Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.74, 2018

Phytochemical Screening and Proximate Analysis of *Balanites aegyptiaca* Kernel

A. J. Alhassan[1*] I.U. Muhammad[1] A. Idi[1] M. A. Danagmbo[1] Y. Ramatu[1] A. Mohammad[2] A. Nasir[3] A.I. Yaradua[3] S.M. Adamu[4] I Alexander[5]

1.Department of Biochemistry, Faculty of Basic Medical Sciences, Bayero University, P. M. B. 3011, Kano, Nigeria

2.Department of Biochemistry, College of Medical Sciences, Abubakar Tafawa Balewa University, P.M.B 0248, Bauchi. Nigeria

3.Department of Biochemistry, Faculty of Natural and Applied Sciences, Umaru Musa Yar´adua University, Katsina, Nigeria

4.Chemical Pathology Department, National Orthopedic Hospital Dala-Kano

5.Department of Biochemistry, Faculty of Natural Sciences, Caritas University, Amorji-Nike, P.M.B. 01784, Enugu, Nigeria

Abstract

Study on the evaluation of nutritional quality as well phytochemical screening of poorly utilized plant products is of immense importance. This research work was aimed at screening the phytochemicals as well as proximate analysis of *Balanites aegyptiaca* kernel using standard methods. Phytochemical screening of the kernel reveal the presence of Alkaloids, Cardiac glycosides, Flavonoids, Phytosterols, Reducing sugars, Saponins, Steroids, Tannins and Volatile oils with the absence of Anthraquinones and Phenolic compounds. Quantification of the phytochemicals content shows a high content of Saponins, Flavonoids, Cardiac glycosides, Alkaloids and Tannins. Proximate analysis of the kernel shows high Lipid and Protein content with very low carbohydrates and crude fiber, ash and moisture content.

Keywords: phytochemicals, proximate, Balanites aegyptiaca, and Kernel

1.0 Introduction

Balanite aegyptiaca (Linn.) is a genus of flowering plants in the caltrop family, commonly known as desert date. *Banalites aegyptiaca* is an important multipurpose tree found in most African countries (Clement *et al.,* 2011). It is a woody evergreen xylophylic tree with a height of 10m grown in various ecological conditions mainly distributed in semi-arid zones in tropical Africa especially in Senegal, Sudan and also Asian countries such as India (Chothani *et al.*, 2011). In Arabic, it is known as lalob, hidjihi, inteishit and heglig. In Hausa, it is called Aduwa and in Swahili and Amharic, it is respectively called mchunju and bedena (Guinand and Dechassa, 2009).

The kernel is traditionally used in the treatment of various ailments such as jaundice, intestinal worm infection, malaria, syphilis, epilepsy, dysentery, constipation, haemorroid among others (Daya and Vaghasiya, 2011). The seed is about 1.5-3.0 cm long, light brown in colour, having a fibrous and hard texture and making up to 50-60% of the fruit. These seeds were reported to contain a cytostatic saponins "balanitins" (Yadav and Manju, 2010), "deltonin" and "isodeltonin" which are used as molluscicidal agents (Gnoula *et al.,* 2007). In addition, various reports on the nutritional and anti-nutritional profile of *Balanites aegyptiaca* seeds powder has shown that it contains a relatively high amount of protein and lipids (Lohlum *et al.,* 2012) and some amount of anti-nutritional factors such as tannins, oxalate and phytic acid (Chothani and Vagh, 2011) as compared to other plant products.

This study could go a long way in providing the phytochemical and proximate content of the kernel obtained in Kano state, Nigeria. Thus, providing a scientific basis for the medicinal and nutritional use of the kernel.

2.0 Materials and Methods

2.1 Sample Collection and Preparation

Balanites aegyptiaca fruits were obtained from Gwammaja market, Dala Local Government Area of Kano state Nigeria. It was authenticated at department of plant biology Bayero University, Kano. The fruit was given an accession number of BUKHAN0359. The fruit was processed by soaking in water for few days, de-pulping and hard cracking the seeds with hammer to obtain its kernel. The kernels were air-dried for 12 hours and pulverized using mortar and pestle.

2.2 phytochemical screening of Balanites aegyptiaca Kernel

Phytochemical tests were carried out by using the standard methods of Harborne (1973), Sofowora (1993), Trease and Evans (1989), Kokate (2003), Rasal (2005) and Savithramma *et al* (2001).

