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Utilization of Indigenous Buton Flora for Natural Bodycare: Preserving Local Knowledge and Community Traditions

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ABSTRACT

The indigenous knowledge of the Buton ethnic community regarding the utilization of plants for soap, detergent, and shampoo is progressively overlooked due to socio-economic transformations, globalization, and contemporary lifestyles. The erosion of local community knowledge is recognized as a key danger to the sustainability of biodiversity and culture. Furthermore, the recording of indigenous plant biodiversity, including that of soap, detergent, and shampoo, on Buton Island, Southeast Sulawesi, Indonesia, is limited. This study employs a qualitative method with an exploratory approach. Data were provided by informants, including traditional leaders, indigenous individuals, and the youth of Buton. The data were assessed by reduction, visualization, and verification methods. Additionally, a relative frequency citation (RFC) study was conducted to ascertain the local significance of each species. Eighteen plant species, categorized into fifteen families, possess the capacity to serve as natural soap, detergent, and shampoo. The specimens were gathered from 14 indigenous settlements. This study highlights the significance of prioritizing indigenous plants in the search for natural biosurfactants suitable for cosmetic applications.

1. INTRODUCTION

Indonesia is an archipelagic nation located in a tropical region abundant in natural biological resources and floral diversity. This natural resource must be safeguarded and conserved for future community utilization. Numerous Indonesian plant species, rich in saponins, serve as biosurfactants and raw materials for soaps, shampoos, and natural detergents. These include tomatoes, binahong leaves, cloves, betel leaves [1, 2], soap nuts [3], pineapple [4, 5], avocado [6], areca nuts, gambir [7], and red frangipani [8]. The concentration of biosurfactants in various soaps, shampoos, and detergents commonly utilized by inhabitants is inferior to that of synthetic surfactants. Many products utilize sodium lauryl sulfate (SLS). Exceeding 1% SLS concentration in prolonged body care may induce skin irritation (itching, dryness, susceptibility to dandruff, and hair loss), ocular irritation, and carcinogenic effects [9]. Consequently, it is essential to investigate the application of natural components derived from various plants as sources of natural biosurfactants in personal care products.

In Indonesia, numerous traditional ethnic groups exhibit distinct traits and cultural identities, along with varied community perspectives and interpretations of the natural resources in their surroundings [10]. The cultural diversity of Indonesian society is seen in its villages, hamlets, and ethnic groups. Every region possesses an identity that defines its distinctiveness [11]. The Buton ethnic group is one of the ethnicities of Indonesia residing on Buton Island. This region was formerly part of the Buton Sultanate, encompassing Buton Island and many other islands. Initially, the Buton monarchy comprised four limbos (villages) situated within the royal fort. It then evolved into the Buton Sultanate, with 72 traditional villages, encompassing Buton Island, southern Muna, Kabaena, and various adjacent tiny islands, including Wakatobi and Poleang. Conventional villages consistently reflect the connection to ancestral origins, customary rites, arts, and organizational structures that differentiate traditional villages throughout various regions [11]. The distinctions encompass the utilization and interconnection of flora, fauna, and the natural environment within the lives of indigenous populations. Kadie-kadie in the erstwhile Buton Sultanate territory represents a distinct local character of Buton, distinguishing these kadie-kadie from traditional villages in other areas. A distinction exists between natural and human resources [12]. Buton Island is situated in the Wallacea Zone, characterized by significant biodiversity and distinct biota, including the transitional area where flora and fauna from the western and eastern sections of Sulawesi converge [13].

The biodiversity of Buton Island serves as a local resource for the Buton ethnic minority. The reciprocal relationship between humans and their local ecosystem designates humans

as an indigenous community [14, 15], namely those who consume and manage local natural resources. Human interactions with nature are influenced by the views of distinct individuals or societies. Indigenous or traditional societies that utilize and manage natural resources are fundamentally grounded in local knowledge systems, sometimes referred to as indigenous knowledge [11, 16]. The intellectual capacity of local communities, guided by a belief system known as a 'worldview,' can establish an adaptive management system for the sustainable utilization of natural resources [17]. Consequently, it is imperative to amalgamate community knowledge in traditional villages with expertise via social contact, reflection, and learning [18].

