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Original Article

Beauty in Baobab: a pilot study of the safety and efficacy of *Adansonia digitata* seed oil

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ABSTRACT

Recently there has been a renewed impetus in the search for novel ingredients to be used in the cosmetic industry and Baobab (*Adansonia digitata* L., Malvaceae) seed oil has received high interest. In this study, a commercial Baobab seed oil sample was characterised (fatty acid content) using GCxGC-ToF-MS and a pilot study on the safety and efficacy of the seed oil was performed. The safety and efficacy of Baobab seed oil after topical application was determined using healthy adult female caucasian participants ($n = 20$). A 2× magnifying lamp was used for visual analysis, while for monitoring and evaluation of the irritancy level, transepidermal water loss (TEWL) and hydration level of the skin, Chromameter®, Aquaflux® and Corneometer® instruments, respectively, were used. In addition, Aquaflux® and Corneometer® instruments were used to assess occlusive effects. Thirteen methyl esters were identified using GCxGC-ToF-MS. The major fatty acids included 36.0% linoleic acid, 25.1% oleic acid and 28.8% palmitic acid with 10.1% constituting trace fatty acids. The irritancy of sodium lauryl sulphate (SLS) in the patch test differed significantly compared to both de-ionised water ($p < 0.001$) and Baobab seed oil ($p < 0.001$) but the difference between the irritancy of Baobab seed oil and de-ionised water was not significant ($p = 0.850$). The moisture efficacy test indicated a reduced TEWL ($p = 0.048$) and an improved capacitance moisture retention ($p < 0.001$) for all the test products (Baobab oil, liquid paraffin, Vaseline® intensive care lotion and Vaseline®). The occlusivity wipe-off test indicated an increased moisture hydration ($p < 0.001$) and decreased TEWL particularly when Baobab oil was applied. Baobab possesses hydrating, moisturising and occlusive properties when topically applied to the skin. Baobab seed oil could be a valuable functional ingredient for cosmeceutical applications.

Introduction

The Baobab (*Adansonia digitata* L., Malvaceae) tree, which has been used extensively as a source of food, fibre and medicine, is commonly referred to as "arbre a palabre", meaning the place in the village where the elders meet to resolve problems (Kamatou et al., 2011). This deciduous tree is approximately 23 m tall and has a smooth, reddish-brown, greyish-brown or purplish-grey bark with green simple or digitate leaves that alternate at the ends of the branches followed by progressively 2–3 foliolate leaves. The flowers are pendulous with five white petals while the pulp-containing fruits are apex-pointed, covered by velvety pale yellow-brown hairs with smooth dark brown to blackish seeds covered by cream-coloured kernels (Fig. 1) (Palgrave, 1983; Wickens and Lowe, 2008; Kamatou et al., 2011). The Baobab tree belongs to a pan-tropical family with six of the eight species spanning Madagascar, the seventh species is endemic to north-western Australia and the eighth species is widely spread in sub-Saharan Africa. In southern Africa (Fig. 2), Baobab is found in Angola, Zambia, Mozambique, Zimbabwe and South Africa (Limpopo region) (Wickens and Lowe, 2008; Rahul et al., 2015).

In South Africa, the Baobab and Marula are two of the most popular indigenous tree species used for seed oil production (Venter, 2012). The seed oil extracted from the baobab fruit pulp is popularly used in the cosmetics industry and sold internationally (Munthali et al., 2012). About 33% of the seed content is oil with oleic and linoleic acids as the major fatty acids followed by palmitic and α-linolenic acids. The high content of linoleic and oleic acids are known to soften the skin and to restore and moisturise the epidermis. In addition, the fatty acids regenerate epithelial tissues which renders the seed oil a very good carrier oil of value to the cosmetic industry (Glew et al., 1997; Chindo et al., 2010).

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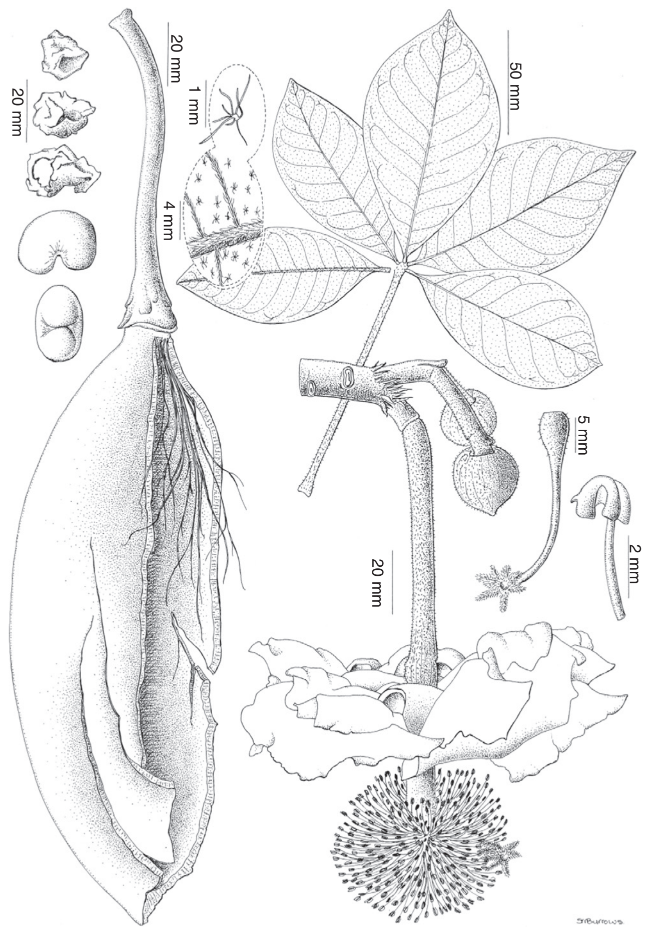

Fig. 1. Botanical line drawing illustrating the diagnostic features of *Adansonia digitata* (Baobab).

