits. *J.* Sci. Res. 2 (1), 144-157.