

Documentation and Phytochemical Screening of Traditional Beauty Products Used in Missenyi District of Tanzania

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Abstract

Background Information: The concept of beauty and cosmetics is as old as mankind and civilization. Raw materials for beauty products are dominated by petroleum and synthetic products. In recent years, there has been an increase of natural product-based cosmetics along with creating beauty from the inside by consumption of nutraceuticals. Tanzania traditional beauty products are still in use especially rural areas, but the documentation is lacking. **Objectives:** This work aimed at documenting traditional beauty products in Kagera region as an effort to avoid loss of useful information and available useful traditional findings for safe utilization in beauty products. **Methodology:** Information was obtained from knowledgeable people in Missenyi district by focus group discussion. Collected materials were identified in Botany and Zoology Departments at the University of Dar es Salaam followed by literature search and phytochemical screening. **Results:** This study afforded to record 13 plants, 4 animal products, mineral and other organic products. Most products are used for skin care (57%) followed by hair care (22%). Literature search supported the use of some of the products and plants subjected to qualitative analysis showed presence of phytochemicals relevant to beautification. **Discussion:** Some of the recorded plant and animal products are incorporated in natural based cosmetic products. Hazardous practice of using skin lightening plant products and dry cell powders was noted. **Conclusion:** The use of products which are already incorporated in the cosmetic products especially in countries where these products are well regulated should be promoted. Products reported for the first time require scientific studies to establish their effectiveness and safety. Since this study recorded the use of some dangerous materials, people need to be educated through media.

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Keywords

Tanzania, Traditional Beauty Products, Phytochemicals

1. Introduction

A cosmetic product refers to any substance or preparation intended to be applied on various external parts of the human body (epidermis, hair system, nails, lips and external genital organs) or on the teeth and the mucous membranes of the oral cavity with a view of cleaning them, perfuming them, changing their appearance and/or correcting body odors and/or protecting them or keeping them in good conditions [1]. Since ancient times, raw materials for preparing these products have been derived from plants, animals and minerals [2].

Cosmetic beautification outcomes are also associated with nutritional and/medicinal effects. Hence, emergence of nutracosmetics is a class of health and beauty aid products that combine the benefits of nutracosmetical ingredients with the elegance, skin feel, and delivery systems [3]. Vitamins (A, C and E) obtained from vegetables and fruits protect cells and tissues against damaging effect of free radicals [4]. On the other hand, some ingredients from natural products are incorporated in cosmetic preparations due to their various therapeutic properties, e.g. sunscreen (skin protection effects), antiaging, moisturizing, antioxidant, antiinflammatory and antimicrobial effects, hair repair/growth stimulants, etc. [5].

The skin has a highly differentiated and complex organizational structure that is particularly vulnerable to free radical damage because of its contact with oxygen and other environmental stimuli [6]. When the skin is exposed to sunlight and other atmospheric conditions production of reactive oxygen species is stimulated. The reactive oxygen species then react with cellular DNA, proteins and fatty acids, causing oxidative damage and impairment of antioxidant system in the body. As a result, regulation pathways of skin are altered and lead to photo aging and sometimes skin cancer development [7].

The effects of aging include wrinkles, roughness, loss of skin elasticity and hyper or depigmentation marks. Herbal extracts or cosmetics containing herbal ingredients act on these areas and produce healing, softening, rejuvenating and sunscreen effects due to the antioxidant activity of phenolic compounds (tannins and flavonoids) present in most of the herbal products used for cosmetic purpose. The antioxidant activity is mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donors and quenchers of singlet oxygen. In addition, they may also possess metal chelating properties [8]. Compared with synthetic cosmetic products, herbal products are mild, biodegradable and assumed to have low mammalian toxicity [8] [9].

In Tanzania, traditional beauty products have been overtaken by imported synthetic and herbal cosmetics. To a great extent, this is due to lack of documentation and research and development of these products that lead to unawareness of their existence among the young generation especially in urban areas. This situation prompts us to start recording such information from rural areas where these products are still meaningful for preserving indigenous knowledge with an anticipation of possible production of local products in more acceptable formulations and packaging in the future. Kagera region was chosen based on the fact that people of the Haya tribe are known for maintaining their culture and traditions that include the use of traditional beauty and products.

