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A Green Tea Containing Skincare System Improves Skin Health and Beauty in Adults: An Exploratory Controlled Clinical Study

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Abstract: Skin dryness, fine lines and wrinkles, red spots, red vasculature, and porphyrin count are common indicators of skin health and beauty. The skincare system in this study contains scientifically validated ingredients such as fermented green tea (*Camellia sinensis*) water, niacinamide, antioxidants, and a variety of natural plant extracts. The purpose of this study was to evaluate the effectiveness of this skincare system in improving facial-skin health and beauty. Twenty-six healthy adults, both female and male, aged 18–54 and of all skin types and tones, were included in the study and participated as either the active or the control group (competitor product) using designated topical products for 30 days. Skin moisture, fine lines and wrinkles, porphyrin count, red spots, and red vasculature count were measured through high-quality photography, Visia® complexion analysis, FitSkin® skin analysis, and survey questions on day 0, day 8, and day 30. Significant improvements were observed in facial moisture, red-spot count, red vasculature count, and porphyrin count on day 30 in comparison with the control group. Non-significant improvements were observed in pores, skin texture, and wrinkles. With extensive well-documented functional ingredients, the studied skincare system used daily may significantly improve key areas of skin health and beauty.

Keywords: green tea; skin health; skin beauty; hydration; wrinkles; porphyrins; red spots; red vasculature

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1. Introduction

Skin is often the first physical layer of protection for the human body; it functions as the first line of immune defense and is an effective barrier against many chemical and physical threats [1]. Healthy skin can be promoted and maintained through a variety of methods such as adequate hydration, vitamin supplementation [2], topical cosmetics [3], skin microbiome [4], healthy non-burning sun exposure [5], and protection from excessive sun exposure. Skincare products are generally intended for application on the skin to improve skin health and function beyond skin appearance. Ever since the COVID-19 pandemic, public awareness of and demand for skincare products have increased, but decreased for makeup products [6]. Such a phenomenon was mostly led by change of lifestyle—many jobs now are not required to be performed in the office, and instead, have shifted to work-from-home permanently, which has made people become more mindful about their skin health and function instead of simply skin appearance [7].

Along with the constantly rising demand for skincare products, there is concern in the industry about certain chemicals, such as heavy metals, contained within some cosmetics products that could be considered harmful or may be associated with increased risks for disease [8,9]. Therefore, ingredients included in cosmetics have shifted to becoming safer and more focused on consumers' skin health. Antioxidants are some of these highlighted ingredients due to their health-promoting potential and ability to function as effective stabilizers [10,11]; some of these antioxidants include niacinamide and other essential vitamins [12]. Some botanicals, such as green tea (*Camellia sinensis)*, and their active compounds also possess strong antioxidant activity, and therefore have been implemented in many skincare formulations [13].

Various measurements are often used to determine the effectiveness of a skincare product, including the number of fine lines and wrinkles, red spots, skin moisture content, red vasculature, and porphyrin skin concentration. Porphyrins are compounds and pigments that can be produced by certain skin bacteria, specifically *Cutibacterium acnes* [14], which plays an important role in the development of acnes vulgaris [15], which affects up to 50 million people in the American population annually [16]. The presence of porphyrins in the skin can be detected by fluorescence surveillance because of its ability to absorb UV light up to 400 nm, which can help determine the risk of skin acne [17]. It is already known that *P. acnes* populate in areas where the sebaceous glands are abundant [18,19]; in other words, individuals who have oily skin may have a higher concentration of *P. acnes*, resulting in higher porphyrin levels [20,21]. Thus, certain skincare products target the control of sebum production to control acne.

The äKwä six-step skincare system comprises various skincare products intended to be applied both morning and night. Some of the notable ingredients included in the product formulas are fermented green-tea water, other ferments, niacinamide, antioxidants, and a variety of natural plant extracts. The purpose of the study was to evaluate the effectiveness of the äKwä six-step skincare system by measuring skin moisture level, fine lines and wrinkles, porphyrin count, red spots, and red vasculature count over a 30-day period.

