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Review

Cosmetopoeia of African Plants in Hair Treatment and Care: Topical Nutrition and the Antidiabetic Connection?

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Abstract: To make the distinction against pharmaceuticals, natural product medicines are more accurately denoted as nutritional therapies. In the context of topical therapies targeting dermatological conditions, nutritional therapy may explain the mechanism of ethnocosmetic plants used in hair treatment and care. Inspired by emerging theories of a connection between dysregulated glucose metabolism and hair loss, the current review of the literature focused on African plants used to target hair conditions in general, such as alopecia or scalp dermis infections, with a cross-examination of the potential of the species to alleviate issues with glucose metabolism. We distinguish between topical nutrition and sterilization (i.e., dandruff and lice). Sixty-eight plants were identified as an African treatment for alopecia, dandruff, lice, and tinea. Fifty-eight of the species have potential as antidiabetic treatments when taken orally. The family Lamiaceae was the most represented (six spp.), followed by Fabaceae and Asteraceae (five spp. each). Most species are herbs, and the most used plant part is the leaf. Thirty of the sixty species have research associated with hair growth and general hair care, with studies focused on 5α-reductase inhibition, biomarkers such as vascular endothelial growth factor, and the rate of telogen to anagen phase transition. While studies tend to conceptualize the mechanisms of these medicinal species similarly to pharmaceuticals, the current review argues that a nutritional interpretation is more appropriate, where a general improvement to local glucose metabolism may play a role.

Keywords: nutrition; androgenetic alopecia; alopecia; hair loss; nutricosmetic

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1. Introduction

People of the 21st century are demonstrating a renewed interest in plant-based cosmetic products for beautification and care. This globe-wide trend is due to the potential detrimental effects experienced by users of cosmetic products comprised of synthetic compounds [1]. In the context of hair care, products or therapies tend to prevent or manage conditions such as androgenetic alopecia, telogen effluvium, other types of alopecia, dandruff, and other infections caused by fungi, bacteria, parasites, or ectoparasites [2,3]. Cosmetic treatments for hair are also focused on aesthetic outcomes by conditioning, cleansing, and increasing the growth rate of otherwise healthy hair [3].

With better recognition and understanding of the mechanisms of topical nutricosmetics [4], the indigenous plant use industry, if sustainably practiced, may be better promoted and embraced by societies and consumers, thereby helping to build on the sustainable development goals. To an extent, it may lead to poverty eradication through job creation, promotion of good health and well-being, and empowerment of women due to a stronger inclination toward the cosmetics industry compared to men [1]. For example, in South Africa, *Citrullus lanatus* (Thunb.) Matsum., and Nakai's brand name, "Royal Honey and Kalahari Desert Melon" is now used to produce a natural hair care product [5], empowering small communities economically. Also, the dried pulp of the unripe fruit of *Citrullus*

colocynthis Schrad is an ingredient of a commercial serum used in the treatment of hair loss in India (Colocynth of Commerce) [6].

Ethnobotanical studies on cosmetic plants, especially in Africa, have always focused on general beautification, skin, and oral care [7,8], with less attention to hair care. This is gradually changing due to the increasing prevalence of scalp and hair pathologies in both men and women, concomitant with the rise of cardiovascular disease and diabetes [9,10]. Given the high demand for plant-based products in the industry for hair care and nourishment, it is important to promote a better understanding of their potential as an adjuvant. Since ethnobotanical studies on nutricosmetic plants for hair care are very scarce in Africa, it is also necessary to comprehensively summarize this knowledge.

Research focused on the mechanism of traditional hair therapies often seeks to explain mechanisms similarly to the pharmaceutical industry by following the single-target or "magic bullet" paradigm. While this approach can sometimes identify natural products that have the potential to become pharmaceuticals, it is more common for traditional therapies to confer systematic effects that can be loosely called nutrition. In the context of androgenetic alopecia, alopecia areata, telogen effluvium, or scarring alopecias, there is a growing body of research that links nutritional shortcomings with their phenotypic presentation [4,9–11].

Research is now starting to demonstrate that the etiology of androgenetic alopecia involves problems with glucose metabolism in the scalp tissue [9,10]. In this regard, a review of the literature demonstrated from a global perspective that 44% of traditional plants used specifically for androgenetic alopecia have ethnobotanical records for diabetes treatment [11]. This finding excluded species that had been researched and demonstrated to have antidiabetic potential but had no ethnobotanical records making the connection. If such studies are included in that metric, a significantly higher correlation would be observed.

Generally, most traditional therapies for hair in Africa are applied topically, whereas the same species, when used for diabetic complaints, are taken orally. While this may seemingly obscure the link between local diabetes (scalp diabetes) and hair loss, natural treatments for hair loss may be conceptualized as a form of topical nutrition that improves glucose metabolism locally rather than systemically.

While there is much information of traditional therapies for hair in other countries and continents of the world, information related to plants used in Africa is quite scarce. Furthermore, by summarizing such species, an opportunity presents itself by enabling the global coincidence of hair care plants and antidiabetic potential to be tested in Africa.

The current study provides a comprehensive summary of the indigenous knowledge of African plants that are being used for hair care. The research on efficacy or mechanism is critically discussed, with particular reference to the similarity in mechanism compared to phytochemical diversity and its role in nutrition [12]. The link to glucose metabolism and the potential antidiabetic activity of the species is discussed. Knowledge gaps are highlighted with the objective of renewing research interest and encouraging the rising numbers of natural product scientists in Africa to consider potentially commercially viable projects that benefit regional communities by creating grassroots-level industries.

2. Methodology

The data accumulated for this review were extracted from websites, search engines, and published journal databases such as African Journal Online (AJOL), Google Scholar, ScienceDirect, Scopus Web of Science, and Scopus. Keywords used to search were "ethnobotany", the name of every African country (Angola, Cameroon, Congo, Egypt, Nigeria, South Africa, Zambia, etc.), "hair care", "hair condition", "dandruff", "lice", "hair infection", "alopecia", "Indigenous knowledge", and "traditional medicinal plants". The plant names were verified on the Plant List website and World Flora Online.

The literature search on different databases resulted in 129 articles from 143 downloaded and published between 1991 and 2023. The selection of the downloaded articles

was based on the following criteria: (1) the article is published in English or translated to English; (2) at least one plant listed or mentioned in the article is used in hair care or treatment; (3) if the study is on the bioactivity related to hair care of any plant listed; (4) if the study listed an African species of plant that is used in another country outside Africa. Articles excluded from this review are based on the following: (1) studies that use chemical agents or non-plant-based agents for the treatment of hair; (2) studies on hair care that were not peer reviewed; (3) studies that mentioned that a plant is used for hair care in Africa without information on how and where it is used; (4) duplicated studies similar to already reviewed articles.

Lastly, the authors then adopted the "2SR" acronym (search, screen, and review) during the review of the articles.

The vernacular names of the plants and the tribes (cultures, civilizations) associated with the traditional use report were recorded as mentioned in the publications. Where the tribe was not available, the country was recorded. The species used in regions other than Africa but distributed in Africa are also included in this paper; in this case, the vernacular names of the plants are based on the local language of the first author, when available (Yoruba).