Numerous nations, like Nigeria [19], India [20, 21], and Thailand [22] have recorded the efficacy of indigenous flora as natural soaps, detergents, and shampoos. Numerous studies have investigated the utilization of natural materials in Indonesia as alternative biosurfactants for soap, detergent, shampoo, and other pharmaceutical items [23]. Nonetheless, there remains a paucity of data of traditional biodiversity, particularly concerning the indigenous plants utilized as soap, detergent, and shampoo by rural communities in Indonesia. The most pressing issue is that ethnobotanical plant usage is being progressively overlooked due to socio-economic transformations; local community knowledge regarding plant utilization has been diminished by globalization and contemporary lifestyles. The erosion of local community knowledge constitutes a primary danger to the sustainability of biodiversity. Consequently, the documentation and assessment of plants with potential applications, together the associated local knowledge via ethnobotanical research, are crucial for the preservation of biodiversity and cultural heritage. The utilization of these indigenous plants in Buton is crucial for identifying eco-friendly natural biosurfactants, while also addressing the urgent need to preserve traditional ethnobotanical knowledge, which holds promise for sustainable development. This project seeks and aims to record botanical data and explore the potential use of indigenous plants as soap, detergent, and shampoo based on the local knowledge of the Buton ethnic population. A hypothesis of this study is that the diverse native plants used by the Butonese ethnic group have the potential to be developed into environmentally friendly soaps.

2. MATERIAL AND METHODS

This study methodology employs observation, interviews, and data validation [24]. Data sources and gathering methods are evaluated using triangulation. A reliability assessment is performed by scrutinizing the entire study methodology. Consequently, researchers may perform a confirmability assessment to ascertain the objectivity of the research. The observation approach involves firsthand examination of native flora within the traditional village of the Buton ethnic people as a data source. The semi-structured approach is employed to interview informants, including traditional leaders, indigenous individuals, and the youth of the Buton ethnic community. The purposive sampling method is employed to choose interview samples [25]. The informants utilized in this model had knowledge and implement regarding the application of plants as soap, detergent, and shampoo, encompassing the regions Buton ethnics group of Kapuntori, Kamaru, Lasalimu, Wabula, Pasarwajo, Gonda, Burangasi, Sampolawa, Batauga, Siompu, Kabanena, Mawasangka, Lowu-lowu, and Melai. So, in this case local communities can help develop knowledge in a wide area, helping to improve conservation management. Furthermore, plant specimens were gathered in the laboratory to ascertain their morphology.

Data analysis, as defined by Miles and Huberman, encompasses reduction, presentation, and verification. Upon completion of the data analysis phase, the process proceeds with the examination of relative frequency citations (RFC) to ascertain the local significance of each species [26]. This is because the relative frequency citation (RFC) indicates how often a particular plant species is used at the local level [27]. Fc represents the quantity of informants who reference species utilization; N is the total number of informants. The RFC ranges from 0 to 1. The local significance of each species is derived from the subsequent equation:

$$\text{RFC} = \frac{Fc}{N}$$

Correlation analysis was employed to ascertain the association between the knowledge level regarding the use of natural soap, detergent, and shampoo and the age of the Buton ethnic population. A study employed a VOS viewer to assess the plant's potential, encompassing keyword identification, database data retrieval, article selection, data validation, and data analysis [28]. Additionally, the plant language is derived from Flora van Java [29], employing abbreviations in accordance with the binomial nomenclature system.

