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ORIGINAL ARTICLE

The medieval skincare routine according to the formulations of Madgistra Trotula and the Medical School of Salerno and its reflection on cosmetology of the third millennium

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Abstract

Background: Officinal plants, minerals, animal derivatives, and miscellaneous have always been used to treat and improve appearance despite the different aesthetic canons of a specific historical and cultural context.

Objective: The aim of this work was to make a critical comparison between medieval and modern dermocosmetics analyzing the works of Trotula de Ruggiero, a female doctor of the 11th century teaching and working inside the illustrious "Medical School of Salerno," who devoted particular attention to the promotion of female care, beauty, and well-being.

Methods: We applied the historical-critical method analyzing the Latin text and the nglish translation of the standardized corpus of the main Trotula medieval manuscript *De Ornatu Mulierum* with a multidisciplinary scientific approach ranging from botany to pharmaceutical chemistry and technology, pharmacology and pathology.

Results: We identified the medicinal plants, derivatives of animal origin and minerals used in the recipes of Trotula, highlighting their biological properties in the light of current scientific knowledge. A critical comparison between medieval and modern dermocosmetics is reported also taking into consideration the chemical, pharmaceutical, and technological literature.

Conclusion: Beyond the obvious changes in the paradigms of cosmetology and the different beauty canons of Middle Age with respect to modern times, our results emphasize the attention of Trotula to female care, beauty and well-being as well as the extraordinary combination of tradition and modernity in her work.

KEYWORDS
botanical ingredients, formulations, scientific interpretation, traditional and modern skincare routine, women and cosmetics

1 | INTRODUCTION

Since ancient times, the search for beauty, well-being, and the improvement of body appearance has been considered on the basis of aesthetic and cultural reference models of a specific historical and cultural context. For this reason, women and men have always exploited medicinal plants, minerals, animal derivatives, and miscellaneous to treat and improve face and body look. Officinal herbs, so called because they are used in laboratories for the preparation of natural remedies, plants and plant wastes, and their formulations have always been employed for the preparation of oils, ointments, perfumes, herbal teas, infusions, tinctures, to preserve health, wellness, and beauty and today as bioactive ingredients in health products' industry.[1–4] Bioactive herbs have been selected over the centuries on the basis of their symbolic qualities or in relation to the medical theories developed in the context of different cultures and eras, such as the Hippocratic humoral theory (5th century BC), which was prevalent until the 17th century and beyond. Body care and attention to aesthetics are apparently much less widespread in the Middle Ages with respect to Ancient Egypt and the classical antiquity, when the cult of beauty and well-being and the use of natural cosmetics were deeply rooted, with the exception represented by the Salerno Medical School.

The Salerno Medical School was an illustrious medieval institution for medicine teaching that was active in southern Italy, in the city of Salerno, from the 9th century. It is still today considered to be the oldest western institution for the teaching of medicine, pioneer of the modern concept of *Universitas studiorum*. The Salerno Medical School teaching and medical practising pays great attention to well-being and beauty, proposing a model of taking care of women and their femininity which is integration and contamination between the Greek-Latin medical tradition and the Arab and Jewish one.[5,6] Salerno women are not only users of this model but also creators, given the high presence of women as doctors, teachers (*magistrae*) and authors of medical treatises. Among the so-called *mulieres salernitanae*, one of the most important was Trotula De Ruggiero.[7] It is believed that Trotula wrote at least two medical texts which were very famous at the time, translated and spread throughout Europe, and that have come down to the present day: "*De passionibus mulierum ante in et post partum*" also known as "*Trotula Maior*," an important medical treatise dedicated to the pathologies of women, and "*De Ornatu Mulierum*," also known as "Trotula Minor". The latter is an innovative and original manual of aesthetic medicine, dermatology, and cosmetics for the time, written by a female doctor who wants to disseminate and teach cosmetology science, based on plants, animal, and mineral remedies combining nourishing, healing and makeup properties, to other women and aspiring doctors.[8–10]

De Ornatu Mulierum collects original and simple remedies, coming from the direct experience of Trotula as a woman very attentive to health and beauty, and as a doctor, who cares to preserve the well-being of her patients. Starting from the examination of the aesthetic or medical problem and the resulting discomfort experienced by the women, Trotula provides very precise information on the treatment to be used, selection of the natural ingredients and miscellaneous, preparation and compounding and how to apply the cosmetic product on skin, hair, and mucous membranes.