2. Materials and Methods

2.1. Skincare Product

The skincare-product system used in this treatment group was the äKwä 6-step skincare system from 4Life Research USA, LLC. (https://www.4life.com/6613461/page/äKwä, accessed on 22 June 2022), and the products used in the control group were participants' own routine topical products. The product directions indicate to use the following products morning and night in sequential order: First Wave Oil-to-Foam Cleanser, Glacier Glow Four-Way Toner, Precious Pool Vitamin Essence, Ripple Refine Eye Cream, and RainBurst Moisture Cream. After application in the morning, Neutrogena sunscreen (Sheer Zinc Face SPF 50) was also applied. A Royal Bath sheet mask was used every Tuesday during the study following the application of the Precious Pool Vitamin Essence. The contents for each product, listed on a weight-percentage basis, were as follows:

First Wave Oil-to-Foam Cleanser: water, glycerin, dipropylene glycol, coco-betaine, coco-glucoside, acrylates copolymer, polyglyceryl-10 laurate, sodium methyl cocoyl taurate, 1,2-hexanediol, *Camellia sinensis* leaf water, sea water, rice ferment filtrate (sake), *Cucurbita pepo* (pumpkin) fruit extract, Saccharomyces ferment, bioflavonoids, *Brassica oleracea italica* (broccoli) extract, *Aloe barbadensis* leaf extract, *Helianthus annuus* (sunflower) seed oil, *Olea europaea* (olive) fruit oil, *Geranium maculatum* oil, *Citrus aurantium bergamia* (bergamot) fruit oil, *Cymbopogon martini* oil, *Lavandula angustifolia* (lavender) oil, *Citrus junos* fruit extract, *Pinus densiflora* leaf extract, *Anthemis nobilis* flower oil, *Artemisia annua* extract, *Citrus aurantium dulcis* (orange) peel oil, ethylhexylglycerin, potassium cocoyl glycinate, sodium chloride, tromethamine, potassium cocoate, propanediol, caprylic/capric triglyceride, disodium EDTA, sodium lauryl glycol carboxylate, caprylyl glycol, and butylene glycol.

Glacier Glow Four-Way Toner: *Camellia sinensis* leaf water, isopentyldiol, glycerin, butylene glycol, 1,2-hexanediol, niacinamide, water, *Saccharomyces* ferment, *Rosa damascena* flower water, adenosine, *Undaria pinnatifida* extract, *Laminaria japonica* extract, *Hizikia fusiforme* extract, *Centella asiatica* extract, *Glycyrrhiza glabra* (licorice) root extract, *Camellia sinensis* leaf extract, *Rosmarinus officinalis* (rosemary) leaf extract, *Chamomilla recutita* (matricaria) flower extract, *Scutellaria baicalensis* root extract, *Polygonum cuspidatum* root extract, *Camellia japonica* flower extract, *Andrographis paniculate* extract, *Morus nigra* fruit extract, allantoin, *Citrus unshiu* peel extract, ethylhexylglycerin, propanediol, betaine, and disodium EDTA.

Precious Pool Vitamin Essence: *Camellia sinensis* leaf water, isopentyldiol, butyleneglycol, dipropylene glycol, cetyl ethylhexanoate, methyl gluceth-20, niacinamide, 1,2-hexanediol, polyglyceryl-3 distearate, octyldodecanol, water, *Saccharomyces* ferment, adenosine, ascor-

byl glucoside, *Saccharomyces* lysate extract, *Acer saccharum* (sugar maple) extract, *Centella asiatica* extract, *Glycyrrhiza glabra* (licorice) root extract, *Scutellaria baicalensis* root extract, *Rosmarinus officinalis* (rosemary) leaf extract, *Camellia sinensis* leaf extract, *Camellia japonica* flower extract, arginine, allantoin, panthenol, *Citrus unshiu* peel extract, *Morus nigra* fruit extract, *Cymbopogon martini* oil, *Lavandula angustifolia* (lavender) oil, *Anthemis nobilis* flower oil, *Chamomilla recutita* (matricaria) flower extract, *Geranium maculatum* oil, *Polygonum cuspidatum* root extract, *Andrographis paniculata* extract, *Citrus aurantium* bergamia (bergamot) fruit oil, *Citrusaurantium dulcis* (orange) peel oil, betaine, ethylhexylglycerin, glyceryl stearate citrate, carbomer, propanediol, and caprylyl glycol.

