Plants used for hair and skin health care by local communities of Afar, Northeastern Ethiopia

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Research

Abstract

Background: Local communities worldwide utilize plants for various purposes, including medicinal and cosmetics application. The Afar people of Northeastern Ethiopia, in particular, use plant extracts for hair and skin care. This study documents the traditional use of plants in hair and skin care practices among the Afar people.

Methods: Three districts, Chifra, Asayita, and Konaba, were selected based on their vegetation cover, traditional plant knowledge, and use of plant resources for hair and skin care. Ninety informants (60 general and 30 key informants) were selected equally across the districts using purposive and snowball sampling methods. Ethnobotanical data were gathered through free listing, semi-structured interviews, guided field walks, and simulation methods.

Results: The study identified 17 plant species used for hair and skin care. The high Informant Consensus Factor (ICF) of 0.95 reflects strong agreement among informants. Five species were selected based on their Relative Frequency of Citations (RFC) and further evaluated through preference ranking analyses. *Ziziphus spina-christi* (L.) Willd. appeared as the most preferred species, followed by *Sesamum orientale* L. leaves were the most frequently utilized plant part while water was the primary medium for preparations. Applications were primarily topical, serving as hair treatments or leave-in conditioner, and as cleansing agent for skin care.

Conclusions: Overall, this study underscores the sociocultural significance of traditional plant knowledge, highlighting the vital role of Indigenous and Local Knowledge (ILK) in shaping healthcare and self-care practices.

Keywords: Asayita, Chifra, Konaba, *Sesamum orientale*, *Ziziphus spina-christi*

Background

Integrating ILK into socio-economic development activities is essential for improving quality of life. Local communities worldwide have developed deep-rooted knowledge through long time interaction and adaptation with their environments. Particularly, people-plant interaction remained strong through uses of plants as medicine, food, repellant, as well as hair and skin care (e.g. Sharaibi *et al*. 2024)

In Africa, especially Ethiopia, many plant species are known for their uses to maintain hair and skin health. For example, the pounded leaves of *Indigofera spp.* and *Lawsonia inermis* L. (**henna**), commonly used as a hair treatment and natural dye to beautify palms, especially in Northeastern and Eastern Ethiopia (Personal observation, Tadesse & Mesfin 2010). Similarly, the pounded root of *Curcuma domestica* Valeton (turmeric) is traditonally used as a skin care remedy and facial mask. Roots of *Boswellia* sp. and *Olea europaea* L. subsp. *cuspidata* are used in traditional steam baths for skincare in Northern Ethiopia. *Aloe harlana* Raynolds and *Ziziphus spina-christi* are valued in traditional medicine for treating dandruff, reported from Eastern Ethiopia (Anteneh & Negussie 2014) and Northwest Gondar, Eastern Ethiopia, Tigray and Afar Regions of the country (Yirga 2010, Zeynu *et al*. 2021), respectively. Despite Ethiopia's rich biodiversity, little effort has been made to document, promote, or sustainably utilize these valuable resources for both economic and health-related benefits. Many of the species may be at risk of genetic erosion and extinction due to neglect and environmental pressures. Conservation, documentation, and sustainable use are urgently needed.

The Afar people of Ethiopia, who inhabit the Afar Regional State of the Northeastern Ethiopia, lead a predominant lifestyle of pastoralism, closely connected to their natural environment. While livestock is central to their survival, they also rely on plant resources for medicine, food, fodder, fuel, cultural and construction materials, and cleansing purposes (Bahiru *et al*. 2011, Bahiru *et al*. 2012, Giday & Teklehaymanot 2013). Although a few studies (e.g. Giday and Teklehaymanot 2013, Seifu *et al*. 2004, Shumbhari 2022, Teklehaymanot 2017, Tewolde 2020, Zeynu *et al*. 2021) have explored the medicinal uses of plants in Afar, no scientific research has been conducted to document ILK related to the use of plants for cleansing, hair and skin healthcare. The region's harsh climatic conditions, recurrent droughts, and the spread of invasive plant species further threaten both biodiversity and the traditional knowledge systems associated with it (Teklehayimanot 2017). Thus, there is an urgent need to document and promote the use of plant resources and their associated knowledge before they are lost. The purpose of this study was to document knowledge of the Afar people in Northeast regarding the use of plants for hair and skin care.

