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# Three major tree nut oils of southern central Africa: Their uses and future as commercial base oils

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## KEYWORDS

African tree-seed oils;  
Sustainability;  
Rural livelihoods

**Summary** There is a pressing need for sustainability of the ecology and environment of Africa. Deforestation is taking place at an alarming rate, and this situation will continue to escalate unless local communities can be given a sufficiently attractive and viable reason to look after their forests and animals. The development of international markets for the tree seed oils is a major step towards solving this growing dilemma. In Zambia the development of sustainable harvest systems and market outlets for the highly valued indigenous tree seed oils, along with the establishment of sustainable wild harvest for 'non-timber forest products' to accredited international certification criteria has enable sustainable livelihoods for large numbers of disadvantaged rural communities from indigenous plant products at the same time as helping to maintain the natural environment.

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## Introduction

From the early days of humanity, the indigenous people of Africa have learnt to use the natural resources available to them. This is still true to this day and the Zambian trees and their products that are discussed in this article have played a significant role in the lives of many local people as sources of nutrition, heat, medicine and beauty therapies. The major positive factor to all the oils

mentioned is that they are extremely stable, even when kept under very poor conditions.

## The trees

The marula tree (*Sclerocarya birrea*) is the most widely spread in Zambia and southern Africa. In Zambia, it is found in the southern half of the country with it being most prolific in the major river valleys. Within the Luangwa valley in the eastern province of Zambia, two subspecies may be found.

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Photo 1 Baobab tree.

The baobab tree (*Adansonia digitata*) is probably the most striking of these trees, as it is also called the upside down tree. It is predominately found in the drier areas of southern Africa and in Zambia it is a common sight in the Zambezi and Luangwa valleys. In terms of numbers it is not as numerous as the marula; it is extremely slow growing with some trees being well over 100 years old (see Photo 1).

The manketti tree (*Schinziophyton rautanenii*) is exclusively found on the Kalahari sands that spread from Namibia, through Angola and into western Zambia. They are a common sight in the western province of Zambia, with isolated pockets being found in the Luapula province and in the Luangwa valley. This tree is possibly the easiest to cultivate as it grows from truncheons and is commonly used as a live fence round fields and livestock kraals.

## Harvesting

All three oils are obtained from the fruit of the tree. In the case of the marula and manketti, when the fruit falls to the ground it is collected by the villagers and eaten or used to make beer. The baobab fruit is eaten as a confectionery, can be made into a drink and is used as a source of nutrition; it is added to the maize porridge fed to babies. The fruit is high in carbohydrates (74%), proteins (2.7%) and fats (0.2%). It also contains a large amount of vitamin C and is said to have up to six times the amount (30 mg/100 g) contained in an orange. After the fruit is harvested it is brought to a central point to be processed; this is always women's work (see Photo 2).

The traditional processing involves cracking the shells and in the case of the manketti and marula, this can be an arduous undertaking. This activity has been harnessed as a source of supply of the raw manketti and marula which, often for the first

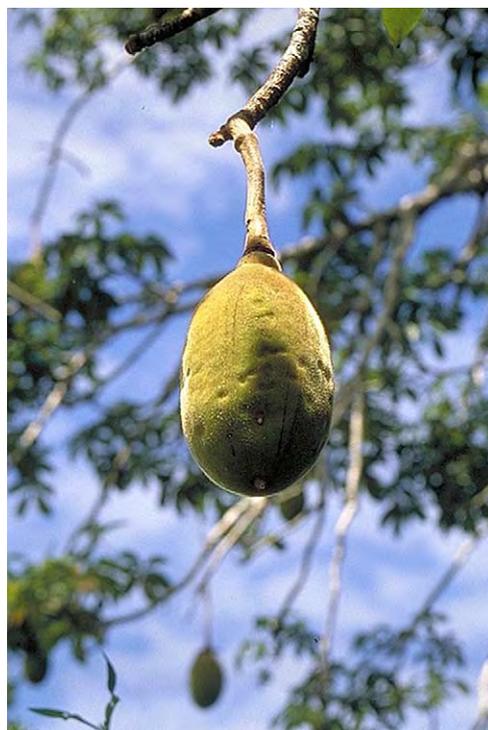


Photo 2 Baobab fruit.

time in the remotest parts of Zambia, is the first income generating opportunity the women have found. Fair trade principles are carefully operated under a transparent buying system and this ensures that a good income can be made for those suppliers involved.