Royal Bath Sheet Mask: water, glycerin, butylene glycol, niacinamide, *Lactobacillus*/milk ferment filtrate, adenosine, hyaluronic acid, sodium hyaluronate, sodium hyaluronate crosspolymer, hydrolyzed hyaluronic acid, hydrolyzed sodium hyaluronate, colostrum, dried egg yolk, *Camellia sinensis* leaf extract, *Glycyrrhiza glabra* (licorice) root extract, dipotassium glycyrrhizate, panthenol, *Zingiber officinale* (ginger) root extract, *Coptis chinensis* root extract, allantoin, arginine, *Citrus limon* (lemon) fruit extract, *Citrus nobilis* (mandarin orange) oil, *Eucalyptus globulus* leaf oil, *Geranium maculatum* oil, *Lavandula angustifolia* (lavender) oil, *Pinus palustris* oil, trehalose, ethylhexylglycerin, carbomer, hydroxyethylcellulose, 1,2-hexanediol, disodium EDTA, PEG-60 hydrogenated castor oil, and pentylene glycol.

Ripple Refine Eye Cream: *Camellia sinensis* leaf water, glycerin, butylene glycol, hydrogenated polydecene, caprylic/capric triglyceride, polyglyceryl-3 distearate, 1, 2-hexanediol, cetearyl alcohol, niacinamide, *Olea europaea* (olive) fruit oil, water, *Butyrospermum parkii* (shea) butter, *Tremella fuciformis* (mushroom) extract, sodium hyaluronate, *Saccharomyces* ferment, ascorbyl glucoside, adenosine, *Cucumis sativus* (cucumber) extract, *Bambusa arundinacea* juice, *Centella asiatica* extract, *Camellia sinensis* leaf extract, *Anthemis nobilis* flower oil, *Polygonum cuspidatum* root extract, *Glycyrrhiza glabra* (licorice) root extract, *Rosmarinus officinalis* (rosemary) leaf extract, *Scutellaria baicalensis* root extract, *Camellia japonica* flower extract, *Morus nigra* fruit extract, *Citrus unshiu* peel extract, *Lavandula angustifolia* (lavender) oil, *Andrographis paniculate* extract, *Citrus aurantium bergamia* (bergamot) fruit oil, *Geranium maculatum* oil, *Citrus aurantium dulcis* (orange) peel oil, *Cymbopogon martini* oil, *Chamomilla recutita* (matricaria) flower extract, betaine, glyceryl stearate, glyceryl stearate citrate, ethylhexylglycerin, sorbitan isostearate, disodium EDTA, propanediol, behenyl alcohol, polyglyceryl-3 methylglucose distearate, ammonium acryloyldimethyltaurate/VP copolymer, hydroxyethylacrylate/sodium acryloyldimethyl taurate copolymer, and caprylyl glycol.

RainBurst Moisture Cream: *Camellia sinensis* leaf water, water, butylene glycol, cetyl ethylhexanoate, octyldodecanol, glycerin, cetyl alcohol, phytosteryl isostearyl dimer dilinoleate, polyglyceryl-3 methylglucose distearate, *Simmondsia chinensis* (jojoba) seed oil, niacinamide, hydrogenated vegetable oil, beeswax, 1,2-hexanediol, *Panax ginseng* root extract, adenosine, *Centella asiatica* extract, sodium hyaluronate, *Saccharomyces* ferment, honey extract, *Andrographis paniculata* extract, *Betula platyphylla japonica* juice, *Scutellaria baicalensis* root extract, panthenol, *Polygonum cuspidatum* root extract, *Camellia sinensis* leaf extract, *Glycyrrhiza glabra* (licorice) root extract, *Rosmarinus officinalis* (rosemary) leaf extract, *Anthemis nobilis* flower oil, *Morus nigra* fruit extract, *Chamomilla recutita* (matricaria) flower extract, *Citrus unshiu* peel extract, *Citrus aurantium bergamia* (bergamot) fruit oil, *Lavandula angustifolia* (lavender) oil, *Camellia japonica* flower extract, *Cymbopogon martini* oil, *Geranium maculatum* oil, *Citrus aurantium dulcis* (orange) peel oil, hydroxyacetophenone, glyceryl stearate, caprylic/capric triglyceride, disodium EDTA, ethylhexylglycerin, microcrystalline wax, glyceryl stearate SE, ammonium acryloyldimethyltaurate/VP copolymer, propanediol, bis-diglyceryl polyacyladipate-2, caprylyl glycol, pentylene glycol, and dipropylene glycol.