2. Methodology

Study site: Traditional beauty natural products were recorded in six different villages of Missenyi district in Kagera region namely; Byeju, Bulembo-Kyaka, Igayanza, Minziro, Mutukula and Ngando.

Study design: Focus group discussion with information providers being mainly those who are expert for decorating young girls during wedding ceremonies.

Data solicitation: Data was collected using semi-structured questionnaires and interviews in Kiswahili and Haya languages. Various questions about cosmetic products and their methods for preparation and use were asked to women who have traditional knowledge, about traditional beauty products used for cosmetics purposes *i.e.* maintaining/uplifting their appearance. The questionnaire consisted of the four parts:

1. What traditional cosmetic products do use for beatification purposes?
2. How are each of the mentioned product(s) prepared?
3. For what cosmetic/hygiene purposes do the mentioned product(s) used for? (*i.e.* face, hair, skin, nails, the oral tract, decoration of eyes and the maintenance of the skin health.)

4. What are the outcomes for the mentioned product(s)? E.g. smoothness of the skin and slightly lightening.

Some of the botanical species and the insect mentioned by the participants were collected and identification done in Zoology and Botany Departments at the University of Dar es Salaam, Tanzania.

2.1. Collection and Preparation of Plant Materials

Plant materials for both herbaria preparation and phytochemical screening and the insect mentioned were collected from Missenyi district. Identification was done in Botany and Zoology Departments at the University of Dar es Salaam. The drying of plant materials was done in open under shade and took 7 to 10 days.

2.2. Extraction

Chemical reagents and solvent were all of the analytical grade solvents and reagents were purchased from Lab Equip Tanzania Ltd. (Dar es Salaam, Tanzania) and Scharlau Company (South Africa).

Dried aerial part of the plant materials were powdered and weighed (29 g of *Bidens schimperii* and 22 g of *Cyphostemma adenocaulis* and 30 g of *Cyphostemma maranguense*). Each sample was defatted using petroleum ether followed exhaustive extraction with 80% methanol by maceration (4×600 ml) for the seven days. Extracts for each solvent were pooled together, filtered and concentrated to dryness under vacuum at 40°C using a Buchi RE 111 rotary evaporator from Gemini BV, The Netherland.

2.3. Phytochemical Analysis

Petroleum ether, methanol, and distilled water extracts of the three plants were used to determine chemical groups using the standard procedures using relevant reagents [10].

Test for tannins: About 0.5 g of each methanol extract was boiled in 20 ml of water in their respective test tubes and then filtered. A few drops of 0.1% ferric chloride was added to each test tube. A brownish green or blue-black coloration indicates the presence of tannins.

Phlobatannins: An aqueous extract of each plant sample was boiled with 1% aqueous hydrochloric acid. A deposition of a red precipitate indicates the presence of Phlobatannins.

Saponins: To 400 ml of distilled water was added 50 g of powdered sample in a conical flask and boiled for 5 min. The mixture was filtered when still hot and 5 ml of sterile distilled water added to a test tube containing equal amounts of cooled filtrate. The test tube was shaken vigorously for 30 seconds and then allowed to stand for 30 min. Formation of honey comb froth indicates the presence of saponins.

Flavonoids: 5 ml of dilute ammonia solution was added to a portion of the aqueous filtrate of each plant extract followed by addition of concentrated H_2SO_4 . Formation of yellow color indicates the presence of flavonoids.

Steroids: 2 ml of acetic anhydride was added to 0.5 g of the methanol extract with 2 ml H_2SO_4 . The change in colour from violet to blue or green indicates the presence of steroids.

Terpenoids: 5 ml of the extract was mixed with 2 ml of chloroform, and concentrated H_2SO_4 (3 ml) carefully added to form a layer (Salkowski test). A reddish brown coloration on the interface indicates the presence of terpenoids.

Sterols: To 5 ml of the extract, equal volume of Salkowski's reagent was added. A bluish-red solution that slowly changes to violet-red, with the fluorescence showed the presence of sterols.

Essential oils: To 2 ml of the extract, 0.1 ml of 2 M sodium hydroxide was added, followed by a small quantity of 2 M hydrochloric acid and shaken. A white precipitate indicates the presence of essential oils.

Phenols: To 2 ml of the extract, 2 ml of Iron III chloride was added to the solution. A deep bluish-green solution indicates the presence of phenols.

Alkaloids: To 1 ml of the extract, concentrated sulphuric acid was added followed by potassium dichromate crystals. An olive-green colour indicates the presence of alkaloids.