2.3 Analysis of proximate contents of Balanites aegyptiaca Kernel

Ten gram (10g) of the flour was soaked in 100 ml of pre-boiled distilled water. The solution was shook vigorously and allowed to stand for 24 hours. It was then filtered using Whatman's No. 1 filter paper and concentrated by freeze-drying to solvent free extract. The proximate analysis of the seed extract for moisture, ash, fibre carbohydrate, crude protein and fat contents were determined as described by AOAC standard assay method (AOAC, 1997).

3.0 Results

The phytochemical contents of *Balanites aegyptiaca* kernel are shown in Table 1 below. The presence of Alkaloids, Cardiac glycosides, Flavonoids, Phytosterols, Reducing sugars, Saponins, Steroids, Tannins, Volatile oils and absence of Anthraquinones and Phenolic compounds were detected. Quantification of some of the phytochemicals reveals high quantities of Saponins, Flavonoids, Cardiac glycosides, Alkaloids and Tannins in mg/100g.

Table 1: Qualitative and some Quantitative Phytochemical contents of *Balanites aegyptiaca* kernel

Phytochemicals	Qualitative	Quantitative (mg/100g)
Flavonoids	+ve	388.33 ± 2.08
Saponins	+ve	427.90 ± 10.17
Tannins	+ve	27.50 ± 0.15
Phenols	-ve	
Reducing Sugars	-ve	
Alkaloids	+ve	68.67 ± 3.06
Steroids	+ve	32.4 ± 0.10
Glycosides	+ve	203.92±1.22
Anthraquinones	-ve	
Phytosterols	+ve	
Volatile oils	+ve	

The results for proximate composition of *Balanites aegyptiaca* kernel was shown in Figure 1. The kernel is rich in Lipid and Protein content but very low in both carbohydrates and crude fiber. Its low ash content indicates that it has low mineral content while its low moisture content shows its ability to be stored for a long period of time under ambient conditions.

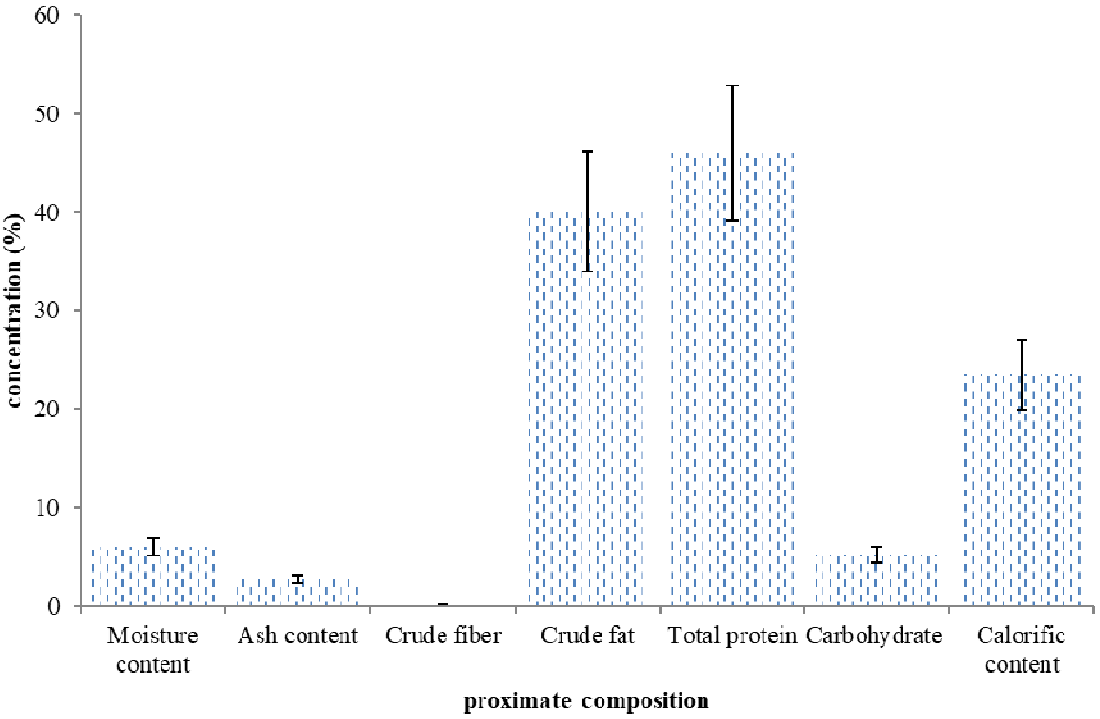

Figure 1: percentage (w/w) proximate composition of *Balanites aegyptiaca* kernel sourced around Kano