The study is highly relevant in promoting local-indigenous knowledge for future development of natural products in various industries. Additionally, it aims to raise awareness about the potential of these underutilized plant species while emphasizing the need for restoration and conservation efforts to ensure their sustainable use.

Materials and Methods

Sampling study sites and informants

Afar regional state is located between 8^{0}49' - 14^{0}30' latitude and 39^{0}34' - 42^{0}28' longitude in Northeast Ethiopia (Fig. 1). Three districts were selected for the purpose of this study based on prior information. Vegetation and presence of knowledge in association with plant resource usage for hair and skin care were the basis for selection of the study sites. Accordingly, **Asayita**, **Chifra**, and **Konaba** districts selected from Western, Eastern and Northwester Afar, respectively. For each district, two villages were selected based on accessibility and their vicinity to a natural vegetation area.

Asayita is one of the districts through which the Awash River crosses. Irrigation based horticulture is among all other activities that uses the water resource from the river. *Ziziphus spina-christi* (L.) Willd. and *Balanites aegyptiaca* (L.) Del. are common trees that occur in the villages established following the river flow. The vegetation in and around **Chifra** district lies under the classification of 'Acacia-Comiphora woodland and bushland' (Friis *et al*. 2010). **Desa'a** forest is located between districts of Tigray and Afar regions. It extends from **Atsbi-Wenberta** district of Tigray to Southern districts of Zone 1 in Afar (Hishe *et al*. 2013), where **Konaba** district is included. Remnants of Dry-Afromontane Forest extending from Western escarpment are shown in Northwestern Afar (Friis *et al*. 2010). These patches of forest were given conservation priority and protected for afforestation by participatory forest management scheme at **Gedarif** kebele of the **Konaba** district (Shumbahri 2021). A great improvement of vegetation cover observed because of designating the area as community protected forest.

Study area

Bengkulu Province is one of Indonesia's provinces located in the western Bukit Barisan mountains. This area is geographically located at 2°16'S to 3°31'S and 101°01'E to 103°41'E, with elevations ranging from 0 to 1,900 m asl. Bengkulu Province has a tropical climate with two seasons: the rainy season, which lasts from December to March, and the dry season, which lasts from June to September. The average annual air temperature is 28.7°C, while the average annual humidity is 76.8%, and the average annual rainfall is 3,658.1 mm with 23.2 rainy days. Bengkulu Province covers an area of approximately 19,919.33 km2and has a population of 2.032 million people, including 1.039 million men and 993 thousand women. Bengkulu province is divided into 10 districts, 129 sub-districts, and 1,514 villages (BPS-Statistics of Bengkulu Province 2022). The ethnobotanical study was carried out in eight villages from four districts of Bengkulu province, Indonesia, i.e. Mukomuko, Lebong, Rejang Lebong, and Bengkulu Selatan (Fig. 1, Table 1).