3. Results

Ethno-Cosmetic Data

This study recorded 23 products used for beauty purposes in Missenyi district. The major sources of these products were plants, animals, minerals and others. Proportions of these products are shown in **Figure 1** and the applications are given in **Figure 2**. Details of the products are presented in **Tables 1-3**.

Table 1. Plant derived cosmetic products used in Missenyi district.

Botanical Name and Family Name	Vernacular Name	Parts Used and Preparation	Uses
<i>Abrus precatorius</i> L. Fabaceae		The bright seeds are strung make jewelry.	Necklaces and hair bands especially by female children.
<i>Bidens schimperi</i> Compositae	Luongwa	Flowers are macerated in water, mixed with papaya latex and applied on the skin.	To lighten the skin.
<i>Carica papaya</i> L. Caricaceae	Omupapari	Latex obtained from the stem and applied directly on the skin three times a day.	To lighten the skin, emollient.
<i>Citrus limon</i> Rutaceae		Fruit juice mixed with egg albumin, honey and cucumber applied on the skin everyday at night.	To smoothen facial skin, treatment of acne.
<i>Cyphostemma adenocaula</i> Vitaceae	Ibombo	Aerial parts are macerated in water and applied on skin.	To lighten the skin.
<i>Cyphostemma maranguense</i> Vitaceae		Juice made from leaves is applied on the normal skin or affected areas, every day. Also can be mixed with water and boiled for drinking to increase CD4 count in HIV patients.	Emollient, Skin diseases treatment: eczema, wounds, bacterial and fungal infection.
<i>Diospyros usambarensis</i> Ebenaceae	omudawa	Root barks applied on the teeth.	To whiten the teeth and oral hygiene.
<i>Eucalyptus globulus</i> Myrtaceae	Omukalitusi	Leaves boiled with ghee, and the steam is applied on the skin.	To smoothen the skin.
<i>Ficus thonningii</i> Moraceae	Mtoma	The milky latex often turning pinkish is used alone or mixed with lemon juice and applied to the vagina early in the morning every day.	Create artificial virginity in women.
<i>Lawsonia inermis</i> L. Lythraceae	Ehina	Leaves are grounded and suspended in water and applied on hair or mixed with lemon juice and soot and applied on nails.	To dye hair; To color the nails.
<i>Musa paradisiaca</i> L. Musaceae	Engemu	Stem is cut into small pieces and boiled, the juice is applied on the skin or the warm stem is rubbed on the skin directly once or twice a day for three months. Banana peels are cooked and the steam is directed to skin. This is done once or twice every day for three months.	To smoothen the skin; To lighten the skin.
<i>Persea americana</i> Mill. Lauraceae		Fruit is mixed with the egg yolk and applied on hair.	Moisturizer, anti-dandruff: to strengthen hair and prevent hair loss.
<i>Phytolacca dodecandra</i> Phytolacaceae	Omuoko	Seeds are mixed with papaya latex and applied on cracked feet.	To smoothen the skin.
<i>Zea mays</i> Poaceae		Corn silk (stigma) aqueous extract is used to wash the skin while fresh ground corn silk is used as body ointment especially after intense sun exposure.	To rejuvenate the skin.

Table 2. Animal mineral and others sources used for beauty in Missenyi district.

Ingredients	Preparation	Use
Bicycle tyre inner tubes	With petroleum jelly, applied on eye brows.	To decorate eyes, similar to eye liner.
Cercopid nymph secretion	Secretions are collected and applied on the face. 10mls three times a day with or without lemon juice for treatment of gastric ulcers and cough.	To remove unwanted facial hairs.
Snail slime	Slime is collected and rubbed on the cracked feet.	To treat cracked feet.
Egg yolk	Mixed with avocado fruit and applied on hair.	To strengthen the hair.
Honey	Mixed with cucumber and lemon juice and applied directly on the skin at bedtime.	To smoothen the skin.
Kerosene	Applied on the nails three times a day.	To strengthen the nails.
Clay (red clay)	With or without water, applied on face at night.	To give a special softness to skin.