3. RESULT AND DISCUSSIONS

3.1 Indigenous knowledge

The Butonese ethnic community possesses local wisdom encompassing indigenous knowledge, an appreciation of customs and traditions, environmental awareness, and the cultivation of positive interpersonal connections. is also known that the Buton Indigenous People have extensive and in-depth local knowledge about herbal plants, which have been used for generations. In addition, indigenous people in several regions of Indonesia have used certain plants as alternatives to soap and shampoo. One of them is that the Butonese indigenous people also have a unique healing tradition that relies on natural plants. In meeting their daily needs, people still use herbal plants in their surroundings for bathing, shampooing, and washing. Although there are no specific records of the use of plants as soap or shampoo, in fact, knowledge of the use of these herbs shows that the Butonese people have a strong tradition of utilizing natural resources for various needs, including medicine and cosmetics. As for bringing up records of the use of natural plants as soap, shampoo, and detergent by the Butonese indigenous people, Table 1 below illustrates the distribution of indigenous plants used by the Butonese indigenous people for the production of soap, detergent, and shampoo. There are various ways to use it, some use it by pounding it and applying it, or soaking it in warm water and then applying it.

Local flora utilized for soap, detergent, and shampoo differs throughout traditional villages, including 2 to 14 species. The existence of flora and local attributes considerably affects variations in plant availability status. Coastal cultures typically utilize a limited number of plant species, such as soap,

detergent, and shampoo, due to the scarcity of available flora (2-4 species). It differs from groups residing in mountainous and forested areas, which often utilize numerous plants, as those with potential for soap, detergent, and shampoo are more prevalent (5-14 species). A portion of them is planted in yards (55.6%), while the remainder grows wild (44.4%) (Figure 1(a)). This shows that it is easier for people to take and directly use plants as a substitute for soap, detergent and shampoo near their homes. The 18 plant species are categorized according to habitus as follows: trees (9 species), shrubs (2 species), herbs (2 species), and lianas (5 species) (Figure 1(b)). The most commonly utilized portions are fruit (33.3%), leaves (27.7%), and a combination of leaves and fruit (16.6%), whereas the least utilized parts (5.5%) are leaves and roots, stems, and tubers (Figure 1(c)). Biosurfactant content such as saponins is known to be found in large quantities in fruit [30] and leaves part [31]. Among the 18 plant species, four species (22.2%) are utilized as bath soap, three species (16.67%) as laundry detergent, seven species (38.8%) as shampoo, two species (11.1%) as conservant soap, and two species (11.1%) as both bath soap and shampoo (Figure 1(d)).

Coconut (*Cocos nucifera*) and katang-katang (*Ipomoea pes-caprae*) are prevalent plants in coastal regions. Coconut extract (VCO/Virgin Coconut Oil) is the predominant vegetable oil derived from ripe coconut kernels obtained from coconut plants. It comprises various nutrients (e.g., vitamin E) and substantial quantities of bioactive food components (e.g., polyphenols). Medium-chain fatty acids in virgin coconut oil can safeguard hair follicles from heat, replenish hair moisture and mitigate damage, and exhibit optimal physicochemical properties for hair washing and maintenance [32]. Currently, katana-katana/horseshoe (*Ipomoea pes-caprae*) is a coastal plant that possesses bioactive chemicals; nevertheless, its specific kind relevant to hair care remains unidentified. In mountainous and forested regions, papaya exhibits RFC values that are recognized for their bioactive compounds, including primary metabolites (carbohydrates and proteins) and secondary metabolites (saponins, flavonoids, tannins, and phenolics), particularly saponins, which promote hair growth [33]. In pharmaceutical and cosmetic research, *Carica papaya* extract, containing active components, demonstrates enhanced accessibility, safety, and compatibility, hence facilitating the promotion of herbal medicine for hair growth therapy with minimal or negligible toxicity or adverse effects.