4.0 Discussion

Phytochemical screening of *Balanites aegyptiaca* kernel reveals the presence of Alkaloids, Cardiac glycosides, Flavonoids, Tannins, Phytosterols, Steroids, Reducing sugar, Volatile oil and Saponins with the absence of Anthraquinones and Phenolic compounds. Quantification of some of the phytochemicals showed Saponin content to be higher followed by Flavonoids, Cardiac glycosides, Alkaloids and lastly Tannins. Saponins are naturally oily glycosides occurring in wide variety of plants (Applebaum *et al*., 1969) and are generally known for their bitter taste, foaming in aqueous solutions, and their ability to haemolyse red blood cells when injected into the blood stream (Birk and Peri, 1980). When eaten, they are practically nonpoisonous to warm blooded animals. However, high saponin level has been associated with gastroenteritis manifested by diarrhea and dysentery (Awe and Sodipo, 2001). Saponin has health benefits which might have accounted for some of the reported therapeutic ability of *Balanites aegyptiaca* kernel (Gloria *et al*., 2011). Various studies have disclosed that saponins have anti-inflammatory, anti-diabetic, anti-HIV, anti-atherosclerotic, hepatoprotective and hypolipidemic (Egbuna and Ifemeje, 2015). The observed saponin content was found to be higher than that reported in *Balanites aegyptiaca* flower (Umar *et al*., 2014).

Flavonoids are chemical compounds that serve as flavoring ingredient of spices and vegetable (Olaofe and Sanni, 1988). Flavonoids have protective effects including anti-inflammatory, anti-oxidant, anti-viral, and anti-carcinogenic properties which In vitro studies have shown that flavonoids also have anti-allergic, anti-microbial, anti-cancer and anti-diarrheal activities. (Egbuna and Ifemeje 2015). The Flavonoid content was found to be higher than that in so many seeds amongst which we have *Daniella oliveri* seeds and *Olax subscorpoidea* seeds (Otori and Mann, 2014).

Alkaloid content is also higher than that in seeds of *Daniella oliveri* and *Olax subscorpoidea* (Otori and Mann, 2014) and *Balanites aegyptiaca* flower (Umar *et al*., 2014). They are often non-toxic and have dramatic physiological activities hence they are widely used in medicine (Olaofe and Sanni, 1988). Lower dose of alkaloids mediate important pharmacological activities, such as analgesic, reducing blood pressure, killing tumour cells, stimulating circulation and respiration (Egbuna and Ifemeje 2015).

Tannins have the ability to precipitate certain proteins. They combine with digestive enzymes thereby making them unavailable for digestion (Abara, 2003). Although, secondary plant metabolites known as phytochemicals are known to be important to both plants and animals but could also be harmful or show some adverse effects to animals especially when consumed in large quantities hence called anti-nutrients. Anti-nutritional factors are known to affect the availability of nutrients required by the body and interfere with metabolic process so that growth and development of the body is negatively influenced. These anti-nutritional factors can easily be reduced to tolerable limits by proper processing techniques such as soaking, cooking and frying (Anhwange *et al*., 2006).

From the percentage proximate composition of *Balanites aegyptiaca* kernel, the ash content was found to be lower than that found in its pulp as described by Sagna *et al* (2014). Since ash is the index of mineral content, the kernel may have low mineral contents compared to the pulp of the fruit. However, it crude fat is quite higher than that of the fruit pulp as reported by Favier *et al* (1993) and Lohlum *et al* (2012). The kernel oil might be edible as Sesame and Groundnut oils which were most popular edible oils in Sudan (Abu-Al-futuh, 1983). This was reported to have a wide range of medicinal uses (Guinand and Dechassa *et al*., 2011) and can be used as a biofuel (Manji *et al*., 2013). In addition, the kernel was found to have high crude protein content similar to that reported for in its seed cake (Ibironke and Emmanuel, 2014) and soybean meal (Ahmed *et al*., 2009). It also has higher protein content than the pulp as reported by Sagna *et al* (2014). It could therefore serve as source of protein for animal feed if its toxic substances are eliminated (Lohlum *et al*., 2012).