Continued

Mercury oxide from battery (dry cells) powder	With water or petroleum jelly applied on the hair.	Hair dye.
Soft charcoal	Applied on teeth.	To whiten the teeth.
Soft charcoal e.g. <i>Zea mays stem</i> charcoal	Crushed and mixed with petroleum jelly and applied on hair.	Hair dye.
Sooty	Fine powder is mixed with petroleum jelly and applied on eyes brows (eye liner).	To decorate the eyes.

Table 3. Detected Phytochemicals and relative amounts of *Cyphostemma adenocaula*, *Cyphostemma maranguense* and *Bidens schimperi*.

Phytochemical Group	<i>B. schimperi</i>	<i>C. maranguense</i>	<i>C. adenocaula</i>
Alkaloids	-	+++	+++
Essential oils	+	+	+
Flavonoids	+++	-	++
Phenols	++	-	++
Phlobatannins	+	-	-
Saponins	-	-	-
Steroids	-	+++	+++
Sterols	-	+	++
Tannins	+++	+	+++
Terpenoids	+++	-	-

Key: += little; ++ = high; +++ = higher.

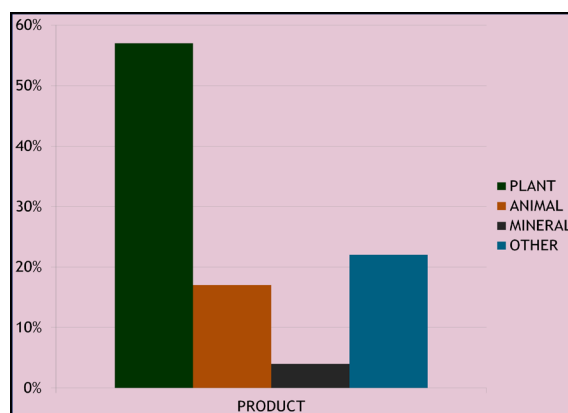


Figure 1. Proportions of beauty product sources.

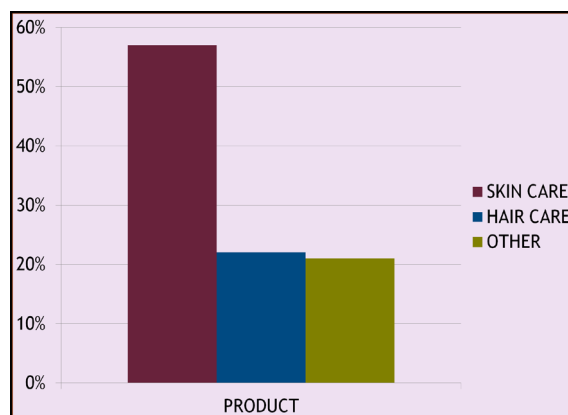


Figure 2. Proportions of product applications.

4. Discussion

4.1. General Observation

Proportions of products for application to the skin were (57%) and hair (22%) this matches with people's concern on skin complexion especially the face and hair look. Regarding the skin, smooth complexion and lightening are main expected beauty outcomes. Information providers were aware of the fact that, besides topical application of cosmetic products, beauty can also result from eating certain foods (concept of nutracosmetics), e.g. banana stems and fruits. Majority of beauty products recorded in this work are supported by scientific results previous studies as described below.

4.2. Beauty Products from Plant Sources: Previous Reports on Uses, the Phytochemical Constituents, Pharmacological and Biological Activity

Abrus precatorius: Unlike other plant beauty products topically applied or eaten, the bright seeds of *A. precatorius* are strung on a thread to make necklaces and bangels which are worn to enhance good looking. In India the natives value bright coloration of *A. precatorius* seeds and use them for making necklaces and other ornaments worn by both children and adults [11].

Carica papaya latex: Latex from unripe fruits, leaves or stem of the papaya tree contains proteolytic enzymes such as papain enzymes which soften and dissolve dead skin layers and simultaneously nourish and support the creation of healthy skin. The enzymes also strengthen collagen tissue due to their ability of protecting and repairing damaged elastic collagen fibers, offering protection to the skin from developing wrinkles [12]. Externally the papaya latex is known to cause contact dermatitis [13]. Cosmetically, papain is used in some dentifrices, shampoos, and face-lifting preparations [14].

Citrus limon: Lemon juice contains citric acid and is very rich in vitamin C, which provide many health benefits for all types of the skin. The citric acid is able to exfoliate the skin, which is an important step in treating acne or pimples. It also has astringent properties, thus drying the blemish itself [15]. The juice acts as an antiaging remedy due to its antioxidant activity and can remove wrinkles and blackheads. Lemon juice is also a natural skin lightener, so it can act to reduce a pimple's redness, speeding up the healing process and cause temporary bleaching to improve the look of the skin. However, citric acid may cause skin irritation [16].