In this work, we analyzed a the Latin text and the English translation relating to the standardized corpus of the main manuscripts of the *De Ornatu Mulierum*, circulating in Europe between the 13th and 14th centuries.[8] We rigorously applied the historical-critical method, starting from the philological analysis of the text, but primary applying a multidisciplinary scientific approach ranging from botany to pharmaceutical chemistry and technology, pharmacology and pathology. Medicinal plants, derivatives of animal origin, minerals and mixed derivatives used in the recipes of Trotula were studied , their biological properties were verified by careful inspection of literature in the light of current knowledge on bioactive plant ingredients and a critical comparison between medieval and modern dermocosmetics was made, taking into consideration the chemical, pharmaceutical, and technological aspects of ingredients and formulations summarized in Tables 1–3.

2 | THE MEDIEVAL SKINCARE ROUTINE ACCORDING TO TROTULA

The medieval skincare routine according to Trotula is based on a selection of herbs, minerals, and animal derivatives, many of which commonly known, while others emerge as botanicals studied and used today for similar bioactivity, as thoroughly demonstrated by the analysis of literature (Tables 1 and 2). However, some ingredients may appear magic potions diffused in the Medieval period, contained in everyday remedies, and associated with superstitious practices and magical rituals. Certainly, they are not usable in mainstream cosmetic.

In this regard, Trotula stands out as a modern health psychologist able to work at the interface between behavioral science, cosmetic, and medicine to guarantee well-being and physical beauty and health. In fact, there are also more strictly medical treatments, which deal with wisdom and expertise in prevention and management of gynecological, dermatological, infectious, and dental problems. Trotula's medicine certainly follows the Arab, Greek, and Latin tradition, blended with the extremely practical approach of the Salerno Medical School, but it tends to overcome the myth and magic that medieval popular culture was strongly imbued with.

De Ornatu Mulierum describes in detail the doses of the ingredients and the procedures to formulate the final remedy (Table 3), so that the recipes can be easily reproduced at home. A particular attention is devoted to describing the methods of application of herbs, ointments, minerals and products of animal origin, curative for the face and body. Recipes range from skin treatments, hair dyes, teeth whitening, eye and lip makeup, and body care procedures (Table 3). To these recipes, Trotula adds psycho-physical wellness and hygiene advice, such as the use of steam baths and massages, and other procedures suggesting a holistic well-being concept comprising alternative health treatments.[71]

TABLE 1 Officinal plants and derivatives—A comparison between medieval and current functional properties

Common name	Scientific name	Main phytocomponents	Cosmetic properties reported in *De ornatum mulierum*	Functional properties reported in the current scientific literature
Astragalus	*Astragalus*	Saponins, flavonoids, and polysaccharides[11]	Skin care	Antiseptic; emollient; soothing[12]
Bistort	*Polygonum bistorta*	Flavonoids and tannins[13]	Face and lip care	Anti-inflammatory; tonic; astringent[14]
Bryony	*Bryonia*	Flavonoids[15]	Face care	Rheumatism; sciatica; anti-inflammatory[16]
Camphor	*Cinnamonum camphora*	Monoterpenes, sesquiterpenes, oxyterpenes[17]	Face care; sunburn	Anti-inflammatory; rubefacient[17]
Rosin	*Pinophyta (Pinaceae)*	Abietic acid[18]	Hair removal	Patches and ointments[18,19]
Cuminum	*Cuminum cyminum*	Phenolic compounds and essential oils[20]	Hair and face care; scabies	Halitosis; stimulates circulation; disinfectant[21]
Cyclamen	*Cyclamen europaeum*	triterpene glycosides or saponin[22]	Cheilitis; face care	Anti-inflammatory effect[22]
Fava bean	*Vicia faba*	Protein, starch, and oil, polyphenol, peptides[23]	Face cleanser	Abscesses; erythema; skin rashes; inflammation of the skin; corns; warts[24]
Ferula	*Ferula galbaniflua*	coumarin, coumarin esters, sesquiterpenes sesquiterpene lactones, monoterpene prenylated coumarins, flavonoids, carbohydrates[25]	Face care	Tonic; stimulating; anti-infective; anti-inflammatory[25]
Ginger	*Zingiber officinale*	volatile oil, gingerol analogues, diarylheptanoids, phenylalkanoids, sulfonate phenylalkanoids, steroids, and monoterpenoid glycosides compounds, other compounds including alkaloids, xanthones[26]	Skin whitener	Anti-spots; anti-dandruff; promotes hair growth[27]
Gum arabic	*Acacia senegal*	Complex polysaccharides[29]	facial hair remover	Emulsifier[28]
Incense	*Boswellia*	Volatile terpenoids, sesquiterpenoids, diterpenoids, triterpenoids, boswellic acids and derivatives[29]	Skin and eye care; burns	Anti-inflammatory; antioxidant; antiaging; soothing; calming; elasticizer for red stretch marks[30,31]
Italian arum	*Arum italicum*	Alkaloids, polyphenols, glycosides (flavonoids, saponin and cyanogenic groups), monoterpenes, sesquiterpenes, lectins[32]	Face care	Expectorant; purgative; anti-inflammatory, antioxidant[33]
Ivy-leaved cyclamen	*Cyclamen hederifolium* L.	Triterpenoid saponins, piperidine alkaloid, sterols, anthocyanin and flavonoid pigments[34]	Detergent; face lightening	Purgative (toxic)[35]
Juniper	*Juniperus*	Sugars, resins, organic acids, alkaloids, terpenic acids, leucoanthocyanins and flavonoids, gums, lignins, and wax[36]	Face care	Astringent; antiseptic; purifying for oily and impure skin and hair[37]
Lilly	*Lilium*	Steroidal saponins, Sterols, Polysaccharides, Phenylpropenoid glycerides, Alkaloids, Flavonoids[38]	Face and lip care; burns	Soothing; moisturizing; acne and imperfections[38]
Marsh mallow	*Althaea officinalis*	Pectin, starch, di-saccharide sucrose, mucilage, flavonoids, coumarins, scopoletin, phytosterols, tannins, asparagine, and many amino acids[39]	Hair care; skin whitener	Moisturizing; emollient; anti-inflammatory; anti-itching[39,40]
Mustard	*Brassica oleracea*	Glucosinolates, vitamins, phenols, and flavonoids[42]	Skin whitener	Dry and brittle hair; anti-dandruff; fall arrest[41]