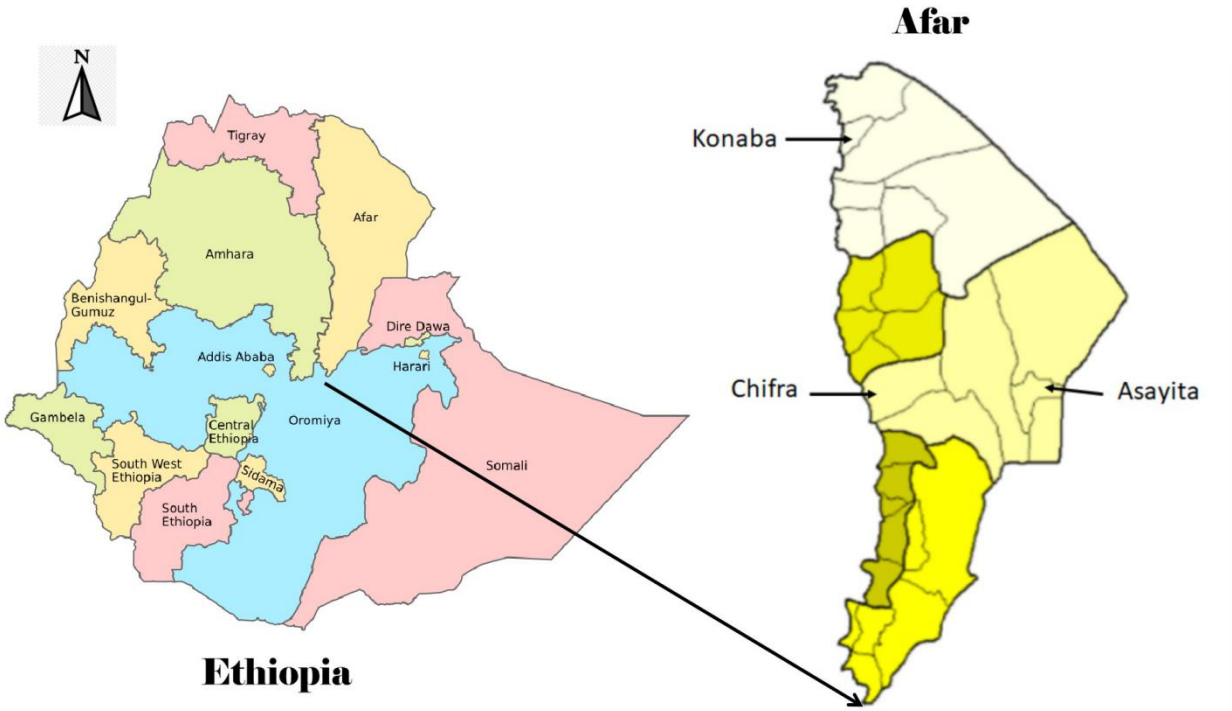

Figure 1 Map showing sampling areas (Sampling Districts of the Afar Region). Base map obtained from https://commons.wikimedia.org/w/index.php?curid=93949036)

Informant sampling

A total of 90 informants were selected using purposive and snow-ball sampling methods. Each district was represented by 30 informants including 10 key informants. Number of participants was determined in consultation with clan leaders and district office representatives. Due to the community's pastoral lifestyle, locating sedentary groups was challenging in this study. Five key informants from each two village in a district were identified based on the information obtained from clan leaders. The primary criteria to select key informants was their in-depth knowledge of plant uses. Each key informant was then asked to recruit two additional informants with similar knowledge.

All informants were over 20 years of age and included both female and male participants. The youngest informant was 20 years old while the oldest was 67. The majority of participants (60%) were between 30 and 49 years old. Six female participants were included, one from each village across the three districts. Pastoral household heads were represented by 48 informants (approximately 53 %), while the remaining participants were drawn from various community services such as teaching, health, and office administration.

Data collection and analyses

All data were collected from primary source using standard ethnobotanical methods following Martin (1995) and Cotton (1996). Methods of unstructured and semi-structured interview were employed to retrieve the knowledge contend by the local communities. Interview was scheduled and conducted in convenience to the respondents: around homesteads, in the

place where the plant resource obtained as well as while conducting some other life activities. Individual and group interview were employed to retrieve the most possible knowledge on plant resources used for hair and skin healthcare. Particularly, the interview while walking and sitting around the natural distribution area of the plant resources is helpful to ensure concurrence (Hoffman & Gallaher 2007). Local language was used to interview respondents and vernacular names recorded in the same language.

Simulation method was employed to retrieve the knowledge of local communities on application of plant products for hair and skin care. This is part of the participant role playing and direct observation method conducted on site. Participant young men demonstrated hair cleansing and styling practices using plant products (supplemental Fig. 1). Such ethnobotanical methods are useful to match informants report with the actual practice (Reyes-Garcia *et al*. 2006).

Taxonomic identification of the reported plant species was performed during the field activities and by using taxonomic keys in the Flora books as well as reference collection from the National herbarium of Ethiopia (ETH). Correctness of nomenclature was confirmed using the Flora books of Ethiopia and Eritrea as well as the International Plant Names Index (IPNI) data base (https://www.ipni.org). Voucher specimens were collected and deposited in the ETH.