Diospyros usambarensis root bark: The antibacterial activity of 7-methyljuglone exhibited against oral pathogenic bacteria: *Streptococcus sp.* and *Porphyromonas* [17] and *Diospyros species* possession of naphthaquinones [18] justify the use of root bark for oral hygiene and as a teeth whitener.

Eucalyptus globulus oil: Due to its antiseptic and antifungal properties, eucalyptus oil can keep the scalp healthy by preventing microbial growth and getting rid of dandruff. It promotes hair growth, maintains strength and elasticity of hair, improves blood circulation which can help to eliminate the build-up of oil and bacteria in the hair follicles as well as revitalizing dull hair and improve hair texture by increasing the production of ceramide [19].

Ficus thonningii latex: Hayas are among those societies from different parts of the world where virginity is highly valued thus forbidden to have sex intercourse before marriage. Some people would attempt to restore virginity by applying some natural products including *Ficus thonningii* latex. Supporting this practice, literature search shows that, there are various herbs that can be used to overcome loose vagina or restore vaginal muscle elasticity, vaginal prolapse, vaginal dryness and discharge, and overall health of the vagina. Examples include *Hamamelis virginiana* and the oak plant which offer fast action in tightening vaginal walls due to its natural phenol content-tannins [20] [21]. Previous study on *Ficus thonningii* stem bark revealed the tannins among other chemicals and antibacterial activity [22].

Lawsonia inermis: This is used and well known worldwide as hair and nail dye whose active component, lawsone, binds to keratin. It is therefore considered semi-permanent to permanent, depending on a person's hair type. Most people will achieve a permanent color from henna, especially after the second dye. With repeated use the orange color builds up into red and then auburn [23] [24].

Musa spp: Banana fruit is used worldwide for its nutritional values and the different parts of banana plant are used to treat different diseases such as hypertension, diarrhea, peptic ulcer and cardiac diseases in human [25]. Bananas have a variety of skin care benefits. The fruit peels have antimicrobial activity against *Staphylococcus* and *Pseudomonas* [26] and high potassium content which makes them ideal for treating acne prone skin. The

spread of bacteria in skin cells is diminished allowing pimples or blemishes to heal at a faster rate. They are known to contain antioxidants such as dopamine, ascorbic acid and flavonoids [27] [28] that provide anti-aging properties. Bananas also contain Vitamin C known to inhibit melanin production, the substance that the skin produces in response to sunlight, which darkens the skin. Banana stem juice contains manganese peroxide enzyme which causes enzymatic degradation of the skin melanin. [29] [30] Thus, skin lightening effect can be associated with anti-melanin formation and/or degradation. The antiinflammatory properties provide soothing effect for dry itchy skin preparation made from banana peels and stem. Ingested stem juice help to detoxify the body, increase skin circulation, boost collagen levels exerts antibacterial and antioxidant activity, as well as providing an overall youthful, fresh looking, smoother and glowing appearance [31].

***Persea americana* (Avocado oil):** Supporting the use of avocado is the fact that, avocado oil present in the avocado fruit has essential nutrients like proteins, Vitamins A, D, E and B6, magnesium, copper, iron, amino acids and folic acid, all of which is extremely essential for hair growth and nourishment. Lecithin contained in the oil gives it good penetrative qualities. The avocado oil is also known to have natural sunscreen properties that can protect the hair and scalp from the damage caused by the harmful UVA and UVB rays of the sun. This oil is also effective in getting rid of dandruff [32].

Phytolacca dodecandra: It is used as a detergent, common medicinal uses include treatment of skin itching (ringworm), abortion, gonorrhoea, leeches, intestinal worms, anthrax and rabies [33].

Zea mays: Chemical constituents of corn silk include; protein/amino acids, carbohydrates, flavonoids, phenols, tannins, steroids, alkaloids, terpenoids, saponins, glycosides, fat/oils fibers, vitamins and minerals (calcium, potassium, magnesium and sodium salts) [34] [35]. Corn silk is an ingredient in cosmetic face powder. Skin rejuvenation can be associated with antioxidant activity of flavonoids and tannins.