## Processing

This is a laborious task, especially in the case of the marula, as the nut is very fibrous. Within the nut the kernel is shaped like a tooth, with a crown and two or three roots. The kernel is painstakingly removed using a thorn or a bit of wire. A single woman can remove in the region of 1–2 kg of kernel per day using this method. The kernel is then pressed using a simple hand press, which yields in the region of 12–14% oil. The baobab is much easier to work as the whole seed is pressed using the same equipment, which yields in the region of 10–12% oil. Manketti is found to be the most viable oil of the three. Once the hard shell has been removed and pressed it yields up to 26% oil, with the average being in the region of 15–18%. All the oils are cold pressed to avoid any alteration in their constituency. The cake is also a valuable form of stock feed, high in protein and essential fatty acids and an excellent feed for chickens and pigs (see Photos 3–5).

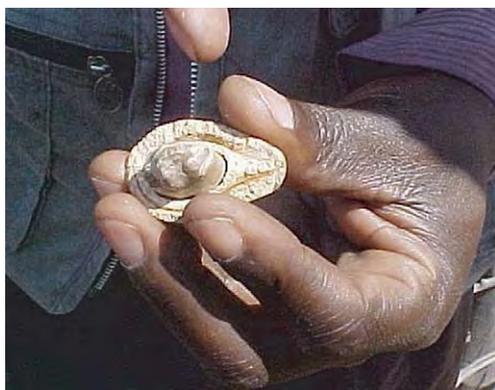


Photo 3 Sectioned manketti nut.



Photo 4 Baobab seed.



Photo 5 Cold press.

The oil is collected from a number of satellite points in the rural areas, from where it is bulked at a central handling facility in Lusaka. Here it is filtered and repackaged for shipment to various buyers.

### Scientific analysis

All three oils are ideal for the aromatherapy and cosmetic industries; their positive characteristics include the following:

- long shelf life;
- exceptional oxidative stability;
- edible;
- easy absorption into the skin.

All three oils have already been used by therapists who rate them very highly for their absorptive properties.

### Marula oil

From a commercial point of view it is our opinion that this oil is the most difficult to extract. Marula oil is already being used in several applications, e.g. as base oil for soap. The rural women within the regions where the trees are common traditionally use it for cosmetic purposes. It is also used as a nose-drop for infants and more popularly as an aphrodisiac. The phyto-trade is currently developing this oil in Namibia in conjunction with European cosmetic companies (see Table 1).

Oleic acid has been well researched as a skin penetration enhancer; numerous trials have confirmed its effectiveness in this regard. In aromatherapy, the low odour and excellent 'slip factor'

Table 1 Chemical composition of *Sclerocarya birrea* oil as compared to olive and peanut oils

Component		Marula	Olive	Peanut
Palmitic acid	16:0	8.7	11.9	11
Linoleic acid	18:2	3.4	3.3	27.1
Oleic acid	18:1	78.5	80.1	56.1
Oleic acid (isomer)	18:1	—	1.6	—
Stearic acid	18:0	9.5	2.8	2.1
Linolenic acid	18:3	—	—	—
Saturated	18:0	18	15	15
Monounsaturated	18:1	79	82	56
Diunsaturated	18:2	3.4	3.3	27
Triunsaturated	18:3	—	—	—
Degree of unsaturation		82	85	83

of this oil on the skin makes it an ideal massage base oil that might additionally aid the penetration of essential oils that are mixed with it. Oily skin conditions may also benefit from application of this oil.