(Continues)

TABLE 1 (Continued)

Common name	Scientific name	Main phytocomponents	Cosmetic properties reported in *De ornatum mulierum*	Functional properties reported in the current scientific literature
Onion	*Allium cepa*	Organosulfur compounds, flavonols, ascorbic acids, and carbohydrate prebiotics[42]	Exfoliating	Anti-inflammatory, exfoliating; healing: antifungal; antibacterial[43]
Rose (oil, water)	*Rosaceae Sp.*	Phenolic compounds, such as phenolic acids, flavonoids or tannins[44]	Skin and lip care	Anti-inflammatory; antioxidant; antiaging[44]
Rose gall	*Rosa canina*	Flavonoids, triterpenes, tannins, phenolic acids, polysaccharide, fatty acids, organic acids, carotenoids and vitamins[45]	Face antiaging	Antioxidant, anti-inflammator Astringent[46]
Sappanwood	*Caesalpinia sappan*	Brazilein[47]	Hair dyeing; reddening of the face and lips	Natural dye[48]
Scilla	*Scilla Urginea maritima*	Cardiac glycoside (proscillaridin A)[49]	Postpartum acne	Cardiotonic (toxic)[49]
Sweet almond	*Prunus Amygdalus Dulcis*	Mono- and polyunsaturated fatty acids[50]	Skin care	Emollient; nourishing; antiaging; soothing; anti-stretch marks; hair care[50,51]
Vinegar	*Vitis vinifera*	Carbohydrates[52]	Hair care and coloring; scabies; face, lip and gum care	Scalp psoriasis; hair care; face exfoliator[53]
Violet (oil)	*Viola Sp.*	Flavonoids, carotenoids, anthocyano-sides, salicylates, polysaccharides[54]	Face care; sunburn	Antiaging; anti-inflammatory; acne; eczema; herpes; psoriasis[55,56]
Viticella	*Clematis viticella*	Triterpenes, flavonoids, lignans, coumarins, alkaloids, volatile oils, steroids, organic acids, macrocyclic compounds, polyphenols[57]	Skin whitener ulcerations	(Toxic)[57]
White lupin	*Lupinus albus*	Phenolic acids, flavones and isoflavones, phytosterol, tocopherol[58]	Hair scabies; face care	Wrinkle; antioxidant[58]
Wine	*Vitis vinifera*	Flavonoids. polyphenols, anthocyanin, stilbene derivatives[59]	Skin and hair care; mouthwash	Antioxidant; antiaging[60,61]
nutmeg	*Myristica fragrans*	Lignans, neolignans, diphenylalkanes, phenylpropanoids, terpenoids, alkanes, fatty acids, fatty acid esters, and a few minor constituents such as steroids, saponins, triterpenoids, and favonoids[62]	Skin and hair care	Antiseptic; tonic; antioxidant; strong and shiny hair; oily skin[62,63]
clove	*Eugenia caryophyllata*	phenolic and flavonoid derivatives[64]	Skin and hair care	Antiseptic; antioxidant[64,65]
Chios mastic	*Pistacia lentiscus L.*	Terpenes, phenolic compounds, phytosterols, arabino-galactanes proteins, natural polymers, and volatile and aromatic ingredients[66]	Skin care; hair removal; scabies; cheilitis; to restore virginity	Oily skin; enlarged pores; acne[67]
Starch	–	Polysaccharides[68]	Face care; cheilitis; scabies	Refreshing; soothing; antiperspirant[68]
Brasiletto	*Caesalpinia sappan*	Neoflavonoid compounds (Brazilin)[69,70]	Hair dyeing; redness of face and lips	Natural dye[69,70]