Crude fiber in *Balanites aegyptiaca* kernel is quite low as compared to that reported in its seed cake by Ibironke and Emmanuel (2014). Low crude fiber content in nuts could lead to constipation if excess of it is being consumed as crude fiber enhances bowel movements. Moisture content of the kernel shows its storage capacity. It was found to be lower than that in the pulp (Sagna *et al*., 2014).

The proximate composition of the kernel indicates it is highly nutritious as it contains high protein content, hence could supplement other protein sources such as beans, peas and groundnuts especially in dry seasons and in arid regions (Okia *et al*., 2011). The crude protein content of the kernel was found to be greater than that of leaves (Kubmarawa *et al*., 2008), flower and fruit pulp (Okia *et al.,* 2013). Therefore, the continuous rise in the cost of animal proteins like meat, egg, fibre and milk could be reduced by processing this kernel and used as a protein supply for feed formulation in both humans and animals nutrition.

5.0 Conclusion

The study revealed that *Balanites aegyptiaca* kernel is rich in phytochemicals that may be responsible for some of its reported pharmacological activities. It also shows that the kernel is of high nutritional value.

Reference

Abara, A.E. (2003). Tannin contents of *Dioscorea bulbufera*. *Journal of Chemical Society of Nigeria*. 28: 55-56.

Abu-Al-Futuh I.M. (1983). *Balanites aegyptiaca*, an unutilized raw material potentially ready for agro-industrial exploitation. United nations Industrial Development Organization, Vienna, Austria report UNIDO, p.10-494.

Ahmed, A. M., Mohammad, H. A., Amani, M. and Asmaa, S. (2009). Effect of using dried fenugreek seeds as natural feed additives on growth performance, feed utilization, whole- body composition and entropathogenic Aeromonas hydrophila-challinge of monsex nile tilapia O. niloticus (L) fingerlings. *Australian Journal of Basic and Applied Sciences* 3: 1234-1245.

Anhwange, B.A., Ajibola, V.O., Okibe, F.G. (2006). Nutritive value and Anti-nutritional factors in Wild seeds. *Journal of Fisheries International*. 2:73-76.

AOAC (1997). Official methods of analysis, Association of Official Analytical Chemists, Washington, D.C., USA. 17th Edition, Pp. 807-928.

Applebaum, S.W., Marfo, S., Birk, Y. (1969). Saponins as possible factors of resistance of legume seeds to the attack of insects. *Journal of Agricultural Food Chemistry* 17: 618- 620.

Birk, Y., Peri, I. (1980). Saponins. In: Liener I.E. (Ed.). Toxic constituents of plant foodstuffs, 2nd edition. New York. Academic Press. Pp. 161-182.

Chothani, A.O., Jacob, G.A., James, M.K., Refaat, A. and Ahmed, A. (2011). Harvesting and Processing of *Balanite aegyptiaca* Leaves and Fruits for Local Consumption by Rural Communities in Uganda. *Journal of Food Technology* 9 (2):83-90.

Clement, A.O., Jacob, G.A., James, M.K., Refaat, A. and Ahmed, A. (2011). Harvesting and Processing of *Balanite aegyptiaca* Leaves and Fruits for Local Consumption by Rural Communities in Uganda. *Journal of Food Technology* 9 (2):83-90.

Daya, L. C. and H. U. Vaghasiya (2011). A review on *Balanite aegyptiaca* Del (Desert date): phytochemical constituent, traditional uses and pharmacological activity. *Pharmacogen Review* 5 (9):55-62.

Egbuna C. and Ifemeje J.C. (2015). Biological Functions and Anti-nutritional Effects of Phytochemicals in Living System. IOSR Journal of Pharmacy and Biological Sciences 10: 10-19.

Favier, J. C., Ireland-Ripert, J., Laussucq, C., Feinberg, M. (1993). Répertoire général des aliments, tome 3. Table de composition des fruits exotiques, fruits de cueillette d'Afrique. Tec Doc Lavoisier (ed). INRA, ORSTOM, Paris. p. 242

Gloria, N., E., Babajide, O. E., Ochuko, L. E. (2011). Activities of some enzymes, enzyme inhibitors and antinutritional factors from the seeds of sponge gourd (*Luffa aegyptiaca M.*). *African Journal of Biochemistry Research*. 5(3), Pp. 86-89.