Table 1. Local plants used by the Buton ethnic community

Family/Species	Local Name/ Indonesian Name	Habitat Type	Wild/ Cultivated Status	Habitus	Parts Used	Usability	RFC
Arecaceae/ *Cocos nucifera*	Kaluku/ Kelapa	BC, MT, GD, FR	CV	TR	FRU	Shampoo	1
Caricaceae/ *Carica papaya*	Kapeya/ Pepaya	GD, YRD	CV	PR	FOL; RAD	Soap	1
Convolvulaceae/ *Ipomea pes-caprae*	Katang-katang/Tapak Kuda	BC	WL	LN	FOL	Soap; Shampoo	0.2
Cucurbitaceae/ *Coccinia grandis*	Popasa/ papasan	FR, GD	WL	LN	FOL; FRU	Shampoo	0.4
Dioscoreaceae/ *Dioscorea hispida*	Ondo/ Gadung	FR, GD	WL	LN	BUL	Detergent	0.15
Euphorbiaceae/ *Aleurites moluccana*	Beau/kemiri	GD	CV	TR	FRU	Shampoo	1
Fabaceae/ *Albizia saponaria*	Wilalo/ langir	FR	WL	TR	CAU	Soap; Shampoo	0.35
Fabaceae/ *Tamarindus indica*	Sampalu/ asam	MT, FR, GD	CV	TR	FRU	Deterjen (konservant)	0.7
Lamiaceae/ *Ocimum tenuiflorum*	Ntulasi/ ruku-ruku	GD, YRD	WL	HR	FOL	Shampoo	0.1
Malvaceae/ *Hibiscus tiliance*	Bontu/waru	FR	WL	TR	FOL	Soap	0.2
Musaceae/ *Musa paradisiaca*	Loka/pisang	GD, YRD	CV	HR	FRO	Shampoo	0.25
Oxilaceae/ *Averrhoa bilimbi*	Tangkurera/ belimbing	GD, YRD	CV	TR	FRU	Detergent	0.7
Passifloraceae/ *Passiflora foetida*	Ngkayo/ Rambusa	FR, GD	WL	LN	FOL	Soap	0.25
Piperaceae/ *Piper aduncum*	Bawulu/	GD, YRD	CV	LN	FOL; FRU	Shampoo	0.1
Rutaceae/ *Aegle marmelos*	Maja	GD	WL	TR	FRU	Detergent (konservant)	0.2
Rutaceae/ *Citrus aurantifolia*	Makolona nipi/ Jeruk nipis	GD, YRD	CV	TR	FRU	Detergent	0.35
Rutaceae/ *Citrus hystrix*	Jeruk purut	GD, YRD	CV	TR	FOL; FRU	Shampoo	0.67
Solanaceae/ *Capsicum annum*	Saha/cabe rawit	GD, YRD	CV	PR	FOL	Shampoo	0.25

Description:
Habitat type: BC; beach; MT: mountain, FR: forest; GD: garden; YRD: yar.
Wild/Cultivate: CV cultivation; WL: wild.
Habitus: TR: Tree, PR: perdu; LN: liana, HR: herbs.
Parts used: CAU: Caulis (stem); RAD: radix (root); FOL: folium (leaves); FRU: fructus (fruit); BUL: bulbous (tuber); FRO: fronds.