4.3. Current Phytochemical Results

In addition to documentation, phytochemical screening of three plants we performed revealed the presence of chemical classed that could be correlated with their use for beauty purposes as follows.

***Bidens schimperi* flower:** Flavonoids and tannins are among other phytochemicals, shown in this study. Skin smoothening effect could be due to antioxidant activity of these compounds.

***Cyphostemma adenocaula* and *Cyphostemma maranguense* leaves:** Both species showed same phytochemical profile with the presence of alkaloids, flavonoids, steroids and tannins in the similar proportions based on the colour intensity observation. However, *C. maranguense* contained less amounts of sterols and tannins than *C. adenocaula*. Saponins, triterpanods and phlobatannis could not be detected. Presence of steroids may be associated with their application for skin lightening since steroids have catabolic and antianabolic effect on the skin which results to the thinning of the skin, making the skin appear lighter [36]. The reported itching effect can be associated with the presence of oxalic acid which exist in form of calcium oxalate crystals known to cause dermatitis upon skin contact [37] [38].

4.4. Beauty Products from Animal Sources: Chemical Constituents, Pharmacological and Biological Activity

Chicken egg yolk: Using egg yolk as a natural hair conditioner or in combination with avocado pulp to nourish and strengthen hair is supported by essential nutrients present in egg yolk. These including; protein, vitamins like A, E and D, high amount of sulfur and fatty sulfur and Vitamin B12 help the hair to grow faster and possession of healthy appearance [39].

Honey: The medicinal use of honey and its incorporation in cosmetic products is well known. When applied to wounds or burns, the high sugar content prevents infections, specifically from *Staphylococcus* bacteria strains, as well as *E. coli* and *Candida albicans*. It is thus recommended for skin-care purposes like promoting wound healing and preventing bacterial or fungal skin infections [40].

Snail secretion (slime): Its use is well supported; the secretion is rich in proteins of high and low molecular weight hyaluronic acid and antioxidants. It has a double function when applied to human skin: (i) to stimulate the formation of collagen and elastin; (ii) dermal components that repair the damaged skin and to minimize effect of free radicals that are responsible for premature skin aging [41].

Spittlebug nymphs: Spittlebug nymphs foam contains anti-repellant chemicals: fatty acid-derived alcohols c-lactones and a single 1-monoacylglycerol, as well as the polyol pinitol and the polyhydroxyalkanoate, poly-3-

hydroxybutyrate [41] [42]. Application in cosmetic products is reported for polyhydroxybutyrate a plastic-like and biodegradable material having skin oil absorbing properties incorporated in skin cleansing products, polyol pinitol having skin moisturizing properties incorporated into skin creams, sunscreens and lotions products and monoacylglycerol used as emulsifying agent [43] [44].

4.5. Other Sources for Beauty Products

Red clay: Clay is a natural substance with a slightly grainy texture which helps the exfoliation, while the nutrients in the clay tone, firm, and nourish the skin. It is able to draw dirt, oils and toxins, resulting in deeply cleansed and softened skin [45]. Red clay in particular is richer in iron oxide, having absorbent properties and is especially good for oily skin. It tones, stimulates, and cleanses the skin pores resulting in skin smoothening and protection against pimples [46].

Unusual products: These include dry cells and inner tube of bicycle tyre. The later contain mercury oxide which has been banned in most countries because of health concerns. Mercury is toxic to the central and peripheral nervous systems. The inhalation, ingestion or dermal exposure of any form of mercury can cause neurological and behavioural disorders, harmful effects to digestive and immune systems, lungs, skin and kidneys, and may be fatal. Symptoms include tremors, insomnia, memory loss, neuromuscular effects, headache cognitive and motor dysfunction [47].

5. Conclusion

This type of study was done for the first time in Tanzania. It afforded to record 13 plants, 4 animal products, minerals and organic products. Skin care products were the most reported products followed by hair care products. Some of the mentioned products are known ingredients that are incorporated in cosmetics based on natural products. These include eucalyptus oil, honey, avocado, papaya latex, egg yolk, lemon oil and corn silk. Most of these are incorporated in body creams, lotions and shampoos. Traditional beauty products reported in this study but with no scientific support require further investigation to determine their safety. Also, people should be educated on the hazardous human health effects of products like dry cells and bicycle inner tubes through mass media such as TV news paper and flares.

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