The species names that were compiled were then searched on Google Scholar using the search words "*genus*, *species*, antidiabetic". Species were considered to have antidiabetic potential if there were in vitro or in vivo studies of hypoglycemic effects in mice or cultured cell lines, or if there were ethnobotanical records associated with the treatment of diabetes, insulin resistance, or metabolic syndrome.

3. Results and Discussion

3.1. Medicinal Plants for Hair Treatment

In the current review, 68 plants distributed in Africa were compiled. Traditional use targets included alopecia, dandruff, lice removal, and tinea treatment (Table 1). Most of the reported plants are from Nigeria, Egypt, Cameroon, Tunisia, and South Africa, while those species that are used in countries like India and Thailand are included in Table 1 if the plant is also distributed in Africa. For example, species like *Ipomoea aquatica*, *Senna siamea*, and *Cymbopogon citratus* are reportedly used for hair in Thailand, while *Abrus precatorius*, Azadirachta indica, and *Melia azedarach* are used in India. Furthermore, the people from Haiti, Samoa, and Tonga used *Calophyllum inophyllum* for hair and scalp care [13].

The 68 species are distributed between 39 angiosperm families, with Lamiaceae having the highest number of species at 6, then Fabaceae and Asteraceae with 5 species each (Figure 1).

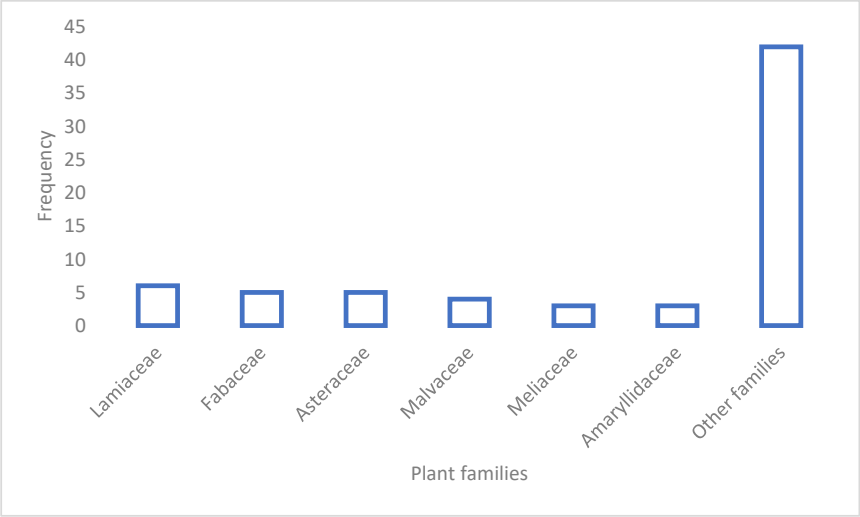

Figure 1. Most recorded families of plants used for hair care in Africa.

The family Lamiaceae has been previously reported as the leading family in terms of cosmetical usage in the Eastern Cape region of South Africa [5], while Asteraceae and Fabaceae have been reported as the leading families for cosmetical use among the Vhavenda women from South Africa [7] and peoples of West Africa [8].

The family Lamiaceae is known for its high yield of essential oils after distillation, with many that are valuable in the cosmetic and perfume industry [14]. Evidently, when the macerated leaves are extracted into a fixed oil, the volatile organic compounds are included, among other lipophilic compounds [15], creating a mixture of biomolecules with transdermal potential [16]. The dominance of the families Asteraceae and Fabaceae is also unsurprising as they are often the second and largest families of angiosperms, respectively, according to many other ethnobotanical studies [17–19]. At the level of genera, the aromatic species from *Lavandula* (Lamiaceae) and the alkaloid-rich species from *Pterocarpus* (Fabaceae) are the most utilized genera, with two species each.

Table 1. African species used for hair care or hair loss.

Family	Species	Country Where Report Was Conducted	Local Name	Part(s) Used	Ailment Targeted, Mode of Administration, and Antidiabetic Potential	Growth Habit	References
Adiantaceae	* *Adiantum capillus-veneris* L	Egypt	Not determined	Aerial part	Baldness or alopecia: whole plant, aqueous then topical. Antidiabetic? Yes [11]	Herb	[20]
Annonaceae	*Xylopia aethiopica* (Dunal) A.Rich.	Nigeria	Eeru	Fruit	Baldness or alopecia: extract from the fruit is applied to the scalp. Antidiabetic? Yes [21]	Tree	[22]
Asteraceae	*Artemisia afra* Jacq.	South Africa; Setswana	Lengana/ umhlonyane	Leaf	Baldness or alopecia: leaves are mixed with the leaves of rosemary to wash hair. Antidiabetic? Yes [23]	Shrub	[24]
Asteraceae	* *Eclipta prostrata* (L.) L. (Synonym: *Eclipta alba* L. Hassak)	Not determined	Not determined	Whole plant	Baldness or alopecia: the juice extract is applied to the scalp. Antidiabetic? Yes [11]	Herb	[25]
Asteraceae	*Gymnanthemum amygdalinum* (Delile) Sch.	Cameroon	Panboka	Leaf	General hair care: extract from the macerated or crushed leaves or infusion of the leaves is applied to the hair. Antidiabetic? Yes [26]	Shrub	[1]
Asteraceae	*Eriocephalus africanus* L.	South Africa; Setswana	Not determined	Twig and inflores-cence	Baldness and hair conditioning: extract from the boiled twigs and inflorescence is applied to the scalp. Antidiabetic? Yes [27]	Shrub	[24]
Asteraceae	*Tridax procumbens* L.	Nigeria	Imi esu (Yoruba)	Leaf	Baldness or alopecia: extract from the leaves is applied to the scalp. Antidiabetic? Yes [28]	Herb	[3]
Arecaceae	*Cocos nucifera* L.	Nigeria	Agbon (Yoruba)	Fruit	General hair care: oil extract from the fruit is applied to the scalp. Antidiabetic? Yes [11]	Tree	[3]
Arecaceae	*Elaeis guineensis* Jacq.	Cameroon and Nigeria	Tî Mbanga	Seed	General hair care: oil extract from the fruit is applied to the scalp. Antidiabetic? Yes [29]	Tree	[1]
Acoraceae	*Acorus calamus* L.	South Africa (Zoa, Kannaland)	Makkalmoes (Afrikaans)	Rhizome	Baldness or alopecia: infused rhizome is used to wash the scalp, or oil extract is applied to the scalp. Antidiabetic? Yes [30]	Herb	[31]
Amaryllidaceae	*Allium ascalonicum* L.	Nigeria (Yoruba)	Alubosa elewe	Bulb	Baldness or alopecia: juice extract of the bulb is applied to the scalp. Antidiabetic? Yes [32]	Herb	[33]
Amaryllidaceae	*Allium cepa* L.	Not determined	Alubosa (Yoruba)	Bulb	Baldness and dandruff: bulb is used to rub the scalp, or juice extract is applied to the scalp. Antidiabetic? Yes [11]	Herb	[3]