Data were organized and analyzed using simple descriptive statistics such as calculating the frequency of plant names mentioned by informants. Standard quantitative ethnobotanical tools that are relevant to this study were used to obtain statistical validation for plant usage in hair and skin care. Informant Consensus Factor (ICF) was computed in order to measure the agreement of informants on traditional use of plants for hair and skin health care. The formula used to calculate ICF, following Trotter and Logan (1986) and Heinrich *et al*. (1998), was: ICF= Nu-Nt/Nu-1, where: Nu= total number of use reports (sum of all citations for all plant species reported); and Nt= number of all relevant plant species reported.

Relative Frequency of Citations (RFC), following Tardio and Pardo-de-Santayana (2008), was calculated to identify the most important plant species. This was done by using the standard formula to compute RFC, which is RFC= FC/N, where FC= number of informants who mentioned a plant species, and N= total number of informants. Five plants species that score the highest RFC were selected and used in the preference ranking analyses. The species were presented to key informants of each district and informants were guided to perform the analyses. They were informed to provide the lowest score (1) for the least considered species, and the highest score (5) for the most important species. Species considered between the highest and the lowest score were given successive numbers as per their choice of preference. Average score of preference ranking result from the three districts was taken as cumulative outcome of the study.

Results

Diversity and importance of plant species used in hair and skin care

A variety of plant taxa were reported by informants as sources for hair and skin care. However, only those with complete information, including strong consensus and availability of specimens for taxonomic identification, have been included in this report. Accordingly, 17 plant species were reported for their uses in hair and skin care by the Afar community (Table 1). These species belong to 13 genera and 12 families, with the family Malvaceae being the most represented, contributing five species across two genera.

The Informant Consensus Factor (ICF) value of 0.95 indicates a strong agreement among informants regarding the use of these plants for hair and skin health. The Relative Frequency of citation (RFC) was notably high for five species compared to the others (see Table 2 and Fig. 2). Among them, three species, *Ziziphus spina-christi*, *Sesamum orientale* and *Grewia villosa,* were mentioned by more than 40 % of informants. Additionally, two species (*Corchorus olitorius* and *Hibiscus micranthus*) were mentioned by more than 25% of informants being used as sources of hair care extracts (Fig. 2). The remaining 12 species were mentioned by less than 25% of the total informants.

Parts used, mode of preparation and application

Leaves were the most commonly used plant parts, as reported by all informants across all species. However, other plant parts were also utilized in specific preparations, including twigs (*S. orientale*), whole part (*C. olitorius* and *H. micranthus*), and seeds (e.g. *Linum usitatissimum* Griseb, not included in this report). In all cases, water served as the primary medium for preparation. For instance, the leaves or twigs of *S. orientale* are soaked in water for a few minutes until they release a gel, which is then applied to the hair for cleansing and styling. Similarly, dried and pounded leaves of *Z. spina-christi* and *Indigofera amorphoides* are mixed with water to form a smooth paste, which is then applied to wet hair as a treatment (see Table 1). All reported applications are topical, serving primarily as hair conditioners and treatments, as well as for skin cleansing. Young men commonly style their hair using leaves of *S. orientale.* They apply it whenever they feel their hair is dirty and lacks attractive style. The use frequency of *Z. spina-christi* is usually associated with dandruff infection.