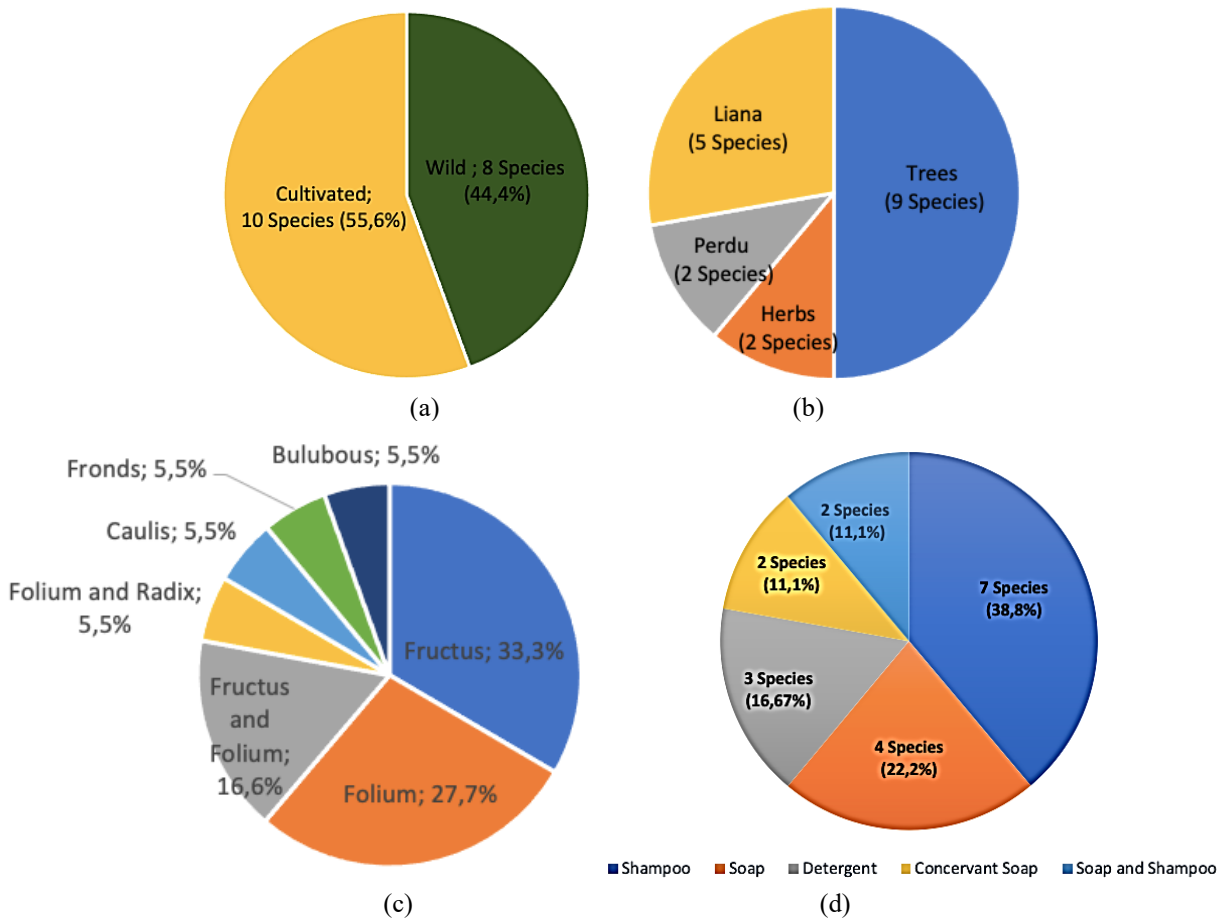


Figure 1. Characteristics of local plants used as soap, detergent and shampoo (a) Wild/cultivated status; (b) Habitus; (c) Parts used; (d) Usability