Table 1. *Cont.*

Family	Species	Country Where Report Was Conducted	Local Name	Part(s) Used	Ailment Targeted, Mode of Administration, and Antidiabetic Potential	Growth Habit	References
Amaryllidaceae	*Allium sativum* L.	Nigeria	Alubosa Ayyu	Bulb	Baldness or alopecia: juice extract of the bulb is applied to the scalp. Antidiabetic? Yes [11]	Herb	[33]
Amaranthaceae	* *Achyranthes aspera* L.	Not determined	Abora (Yoruba)	Root	Baldness and dandruff: paste from the fresh root is applied to the scalp overnight. The ash from the whole plant is also used in making hair dye. Antidiabetic? Yes [34]	Herb	[35]
Asparagaceae	*Asparagus africanus* Lam.	South Africa (Eastern Cape)	Ubumhlope/ umathunga	Aerial part	Baldness or alopecia: the aerial part is used to rub the scalp. Antidiabetic? Yes [36]	Shrub	[5]
Calophyllaceae	* *Calophyllum inophyllum* L	Haiti, Samoa, & Tonga		Flower and nut	Baldness and scalp care: oil extracted from the nut is applied to the scalp alone or mixed with coconut oil. Flowers are used as a fragrance in coconut oil for scalp care. Antidiabetic? Yes [37]	Tree	[13]
Caricaceae	* *Carica papaya* L.	Nigeria	Ibepe	Fruit	General hair: fruit is used as a poultice on the scalp. Antidiabetic? Yes [38]	Tree	[39]
Cannabaceae	* *Cannabis sativa* L.	Cameron, South Africa (Venda), and Nigeria	Mbângué (Gbaya, Cameroon), Igbo, (Nigeria), banzhe (Venda, South Africa	Leaf and seed	Baldness and general hair care: extract from crushed seeds or leaves is applied to the scalp for hair care in Cameroon. Powder from the dried leaves mixed with cream is applied to the scalp for baldness in Nigeria. Extract from the macerated seed is applied to the scalp for baldness in South Africa. Antidiabetic? Yes [11]	Herb	[1,7]
Cornaceae	* *Alangium salviifolium* (L.f.) Wang	Not determined	Not determined	Seed and stem bark	Baldness and dandruff: paste made from seed is applied to the scalp. Paste made from fresh stem bark is applied to the scalp for dandruff. Antidiabetic? Yes [40]	Tree	[35]
Convolvulaceae	* *Ipomoea aquatica* Forssk.	Not determined	Not determined	Leaf and stem	Baldness and hair conditioning: decoction of leaves and stem is applied to the scalp. Antidiabetic? Yes [41]	Creeper	[42]
Convolvulaceae	*Ipomoea batatas* (L.) Lam	Cameroon	Mouké	Leaf	General hair care: extract from the macerated or crushed leaves or infusion is applied to the scalp. Antidiabetic? Yes [43]	Creeper	[1]
Cucurbitaceae	* *Citrullus colocynthis* Schrad	Not determined	Not determined	Fruit and seed	Baldness or alopecia: oil extracted from the seeds is applied to the scalp. Dried pulp from the unripe fruit is applied to the scalp. Antidiabetic? Yes [44]	Trailer	[6]
Cyperaceae	*Cyperus longus* L.	Egypt	Su'd	Leaf	Baldness or alopecia: powder from the dried leaves mixed with cream is applied to the scalp. Antidiabetic? No records found	Herb	[45]
Cyperaceae	*Cyperus rotundus* L.	Egypt	Not determined	Tuber	Hirsutism: oil extracted is applied to the scalp. Antidiabetic? Yes [46]	Herb	[47]
Dilleniaceae	*Tetracera alnifolia* Willd.	Nigeria	Igi opon	Leaf and fruit	Baldness or alopecia: powder from the ground leaves or fruits is applied to the scalp. Antidiabetic? Yes [48]	Climber	[33]

Table 1. *Cont.*

Family	Species	Country Where Report Was Conducted	Local Name	Part(s) Used	Ailment Targeted, Mode of Administration, and Antidiabetic Potential	Growth Habit	References
Ericaceae	*Erica multiflora* L	Tunisia and Morocco	Not determined	Not determined	Baldness or alopecia: extract from the plant is applied to the scalp. Antidiabetic? No records found	Shrub	[49]
Euphorbiaceae	*Ricinus communis* L	Tunisia	Not determined	Seed	General hair care: oil extract from the seeds is applied to the scalp. Antidiabetic? [11]	Shrub	[50]
Euphorbiaceae	*Spirostachys africana* Sond.	South Africa (Amandwe)	Umthombothi	No records	Hairdressing and lice: method of administration not determined. Antidiabetic? No records found	Tree	[51]
Fabaceae	*Abrus precatorius* L.	Reported in India	Not determined	Seed and root	Baldness and hair tinea: the seed paste is applied to the scalp for baldness or alopecia. The seed oil is applied to the scalp to prevent hair from falling as a result of a *Tinnea capitis* infection. Paste made from the root, seed, and honey is applied to the scalp for alopecia or baldness. Antidiabetic? Yes [11]	Climber	[35]
Fabaceae	*Pterocarpus erinaceus* Poir.	Togo	Tém	Latex	Hair tinea: latex is applied to the scalp. Antidiabetic? Yes [52]	Tree	[53]
Fabaceae	*Pterocarpus soyauxii* Taub. (Padouk)	Cameroon	Koula	Bark	Hair colourant: bark is macerated or crushed and applied to the scalp used as a natural dye. Antidiabetic? Yes [54]	Tree	[1]
Fabaceae	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Not determined	Not determined	Leaf	Dandruff, oily scalp, and general hair care: decoction of the leaves is applied to the scalp. Antidiabetic? Yes [55]	Tree	[42]
Fabaceae	*Trigonella foenum-graecum* L.	Not determined	Not determined	Seed	Baldness or alopecia: ground seeds are mixed with oil and applied to the scalp. Antidiabetic? Yes [11]	herb	[11]
Lamiaceae	*Ajuga iva* (L.) Schreb	Tunisia	Chendgoura	Leaf	Hair softener: oil macerated from the leaves is applied to the scalp. Antidiabetic? Yes [56]	Herb	[57]
Lamiaceae	*Lavandula coronopifolia* Poir	Tunisia	'Khzema	Flowers	Hair softener and perfume: oil macerated from the flowers is applied to the scalp. Antidiabetic? Yes [58]	Shrub	[57]
Lamiaceae	*Lavandula multifida* L	Tunisia	Kammoun	Flowers	Hair softener and perfume: oil macerated from the flowers is applied to the scalp. Antidiabetic? Yes [59]	Shrub	[57]
Lamiaceae	*Leonotis leonurus* (L.) R.Br	South Africa (Sestwana)	Utshwala-bezinyoni (isiZulu)	Leaf	Baldness or alopecia: extracts of the leaves is taken orally. Antidiabetic? Yes [60]	Shrub	[24]
Lamiaceae	* *Ocimum sanctum* L.	Not determined	Not determined	Leaf	Baldness and general hair care: oil macerated from the leaves is applied to the scalp. Antidiabetic? Yes [61]	Herb	[3]
Lamiaceae	*Salvia aegyptiaca* L.	Tunisia	'Kammouna	Flower	Hair perfume: oil macerated from the flowers. Antidiabetic? Yes [62]	Herb	[57]
Lauraceae	*Cassytha ciliolata* Nees	South Africa (Zoar and Vanwyksdorp Kannaland	Nooienshaar	Whole plant	Baldness or alopecia: whole plant decoction is applied to the scalp. Antidiabetic? No records found	Climbing or twin-ning herb	[31]