Gnoula, C., Guisso, P., Duez, P., Frederich, M. and Dubois J. (2007) Nematocidal compounds from seeds of *Balanitesa egyptiaca* Isolation and structure Elucidation. *International Journal of Pharmacology* 3:280-4.

Guinand, Y. and Dechassa, L. (2009) Wild-Food Plants in Southern Ethiopia: Reflections on the role of 'famine-foods' at a time of drought" UN-OCHA Report.

Harborne, J.B. (1973). Phytochemical Methods, London Chapman and Hall Ltd. Pp. 49-188.

Ibironke, A. A., Emmanuel N. I. (2014). Short term toxicological analysis and effect of totalreplacement of wheat with *Balanite aegyptiaca* seed cake on albino rats. *IOSR Journal.*

Kokate, C.K. (2003). Practical Pharmacognosy.

Larsgon, M., Rossande- Hulthen, L., Sandstome, B. and Sandberg, A. (1996). Impoved iron and zinc absorption from breakfast meals containing malted oats with reduced phytate content. *Journal of Nutrition* 76:677-688.

Liener, I.E. and Kkade, M.L. (1980). Protease inhibitor, Toxic constituents of plants foodstuffs. Academic Press. New York. Pp. 7-71.

Lohlum, S.A., Forcados, E.G., Agida, O.G., Ozele, N. and Gotep J.G. (2012) Enhancing the Chemical Composition of *Balanites aegyptiaca* Seeds through Ethanol Extraction for Use as a Protein Source in Feed Formulation. Biochemistry Division, National Veterinary Research Institute Vom, Jos. Nigeria. URL:http:/dx.doi.org/10.5539/sar.v1n2p251. Retrieved, July 28, 2017.

Manji A. J., Sarah E. E., Modibbo U. U. (2013). Studies on the potentials of *Balanites aegyptiaca* seed oil as raw material for the production of liquid cleansing agents. *International Journal of Physical Sciences*. 8(33): 1655-1660.

Okia, C.A., Agea, J.G., Kimondo, J.M., Abohassan, R. A. A., Okiror, P., Obua, J. and Teklehaimanot, Z. (2011). Use and management of *Balanites aegyptiaca* in the drylands of Uganda. *Research Journal of Biological Sciences* 6(1): 15-24, 2011.

Olaofe, O., Sanni, C.O. (1988). Nutritional Component of some non-conventional leaf Vegetable consumed in Cameroon. *Food Chemistry* 30:73-77.

Otori, A.A. and Mann, A. (2014). Determination of chemical composition, minerals and antinutritional factors of

two wild seeds from Nupe land, North Central Nigeria. *American Journal of Chemistry and Application* 1(1): 20-26.

Rasal, V.P. (2005). Screening Shorea robesta Geartn F. for burnealing and antioxidant activities. M. Pharm. Thesis. K.L.E.S.'s College of Pharmacy, Belgaum, Karnataka, India.

Savithramma, N., Rao, M.L. and Suhrulatha, D. (2011). Screening of medicinal plants for secondary metabolites. Midlle-East Journal of Scientific Research, 8(3): 579-584.

Sofowora, A. (1993). Medicinal Plants and Traditional Medicine in Africa. Spectrum Books Ltd, Ibadan, Nigeria. Pp. 289.

Trease, G.E. and Evans, W.C. (1989). Pharmacognosy. A physician guide to herbal medicine, 11edn. Ballere Tindal, London, UK, pp530.

Umar, K.J., Abubakar, L., Alhassan, B., Yahaya, S.D., Hassan, L.G, Sani, N.A., Muhammad, M.U (2014). Nutritional Profile of *Balanites aegyptiaca* Flower. *Studia Universitatis "Vasile Goldiş", Seria Ştiinţele Vieţii* (24): 169-173.

Yadav, J.P. and Manju, P. (2010).*Balanites aegyptiaca* (L.) Del. (Hingot): A review of its traditional uses, phytochemistry and pharmacological properties. *International Journal of Green Pharmacology* 4:140-6.