

The uses and properties of marula oil

Introduction

The Marula tree (*Sclerocarya birrea*) is a medium to large (15-20m high), deciduous, with a wide crown and characteristic silvery, mottled bark, peeling in disc-shaped flakes (Palmer and Pitman, 1972). The small dark red flowers are unisexual and found in fragrant clusters at the end of the branches. The compound leaves are grey-green in colour, but turn pale yellow prior to being shed. Denuded of leaves, the top branches appear abnormally thick and erect, like upturned fingers (digitaliform). The leaves attract many butterflies, including the magnificent green lunar moth, whose large silkworm-like cocoons, are used by Southern Africans, as ankle rattles for dancing. The tree remains bare for several months of the year (Watt and Breyer-Brandwijk, 1962).

The Marula tree is in the same family, Anacardiaceae, as the mango, cashew and pistachio nut. The plum sized fruits are covered in a soft, leathery, pale green-yellow exocarp which encloses the juicy white flesh (Hall, 2002). The fruit has an exotic flavour and a distinctive scent. The fruit contains a large hard seed, surrounding two or more edible kernels, rich in oil.

The generic name (*Sclerocarya*) is derived from the Greek for hard (skleros) and nut (karyon). Marula trees are distinctive for their exceptional fruit and nut yields, making them very easy to harvest. In fact this characteristic has not only been noted by humans, but also by elephants who will travel miles to gorge on the fruits (Hutchings et al, 1996). Importantly, the Marula fruit harvest occurs at the beginning of the school year making the cash income from their sale very important for the payment of school fees and clothing (Wynberg et al, 2003).

The Marula tree is one of the great trees indigenous to Southern Africa. Its drought resistance make it ideally suited to Namibia, Botswana, Zambia and Zimbabwe where it is found in abundance from bushveld to woodlands. Wherever it grows it is venerated and preserved by Africans for the abundance and reliable harvest of edible fruits.

Uses of marula

Archaeological evidence has confirmed that the Marula tree has been a central part of the Southern African way of life for thousands of years; hoards of Stone Age Marula nuts have been found in Zimbabwean caves, with carved tools and piles of shells in close proximity (Hutchings et al, 1996). The same tools are used to this day to crack the stones and extract the kernels. It is likely that the modern day uses for the tree have also been passed down the generations from Stone Age *homo sapiens*. Every part of the tree is utilised for an incredible variety of domestic needs.

The fruits are edible, eaten either raw or made into a delicious jelly. They are also brewed into a popular beer; a marula liqueur is available commercially. The kernels are either eaten raw or roasted, have a delicious taste and are regarded by many indigenous people as a delicacy, a 'Food of Kings' (Wehmeyer 1976). An oil can be also extracted from the kernels which is traditionally used for cooking, as a meat preservative and for skin care and hair applications. The bark is widely used medicinally to treat diarrhoea, diabetes, fever and malaria, and the roots are used to treat sore eyes. The leaves are used to make a relish, and the hard wood makes excellent kitchen utensils.

It is the oil from the Marula kernel that has come to give the Marula tree its spiritual status. The kernels are so full of oil that a squeeze with the hand can release a rich yield. This healing oil is used as a cosmetic, by Southern African women, and is massaged onto the skin of their face, feet and hands. Across the generations it has proven to protect against dry, cracking skin and in fact its moisturising properties are so effective that it is also used to treat leather and in preserving meat. Hence within the Zulu tribe, the Marula tree symbolizes women’s fertility, softness and tenderness, and new-born baby girls are welcomed into the world with traditional Marula ceremonies (Palmer + Pitman, 1972).