Table 1. *Cont.*

Family	Species	Country Where Report Was Conducted	Local Name	Part(s) Used	Ailment Targeted, Mode of Administration, and Antidiabetic Potential	Growth Habit	References
Lauraceae	*Persea americana* Mill	Cameroon, South Africa (Venda), Tanzania	Afukhuda (Venda)	Fruit	General hair care, baldness, dandruff, and hair moisturizer: oil macerated from the fruit is applied to the scalp and used for hair care in Cameroon. Fruit is applied to the scalp for hair nourishment in South Africa. The mesocarp of the fruit is mixed with the egg yolk and used as a hair moisturizer, for dandruff, and to prevent hair loss. Antidiabetic? No; leaves and seeds: yes [63]	Tree	[1,7,64]
Lythraceae	* *Lawsonia inermis* L.	Not determined	Not determined	Leaf	Dandruff: paste made from fresh leaves is applied to the scalp. Leaves extract is used in making hair oil for hair tonics and dyes. Antidiabetic? Yes [11]	Shrub	[3]
Malvaceae	*Hermania* spp.	Mbeere Kenya (Karundu)	Not determined	Leaf	General hair care: leaves are added to water and used as shampoo to wash the hair. Antidiabetic? No records found	Shrub	[65]
Malvaceae	* *Hibiscus rosa-sinensis* L.	Not determined	Not determined	Leaf	Baldness or alopecia: extract from the leaves is applied to the scalp. Antidiabetic? Yes [11]	Shrub	[3]
Malvaceae	*Malva parviflora* L.	South Africa (Eastern Cape)	Umajikanelanga/ijongilanga	Leaf and root	Dandruff and hair softener: decoction of the roots or leaves is applied to the scalp. Antidiabetic? Yes [66]	Herb	[5]
Malvaceae	*Triumfetta pentandra* A. Rich.	Cameroon	Mbol	Bark	General hair care: extract from macerated or crushed bark or infusion of bark is applied to the scalp. Antidiabetic? Yes [67]	Herb	[1]
Meliaceae	* *Azadirachta indica A. Juss.*		Dogo Yaro (Yoruba)	Leaf, seed, and sap	Baldness, dandruff, and lice: leaves and seeds are crushed and applied to the scalp for lice. Infusion of fresh leaves for dandruff. The mixture of the seed and the sap from the tree growing near the water is used to massage bald heads for baldness. Antidiabetic? Yes [68]	Tree	[35]
Meliaceae	* *Melia azedarach* L.	Not determined	Not determined	Flower	Dandruff: the crushed flowers are applied to the scalp. Antidiabetic? Yes [69]	Tree	[35]
Meliaceae	*Trichilia dregeana* Sond	South Africa (Eastern Cape)	Umkhuhlu	Seed	General hair care: ointment made from the seeds is applied to the scalp. Antidiabetic? No records found	Tree	[5]
Mesembryanthemaceae	*Psilocaulon coriarium* (Burch. ex N.E.Br.	South Africa (Eastern Karoo)	Loogbossie	Whole plant	Pimples or pustules: infusion of the whole plant is used to wash the scalp or as a poultice. Antidiabetic? No records found	Herb	[70]
Moraceae	*Ficus sur* Forssk	Togo	Kaliay	Leaf	Hair tinea: leaves are used to rub the scalp. Antidiabetic? Yes [71]	Tree	[53]
Myrtaceae	*Eugenia nigerina* A. Chev	Nigeria	Kanafuru	Fruit	Baldness or alopecia: powder from the ground dried fruit is mixed with oil and applied to the scalp. Antidiabetic? Yes [72]	Shrub	[33]
Myrtaceae	*Myrtus communis* L.	Tunisia	Not determined	Leaf and twig	General hair care: essential oil extracted from leaves and twigs is applied to the scalp. Antidiabetic? Yes [11]	Shrub	[73]

Table 1. *Cont.*

Family	Species	Country Where Report Was Conducted	Local Name	Part(s) Used	Ailment Targeted, Mode of Administration, and Antidiabetic Potential	Growth Habit	References
Passifloraceae	*Adenia gummifera* Harms.	South Africa; Sestawana	Mfulwa (isiZulu)	Leaf	Baldness and hair conditioning: leaves mixed with rosemary plant to wash the hair. Antidiabetic? No records found	Climber	[24]
Pedaliaceae	*Sesamum senecioides* (Klotzsch) Byng & Christenh.	South Africa and Zimbabwe	Museto (South Africa; Tshivenda)	Leaf	Baldness and hair softener: extract from the leaves is applied to the scalp. Antidiabetic? No records found	Creeper	[74]
Pedaliaceae	*Sesamum indicum* L.	Cameroon	Soundou	Seed	General hair care: extract from the crushed seeds or infusion of the seeds is applied to the scalp. Antidiabetic? Yes [11]	Herb	[1]
Poaceae	* *Cymbopogon citratus* Stapf.	Not determined	Ewe tea/kooko oba (Yoruba)	Whole plant	Oil scalp and general hair care: decoction of the whole plant is used to wash the hair. Antidiabetic? Yes [11]	Herb	[42]
Phyllanthaceae	* *Phyllanthus emblica* L.	Not determined	Not determined	Fruit	Baldness or alopecia: oil extracted from the dried fruit is applied to the scalp individually or when fried in sesame oil. Antidiabetic? Yes [11]	Tree	[3,42]
Rubiaceae	*Chassalia kolly* (Schumach.) Hepper	Togo	Tiyah	Root	Hair tinea: paste made from the roots is applied to the scalp. Antidiabetic? No records found	Shrub	[53]
Rubiaceae	*Gardenia ternifolia* Schumach and Thonn.	Togo	Kaou	Root	Hair tinea: calcinate made from the root is applied to the scalp. Antidiabetic? No records found	Small tree	[53]
Rutaceae	*Ruta graveolens* L.	South Africa; Sestwana	Not determined	Stem	Baldness or alopecia: decoction of the stem is used to wash hair. Antidiabetic? Yes [75]	Herb	[24]
Sapotaceae	*Baillonella toxisperma* Pierre	Cameroon	Guibi	Seed	General hair care: oil from the macerated or crushed seeds is applied to the scalp. Antidiabetic? Yes [76]	Tree	[1]
Sapotaceae	*Vitellaria paradoxa* C.F. Gaertn.	Cameroon and Nigeria	Igi oori (Yoruba, Nigeria)	Seed	General hair care: oil from the macerated or crushed seeds is applied to the scalp. Antidiabetic? Yes [77]	Tree	[1]
Solanaceae	*Nicotiana tabacum* L.	Cameroon and Nigeria	Ndalka (Cameroon) Taaba (Yoruba; Nigeria)	Leaf	Baldness or alopecia: extract from crushed leaves is applied to the scalp in Cameroon. Dried leaves are ground to powder, mixed with oil, and applied to the scalp in Nigeria. Antidiabetic? Yes [78]	Herb	[1,33]
Sterculiaceae	*Theobroma cacao* L.	Cameroon and Nigeria	Koko (Nigeria)	Seed	Baldness and general hair care: extract from crushed or macerated seeds is used for hair care in Cameroon. Dried seeds are ground into powder and mixed with cream for baldness in Nigeria. Antidiabetic? Yes [79]	Tree	[1]
Xanthorrhoeaceae	*Aloe ferox* Mill.	Lesotho	Lekhala-la-Quthing	Leaf	General hair care: extract from leaves is applied to the scalp. Antidiabetic? Yes [80]	Tree	[81]
Xanthorrhoeaceae	*Aloe vera* (L.) Burm.f.	Cameroon, Nigeria and Tunisia	Eti eerin (Nigeria)	leaf	General hair care: macerated gel from the leaves is applied to the scalp. Antidiabetic? Yes [11]	Herb	[1,50]
Zingiberaceae	* *Zingiber officinale* Roscoe	Not determined	Ataale (Yoruba	Rhizome	Baldness and oily scalp: juice extracted from fire-grilled rhizomes is applied to the scalp. Antidiabetic? Yes [11]	Herb	[42]

