Mimusops zeyheri

Subjects: Plant Sciences

Contributor: Adeyemi Aremu

Many African countries are endowed with rich biodiversity with enormous nutritional and economic prospects, but the majority of these resources are not fully harnessed. Exploring these neglected resources, for example, the Transvaal red milkwood tree [(Mimusops zeyheri) Sond. family: Sapotaceae] is of paramount importance for food and nutritional security as well as economic prosperity. This review provides a critical appraisal of the nutritional and health benefits as well as the economic potential of Mimusops zeyheri. The plant is known for its diverse uses among rural communities. In folk medicine, the decoction from the bark and leaves of Mimusops zeyheri are used for treating wounds and ulcers, while the root is used as an infusion taken to treat candidiasis and other health issues. The nutritional profile of the fruit tree is similar to popular exotic fruits and richer in vitamin C when compared to guava and orange. Mimusops zeyheri is a rich source of vitamins, protein, and fatty acids. Based on the rich chemical pool, especially in the fruit and seeds, it has the potential to provide an accessible, readily available, and affordable enriched functional food with valuable health benefits. However, the successful exploration of Mimusops zeyheri for food security and sustainability requires multidisciplinary research. This will help achieve the envisaged food-nutrition security and poverty alleviation potential of the plant, especially among local communities.

Keywords: ethnobotanical uses ; functional food ; hidden hunger ; micronutrients ; indigenous fruit ; phytochemicals ; sapotaceae ; sustainability ; traditional food

1. Introduction

Mimusops zeyheri is a perennial fruit tree and a member of the family Sapotaceae and the common names include Transvaal red milkwood (English), Moepel (Afrikaans), Mmupudu (Northern Sotho), Umpushane (Zulu), Mubululu (Venda) and Mgamba kapu (Swati) [1]. It is a medium-sized tree ranging from 15–25 m high and the bark is grey to dark brown [1]. The leaves are glossy and arranged spirally, stipules are absent, and the petiole is 0.5–3.5 cm long [1]. The fruit is yellow-orange, 4.5 cm long at maturity, with 1–2 seeds that are shiny, but pale brown with a small circular basal scar.

The tree occurs in several southern African countries including South Africa, the Kingdom of Eswatini (Swaziland), Botswana, Lesotho, Namibia, Mozambique, and Zimbabwe [2][3]. As shown in Figure 2, its distribution extends to other parts of tropical Africa. Mimusops zeyheri occurs in open, dry, and bushveld woodland [4][5]. It is suited for cultivation in low to medium-altitude areas of summer rainfall where frost is minimal or absent and can withstand various soil and climate conditions [6]. In larger gardens and open spaces, Mimusops zeyheri is easily cultivated and best used as a reliable shade and used as a shelter for birds and other animals [7]. Furthermore, Mimusops zeyheri can tolerate freezing without damage and it requires little maintenance (six or more hours of daily sunlight and a minimal amount of water to survive).

Figure 2. Occurrence and distribution of Transvaal red milkwood (Mimusops zeyheri) in Africa.

2. Diverse Uses of Mimusops zeyheri

The continuous increase in the human population remains a key cause for concern in terms of meeting the daily food, nutritional, and medicinal requirements, especially in developing countries. Therefore, documenting the benefits and potential of Mimusops zeyheri is important from nutrition and health as well as ethnomedicinal perspectives. This is also relevant for the perception and socio-economic benefits of the potential consumers for this undervalued fruit tree. Some of these uses are discussed in the following sections.

2.1. Ethno-Medicinal Applications

In traditional medicine, Mimusops zeyheri extracts are used for different purposes. For instance, Lapeña et al. [8] observed that the bark of Mimusops zeyheri is used to treat wounds and sores by the Zulus of South Africa. It is also a local remedy for sexually transmitted infections (STIs), especially gonorrhea [9]. In the Kingdom of Eswatini (Swaziland), a root infusion is taken to treat candidiasis and a bark decoction is a traditional remedy for treating wounds and ulcers [10]. The ground seeds of the fruit tree are used as a teeth whitening agent [11]. Mimusops zeyheri is considered an effective remedy for treating inflammation, bleeding gums, tuberculosis, and diverse sexually transmitted diseases [10]. The bark and root of Mimusops zeyheri are used to treat different forms of wounds and ulcers. The root of Mimusops zeyheri is used as an infusion for treating candidiasis, tuberculosis, weight loss, womb problems, and STIs [12][13].