2.2. Specific Usage Instructions Were as Follows

First Wave Oil-to-Foam Cleanser: Squeeze a dime-sized amount onto clean fingers and massage lightly over dry face, making sure to cover and loosen eye makeup. Add

water, lather up, and rinse with clean, room-temperature water. Pat dry. Use both AM and PM daily.

Glacier Glow Four-Way Toner: Saturate a cotton pad with toner. Lightly wipe across face, neck, and closed eyes to remove any residual oil or makeup. Lightly pat dry until absorbed. Use both AM and PM daily.

Precious Pool Vitamin Essence: Dispense a drop-sized amount onto fingertips and gently sweep over face, neck, and around delicate eye area. Lightly pat into skin until completely absorbed. Use both AM and PM daily.

Royal Bath Sheet Mask: After Cleanser, Toner and Essence, remove a premoistened mask from the packaging. Gently lay it across the face to fit. Press lightly so the mask comes in contact with the entire face. If possible, lie down and relax for 15–20 min, but can also be used while remaining active. Afterwards, remove the mask and tap or gently rub in any remaining moisture. Follow with the Eye Cream and the remaining steps. Use on Tuesdays only.

Ripple Refine Eye Cream: Dispense a drop-sized amount onto fingertips and lightly apply all around the delicate eye area, including eyelids and between the eyes. Lightly tap with fingertips to set. Use both AM and PM daily.

RainBurst Moisture Cream: Apply a dime-sized amount onto face, neck, and chest and allow to absorb. AM regimen: Follow with SPF 50 Day Moisturizer. PM regimen: Retire to a restful night's sleep.

Neutrogena Sunscreen (Sheer Zinc Face SPF 50): Apply a dime-sized amount evenly across face and neck to achieve uniform coverage. Follow with powder foundation and other color cosmetics as desired. Use AM as the last step of regimen before applying makeup.

2.3. Clinical Study Design

Prior to the 30-day study, all participants were required to pass through a four-day dry-out period. Following the dry-out period, all other skin products that were previously being used by participants were not allowed to be used during the study period. The treatment began thereafter, and results were measured on day 0, day 8, and day 30. Results from the study were compared to a control group using a competitor's products over the same study period.

2.4. Subjects

The study was reviewed and approved by an ethics committee before starting. Informed consent from all study subjects was obtained at the beginning of the study. The study is registered on ClinicalTrials.gov (NCT05476406).

Twenty-six (26) participants were recruited as volunteers from 4Life Research, LLC. (Sandy, UT, USA); 15 individuals were randomly assigned to the äKwä group (12 female and 3 male) and 11 (8 female and 3 male) were assigned to the control group. The participants' ages ranged from 18 to 54 years old (5 individuals were 18–24, 9 were 25–34, 6 were 35–44, and 6 were 45–54), and all skin types were included (according to the Fitzpatrick scale) in both groups as well as different skin tones (Hispanic, Asian, and Caucasian). Participants had a wide range of skin sensitivities.

2.5. Inclusion Criteria

Individuals could participate who were at least 18 years old and in self-assessed general good health.

2.6. Exclusion Criteria

Participants were excluded if they had allergies or contraindications to any ingredient of the products, had a history of any acute or chronic disease that could interfere with or increase the risk of study participation, or had had any medical procedures, such as laser resurfacing or plastic surgery on the test sites within the last 12 months (including Botox,

Restylyn, or other fillers). Participants could not have chronic skin allergies (dermatitis, eczema, psoriasis), have been treated for skin cancer within the last 12 months, or have damaged skin near the facial area (e.g., sunburn, tattoos, scars, or other disfigurations). Participants were not allowed to participate if they were pregnant or planning to become pregnant in the following 12 weeks, or lactating.

2.7. Usage Schedule

Morning:

1. First Wave Oil-to-Foam Cleanser
2. Glacier Glow Four-Way Toner
3. Precious Pool Vitamin Essence
4. Ripple Refine Eye Cream
5. RainBurst Moisture Cream
6. Neutrogena Sunscreen

Night:

1. First Wave Oil-to-Foam Cleanser
2. Glacier Glow Four-Way Toner
3. Precious Pool Vitamin Essence
4. Ripple Refine Eye Cream
5. RainBurst Moisture Cream
6. The Royal Sheet Mask was worn every Tuesday.

2.8. Assessments

The specific markers that were measured during the study were skin moisture, fine lines and wrinkles, porphyrin count, red spots, and red vasculature count.