Plants with * are not used in Africa but distributed in Africa.

3.2. Habit of Plants, Plant Part Used, and Preparation Methods

Regarding the habits of the species recorded in this review, most of the plants are herbs (24), followed by trees (21), shrubs (15), and climbers/creepers/trailers (8) (Figure 2). Herbaceous plants have been reported as the most common habit due to the ease of collection and global distribution, and they will also be easier to use topically for cosmetic purposes because of their soft organs [8,82].

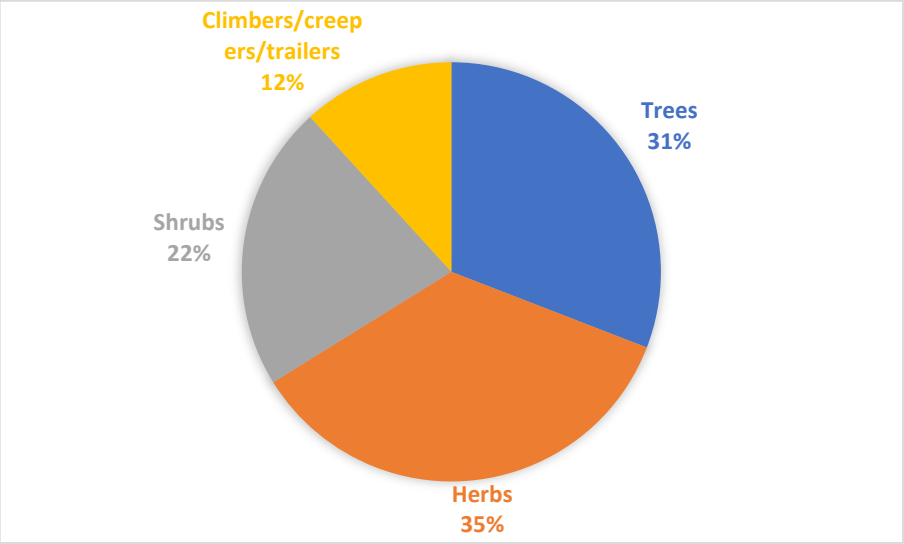

Figure 2. Habit of the recorded plants used in hair treatment and care in Africa.

The plant parts that are mostly used in the preparation of medicinal plants for hair treatment in Africa are the leaves (24), followed by seeds (13), and then fruits (8). Other plant parts such as root, stem, rhizome, twig, nut, and the whole plant are also used, albeit less frequently. Plant parts are mostly prepared through maceration and decoction and are sometimes used as poultices or extracted into a carrier oil. The observation of a high frequency of use of leaves in the context of cosmetic benefit is consistent with other reports [7,8]. Furthermore, the high frequency of seeds and fruits may be because they contain a high concentration of essential oils (sterilizing effects and anti-inflammatory effects), with fatty acid components such as arachidic, linoleic acid, oleic, and stearic acids. The fatty acid and triglyceride components are natural preservative ingredients commonly used in the manufacturing of cosmetics for skin and hair care and rejuvenation [83,84]. Fatty acids tend to change the aesthetic feel of hair and improve the dryness of scalps afflicted with dermatological complaints.

As expected, nearly all the extracts of species are administered topically, except for *Leonotis leonurus*. In this case, the leaf extract is drunk for hair growth [24]. A probe into the oral toxicological profile of *L. leonurus* revealed that its aqueous extract caused cardiovascular changes in male rats at doses ranging from 125–500 mg/kg [85], and histopathological and haematological changes in female rats from 125–3200 mg/kg body weight, with death occurring at the higher concentration [86]. While the studies emphasized dose as key to these safety concerns, the material collected for these studies should be examined for similarity to the chemical profile used in other regions of the country. It is common for chemical variation across geography to be a significant factor in toxicity and non-toxicity [87]. It should also be noted that these doses in humans equate to 10–256 g for an 80 kg mass, which may exceed the dose taken in traditional medicine. But even at lower doses, chronic toxicity from long-term use should be considered.

Nevertheless, it is clear that topical administration of medicinal plant extracts is the most preferred choice in cosmetic applications for hair and skin care [7]. This is suggestive that practitioners of nutritional medicine are unaware of the importance of

the two-thronged approach recommended by researchers, where both a topical and an oral approach is recommended [10].

3.3. Perspectives on the Culture of Hair Care in Africa

Allegedly, the sub-Saharan African people are less concerned with hair loss by comparison with the other cultures of the world. Until recently, these same people were unlikely to experience pattern hair loss, also known as androgenetic alopecia or "male pattern baldness" [88]. However, studies are demonstrating an increase in occurrence, such as in Nigeria, where prevalence has reached 30% in men compared to approximately 50% in Europeans [89].

The lower frequency of topical and oral treatments for AGA in southern and southwestern parts of Africa is rumored to be due to a cultural indifference to balding, since many sub-Saharan Africans shave their hair off. An alternative perspective is that AGA was not prevalent in earlier generations, giving less time for traditional medicines to be discovered through iterative trial and error selection.

The apparent generational change in the frequency of AGA in Africans has confounded perspectives on the genetic aspect of AGA. This is because cultures that previously had minimal occurrence of the phenotype in recent or ancient history are now demonstrating baldness. In Nigeria, familial history of AGA accounts for approximately 50% of incidences, with the remainder having no apparent genetic basis for its occurrence [89]. This is evident in other cultures, too, such as Korea [90] and China [91], with family history of AGA accounting for only 48.5% and 30% of those with the phenotype, respectively.

The rising prevalence of AGA has also been observed in several countries but epidemiological studies that confirm this observation are scarce. A study of Korean men documented that the average age of men who developed AGA in the years from 2006 to 2010 decreased from 34.1 to 31.6 years [92]. A study of a population in Israel over the course of a decade (2010–2020) measured an increased rate of AGA from 17% to 32% [93] in the general population.