Table 1. List of plant species reported for their uses as hair and skin care

Species	Family	Vernacular Names	Voucher No in ETH	Parts used	Mode of preparation and application
Aloe camperi Schiweinf.	Aloaceae	**Quorayta**	ETTW_265	Leaf	The jelly sap of the leaf is extracted and applied during hair wash. It is used both as shampoo and hair mask
Cleome paradoxa R. Br. ex DC.	Capparidaceae	**Qamqe**	ETTW_264	Stem	Water extract is used for cleansing purpose
Corchorus depressus (L.) Edgew	Malvaceae	**Sigbo**	ETTW_259	Above ground part	Pounded and mixed with water. The solution applied for hair wash
Corchorus olitorius L.	Malvaceae	**Mahulea**	ETTW_258	Above ground part	Pounded and mixed with water. The solution applied for hair wash
Cordia monoica Bojer	Boraginaceae	**Madeera**	ETTW_255	Leaf	Dried and pounded leaf mixed with water to apply on hair during washing
Euclea divinorum Hiern	Ebenaceae	**Gaboo**	ETTW_266	Leaf and root	Pounded leaves and root mixed with water and applied during hair wash as shampoo
Grewia cf. tenax	Malvaceae	**Sereekto**	ETTW_253	Leaf and inner bark	Leaf and/or the inner bark mixed with water and applied during hair wash as shampoo
Grewia mollis Juss	Malvaceae	**Cedayto, Xewayito**	ETTW_254	Leaf and inner bark	Leaf and/or the inner bark mixed with water and applied during hair wash as shampoo
Grewia villosa Willd.	Malvaceae	**Habalyta**	ETTW_252	Leaf and bark	Pounded and mixed with water. The solution applied for hair wash
Hibiscus micranthus L.	Malvaceae	**Rugaage-qaysha, Rugaageyta**	ETTW_251	Leaf	Dried and pounded leaf mixed with water to apply on hair during washing
Hibiscus noldeae Baker f.	Malvaceae	**Cammukto, Gini-camooka**	ETTW_267	Root	Pounded root mixed with water and applied during hair wash as shampoo
Indigofera amorphoides Jaub. & Spach	Fabaceae	**Elawto**	ETTW_256	Leaf	Dry and pounded leaf mixed with water. The well-developed mix is applied on wet hair and kept for few hours before rinsing
Phytolacca dodecandra Sessé & Moc.	Phytolaccaceae	**Semex**	ETTW_260	Leaf	Pounded and used as soap (also used to wash cloths)
Sesamum orientale Sieber ex	Pallidaceae	**Selid**	ETTW_101	Above	Soaked in a vessel containing water. The jelly product applied on an

C.Presl				ground part (particularly the leaf)	already washed hair for styling (as styling conditioner)
Verbena sp.	Verbenaceae	**Anxax sirri**	ETTW_268	Leaf	Dried and pounded leaf mixed with water and applied to wet hair as a treatment
Ziziphus spina-christi (L.) Willd.	Rhamnaceae	**Kusrayto**	ETTW_221	Leaf	Dry and pounded leaf mixed with water. The well-developed mix is applied on wet hair during hair wash as a shampoo. It may also be used together with 'Henna' as hair mask.
	Asteraceae	**Cindilie**	ETTW_269	Leaf	Dried and pounded leaf mixed with water and applied to wet hair as a treatment

Table 2. Number of citation and Relative Frequency of citations with five most cited species in Bold

Species name	No. of mentions	RFC	RFC%
A. *camperi*	14	0.16	16
C. paradoxa	2	0.02	2
C. depressus	22	0.24	24
C. olitorius	**24**	**0.27**	**27**
C. monoica	2	0.02	2
E. divinorum	8	0.08	8
G. *mollis*	15	0.17	17
G. villosa	**36**	**0.4**	**40**
Grewia cf. tenax	7	0.07	7
H. micranthus	**25**	**0.28**	**28**
H. noldeae	14	0.16	16
I. coerulea	15	0.17	17
P. dodecandra	5	0.05	5
*S. orien*tale	**60**	**0.67**	**67**
Verbena sp.	2	0.02	2
Z. spina-christi	**70**	**0.78**	**78**
Asteraceae	2	0.02	2