TABLE 2 Minerals, animal, and mixed derivatives—A comparison between medieval and current use

Common name	Scientific name	Medieval use	Modern use
Alum	Aluminum sulphate and potassium dodecahydrate	Hair dye; face makeup; to restore virginity	Deodorant; antibacterial
Animal fat (chicken, hen, pork…)	–	Face care ointment	Cleansing
Borax	Sodium borate	Skin care	Emulsifier; detergent; exfoliating
Bran		Skin and hair care; scabies	Calming; soothing
Bread crumbs	–	Face exfoliator	–
Crystals	Quartz	Face care	Soft focus anti-wrinkle
Egg white	–	Skin care	Astringent, lightening, smoothing
Egg yolk	–	Lightening and strengthening hair	Nourishing for damaged hair
Gallic soap	Mixture of tallow (animal fat) and ash	Cleansing	–
Honey	–	Lightening hair and face; skin and lip care; fistulas; abscesses	Moisturizing; emollient; tonic; nourishing; smoothing
Lead white	Basic lead carbonate	Face lightening	(Toxic)
Tartar	Tartaric acid	Exfoliating; abscesses	Keratolytic; lightening; antioxidant; antiaging
Wax		Hair removal; nourishing ointment; face makeup	Cosmetic products

By reading Trotula's texts and analyzing the data on the basis of current scientific knowledge (Tables 1–3),[12–70,72] it is possible to clearly grasp the medieval aesthetic trends and it can be clearly seen how many of the aesthetic defects that afflicted women of that time are equally felt today.[73–75] The facial treatment, together with that of the hair, is essential for the *mulieres salernitanae*. Trotula's beauty tips for the face are surprisingly current and resemble the modern "skincare routine," as they involve a pre-treatment, consisting of thorough washing together with what we can define a modern peeling and a simple exfoliating mask before the application of specific functional treatments.[76,77] The evolution of concepts, practices, ingredients, and methodologies in use in the aesthetic field from the Middle Ages to today, allow us to underline similarities and differences (Table 3). Indeed, the specific recipes for facial treatment confirm the study and interest in aesthetic problems and "cosmetic" products by the Salerno Medical School. The original cosmetic science of Trotula shares with modern cosmetology, even in the case of the treatments proposed for the face, the goal of seeking to improve one's appearance, making us perceive the existence of a canon of beauty of the time, but also to preserve skin health or cure various skin diseases, with a focus on prevention, a key and modern concept of Salerno practical medicine. This need is met with a wide application of herbs, minerals, and animal fats, used as raw materials to formulate cosmetics that we would currently define as "functional".

The advancements in the scientific knowledge in pharmacognosy, phytochemistry, and biology allow us to explain the effects on the skin and, more generally, the "health" effects of the traditional products and ingredients mentioned by Trotula in her text. The recipes for cleansing, lightening, moisturizing, and softening the skin of the face are quite simple in composition, involve the use of a few classes of cosmetic ingredients, mainly including animal fats used to lubricate, soften, or as lipid components of ointments and creams (Table 3). Interesting is the attention paid to plants, their derivatives, and extracts with an irritating action for the skin and mucous membranes which, if used in the right proportions, have a keratolytic action by operating the peeling that stimulates cell turnover or have a lightening or softening/refreshing action (Table 1). The recipes contain essential oils plentifully employed to perfume the cosmetic product. Many components of mineral origin are used by medieval women both for their mechanical properties as smoothing in scrub bases, as well as for their chemical–physical whitening/ lightening action. The suggested cosmetic preparations are mostly ointments, based on animal fats (Table 2). Only in some cases, in fact, hydrophilic ointments or simple emulsions are described. This observation helps us to understand how medieval cosmetics were much more "fatty" than modern ones. In the 21st century, facial treatments appear, for the most part, as light emulsions (creams, milks, serums), certainly more pleasant to apply and with greater sebum-similarity and orthodermy. The medieval fat-based products (ointments), being occluding and "non-absorbable" by the skin, allowed to ensure a long contact time between the skin and the active ingredients, but required the elimination of the excess applied by subsequent washing. Trotula herself in her recipes suggests their use at night for convenience and their remotion in the morning. As can be seen from the analysis of some of the recipes reported below, it is particularly interesting to note that Trotula proposes different recipes for the same cosmetic purpose (like cleansing, whitening, and exfoliating) (Table 3). This demonstrates her attention in proposing recipes that are truly accessible to all women, taking into consideration the technical difficulty of the preparation, the cost of the ingredients and

TABLE 3 Overview of Trotula formulations for the skin face and their correspondence in modern cosmetics