Marula Oil Properties

Marula oil is a clear, pale, yellowish-brown colour and has a pleasant nutty aroma. The main properties of the oil include:

- High nutritional value (See Table 1)
- Extraordinary oxidative stability
- Antioxidant action
- Free radical scavenging properties
- Moisturizing properties

Nutritional Content of Marula Kernels	
Moisture	4.0
Ash	3.8
Protein (g/100g)	28.3
Fat (g/100g)	57.3
Fibre (g/100g)	2.9
Carbohydrates (g/100g)	3.7
Energy Values (KJ/100g)	2703
Ca (mg/100g)	118
Mg (mg/100g)	462
Fe (mg/100g)	4.87
Na (mg/100g)	3.81
K (mg/100g)	601
Cu (mg/100g)	2.81
Zn (mg/100g)	5.19
P (mg/100g)	808
Thiamine (mg/100g)	0.42
Riboflavin (mg/100g)	0.12
Nicotinic Acid (mg/100g)	0.72

(Source: Arnold et al, 1985)

Table 1. Nutritional content of Marula kernels

Marula oil contains a large proportion of mono-unsaturated fatty acids and natural antioxidants. It can be classified as a high-oleic acid (70-78%) with relatively low tocopherol content. The exceptional stability has therefore been suggested to be due to its fatty acid composition. (Burger et al, 1987; Eromosele & Paschal, 2003; Glew et al, 2004; Houghton, 1999). However, recent studies have mentioned that some of the minor components in the oil may also be contributing to this important anti-oxidant property (Wynberg et al, 2002). Marula oil contains a similar fatty acid composition to olive oil however it is 10 times more stable to oxidation.

Oxidative Stability of Marula Kernel Oil compared with different oils	
Oil Sample	Induction period (h) **
Marula oil *	34.2
Olive oil	4.6
Sunflower oil	1.9
Cottonseed oil	3.1
Palmolein oil	8.5

* Average taken from different marula oil samples

** Measured by Rancimat at 120 C and 20 l/h airflow

(Source: Burger et al, 1987)

Table 2. Oxidative stability of Marula kernel oil, olive oil, sunflower oil, cottonseed oil and palmolein oil

Marula oil has been shown to have free radical scavenging properties higher than most oils on the market. The free radical scavenging properties can be attributed to the unsaponifiable fraction which varies from 3800-4300mg/kg. Research towards the identification of the unsaponifiable fraction is still underway. The anti-oxidant properties exhibited by the unsaponifiable fraction of Marula is much higher than in substances with higher concentrations of unsaponifiables.

Easily absorbed, high proportions of oleic acid, as well as the essential linoleic fatty acid (4-7%) combine to make the oil ideal for topical application. Marula oil has also shown to improve skin hydration, skin smoothness and reduce redness (Gruenwald, 2006).

Tests and commercialisation trials to investigate the potential of marula oil as an ingredient in cosmetic formulations have been successfully carried out. Tests included 'skin hydration', 'transepidermal water loss' and 'increase in skin smoothness' with marula oil performing significantly well (Houghton 1999, CRIAA SA-DC, 1997-2001)

PhytoTrade Africa and its partner Aldivia have after extensive research and development come up with a process they have coined Ubuntuisation. This process treats virgin oils to reduce microbial loads typical of cold pressed oils whilst retaining all the oils original properties.

Technical Specifications of Ubuntu Marula oil

Parameter	Specification
Colour	Light yellow
Odour	Sweet odour
Appearance	Clear oily liquid
Microbiology	<100cfu/g (same as acid value/2)
Acid Value	<5 mg KOH/g
Peroxide value	<15 meqO ₂ /kg
Rancimat (120°C , 20L/h)	20-45
Specific gravity (15oC°)	0.915-0.92
Refractive Index	1.455-1.465
Iodine value	70-76 g I ₂ /100g
Saponification value	188-196 mg KOH/g

Saturated fatty acids	
Myristic	<0.2%
Palmitic	9.0-13%
Stearic ac	4.0-8.0%
Arachidic	<1.0%
Unsaturated fatty acid	
Palmitoleic	<0.2%
Oleic	70-80%
Linoleic	4.0-9.0%
Linolenic	<0.7%
Eicosenoic	0.5%
Heavy Metals	<20ppm
Arsenic	<1
Antimony	<5
Cadmium	<1
Chromium	<1
Lead	<2
Nickel	<3
mercury	<1

Applications

Skin:

- To treat dry, chapping skin.
- To maintain hydrated, smooth skin
- To reduce redness.
- Can be used around the eyes.
- A good Massage oil.
- Anti aging face cream

Baby care: massage oil

Hair care: shampoo for dry damaged and fragile hair

Cosmetics: component of lipsticks

Food: antioxidant properties for the nutraceutical industry

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