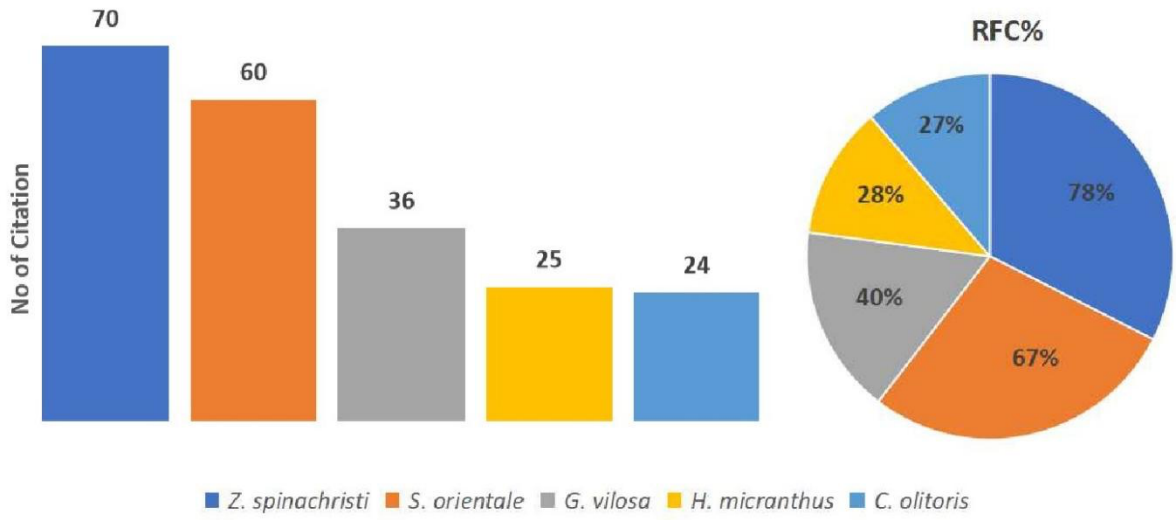

Figure 2 Number of citation and percentage of Relative Frequency of citations (RFC) for five selected species

Use specification

All the reported species were identified for their role in hair and skin care, each with a specific purpose. The majority were noted for their cleansing properties, while some were recognized for their anti-fungal effects. Notably, all informants agreed on the anti-dandruff properties of *Z. spina-christi*, using it exclusively for this purpose rather than for cleansing, treatment, or styling. On the other hand, the fresh leaves of *S. orientale* were primarily used for hair cleansing and styling.

Preference ranking

Analyses of preference ranking for the Konaba district showed *Z. spina-christi* the most preferred species (score=48) while *S. orientale* is the most preferred species by the key informants in Asayita and Chifra districts scoring 46 and 47 points, respectively (Table 3). Analyses for combined data set showed cumulative score of 123 for *Z. spina-christi* followed by 122 for *S. orientale* (Table 4).

Table 3. preference ranking analyses by district

Species	Score by each Key informant - Asayita District										Total scores	Rank
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
C. olitorius	3	2	2	1	1	1	1	2	2	2	17	5
G. villosa	1	1	1	3	3	3	3	3	3	3	24	3
H. micranthus	2	2	2	2	2	2	2	2	2	2	22	4
S. orientale	5	5	5	4	4	5	5	4	5	5	47	1
Z. spinachristi	4	4	4	5	5	4	4	5	4	4	43	2
Score by each Key informant - Chifra District												
C. olitorius	2	1	1	1	2	1	1	2	2	2	15	4
G. villosa	5	4	5	3	5	3	4	5	4	4	42	2
H. micranthus	1	2	2	2	1	2	2	1	1	1	15	4
S. orientale	4	5	4	5	4	5	5	4	5	5	46	1
Z. spinachristi	3	3	3	4	3	4	3	3	3	3	32	3
Score by each Key informant - Konaba District												
C. olitorius	3	2	2	1	3	2	3	1	3	2	22	4
G. villosa	4	4	4	4	4	3	1	3	1	4	32	2
H. micranthus	2	3	1	2	2	1	2	2	2	1	18	5
S. orientale	1	1	3	2	1	4	5	4	5	3	29	3
Z. spinachristi	5	5	5	5	5	5	4	5	4	5	48	1

Table 4. Cumulative scores and preference ranks

Species	Asayita	Chifra	Konaba	Total score	Rank
C. olitorius	17	15	22	54	5
G. villosa	24	42	32	98	3
H. micranthus	22	15	18	55	4
S. orientale	47	46	29	122	2
Z. spinachristi	43	32	48	123	1

Discussion

This study employed a scientific approach to document local indigenous knowledge regarding the use of plants for hair and skin care. Consequently, only Seventeen species were analyzed, despite informants mentioning a larger number of plant taxa. Therefore, As highlighted by Martin (1995) and Jain (2004), ensuring precision in information and obtaining strong statistical support for collected data are crucial. The incomplete information may be due to highly localized or specialized knowledge, a narrowly shared experience, or absence of the cited species in the expected distribution area. For example, many informants mentioned a plant taxon known locally as **Gini-Selid** or **Baro-Selid** for its use in hair care. However, despite multiple rounds of field data collection, the plant was not found in its natural distribution area. This indicates that the particular knowledge and related biodiversity might be at a risk of loss.