Due to the apparent contradictions to the theory of genetic origins of AGA, scholars are now shifting their focus to epigenetics, where diet and lifestyle factors may be driving epigenetic changes that accumulate along family lineages [9]. This may explain why family history does have an association with AGA development but does not account for most cases. It is speculated that the same diet and lifestyle factors leading to cardiovascular disease and diabetes may be responsible for the emergence of AGA in family lineages with no history of this phenotype.

Challenges to this perspective include the documentation of baldness during the times of ancient Rome and Greece. However, the theory of epigenetic factors in AGA gives cognizance to the potential for such changes to be reversed when negative lifestyle and dietary factors are removed [94,95], meaning that AGA can be created in or removed from family lineages. While this theory is still in early development, it is currently the best explanation for the changing epidemiology of AGA in societies that have a more recent history of progression into the "western diet".

Thus, the changed diet and lifestyle of the sub-Saharan African people may be considered a factor in the rising prevalence of AGA and the infrequency of records of flora used to reduce the severity of the phenotype. For example, most records in Table 1 are for hair problems that are not AGA.

It is also common for women to want their hair to grow or regrow faster, so a unique approach is utilized to find a species that does not resolve hair loss per se but promotes hair growth. An example is the southern African climber, *Cassytha ciliolata*, which is selected for this application based on a "doctrine of signatures" approach. It grows atop other bushes and colonizes the canopy, creating the appearance of a thick head of hair over its host. The rapid and thick growth of the species is conceptually replicated if an extract of its aerial parts is applied topically.

While studies of medicinal plants used to treat hair loss tend to focus on identifying single active metabolites with selective mechanisms of action, natural products are not pharmaceuticals and should, therefore, not be thought of as having single targets and mechanisms. The studies listed in Table 2, for example, tend to focus on isolated hair follicles or cells and measure biomarkers of growth, changes to the growth rate of hair fibers, or proliferation of cells. While these studies give some level of credence to the medicinal species and may also demonstrate a lack of toxicity, the systematic nature of AGA is ignored in those studies. Therefore, the current review argues that it makes more sense to consider that benefits to hair are mainly due to the use of nutritional species that are prophylactic to lifestyle diseases and can work locally to alleviate the damaging effects of dietary components in a matrix of cells that have a pathophysiological difference compared to non-balding tissues.

3.4. Topical Nutrition: Biological Activities of the Recorded Plant Species

An earlier review of natural therapies for hair loss, from a global perspective, recognized that a high number of remedies are also used to treat diabetic complaints, such as insulin resistance and metabolic syndrome, as well as the symptoms of diabetes mellitus type two [11]. From these observations, multiple theories of hair loss etiology and pathogenesis have been proposed where androgenetic alopecia is partly mediated by issues of glucose metabolism leading to mitochondrial fatigue and reactive oxygen species accumulation in the cells at the base of the hair follicle [9,10].

Research has also demonstrated that hair loss of all types is linked to eight key etiological components, including inflammation, accelerated lipogenesis, androgen imbalance, glucose metabolism, prostaglandin imbalance, microbial overgrowth of the scalp, fibrosis, and nutritional deficiency [10]. Hence, topical therapies can ameliorate factors leading to hair loss by contributing nutrients to the scalp, reducing inflammation, reducing microbial density, and harmonizing glucose metabolism.

Transcriptomic studies have identified that cells at the base of the hair follicle (dermal papilla cells) demonstrate a malfunction of the electron transport chain and a high rate of reactive oxygen species generation [96]. This indicates that even penetrating antioxidants from plants can be supportive of hair growth [97]; however, a greater effect can be achieved if natural products support or promote the production of endogenous antioxidants, such as superoxide dismutase, catalase, or glutathione.

Isoflavones have been linked to endogenous antioxidant promotion [98–100]. A significant number of species used to treat hair loss express isoflavones in their metabolome [11]. Furthermore, the mechanism of diabetes attenuation is often linked to the promotion of endogenous antioxidants [101]. Thus, the nutritional effects of oral or transdermal hair nutraceuticals may be related to the attenuation of redox imbalance, explaining the link between attenuating diabetic symptoms and hair rejuvenation.

The restoring of redox balance may also be linked to a more efficient metabolism of androgens, cholesterol, and endogenous artifacts of mitochondrial overactivity. For example, the isothiocyanates in species of *Allium* or *Brassica* are associated with improved cellular antioxidant status [102] and improve the activity of dermal metabolizing enzymes, including 3α-hydroxysteroid dehydrogenase [103], an enzyme that eliminates dihydrotestosterone, which is an androgen linked to androgenetic alopecia [10].

While the mechanisms of hair loss therapies are not immediately obvious, published bioassays may assist with reinforcing the efficacy of natural products and demonstrating safety if tolerated by animals or humans [18]. Of the 68 plants recorded, 30 have been tested for activities related to managing alopecia (hair growth) and hair care, like dandruff and scalp care (Table 2). To the latter, while these items are not directly linked to hair growth, it is the contention of some scholars that alleviating microbial overgrowth, resolving inflammation, and conditioning will directly contribute to the quality and quantity of hair strands on the scalp [10].

Table 2. Studies and findings of species used for hair care and rejuvenation.

Plant Species	Plant Part	Extract Used/Isolated Compound	Type of Study and Result	Phytochemicals	References
Abrus precatorius	Leaf	Petroleum ether and ethanolic extract	Preclinical (in vivo): promotes hair growth by accelerating hair follicles in up to 71% hair population from the telogen phase to the anagen phase.	NA	[104]
Adiantum capillus-veneris	Aerial part	Ethanol	Preclinical (in vivo): follicular density in the treated group was higher than in the testosterone-treated group (1.92 vs. 1.05). Anagen/telogen ratio is also higher (0.92 vs. 0.23).	Triterpenes, flavonoids, phenyl-propanoids, and carotenoids	[20]
Allium ascalonicum	Bulb	Methanol	Preclinical (in vitro): promotes hair growth by inhibiting the androgen gene expression and amplification of the genes associated with Wnt/β-catenin, sonic hedgehog and angiogenesis pathways.	*p*-coumaric acid, quercetin, and rosmarinic acid	[105]
Allium cepa	Bulb	Juice	Clinical: improved hair re-growth in people with alopecia areata by up to 93%.	NA	[106]
Azadirachta indica	Seed	Shampoo based on seed extract	Clinical: shampoo was effective on head lice with a mortality rate of up to 93%	NA	[107]
Calophyllum inophyllum	Leaf	Polyphenol, flavonoid, anthocyanin, and saponin	Preclinical (in vitro): promotes hair follicle proliferation up to 25 μg mL^{-1} and reduces the expression of genetic biomarkers associated with reduced hair growth, namely *DKK1* and *TGFB1*.	Procyanidin, sinapic acid, and 3,4,5-tri-*O*-caffeoylquinic acid	[13]
Cannabis sativa	Seed	Oil	Clinical: the oil markedly improved hair growth in 25% of the patients with alopecia areata between 4 and 8 weeks.	Cannabidiol	[108]
Capsicum annum	Fruit	Capsaicin and isoflavone	Clinical and preclinical (in vitro and in vivo): capsaicin and isoflavone also significantly promote hair growth by up to 64.5% in humans with alopecia. Capsaicin increased IGF-1 in hair follicles and hair development.	Capsaicin and isoflavone	[109,110]
Carica papaya	Fruit	Isopropyl 2,5-dihydroxyben-zoate	Preclinical (in vitro): the compound significantly promotes growth of human hair follicle dermal papilla cells by 112%	Isopropyl 2,5-dihydroxyben-zoate	[111]