3.2 The potential of indigenous Buton ethnic flora as cosmetic ingredients

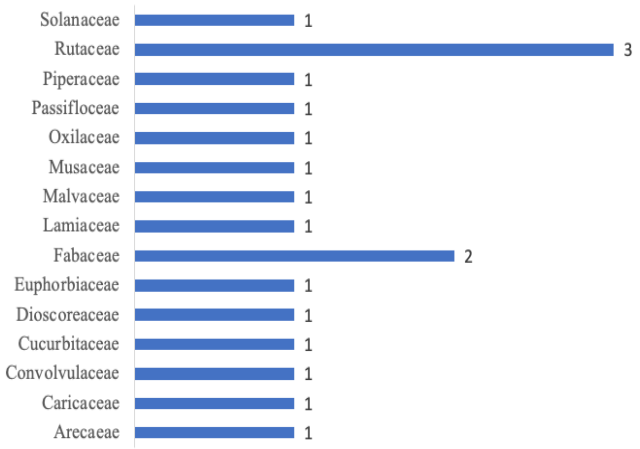
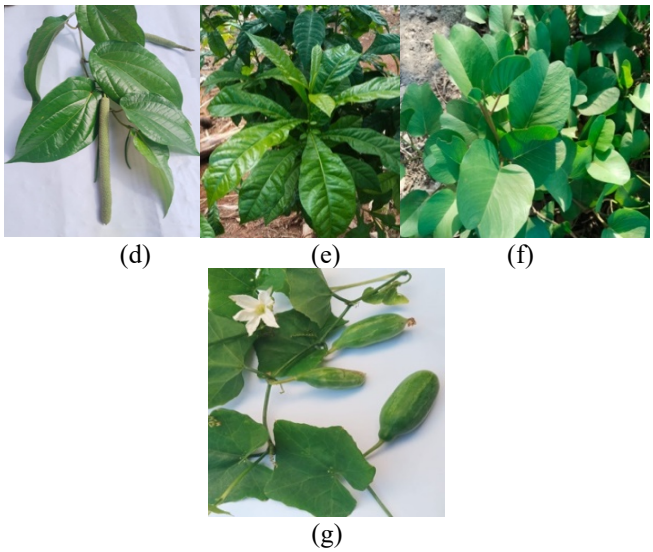


Figure 2. Local plant families used as soap, detergent, and shampoo

Sixteen plant families are utilized in the production of soap, detergent, and shampoo. The most significant family represented is Rutaceae, comprising three species (16.7%) (Figure 2). Groppo et al. [34] indicated that Rutaceae is a family characterized by members that possess aromatic compounds with antibacterial and antifungal effects. This family additionally generates significant secondary metabolites. The local community is unaware that secondary metabolite chemicals necessitate the cultivation of plants in their homes or gardens to fulfil daily requirements for natural soap, detergent, and shampoo. Rutaceae Family, the practice of raising plants to fulfil essential needs has historically been conducted to impart ideals of collaboration and appreciation for the yield.

Table 1 presents plants utilized as soap, detergent, and shampoo, either wild or cultivated, by the Buton ethnic population, based on the RFC value. Three species, specifically Carica papaya, Cocos nucifera, and Aleurites moluccana, possess an RFC value of 1.00 (or 100%), indicating universal recognition among respondents. Eleven (11) plant species possess an RFC value ranging from 0.01 to 0.40. Plants exhibiting low RFC values, predominantly uncommon in their habitats and at risk of extinction, include langar (*Albizia saponaria*), rambusa (*Passiflora foetida*), ruku-ruku (*Ocimum tenuiflorum*), sirih hutan (*Piper aduncum*), maja (*Aegle marmelos*), katang-katang (*Ipomea pes-caprae*), and kemarungan (*Coccinia grandis*) (Figure 3).

(a) (b) (c)



(d) (e) (f)

(g)

Figure 3. Plant species that have low RFC values and are threatened with extinction: (a) *Albizia saponaria*; (b) *Passiflora foetida*; (c) *Ocimum tenuiflorum*; (d) *Piper aduncum*; (e) *Aegle marmelos*; (f) *Ipomea pes-caprae*; and (g) *Coccinia grandis*

Techniques for processing plant materials have emerged from the traditional knowledge cultivated by the Buton ethnic community since antiquity. Interviews with traditional leaders and local Buton ethnic communities reveal that each plant utilized for soap, detergent, or shampoo has a distinct traditional application, as illustrated in Table 1.