This situation may also be linked to a disruption in traditional knowledge transmission, potentially influenced by changing attitudes toward indigenous practices. With the introduction and increasing availability of industrially produced hair care products, many people have shifted toward using imported alternatives, which has negatively impacted the transfer of ethnobotanical knowledge. Additionally, the effects of recurrent climate change may have led to the local extinction of certain plant species, further contributing to the erosion of associated traditional knowledge. This calls further study, documentation and biodiversity conservation action.

In this study fewer plant species were reported compared to previous ethnobotanical research in Afar. Seifu *et al.* (2004) documented 70 medicinal plant species, while Teklehaymanot (2017) identified 99 species. This difference arises because

the present study focused specifically on plants used for hair and skin care, whereas the previous studies covered a broader range of medicinal uses. Additionally, no plant species with similar uses were commonly reported across all the three studies. The restricted single use-report per species might have limited the scope and depth of ethnobotanical information. Therefore, future studies on a broader perspective are recommended to provide a more comprehensive understanding of plant knowledge and their cultural significance.

The high value of ICF (0.95) indicates the strong integration of traditional hair and skincare practices within the ethnobotanical knowledge of the Afar people in northeastern Ethiopia. While modern beauty and personal care often focus on appearance enhancement, traditional practices emphasize a holistic approach, incorporating plant-based formulations for both aesthetic and medicinal purposes. The study identified a variety of plant species used for hair and skincare, supporting findings from previous research elsewhere in the country (Anteneh & Negussie 2014, Tadesse & Mesfin 2010, Yirga 2010).

Out of the 17 reported species, five species were mentioned by more than 25% of all the participating informants. A key finding is the extensive use of *Z. spina-christi*, which is widely recognized for its anti-dandruff properties and facial care applications, aligning with earlier reports (Yirga 2010, Zeyinu *et al*. 2021). Further phytochemical screening and bioactive compound isolation confirmed the anti-fungal property of the species (not included in this report). In addition, the methanol extract of *Z. spina-christi* exhibited significant inhibitory effects against *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhimurium*, and *Klebsiela pneumoniae* (Seid 2024). Similarly, *S. orientale* is utilized for hair cleansing and styling, with phytochemical evidence suggesting the presence of secondary metabolites that enhance its efficacy as a natural cleanser. Leaves of *S. orientale* (reported using the synonym-*S. indicum*) are used in bathing by local peoples residing in Uttaranchal hills of India (Mehta & Bhatt 2007), aligning with the current finding for the efficacy of the plant as cleancing agent. The other three highly mentioned species (*H. micranthus, C. olitorius, G. villosa*) are primarily used as cleansing agents for hair.

The remaining 10 species obtained few mentions, less than 25% of the participating informants. Most of these species were not mentioned in any other ethnobotanical studies for hair and skincare purpose. However, *Aloe camperi,* reported for its role as a traditional soap with scalp healing properties, mirroring the reported uses of *A. harlana* (Anteneh & Nigussie 2014) and *A.* cf *steudneri* (Fentaw et al. 2020) in other Ethiopian regions . Similarly, related uses were reported by different species of Grewia and Aloe. Leaves of *Grewia optiva* Drummond, Bark of *G. bicolar* Juss, gel of *A. barbadensis* Mill. and *A. citrina* Carter & Brandham were reported for their uses as source of traditional skincare products (Mehta & Bhatt 2005, Sharaibi *et al*., 2024, Sultan *et al*., 2024). Though few mentions, *Indigofera amorphoides* was also reported for its use as coloring and promoting hair growth in the current study. Several species of Indigofera were known for their uses as source of the indigo color (Hedberg & Edwards 1989). *Indigofera tinctoria* L. was used in formulation of herbal hair dye by Bhuvaneswari *et al*. (2021). Therefore, findings of this study align with other studies from elsewhere in the country as well as globally.

Currently, natural products, particularly those derived from plants, are gaining momentum due to their proven efficacy and relatively low risk of side effects. This growing interest has spurred the formulation of natural products grounded in traditional ethnobotanical knowledge. For instance, in Ayurveda, oils such as coconut and *Bhringraj* (*Eclipta alba* Hassk.) have long been used for promoting scalp health and nourishing hair (Sharma & Gupta, 2020). Satheeshan et al. (2020) developed a herbal hair oil using virgin coconut oil and extracts from various medicinal plants, demonstrating the continued relevance of traditional formulations in modern contexts. Similarly, Native American communities traditionally used root extracts of yucca (*Yucca schidigera* Roezl ex Ortgies and *Yucca angustifolia* Engelm. ex Trel.) as a natural shampoo for their cleansing and hair-strengthening properties (Moerman, 1998), which were later adapted and commercialized into modern products.