Recipe number	Formulation type	Ingredients	Preparation procedure	Trotula recommendations of application	Medieval use	Corresponding current cosmetic product
1	Oil	Tartar, vinegar, oil	Soaking the tartar in vinegar and heating until carbonization. The residue is then soaked in oil for 3–4 nights in the air, and the oil is recovered from suitably inclined iron containers	Applying the oil for at least 7 consecutive nights. A particularly dry skin may require prolonged treatment for up to 15 days	Softening, lightening and smoothing action	Oil for dry skin
2	Mask	Rosin, wax, Ferula essential oil. Additional resins: incense, chios mastic, gum arabic	Take rosin and wax and melt in a jar. After having dissolved them well, add a drop of galbanum to them, cook for a long time, stirring with a spatula. Likewise, take some mastic, incense, and gum arabic, and mix with the rest	Apply the cooled mask on the face skin and remove one hour after application	Exfoliating and depilatory facial skin treatment before applying moisturizing, nourishing and re-lipidizing treatment	Paste or cream for gommage
3	Ointment *"ceroton"*	Hen fat, violet or rose oil, bleached wax, egg white, white lead powder, camphor, nutmeg, cloves	Melt the fat and powders in an earthenware container, and filter. Add camphor, nutmeg, and 3–4 cloves to the filtrate. The final preparation is wrapped in paper	Apply the wax on the face only when it is impregnated with the perfume of the essences. Apply later tonic/astringent treatment with cotton soaked in rose water with alum and Sappanwood filing	Nourishing treatment	Make-up remover and tonic cream
4	Ointment	Hen fat, crystals, juniper gum, rosehip galls, borax, sodium tetraborate decahydrate—tragacanth, camphor, lead white, and almonds	Mix all the powders with hen fat	Apply to well-washed facial skin	Lifting and nourishing ointment	Lifting and nourishing night cream (W/O emulsion)
5	Ointment	Cyclamen juice, viticella, bistorta, arum, rose water, spices (ginger, frankincense, white or wild mustard, cumin), wax, and honey	Mix these powders and add the juice of each in the quantity of one goose egg or one half. Then take a little white lead washed with water in the sun, and add rose water heated to the substances, and let it boil a little over low heat, and halfway through cooking, add ground ginger, incense, white mustard or wild, cumin in equal quantities. Mix it all with wax and honey	Apply on the face after a steam bath, in the evening before going to bed	To whiten and refine the skin	Repairing night serum
6	Powder	Breadcrumbs, bean powder, lupin flour	Chop the ingredients	Use in the morning after applying ointment the night before	Face deep exfoliator	Scrub

TABLE 3 (Continued)

Recipe number	Formulation type	Ingredients	Preparation procedure	Trotula recommendations of application	Medieval use	Corresponding current cosmetic product
7	Ointment	Deer fat, juniper gum powder, crystals	Boil deer fat in water. Then pour it into other water and, once poured, mix for a long time with your hands, and then add crystal powder and juniper gum.	Apply on the face	For the roughness of the face caused by sun and wind or skin lightener	Anti-wrinkle, skin repairer cream/ paste
8	Ointment	Whole eggs, vinegard, white mustard, ginger	Whole eggs are put in very strong vinegar and left in it until the shell becomes like the inner, and then add white mustard and four ounces of ginger, and grind together.	Apply to the face frequently	Skin lightener	Lightening cleansing mousse
9	Ointment	Lilly root	Vigorously grind the lily root, first washed and cleaned until it turns white. Then, when the woman goes to the baths, mix one or two eggs with the ground roots and let them rest.	Apply during a bath, wash well	Skin lightener	Lightening cleansing mousse
10	Ointment	Bistorta, marshmallow, bryonia, honey, camphor, borax, double salt, lilly roots, rose water, pork fat	Grind bistorta or marshmallow (altea), or vigorously pound bryony, and then mix with white honey, and boil for two hours, and at the end of cooking, add camphor powder, borax, and rock salt, mixing for a long time with a spatula, and keep for use	Apply once a week, after doing a peeling with bran three days a week	Refine the skin of the face	Scrub
11	Ointment	Onion, scilla, and goat tallow	Onion or squill should be smeared on the face and then the skin will lift	After having the skin lifted, apply fresh goat fat to the face and then remove the lifted skin.	Deep peeling to remove abscesses	Peeling treatment
12	Powder	uill, incense, bistorta, and cuttlefish bone	Take some quill, incense, bistorta, and cuttlefish bone, prepare a powder in equal quantities	Apply it three times a week, after having washed your face well in bran water, and on Saturday wash your face well with egg white and starch, and leave it on your face for an hour, but wash it first with fresh water and spread it over	Deep peeling to remove abscesses	–