The utilization of plants as soap, detergent, and shampoo is a time-honored tradition on Buton Island. Prior to the advent of soap, shampoo, and synthetic detergents, the indigenous inhabitants of Buton Island utilized botanical materials, ash, and other natural substances for bathing and laundering. Numerous initiatives have been undertaken to catalog knowledge regarding plants that yield soap, detergent, and shampoo. Certain plant species continue to serve as alternatives to soap, detergent, and shampoo to this day. Inhabitants of Buton Island have recognized 18 plant species across various habitats.

Local knowledge of residents regarding the use of native Buton plants is very helpful in improving conservation management and sustainable biodiversity enhancement. Local knowledge about soap plants can help communities use their natural resources wisely. Where knowledge about soap plants can be used to make alternative environmentally friendly soaps. Most of the time in many tropical forests, data on biodiversity use is still unavailable, incomplete, or unreliable, while studies on biodiversity are hampered by the high costs, time, and expertise required. Therefore, research is now considering alternative approaches that prioritize the use of local knowledge. In addition, the recording of local knowledge of residents regarding plants that are used to make soap and detergent is expected to help in the framework of sustainable development, such as formulating regional policies and short-term and long-term regional plans.

The utilization of numerous plant species demonstrates the existence of a substantial heritage of traditional knowledge within local populations. It is mostly linked to the educational results and interactions of local communities with nature across generations. Local cultures utilize plants as soap due to their foaming properties, including *Carica papaya, Ipomea pes-caprae, Coccinia grandis, Passiflora foetida, Albizia saponaria*, and *Hibiscus reliance*. Compounds in the leaves and roots of Carica papaya exhibit diverse biological actions, including antifungal [35] and antibacterial [36] properties. The flavonoid and saponin constituents in *Carica papaya, Ipomea pes-caprae, Coccinia grandis, Passiflora foetida*, and *Hibiscus reliance* leaves generate foam that serves as an eco-friendly surfactant [37], whereas Albizia saponaria stems possess antioxidant, antibacterial, anti-dandruff, and anti-inflammatory properties [38, 39]. Biosurfactants generated from plants provide numerous attributes, including natural abundance, renewability, sustainability, cost-effectiveness, enhanced stability, biocompatibility, biodegradability, and reduced environmental toxicity relative to synthetic surfactants.

Local inhabitants identify detergent properties in *Dioscorea hispida*, *Averrhoa bilimbi*, and *Citrus aurantifolia* plants. The Buton ethnic community utilizes Dioscorea hispida for stain removal on clothing. The traditional Kumaun Himalayan culture employs detergent derived from *Dioscorea hispida* tubers to eliminate stains from garments [40]. The Buton ethnic minority utilizes Averrhoa bilimbi fruit to cleanse fabric and eliminate fishy odors from food. *Averrhoa bilimbi* is recognized for possessing the greatest saponin concentration among fruit plants. The saponin component in starfruit functions as a natural surfactant, effectively cleansing eating utensils of germs, eliminating dirt and bacteria, and imparting a fresh, natural aroma [41-43]. Moreover, *Citrus aurantifolia* is utilized by the Buton ethnic minority to eliminate fishy aromas from food and to sanitize silverware. *Citrus aurantifolia* possesses essential oil glands that contain D-limonene and α-terpineol, serving as soap, aroma, and antibacterial [44]. The Buton ethnic community use two plant species for rust removal: *Aegle marmelos* and *Tamarindus indica*. *Aegle marmelos* and *Tamarindus indica* have been utilized as natural remedies for generations based on traditional knowledge. The acidic characteristics of *Aegle marmelos* fruit flesh serve as a metal cleanser [45], whereas *Tamarindus indica* fruit include flavonoids, tannins, glycosides, and saponins, which are phytochemicals that act as antioxidants [46, 47].