There is some evidence that oleic acid if given over long periods can lead to cutaneous 'immune suppression' and thus regular application of this oil may benefit hyper-reactive skin. A condition where this oil may not be helpful is in the treatment of acneic skin, where there is already over secretion of oleic acid.

High oleic acid containing oils also have potential as starting materials for the production of cocoa butter equivalents; this has application for both food and cosmeceutical industries.

Potential uses:

- Fixed oil for general massage purposes as a replacement for *Prunus amygdalus*.
- Topical preparations to relieve skin irritation: after sun lotions, after shaves, makeup removers, etc.
- Facial oil in combination with other products such as jojoba, *Simmondsia chinensis*.
- Incorporation into creams for prevention of dermatitis reactions.

Richness: medium-rich

Skin feel: silky to touch, penetrates well, excellent 'slip factor' for massage.

### Baobab oil

As in the case of marula, the baobab is an exceptional tree. Traditionally the pulp of the fruit is used in many applications to treat fever, diarrhoea and scorbutic complaints (vitamin C deficiency). The pulped seed is said to cure gastric and kidney diseases and is traditionally used for these purposes in rural areas. In Zambia and other rural parts of Southern Africa where the tree is prevalent, the oil is commonly used for cooking; it is also used as a cosmetic by the Tonga women of southern Zambia (see Table 2).

The chemical composition of baobab oil gives the potential of a highly emollient fixed oil with a wide range of cosmetic and aromatherapy applications. Its luxurious consistency is ideal for skin care with its composition suited to all skin types, especially dehydrated, dry and mature skins or where barrier properties are required.

Baobab seeds contain anti-nutritional factors that require removal before the oil is offered for culinary purposes.

**Table 2** Chemical composition of *Adansonia digitata* oil as compared to olive and peanut oils

Component		Baobab	Olive	Peanut
Palmitic acid	16:0	31.6	11.9	11
Linoleic acid	18:2	27.8	3.3	27.1
Oleic acid	18:1	34.3	80.1	56.1
Oleic acid (isomer)	18:1	0.7	1.6	—
Stearic acid	18:0	3.5	2.8	2.1
Linolenic acid	18:3	—	—	—
Saturated	18:0	32	15	15
Monounsaturated	18:1	35	82	56
Diunsaturated	18:2	27	3.3	27
Triunsaturated	18:3	—	—	—
Degree of unsaturation		62	85	83

Potential uses:

- Fixed oil for massage and topical purposes especially if the skin is prone to dryness, chapping and flaking.
- Wound care.
- Ideal for mature and dehydrated skins.
- Oil for prevention of stretch marks in pregnancy.
- Luxury bath oil preparations.
- Hot oil soaks for hair and nail conditioning.

Richness: thick, viscous with a nourishing feel.

Skin feel: luxurious, remains on skin following application, highly emollient.

Traditionally the oil is harvested by crushing the kernels and boiling them, after which it is allowed to cool and the oil is collected off the top of the water.

### Manketti oil

Similar oils used in cosmetology and aromatherapy include Rose hip seed, *Rosa rubiginosa*, Evening Primrose, *Oenothera biennis*, Borage, *Borago officinalis* and Safflower, *Carthamus tinctorius*. These fixed oils are widely used in the treatment of inflammatory conditions of the skin.

As it is rich in linoleic and linolenic acid, manketti oil has applications in the treatment of eczematous and atopic disorders where it may assist with reduction of inflammation and promotion of cellular repair and tissue regeneration. Further studies need to ascertain if this oil is rich in  $\alpha$  or  $\gamma$  linolenic acid (see Table 3).