(Continues)

TABLE 3 (Continued)

Recipe number	Formulation type	Ingredients	Preparation procedure	Trotula recommendations of application	Medieval use	Corresponding current cosmetic product
13	Ointment	Elecampane, vinegar, incense, mastic, aloe, orpiment, cumin, quicksilver, cuttlefish bone, soap, fat, euphorbia root, q	Prepare this ointment. Take some well-shredded elecampane and cook it for a long time in vinegar. Then, crush it vigorously and mix it with a powder made with three ounces each of incense, mastic, litharge, aloe, orpiment, cumin, and quicksilver quenched with saliva, plus cuttlefish bone, soap and fat. Prepare everything with vinegar, in which the euphorbia root has been cooked	Take a little bit of quill and pound vigorously and rub on the affected area for a long time. Then, take some bran and leave it to infuse in boiling water, and wash the affected area with it, and then dry it, and	Deep peeling to remove abscesses	–
14	Ointment		Take home lily roots, peeled and cooked in water, and crush them vigorously. Then take an ounce of mastic powder and one of incense, two scruples of camphor and two of white lead, pork fat with which it should be prepared, and similarly prepare it with rose water, and keep it for use. Clean the lily root and cook it in water, after having cooked it, crush it vigorously, and pour over fat dissolved on the fire and desalted and mixed. Then pour the aforementioned powder into rose water	In the evening, the woman should anoint herself in front of the fire in such a way that in the morning they are cured.	Against sun burns and chapping of the lips and all types of facial pustules and for bruises and their prevention	Lip balm, protective ointment

their availability according to the seasons, so that every woman can choose the cosmetic that best suits her needs and possibilities.

On the following, we report a short commentary on some of the recipes contained in the chapter of *De Ornatu Mulierum* devoted to face skin care "De ornatu faciei" (On women's face cosmetics).

The description of the ingredients, procedures, method of applications on skin, and mucous membranes emphasizes the attention of Trotula to the women, their need in improving face look, evidencing the Medieval canon of reference for beauty and well-being as well as the extraordinary combination of tradition and modernity of the Trotula work.

3 | FACE WASHING, SOFTENING, LIGHTENING TREATMENTS

In the chapter dedicated to face skin care, the first recipe begins by prescribing face washing with hot water and natural handcrafted soaps, such as "Marseille soap," followed by a light bran-based peeling together with a first steam bath, to facilitate the opening of the pores that are present on the skin surface. As it is easy to guess, Trotula suggests a more than modern facial cleansing, to pre-treat, wash, eliminate impurities from the face and prepare the skin to receive subsequent specific treatments. One of the pre-treatments proposed by Trotula is based on tartar oil which has a softening, lightening, and smoothing action (Table 3, recipe 1). The tartar oil, cited by *De Ornatu mulierum*, is not a simple saturated solution of potassium carbonate (which is prepared by putting the potassium carbonate in a humid place, in an iron dish, for a few days), but a more complex product obtained by soaking the tartar in vinegar and heating until carbonization. The residue is then soaked in oil for 3–4 nights in the air, and the oil is recovered from suitably inclined iron containers. Trotula recommends applying tartar oil at night for its greasiness, for at least 7 consecutive nights, in relation to the type of skin; a particularly dry skin may require prolonged treatment for up to 15 days. During the day, in the period of night treatment with tartar oil, the skin should be washed with water and starch, which acts as a sprinkling and adsorbent/lightening powder. To prepare the starch, fresh barley grains are left to rot in three parts of water and ground in a mortar. The resulting slurry is crushed, and then, the water is left to evaporate in the sun in order to obtain a dry product that can be stored for subsequent applications. A second steam bath prepares for the last keratolytic and desquamating pre-treatment, that is at the same time depilatory, for the removal of the superficial and thickened stratum corneum. Moreover, Trotula reports a recipe of what we could today define a "gommage" (Table 3, recipe 2), based on rosin and wax melted in an earthenware container. Another ingredient of the gommage is the essential oil of galbanum (*Ferula galbaniflua*) that is characterized by an acute, fresh, decisive, strong, euphoric, purifying, and calming aroma and has analgesic, anti-inflammatory, antimicrobial, and antiseptic properties. Ferula is indeed currently used in aromatherapy for the treatment of acne, boils, inflammation, and circulatory problems.[78] To the base made by rosin and wax, must be added resins, incense, Chios mastic, and gum Arabic, which perform the functions of modern thickeners/rheological additives and emulsifiers. The mask thus prepared is applied warm and is removed one hour after application. The "peeled" face skin, with the thinned stratum corneum, is thus ready to receive moisturizing, nourishing, re-lipidizing functional treatments.