2.2. Nutritional Content

Evidence of the diverse nutritional pool existing in different parts of Mimusops zeyheri has been demonstrated by different researchers (Table 2). According to Wilson and Downs [14], the fruit of Mimusops zeyheri contains high concentrations of sucrose, glucose, and fructose. The orange color of the fruit is an indication of its high beta-carotene content. The leaves of Mimusops zeyheri contain 10 elements such as nitrogen, phosphorous, potassium, calcium, and magnesium [13]. The quantity for these 10 elements was within the permissible limits, thereby suggesting its safety [10]. Analysis of the fruit revealed varying levels of carbohydrates and ash content [15][16][17]. Also, the seeds of Mimusops zeyheri are considered as a dietary energy supplement and oil source [18][19].

Table 2. Mineral, proximate, and amino acid composition for different parts of Mimusops zeyheri.

Plant Part	Nutrient Composition	Composition (%)	Reference
Leaves	**Nitrogen**	**6.33**	**[10]**
	Phosphorous	**0.33**	
	potassium	**1.25**	
	Calcium	**0.39**	
	Magnesium	**0.06**	
	Zinc	**0.0029**	
	Copper	**0.0014**	
	Iron	**0.0409**	
	Aluminum	**0.007407**	
	Manganese	**0.005185**	
Fruit	**Dry matter**	**91.10**	**[18]**
	Organic matter	**83.30**	
	Protein	**9.30**	
	Ash content	**2.80–4.1**	
	Carbohydrates	**2.0**	**[10]**
Seeds	**Mineral**	**Mean value (mg per 100 g)**	**[18]**

Plant Part	Nutrient Composition	Composition (%)	Reference
	Calcium	**587.4**	
	Magnesium	**102.3**	
	Phosphorus	**110.37**	
	Proximate component	**Mean value (g/kg)**	**[33]**
	Dry matter	**911**	
	Organic matter	**883.39**	
	Crude protein	**93.45**	
	Ether extract	**256.12**	
	Lipid yield	**212.5**	
	Ash	**27.61**	
	Fiber fraction (g/kg)	**Mean**	**[18]**
	Neutral detergent fiber	**332.46**	
	Acid detergent fiber	**153.41**	
	Fatty acid	**Percentage (%)**	**[18]**
	16:0 (palmitic acid)	**15.25**	
	18:1n9 (oleic acid)	**84.59**	
	Vitamin	**µg/g**	**[18]**
	Vitamin E	**1.97**	

Analysis of the seeds revealed the presence of different mineral elements including calcium and phosphorus, organic matter, crude protein, and ash content [18]. Based on the proximate analysis, dry matter, organic matter, and ash content constituted 91.1%, 88.3%, and 2.8% of the seed mass, respectively. Chivandi et al. [18] identified 17 amino acids in the seeds of Mimusops zeyheri, which accounted for an estimated 97% of the crude protein content (9.3%). Glutamic acid, which was the major amino acid constituted approximately 13.8% of the crude protein. Furthermore, oleic and palmitic acids were the only lipids that were detected. Neutral detergent fiber and acid detergent fiber constituted 33.2% and 15.3%, respectively [17][18].

Mimusops zeyheri contains varying concentrations of the different compounds (Table 2). Particularly, the plant is a rich source of vitamins (A = retinol, C = ascorbic acid and E), amino acids, and fatty acids [18][19]. In addition, the medium fiber content in the Mimusops zeyheri seeds could be useful in providing the necessary bulk for the facilitation of normal gastrointestinal motility in the food and feeds of humans and animals, respectively [18]. Based on the presence of vitamin E, Mimusops zeyheri seeds could potentially be used as a dietary ingredient to increase the systemic antioxidant pool, thus protecting the body against potential oxidative damage.