Scientific studies further confirm the pharmacological value of widely used plants such as *Aloe vera* and *Curcuma domestica* (turmeric), which exhibit anti-inflammatory, antimicrobial, and wound-healing properties, supporting their continued use in traditional skincare systems (Surjushe et al., 2008). Likewise, the pharmaceutical evaluation of a herbal hair dye by Bhuvaneswari et al. (2021) demonstrated the advantages of plant-based formulations in maintaining healthy hair while avoiding the adverse effects of synthetic products.

These overlaps between traditional practices and pharmacological findings reinforce the scientific validity and value of indigenous knowledge. The process of transforming traditional remedies into modern applications reflects a deep cultural heritage and ecological wisdom passed down through generations. In this context, the longstanding use of local plant

resources by the Afar community for hair and skin healthcare purposes not only contributes to cultural preservation but also presents a promising opportunity for the development of sustainable, plant-based personal care products.

As emphasized by Buenz et al. (2005), and Sultana and Anwar (2008), the transmission of indigenous knowledge plays a critical role in the sustainable development of natural products for both personal care and modern pharmacology. Documenting and preserving these practices is essential not only for scientific innovation but also for safeguarding traditional medicine systems (Cotton, 1996; Martin, 1995). Furthermore, promoting and empowering local communities is crucial for ensuring the continued transmission and sustainable use of this knowledge across generations (Ramirez, 2007).

Major limitations of this research includes the relatively small number of plant species reported. This may affect the comprehensiveness ethnobothanical knowledge within the community. In addition, there might be a potential bias in informant selection, which probably affect the result. The consortium of informants was predominantly male, mainly due to cultural barriers that limits access to female participants. This might have affected the diversity of knowledge reported in this study, particularly about plant uses known or practiced by female.

Conclusion and Recommendation

This study highlights the traditional knowledge of the Afar people regarding hair and skin care. Fewer plant species were reported compared to other studies in the area or elsewhere, because this research focused on specific uses. On the other hand, most of the species documented here have not been reported for their uses as hair and skin care in other studies. This may be because most ethnobotanical studies prioritize medicinal plants used to treat or prevalent diseases, and health disorders rather than those used for general health care. Therefore, the findings of this study are unique to both the region and the field of ethnobotany. The insights from this study provide a foundational basis for future research on the development and commercialization of plant-derived hair and skincare products, promoting both cultural preservation and sustainable resource utilization. The low number of species report indicates a decline in knowledge related to these specific plant uses. Thus, further integrative documentation and conservation efforts are essential in the Afar region, particularly in semi-arid and arid ecosystems, as well as on a national scale.

Declarations

List of abbreviations*:* ETH: National Herbarium of Ethiopia; ILK: Indigenous Local Knowledge; ICF: Informant Consensus Factor; Nu: Number of use cited; RFC: Relative Frequency of Citation; FC: Frequency of Citation

Ethics approval and consent to participate: A support letter was obtained from Addis Ababa University and Semera University to obtain consent from local communities in Afar Region. Accordingly, the consent was obtained from local administrations and traditional leaders in each district. Following an explanation about the purpose and potential benefits of the study, verbal consent was received from participants for the use of all photographs and videos taken during the process of 'Simulation'. Hence, the study applied the 'Prior Informed Consent' principle.

Consent for publication: Not applicable

Availability of data and materials: Any additional data will be available upon request

Competing interests: All authors confirm that they have no known financial conflict or any other factors that could have appeared to influence the work reported in this paper.

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Author contributions: Tigist Wondimu: Conceptualized and developed proposal of the project, conducted the research, participated in all data collections, analyses and drafted and developed the manuscript.**;** Ali Zeynu: coordinated and participated in the field data collection ; Amelework Eyado: Participated in field data collection, reading and reviewing the manuscript; Yalemtshay Mekonnen: Participated in reading and reviewing the manuscript

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