4 | WHITENING, NOURISHING, AND ANTI-AGING TREATMENTS

Whitening the skin of the face seems essential to respond to one of the beauty standards of medieval Salerno women, for which Trotula also suggests some simpler remedies to prepare. In the recipe entitled "In the same way to make abscesses disappear after childbirth" (Table 3, recipe 11), it is advisable to treat the skin of the face with onion or squill, to "lift" the skin (currently we would say for a deep peeling), followed by an application of fresh goat fat. Onion is still today considered an anti-aging remedy because it contains a phytocomplex rich in water, polysaccharides, sulfuric derivatives (alliin), proteins, flavonoids, B vitamins, vitamin C, together with anti-inflammatory prostaglandins.[79] The irritating effects, thanks to modern phytochemical studies, are attributed to the sulfuric active ingredients in onion and squill. The squill referred to by Trotula with the term "squilla" could be the *Scilla*, a bulbous plant of the *Asparagaceae* family, or the *Drimia maritima*, also known as the maritime onion, whose medicinal properties were already known to the ancient Egyptians, being mentioned in the Ebers papyrus and in Greco-Roman medicine.

In the recipe "A wax with which the face can be greased every day to lighten it", the procedure for obtaining a wax, called by Trotula "*ceroton*" (Table 3, recipe 3), based on hen fat, flavored with violet, or rose oil, bleached wax, egg white, and white lead powder is described in detail. The preparation requires that the fat and powders are melted in an earthenware container, filtered, and that camphor, nutmeg, and 3–4 cloves are added to the filtrate. The final preparation is wrapped in paper. It is necessary that the wax begins to diffuse the perfume by evaporation of the essences before its use. Trotula recommends applying later toning/astringent packs to the face with soaked cotton. The pack is prepared with brasiletto shavings, rose water, and alum (aluminum sulfate and potassium dodecahydrate) in an eggshell. Even if Trotula mentions white lead as an ingredient of different recipes, she also warns about its use, since even if it makes the face very white, like porcelain, skin becomes much more subject to sudden aging. White lead is a white mineral pigment, composed of basic lead carbonate, also called ceruse, London white, Crems white or silver.[80] The ancient preparation process involved putting lead in the vinegar for a few days: The crust that forms on the surface of the metal is white lead, which can be easily removed by scratching it. It was the only white pigment, or in any case the most used from ancient times up to the nineteenth century both in paints and cosmetics, despite its toxicity, thanks to its smooth texture and covering power. Only later, with the advent of Zinc White (1840) and Titanium White (1930), it gradually dropped into disuse.[80]

5 | LIFTING, LIGHTENING, SCRUB, AND GOMMAGE

The equivalent of a modern lifting and nourishing night cream (Table 3, recipe 4) of the water-in-oil emulsion type is described in the recipe "Ointment with which you can grease your face at any time" to be applied to well-washed facial skin. The ointment is based on chicken fat in which various powders (crystals, juniper gum, rosehip galls, borax—sodium tetraborate decahydrate—tragacanth, camphor, lead white) and almonds have been finely ground, thus acting by light scrub. The first step is to lighten the face with cyclamen juice (*Cyclamen hederifolium L*., Primulaceae), that is irritating to the skin and mucous membranes and toxic, due to the presence of saponins, in particular cyclamine.[34] Viticella (*Clematis viticella)* and bistorta (*Polygonum bistorta*), rich in tannins and proanthocyanidins with a protective antinflammatory action on the skin, capillaries, and varices, are added to the cyclamen juice.[81] This complex recipe also contains arum (*Arum italicum*, wild calla, Araceae), a toxic and mucous irritating plant, and refined honey, an ingredient frequently used in Trotula recipes for its moisturizing properties. This complex recipe is described in detail (Table 3, recipe 5). In fact, Trotula indicates the precise quantity equal to "a goose egg or half" (today we would say a walnut), the boiling procedure with rose water, and the flavoring after boiling with a series of spices and refreshing vegetable ingredients, such as ginger, frankincense, white or wild mustard, cumin (*Cuminum cyminum*) and, finally, wax and honey. Being very greasy, the ointment residue should be eliminated in the morning by using real scrubs made of breadcrumbs, bean powder, or lupine flour, which work like the natural abrasive microgranules used in modern scrubs to obtain a deeper exfoliation. Among contemporary beauty treatments, scrubs are very similar to gommage, because they are based on the exfoliating action of microgranules. It is the degree of intensity of the treatment that determines the difference, as the scrub exfoliates with greater delicacy having a moisturizing base, consisting of nourishing vegetable creams or oils. The peelings, on the contrary, are completely different, since they are based on the chemical action of substances, such as alpha and beta-hydroxy acids, including glycolic acid, in accelerating the process of natural cell renewal of the skin, thus generating younger and vital cells. The level of penetration of the treatment depends on the choice of the substance used in the chemical peeling, which can therefore be light, medium, or deep. Based on the specific ingredients used, Trotula recipes resemble, depending on the case, modern scrubs (breadcrumbs, bean powder, or lupine flour), gommage (rosin, wax, galbanum), or peelings (onion or squill), as described in the recipes above (Table 3, recipes 6, 10–13).