Table 2. *Cont.*

Plant Species	Plant Part	Extract Used/Isolated Compound	Type of Study and Result	Phytochemicals	References
Citrullus colocynthis	Fruit	Petroleum ether and ethanol	Preclinical (in vivo): reduction in hair growth initiation time and time required to complete hair growth in rats through promotion of the hair follicles from the telogen to anagen phase by more than 70%.	NA	[6]
Cocos nicifera	Oil	Vatika enriched coconut hair oil	Clinical: oil is effective in the management of dandruff and hair fall by increasing hair health parameters.	NA	[112]
Cymbopogon citratus	Whole plant	Ethanol	Preclinical (in vitro): inhibited 5α-reductase in vitro and improved hair growth.	NA	[42]
Cyperus rotundus	Tuber	Oil extract	Clinical: extract significantly reduced axillary hair growth in humans at $p < 0.5$.	Flavonoids, lignans, and polyphenols	[47]
Dicerocaryum senecioides	Leaf	Flavonoid glycosides extract	Preclinical (in vivo): increase in hair follicle length of individual hairs up to 12 mm compared to control, which is 5 mm.	Steroidal glycosides, triterpenoid glycosides, and flavonoid glycosides	[74]
Eclipta prostrata	Whole plant	Methanol	Preclinical and clinical (in vivo and human trial): promotes hair follicle counts in mice by inducing anagen transition from the telogen (resting) phase in hair follicles. It also showed 54% efficacy in a human trial.	Flavonoids, glycosides, and thiophene	[25]
Erica multiflora		Ethanol	Preclinical (in vivo): the extract promotes dermal papilla cell proliferation and hair growth up to 144% at 5000 µg/mL	NA	[49]
Hibiscus rosa-sinensis	Leaves	Petroleum ether extract	Preclinical (in vivo): leaf extract increased hair light up to 17 mm after 30 days compared to control (13.6 mm). It also reduced the rate of telogen hair follicles in mice.	Flavonoids, glycosides, lipids, and citrus and oxalic acids	[113,114]
Ipomoea aquatica	Leaf and stem	Ethanol extract	Preclinical (in vitro): inhibited 5α-reductase activity with IC_{50} of 13.16.	NA	[42]

Table 2. *Cont.*

Plant Species	Plant Part	Extract Used/Isolated Compound	Type of Study and Result	Phytochemicals	References
Ipomoea batatas	Rhizome	Oil extract	Preclinical (in vitro): promoted hair growth in mice through expression of vascular endothelial growth factor up to 392 pg/mL compared to control (246 pg/mL).	Ethyl α-linolenate, ethyl linoleate, and ethyl palmitate	[115]
Lawsonia inermis	Leaf	Ethanol	Preclinical (in vitro): inhibited 5α-reductase activity with IC_{50} of 12.58.	NA	[42]
Malus domestica	Fruit	Procyanidin B-2 (epicatechin-(4b-8)-epicatechin)	Preclinical (in vitro and in vivo): Procyanidin B-2, procyanidin B-3, and procyanidin C-1, inhibited protein kinase C and promoted hair growth.	Procyanidin B-2, procyanidin B-3, and procyanidin C-1	[116–118]
Myrtus communis	NA	Aqueous extract plus vinegal	Clinical: the solution was effective against scaly scalps and dandruff at $p < 0.001$.	NA	[119]
Ocimum sanctum	Whole plant	Fermented product from the powder	Preclinical (in vitro): inhibited different strains of *Malassezia furfur*, causing dandruff up to the 17 mm zone.	NA	[120]
Persea americana	Fruit	Oil	Preclinical (in vitro): the compounds improved damaged hair cells in zebrafish.	(2R,4R,6Z)-1,2,4-trihydroxynonadec-6-ene and (2R,4R)- 1,2,4-trihydroxyheptadecadi-14,16-ene	[121]
Phyllanthus emblica	NA	Ellagic acid	Preclinical (in vitro): inhibited 5α-reductase activity, and it is associated with the expression of vascular endothelial growth factor (a biomarker for hair growth).	Ellagic acid	[122]
Ricinus communis	Seed	Oil	Preclinical (in vitro): promotes the shining of the hair. It improves the dilation of blood vessels to the hair follicle. Decreases the expression of prostaglandin D2.	Ricinoleic acid and fatty acids	[123]
Senna siamea	Leaf	Ethanol	Preclinical (in vitro): inhibited 5α-reductase inhibitory activity with IC_{50} 12.87.	NA	[42]
Sesamum indicum	Seed	Oil	Preclinical (in vitro): inhibited 5α-reductase by 37%	Sesamin	[124]
Theobroma cacao	Fruit peel	Ethanol	Preclinical (in vivo): extract improved hair growth in rabbits at concentrations above 15%.	NA	[125]

Table 2. *Cont.*

Plant Species	Plant Part	Extract Used/Isolated Compound	Type of Study and Result	Phytochemicals	References
Tridax procumbens	Aerial part	Ethanol	Preclinical (in vivo): extract in the form of 10% ointment promotes hair growth and development	Flavonoids, beta-sitosterol, alkaloids, tannin, luteolin, glucolteolin, and isoquercetin	[3,126]
Trigonella foenum-graecum	Leaf	Ethanol and petroleum ether	Preclinical (in vivo): it significantly improved hair length in mice at $p < 0.05$.	Vitexin	[127]
Xylopiaaethiopica	Fruit	Mixture of Xylopia aethiopica and sulphur	Preclinical (in vivo): topical application promoted hair re-growth and cured psoroptic mange in rabbits at $p < 0.05$.	NA	[22]
Zingiber officinale	Rhizome	Ethanol	Preclinical (in vitro): inhibited 5α-reductase activity with IC_{50} 18.32.	NA	[42]

The list in Table 2 demonstrates a deficit of research in West Africa that is focused on bioassays of hair loss therapies. Nevertheless, from the publications summarized, several potential mechanisms have been proposed. For example, ricinoleic acid from *R. communis* oil allegedly decreases the expression of prostaglandin D2 in the scalp [123], which is a negative growth factor.

Studies that explore the efficacy or mechanism of species often measure the expression of vascular endothelial growth factor (VEGF) in human hair follicle dermal papilla cells (HFDPC) as a biomarker of improvement in growth. Such studies include ellagic acid from *Phyllanthus emblica*, isopropyl 2,5-dihydroxybenzoate (Figure 3) from the fermented fruits of *Carica papaya*, *shochu* oil from *Ipomoea batatas*, and a crude ethanol extract from *Erica multiflora* [49,111,122]. While these studies tend to associate the measured increase in the expression of growth factors as a mechanism of action leading to improved hair growth, it is not likely to have been directly related. These changes are more correctly interpreted as part of the downstream cascade of biochemical changes caused by another more general mechanism, quite likely related to the promotion of the electron transport chain through phytochemical nutrition.