The Buton ethnic community in Southeast Sulawesi, Indonesia, traditionally utilizes plants for soap, detergent, and shampoo. This tradition has been inherited by ancestors from antiquity. This traditional community's existence is shaped by its surroundings, passing down the ancestral lifestyle from one generation to the next. The cultural values of the Buton community are currently preserved and disseminated through three forms of local traditions: belief systems, Islamic religious rites, and life cycle customs. The Buton community (Lebe) assumes a pivotal and regulatory function in the transmission of cultural values within the Buton community through a charismatic leadership strategy [48]. This conventional way of life thereafter constitutes local knowledge.

Local wisdom is typically associated with human behaviors, the natural environment, and interdependent linkages that constitute an ecological system [49]. Inhabitants in traditional villages routinely utilize plant-derived soap and shampoo when bathing in the river. A tradition of bathing in the river occurs seven days following the death of a family member. Local inhabitants continue to utilize plants as soap, detergent, and shampoo when bathing. Typically, bathing involves the use of soap derived from the leaves of *Carica papaya*, *Passiflora foetida*, or *Coccinia grandis*, which are commonly found in the yard or garden, while *Cocos nucifera* coconut

milk serves as shampoo. In a different practice, individuals utilize *Citrus histrix* fruit juice to cleanse the hair of the deceased during the Kala (kadha) acceptance and funeral ceremonies. Local residents favor utilizing *Averkhoa bilimbi* and *Dioscorea riptide* for stain removal on garments instead of commercial detergents.

The utilization of plant species as alternatives to soap, detergent, and shampoo holds significant promise, particularly when accompanied by value addition or education on raw material processing for customers. Certain species, including *Dioscorea hispid, Averrhoa bilimbi, Passiflora foetida, Ipomea pes-caprae, Ocimum tenuiflorum, Hibiscus reliance*, and *Coccinia grandis*, have not been employed as raw materials for soap, detergent, or shampoo products. Furthermore, two specific plant species are utilized as conservant soaps: maja and asam. The COVID-19 pandemic has underscored the significance of hand cleanliness and self-care. The demand for natural soaps and shampoos devoid of harsh chemicals and sulfates has risen, rendering them safer for use on the scalp and delicate skin. Utilizing plant species as alternatives to soap, detergent, and shampoo can enhance the market value of eco-friendly products, hence elevating the preference for healthier, natural components for skin and hair care.

Local communities are often perceived to be more supportive and engaged in conservation programs when they derive direct benefits from these efforts [50]. When handled properly, these plants can serve as a viable source of revenue for local people. Numerous species are becoming scarce on Buton Island. Changes in land use were noted and recognized as the cause of the population loss of *Albizia saponaria*, *Passiflora foetida*, *Ocimum tenuiflorum*, and *Aegle marmelos*. Few individuals in this region possess knowledge of sustainable land use management; therefore, the conservation of these plants must be executed promptly, both in situ and ex situ. The demand for natural shampoos, soaps, and detergents is primarily influenced by customer preferences for eco-friendly, sustainable, and healthier products. The market is anticipated to expand as an increasing number of customers recognize the advantages of utilizing natural ingredients and ecological packaging.

4. CONCLUSIONS

The Buton ethnic community use 18 plant species from 15 families for soap, detergent, and shampoo. The parts of the plant utilized include leaves, fruits, stems, roots, and tubers. The customs of the Buton ethnic minority are transmitted from one generation to the next. The findings of the FRC analysis indicate that not all plants are recognized by the local community in various Buton ethnic traditional villages for their advantages as soap, detergent, and shampoo; some of these species are at risk of extinction owing to alterations in land usage, necessitating conservation measures. Recording local plant types of the Buton ethnic group for use as biosurfactant-producing plants in making soap, detergent, and shampoo depends on the reliability of local knowledge from indigenous peoples. Additionally, the scientific knowledge of researchers plays a crucial role in the conservation and sustainable use of biodiversity. The development of biosurfactants from native Buton ethnic plants, using local knowledge, is expected to enhance collaboration among indigenous communities, conservation practitioners, researchers, and local governments in conservation management.

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