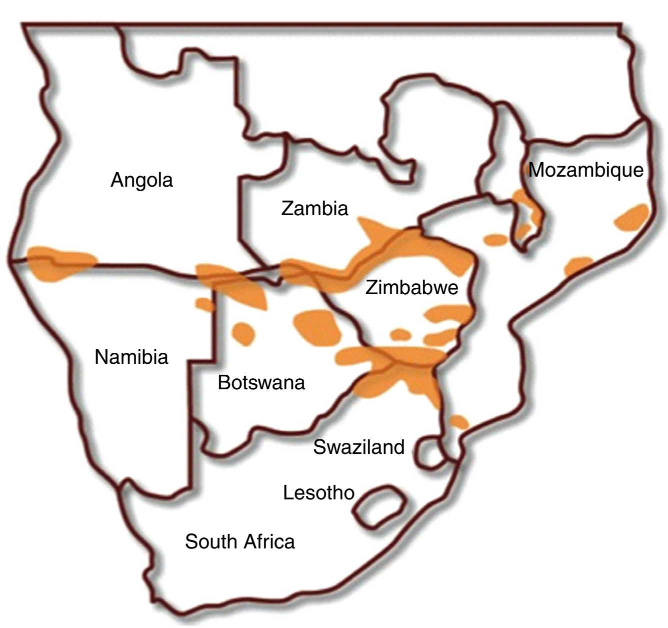

Fig. 2. Distribution map of *Adansonia digitata* (Baobab) in southern Africa.

The seed oil has been used for centuries by local communities for food, medicine and cosmetic applications. The nutritional seeds are rich in protein and the oil is generally used in food preparation for sauce/paste or eaten raw/roasted (Osman, 2004). It has been used to produce lubricants, soaps and toothpaste, in the topical treatment of various conditions such as muscle spasms, varicose veins and wounds and applied as a moisturiser for skin hydration, for hair and nail conditioning and to treat dandruff (Zimba et al., 2005; Nkafamiya et al., 2007; Chindo et al., 2010). Sidibe and Williams (2002) reported that the Baobab seed oil is used for cosmetic applications to treat skin ailments. The Baobab tree has been referred to as a small pharmacy or chemist tree and many authors have reported that all Baobab plant parts are valuable (Gebauer et al., 2002; De Caluwé et al., 2010).

Baobab oil, extracted from the seed, is used in the cosmetics industry and is also sold internationally even though there is a lack of clinical studies to confirm its traditional use (Gruenwald and Galizia, 2005). The global demand for Baobab oil has grown substantially with exports to Europe, Asia and North American markets. In Zimbabwe, approximately 20,000 litres of Baobab oil worth $100,000 is produced annually (Kamatou et al., 2011; Vermaak et al., 2011; Venter, 2012). In South Africa, commercialisation of the seed oil started as early as 2005 at the Vhembe Municipal District in the Northern region of Venda where seeds were sold at local markets and the oils extracted from the seeds were sold to the cosmetic market (Venter and Witkowski, 2010).

There have been several reports on the physico-chemical properties, nutritional content and fatty acid profile of the seed oil using conventional methods such as gas-chromatography coupled to mass spectrometry (GC–MS) (Sidibe and Williams, 2002; De Caluwé et al., 2010). Comprehensive two-dimensional analysis which provides better separation could give further insight into the composition as it can identify fatty acids present in trace-level concentrations. This study characterised the fatty acid composition of commercially available Baobab seed oil subsequently used in a pilot study to determine its safety and efficacy.

Materials and methods

Materials and sample preparation

Refined Baobab seed oil (Batch number: BAO0311EP; Product code: PDBAOA DO1) was purchased from a reputable commercial supplier (Scatters® Oils). Scatters® Oils (South Africa) is a supplier and exporter of natural, indigenous organic oils to the local and international market (http://www.scattersoils.com/). The odourless yellow seed oil was stored at 2–8 °C and allowed to warm up to room temperature before commencement of the pilot study. The certificate of analysis indicated a refractive index of 1.476 (1.474–1.485) and a relative density of 0.894 g/ml (0.892–0.950 g/ml). A retention sample (BAOB005) is stored in the Department of Pharmaceutical Sciences, Tshwane University of Technology. A fatty acid methyl esters (FAMEs) 37-component standard mixture as well as pure (≥99.0%) reference standards (linoleic, oleic, palmitic, stearic, arachidic, linolenic and myristic acid) were obtained from Sigma–Aldrich® (Johannesburg, South Africa). The FAMEs were prepared using the modified method of Rossé and Harynuk (2010). A volume of 310 μl of the oil sample and the standards ($n = 7$) were separately prepared in a vial and mixed with 500 μl of 2.8 g potassium hydroxide in 100 ml of methanol solution (stock solution) and sonicated for 30 min in a water bath at 60 °C. Boron-triflouride (1000 μl) in methanol was used as a catalyst and the mixture was sonicated again for 30 min at 60 °C. Petroleum ether (1000 μl) and saturated sodium chloride was added to the mixture. Finally, the mixture was centrifuged for