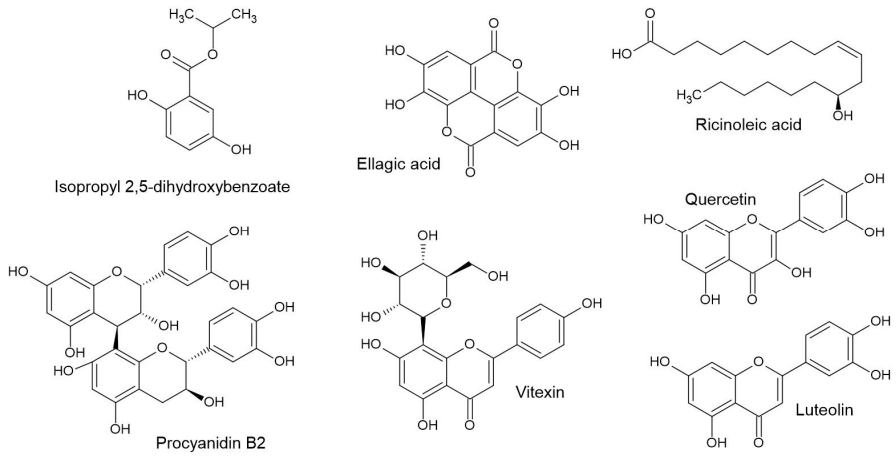

Figure 3. Structures of some metabolites responsible for hair care activity in African plants.

Generally, when studies focus on inhibition of 5α-reductase, the IC_{50} values are not realistically met in vivo to actualize the outcome unless applied topically. For example, the study of *P. emblica* reported that the extract can reduce the expression of 5α-reductase while increasing VEGF at 50 µg/mL [122]. While this concentration is unfeasible with oral ingestion, it is achievable with topical application and transdermal absorption of the active constituents [16]. Changes to the expression of 5α-reductase may be via any number of hypothetical mechanisms not necessarily familiar to the mechanism of the pharmaceutical 5α-reductase inhibitor finasteride.

Similar comments can be made in relation to studies of other species, such as the whole plant of *Cymbopogon citratus*, leaves of *Senna siamea*, *Lawsonia inermis*, *Ipomoea aquatica* (leaf and stem), rhizome of *Zingiber officinale*, and sesamin from *Sesamum indicum* L [42,122,124]. Concentrations required to inhibit 5α-reductase are many orders higher than the standard pharmaceutical 5α-reductase inhibitor finasteride, but due to the advantages of transdermal penetration, the in vivo outcome is feasible.

Nevertheless, due to the difficulty in defining the mechanism of action or the potential for improper interpretation of such studies, it is often better to conduct in vivo studies. For example, capsaicin and isoflavones from the fruit of *Capsicum annum*, juice from *Allium cepa*, the extract from the aerial parts of *Adiantum capillus-veneris*, the leaves from *Abrus precatorius*, the whole plant of *Eclipta prostrata*, the leaves of *Hibiscus rosa-sinensis*, and the leaves of *Citrullus colocynthis* promoted hair growth in mice and people by shortening the time for hair follicles to transition from the telogen to anagen phase [6,20,25,104,109,110,113,114]. While these studies are not about mechanisms, they do convey phenotypic changes that are consistent with claims about being supportive of hair growth. Nevertheless, because these studies are commonly conducted in mice with testosterone-induced hair loss, the pathological state of the dermis of the mouse cannot be compared to that of the human with dissimilar pathophysiology caused by androgenetic alopecia or other hair loss pathologies.

For example, human scalps with a true hair loss pathology often benefit from disinfection. This is because hair loss pathologies may involve potentiating factors, such as bacterial overgrowth due to excessive sebum production, *Malassezia furfur* overgrowth leading to dandruff, or ectoparasite infection by *Demodex* spp. [10]. These microbes contribute to inflammation and can interfere with the health of the scalp dermis, creating a barrier to the efficacy of other lines of therapy. They can also create cosmetic effects that are undesirable, such as dandruff. Hence, other extracts from plants such as *Azadirachta indica*, *Cocos nicifera*, *Myrtus communis*, and *Ocimum sanctum* may benefit hair by nurturing the health of the dermis, in the management of dandruff, lice, inflammation, and scaly scalps [107,112,119,120].

3.5. Comment on the Geography of Species and Reports

The countries in Africa from where the reports originated, and the species used in hair care are summarized in Table 1. The information conveys that the countries with the highest number of reports are Nigeria, Tunisia, and South Africa. While this may be an artifact of the numbers of ethnobotanical studies conducted in each country, it also gives a very general overview of cultural differences across the continent.

Nevertheless, due to the high possibility of chemical differences in species according to geography, it is necessary to acknowledge that species with efficacy in hair care from one country might not be replicated in another if the raw material is sourced locally. The geographical specificity of chemistry has been extensively documented in the published literature [87,128,129]. While such variation has not been comprehensively explored in the species relevant to the current review, the chemovariability of medicinal and edible species is a widely established phenomenon.

4. Conclusions

The paper presents, for the first time, an overview of medicinal plants used in hair treatment and care in Africa. The 68 reported plants are distributed among 39 angiosperm

families, with Lamiaceae having the highest number of species. Regarding the habits of the species recorded in this review, most of the plants are herbs (23), followed by trees (21), shrubs (16), and climbers/creepers/trailers (8). The frequently used plant parts are leaves (24), followed by seeds (13) and fruits (8), and they are mostly prepared through maceration, oil extraction, and decoction, and are sometimes used as poultices. Of the 68 plants recorded, 30 have been evaluated for different biological activities, particularly in relation to phenotypic changes demonstrated by in vivo studies.

The beneficial effects of these therapies may be conceptualized as a type of topical nutrition since the mechanisms are not easily explained in the pharmaceutical paradigm. In most cases, such species restore redox balance, support the electron transport chain in mitochondria, and reduce triggers of inflammation. This lends credence to the folkloric use of plants in hair treatments and care.

Furthermore, 58 of the 68 species have demonstrated the potential to be used as antidiabetic therapies, so the link between hair loss and dysregulated glucose metabolism is reinforced. While potent antioxidation can alleviate diabetic symptoms, restore redox balance, and rejuvenate levels of NADPH, the same extracts can also confer sterilizing and anti-inflammatory effects that support their efficacy in a systematic way.

Future studies of the species used to support hair growth should, therefore, focus on natural products and their pharmacophores that sensitize insulin as an extrapolation of efficacy linked to hair growth. The same studies, if focused on yield and potency of metabolites, may reveal commercial opportunities. Currently, the strongest research deficit on natural products, particularly as candidates for hair care, is in West Africa; therefore, this part of Africa may represent the least explored region in this context, with the highest potential for novel findings to be made.

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