The lipid in Mimusops zeyheri seeds is similar to that found in soybean (Glycine max). The lipid content of 21.3% is comparable to that of soybean, which has between 15 and 25% lipid content [17]. However, the oil content of Mimusops zeyheri seeds is lower than that of the cottonseed (Gossipium hirstum), which has 35–40% oil content [18]. Furthermore, the oleic acid content of Mimusops zeyheri seed oil (85% of lipid yield (84.59) is high when compared to the 70–78% oleic acid in Marula tree (Sclerocarya birrea) kernel oil and 63% oleic acid in red sour plum (Ximenia caffra) kernel oil [20]. Interestingly, these two (2) aforementioned indigenous fruit trees flourish in a similar environment as Mimusops zeyheri in southern Africa. The vitamin C content in Mimusops zeyheri fruit range from 50–80 mg/g fresh fruit and this content is relatively higher when compared to guava, which is an exotic fruit with 20 mg/g vitamin C [21][22].

2.3. Phytochemicals and Biological Properties of Mimusops zeyheri

Mimusops zeyheri is a member of the family Sapotaceae, which are well-known for their wide range of phytochemicals, especially saponins, flavonoids, and polyphenolics [23]. Currently, the biological activities of Mimusops zeyheri are relatively scarce, however, studies on members of the genus Mimusops have demonstrated antifungal, gastro-protective, and antinociceptive properties [23].

2.4. Miscellaneous Uses

Other uses of Mimusops zeyheri have been documented in areas where the species exists. The importance of the fruit and pulp of Mimusops zeyheri for the production of jelly, alcoholic, and non-alcoholic beverages have been indicated [6]. These products are currently sold in rural and urban open markets, thereby contributing to the economic status of rural households [18][24]. Mimusops zeyheri is believed to improve soil fertility and this is a good contribution toward environmental sustainability as this reduces the cost of agricultural production [11][24]. In addition, the latex from the tree is used as a pesticide and the dried pulp can stay long, stored, and for consumption during winter [25]. Furthermore, Mimusops zeyheri is a useful multipurpose tree, which could be economically useful for furniture and other carpentry purposes. It is also a good horticultural tree for shade, energy, fencing, and ornamental purposes [10].

Based on the study by Chivandi, Davidson, and Erlwanger [20], Mimusops zeyheri has enormous economic and environmental benefits for rural communities through the sales of seedlings and/or fruits and combating land degradation. In addition, Ripple et al. [25] identified the seeds of Mimusops zeyheri as a potential source of calcium, which could be useful for human and animal nutrition requirements.

References

1. Lemmens, R.H.M.J. Mimusops Zeyheri Sond; Plant Resources of Tropical Africa/Ressources végétales de l’Afrique Tropicale: Wageningen, The Netherlands, 2005.
2. Harris, B.J. Secondary Industrialisation in South Africa. In The Political Economy of the Southern African Periphery; Springer: Berlin/Heidelberg, Germany, 1993; pp. 17–51.
3. Fabricius, C. The fundamentals of community-based natural resource management. In Rights Resources and Rural Development; Taylor & Francis Group: Milton, UK, 2013; pp. 18–58.
4. Deutschländer, M.S.; Lall, N.; van de Venter, M. Plant species used in the treatment of diabetes by South African traditional healers: An inventory. Pharm. Biol. 2009, 47, 348–365.
5. Manning, J. Southern African Wild Flowers-Jewels of the Veld; Penguin Random House: Johannesburg, South Africa, 2013.
6. Chivandi, E.; Mukonowenzou, N.; Berliner, D. The coastal red-milkwood (Mimusops caffra) seed: Proximate, mineral, amino acid and fatty acid composition. S. Afr. J. Bot. 2016, 102, 137–141.
7. Hankey, A. Mimusops Zeyher Sond. (Sapotaceae). 2005. Available online: http://pza.sanbi.org/mimusops-zeyheri (accessed on 30 October 2020).
8. Lapeña, I.; Turdieva, M.; Noriega, I.; Ayad, W. Conservation of fruit tree diversity in Central Asia: Policy options and challenges. In Conservation of Fruit Tree Diversity in Central Asia: Policy Options Challenges; Bioversity International: Rome, Italy, 2014.
9. De Wet, H.; Nzama, V.; Van Vuuren, S.F. Medicinal plants used for the treatment of sexually transmitted infections by lay people in northern Maputaland, KwaZulu–Natal Province, South Africa. S. Afr. J. Bot. 2012, 78, 12–20.
10. Mngadi, S.V. Elemental Composition and Nutritional Value of the Edible Fruits of Coastal Red Milkwood (Mimusops caffra) and Transvaal Red Milkwood (Mimusops zeyheri) and the Impact of Soil Quality; University of KwaZulu-Natal: Durban, South Africa, 2017.
11. Mashela, P.W.; Tseke, P.E.; Pofu, K.M.; Mafeo, T.P. Potential commercialisation of Mimusops zeyheri: An indigenous tree selected for research and development through indigenous knowledge systems. In Proceedings of the 11th African Crop Science Proceedings, Sowing Innovations for Sustainable Food and Nutrition Security in Africa, Entebbe, Uganda, 14–17 October 2013; Volume 11, pp. 667–669.
12. Choat, B.; Jansen, S.; Brodribb, T.J.; Cochard, H.; Delzon, S.; Bhaskar, R.; Bucci, S.J.; Feild, T.S.; Gleason, S.M.; Hacke, U.G. Global convergence in the vulnerability of forests to drought. Nature 2012, 491, 752–755.
13. Okatchi, H.; Raletamo, K.; Marobela, K. Determination of potentially toxic heavy metals in traditionally used medicinal plants for HIV/AIDS opportunistic infections in Ngamiland District in Northern Botswana. J. Anal. Chim. Acta 2012, 730, 42–48.
14. Wilson, A.; Downs, C. Fruit nutritional composition and non-nutritive traits of indigenous South African tree species. S. Afr. J. Bot. 2012, 78, 30–36.
15. Song, B.C.; Joo, N.-S.; Aldini, G.; Yeum, K.-J. Biological functions of histidine-dipeptides and metabolic syndrome. Nutr. Res. Pract. 2014, 8, 3–10.