Additionally, it has been shown that products rich in linoleic acid may assist in antibacterial protection of the skin in persons with atopic dermati-

**Table 3** Chemical composition of *Schinioziphyton rautenii* oil as compared to olive and peanut oils

Component		Manketi	Olive	Peanut
Palmitic acid	16:0	9.8	11.9	11
Linoleic acid	18:2	39.0	3.3	27.1
Oleic acid	18:1	19.2	80.1	56.1
Oleic acid (isomer)	18:1	0.3	1.6	
Stearic acid	18:0	7.7	2.8	2.1
Linolenic acid	18:3	16.7		
Saturated	18:0	18	15	15
Monounsaturated	18:1	20	82	56
Diunsaturated	18:2	39	3.3	27
Triunsaturated	18:3	17		
Degree of unsaturation		76	85	83

tis; these persons are vulnerable to colonisation by *Staphylococcus aureus* due to anomalies in epidermal surface lipids. In acneic skin, where follicular hyperkeratinisation appears to be linked to a localised linoleate deficiency in the follicular epithelium, topical application of a product such as manketti seed oil may help reduce overproduction of oleic acid and squalene and restore linoleic acid levels to normal.

This oil may also be of use in the reduction of itching, redness, unsightly scarring and the prevention of keloids. Hydration of the skin may also increase following topical application. Whereas oils such as Evening primrose and borage seed oils are considered drying due to their high iodine value, often requiring dilution on the skin, manketti oil has a lower polyunsaturated and a higher monounsaturated fatty acid content, making it both more stable and able to be used without dilution on the skin.

Due to its level of unsaturation, this oils overall stability is less than that of marula or baobab.

Potential uses:

- Topical applications singly or in combination with macerated oils such as *Calendula officinalis* for inflamed skins, eczematous lesions, scarring, and burns.
- Topical aid to accelerate wound healing.
- Topical application to acneic skin for prevention and treatment of eruptions.

Richness: thin oil.

Skin feel: light texture, penetrates immediately after application.

## Sustainability

The sustainability of the ecology and environment of Africa is becoming more prominent with each

day that passes. Deforestation is taking place at an alarming rate, and this situation will continue to escalate unless local communities can be given a sufficiently attractive and viable reason to look after their forests and animals. To this effect, it is imperative that the people have another form of income to the common and wide spread practices of charcoal production and illegal hunting, both of which have devastating effects.

The development of international markets for the tree seed oils is a major step towards solving this growing dilemma. In order to ensure that this potentially supportive route does not lead down the same road of over demand on the natural regenerative properties of the African bush, sustainable wild harvest standards are being established in Zambia. In 2004, a pilot program was instigated in accordance to the international labelling standards of the Forestry Stewardship Council (FSC), and will be developed with the support of Woodmark, an advocacy and standards organisation in the UK. The aim is to establish sustainable wild harvest standards for these 'non-timber forest products' and to establish criteria used for product labelling of this status. In most situations, sustainable wild harvest labelling is reported to attract a tangible increase in consumer interest in the product and gain higher trade and retail prices in Western markets. It is intended that a sustainable wild harvest auditing and training facility will be set up in Zambia this current year to ensure producers are able to take the correct steps towards FSC certification.

Another solution to over harvesting of indigenous resources is to encourage rural communities to develop plantations of marula, manketti or baobab for the supply of the raw material for rural income generation. However, the success of this has not yet been estimated and has not been implemented on any practical scale.

## Conclusion

These trees from ancient times have played a central role in the lives of the indigenous people of southern central Africa. It is only recently that the virtues of these oils have become known.

These fixed oils of marula, manketti and baobab present very different chemical compositions that can be applied to a diverse range of dermatological and cosmeceutical preparations. Unrefined fixed oils such as these also contain 0.1–3% lecithins, including phospholipids, and small amounts of waxes, sterols and other hydrocarbons such as carotenoids, tocopherols and tocotrienols. These can further contribute to therapeutic activity.

Therefore further work needs to be conducted on the unsaponifiable part of these uniquely African oils.

The international marketplace may have a serious part to play in securing the futures of these and other exotic indigenous plant materials of Zambia. An important traditional resource of the country's heritage, their development as marketable commodities for the modern world could afford a more sustainable future for the environment and for the Zambian communities, the custodians of these trees.

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