In the recipe "For the roughness of the face caused by sun and wind or to lighten and brighten the face" (Table 3, recipe 7), Trotula recommends the use of another animal fat, deer fat, that must be boiled in water, extracted, and added with juniper gum powder and crystals. In the recipe "To lighten the face" (Table 3, recipes 8–9), another product is described based on whole eggs in strong vinegar, white mustard, and ginger ground together, or lily root, washed, cleaned, and ground together with an egg or two. This last remedy is to be applied during a bath and to be eliminated by washing.

A decoction of ground bistorta (*Bistorta officinalis*) or marshmallow (*Althaea officinalis*) with bryonia and honey (moisturizing ingredient) brought to a boil for two hours with the addition of camphor, borax and double salt, lily roots boiled in water and fresh pork fat in rose water are an essential remedy to "Refine the skin of the face" (Table 3, recipe 10). Trotula's advice is to apply the ointments once a week, after doing a light peeling with bran, three days a week.

Marshmallow, animal fats, resins such as Chios mastic and incense, and egg yolk are repeatedly recommended in the recipes for facial skin reported in *De Ornatu Mulierum*. The knowledge and experience of the Salerno Medical School allow mallow to be recognized for its emollient, softening, anti-inflammatory, soothing properties for the skin and hair; as well as animal fats (hen, pork, goat, deer) boiled in wine or vinegar, are known for the emollient and lubricating properties capable of protecting skin and hair, and for their basic function for ointments and creams.[39]

6 | CONCLUSIONS

The paradigms of cosmetology have changed a lot over the years in relation to the evolution of the concepts of beauty and well-being. Considering the history of the development of cosmetic products over time, it is possible to grasp a trend line for which the "product" responds to the canon of reference for beauty, well-being, and health, valid and accepted in a definite historical moment and a specific cultural and social context. The process that leads from the concept of a cosmetic to the final product, although modern in definition, represents a timeless *modus operandi* that realizes, in the proposed product, the aesthetic ideal that is characteristic of each era, starting from the substrate of scientific and technological knowledge and their evolution over time.

In ancient times, knowledge of plants, minerals and animals prevailed, and cosmetic science is based on their wise use. From the twentieth century, with advances in the field of biomedical, technological-pharmaceutical, marketing and communication disciplines, cosmetics take on a new dimension, while maintaining a continuity with the past that lies in the use, still today, of many of those natural ingredients, which were already empirically well known to the ancients. The concept of a cosmetic product, which evolves over time, is therefore also greatly influenced by the customs, trends, and social behaviors prevailing in a historical moment.

Data inferable from the examination of Trotula's text, their analysis and interpretation on the basis of the current scientific knowledge, and most relevant literature give evidence that support the direct line from Trotula's cosmetology to the modern one. Though apparently so different, they lie in the aspiration to search for natural formulas, in the effect and in the components and lives in the use of ingredients of natural and biological/organic origin. The discovery or rediscovery of such ingredients, that we are witnessing in our times, is strongly linked to the search for sustainability, the

attention in safeguarding the environment and to the impact on the environment of products and processes. But above all, Trotula's cosmetics and modern cosmetics seem to share a holistic vision since both don't only look at the "product" and the "remedy" separated from the person to whom it is addressed. They have in common the attention to the balance and harmony of the individual, in the "man / woman-product-environment" interaction. Sustainable solutions and products, environmental protection, cost optimization with respect to performance are the drivers of cosmetology of the third millennium which, like Trotula's cosmetology, is at the service of the person, aims to contribute to accompanying and slowing down the normal and physiological aging, wants to cooperate in well-being, using the help that comes from the plant world and the ecosystem in general.

AUTHOR CONTRIBUTIONS

Simona Pisanti, Teresa Mencherini, Tiziana Esposito, Maurizio Bifulco, and Rita P. Aquino conducted the research; Simona Pisanti and Maurizio Bifulco studied primary historical source materials; Simona Pisanti, Teresa Mencherini, Tiziana Esposito, Maurizio Bifulco, and Rita P. Aquino analyzed the data; Simona Pisanti, Teresa Mencherini, Tiziana Esposito, Valeria D'Amato, Tania Re, and Rita P. Aquino wrote the initial draft; Simona Pisanti, Teresa Mencherini, Tiziana Esposito, Maurizio Bifulco, and Rita P. Aquino wrote the final paper. All authors have read and approved the final manuscript.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The authors declare human ethics approval was not needed for this study.

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