16. Mngadi, S.; Moodley, R.; Jonnalagadda, S.B. Elemental composition and nutritional value of the edible fruits of Transval red milkwood (Mimusops zeyheri) and impact of soil quality. Environ. Monit. Assess. 2019, 191, 135.
17. Chivandi, E.; Mukonowenzou, N.; Nyakudya, T.; Erlwanger, K.H. Potential of indigenous fruit-bearing trees to curb malnutrition, improve household food security, income and community health in Sub-Saharan Africa: A review. Food Res. Int. 2015, 76, 980–985.
18. Chivandi, E.; Davidson, B.; Pretorius, B.; Erlwanger, K. Proximate, mineral, amino acid, fatty acid, vitamin E, phytate phosphate and fibre composition of Mimusops zeyheri (Red Milkwood) seed. Int. J. Food Sci. Technol. 2011, 46, 555–560.
19. Omotayo, A.O.; Aremu, A.O. Underutilized African indigenous fruit trees and food–nutrition security: Opportunities, challenges, and prospects. Food Energy Secur. 2020, e220, 1–16.
20. Chivandi, E.; Davidson, B.C.; Erlwanger, K.H. A comparison of the lipid and fatty acid profiles from the kernels of the fruit (nuts) of Ximenia caffra and Ricinodendron rautanenii from Zimbabwe. Ind. Crop. Prod. 2008, 27, 29–32.
21. Mashela, P.W.; Mollel, N. Farmer-identified indigenous fruit tree with suitable attributes for the semi-arid Northern Province of South Africa. S. Afr. J. Agric. Ext. 2001, 30, 1–12.
22. Venter, F.; Venter, J.A. Making the Most of Indigenous Trees; Briza: Pretoria, South Africa, 1996.
23. Moustafa, H.; Amal, M.; Mohamed, R.; Eman, G. A review on phenolic compounds from family Sapotaceae. J. Pharmacogn. Phytochem. 2016, 5, 280–287.
24. Mojeremane, W.; Tshwenyane, S. Azanza garckeana: A valuable edible indigenous fruit tree of Botswana. Pak. J. Nutr. 2004, 3, 264–267.
25. Chivandi, E. In Vitro and In Vivo Chemical Characterization of Kigelia africana, Mimusops zeyheri, Terminalia sericea and Ximenia caffra Nuts and Nut Meals. Ph.D. Thesis, University of the Witwatersrand, Johannesburg, South Africa, 2013.