2.8.1. VISIA® Complexion Analysis

VISIA complexion analysis (Model VISIA-6) was used to quantify brown and red skin spots, wrinkles, pore visibility, red-area vasculature count, and UV spots. Skin porphyrin presence was measured with UV-fluorescence imaging. A decrease in the score of any of these markers was considered skin improvement.

2.8.2. Neutrogena Skin360® Skin Care Analysis

Skin moisture was measured using the Neutrogena Skin360® smartphone application powered by FitSkin®. The application utilizes an extensive database of humans of various genders, ages, and ethnicities as a comparative measurement when scanning the image pixels from the facial scan. Fine lines and pores were also measured.

2.8.3. Professional Photography

Facial photographs of all participants were taken at the three measurement time points of the study for the purpose of comparing noticeable changes in skin appearance.

2.9. Statistical Analysis

A t-test was performed to compare the differences between day 0, day 8, and day 30 for the äKwä group, and between the äKwä group and the control group on day 30. A $p \leq 0.05$ was considered statistically significant.

3. Results

Several significant differences in skin health were found among the study participants. The results are summarized in Tables 1–3. Participants in the äKwä group showed a significant improvement in skin-moisture level from day 8 ($p = 0.035$) compared to day 0. Interestingly, though there was no statistical difference between day 30 and day 0 ($p = 0.154$), 66.7% of participants showed an improvement in skin moisture on day 30.

Table 1. Facial-skin parameters for the äKwä group on day 0 and day 8.

	Day 0 Baseline äKwä	Day 8 äKwä	*p*-Value
FitSkin Moisture	**59.47 ± 8.86**	**66.07 ± 12.8**	**0.035 ***
Red-spot count	71.47 ± 26.35	74.67 ± 29.17	0.418
Red-spot score	42.87 ± 30.36	54.53 ± 30.82	0.053
Red vasculature count	**89.2 ± 42.03**	**77.47 ± 37.38**	**0.034 ***
Wrinkle score	51.73 ± 29.1	42.53 ± 22.55	0.108
Wrinkle count	17.67 ± 7.94	18.27 ± 9.46	0.757
Porphyrin count	**1457.13 ± 1106.98**	**734.33 ± 700.73**	**0.037 ***
Porphyrin score	28.4 ± 28.56	58.8 ± 37.54	0.01 *
FitSkin lines	72.67 ± 12.3	83.2 ± 7.94	0.003 *
Pore count	827.47 ± 304.09	777.93 ± 328.29	0.34
Pore score	27.53 ± 30.48	30.13 ± 32.4	0.501
FitSkin pores	**80.4 ± 9.36**	**70.27 ± 16.89**	**0.005 ***
Texture count	748.53 ± 460.91	710 ± 470.6	0.583
Texture score	62.00 ± 36.64	65.53 ± 32.77	0.609
UV-spot count	265.4 ± 71.25	225.33 ± 108.73	0.064
UV-spot score	21.73 ± 15.56	36.33 ± 26.09	0.045 *
Brown-spot count	297.27 ± 48.56	294.8 ± 54.11	0.944
Brown-spot score	32.20 ± 18.57	39.27 ± 22.17	0.126

* Indicates significant differences were found ($p \leq 0.05$); bolded text indicates significantly positive improvements.

Table 2. Facial-skin parameters for the äKwä group on day 0 baseline and day 30.

	Day 0 Baseline äKwä	Day 30 äKwä	*p*-Value
FitSkin moisture	59.47 ± 8.86	65.4 ± 16.2	0.154
Red-spot count	71.47 ± 26.35	64 ± 26.98	0.069
Red-spot score	42.87 ± 30.36	55.93 ± 27.14	0.087
Red vasculature count	**89.2 ± 42.03**	**68.13 ± 33.3**	**0.007 ***
Wrinkle score	51.73 ± 29.1	41.87 ± 19.04	0.063
Wrinkle count	17.67 ± 7.94	17.13 ± 8.15	0.798
Porphyrin count	**1457.13 ± 1106.98**	**706.8 ± 604.01**	**0.014 ***
Porphyrin score	28.4 ± 28.56	55.8 ± 35.93	0.008 *
FitSkin lines	72.67 ± 12.3	78.53 ± 9.51	0.039 *
Pore count	827.47 ± 304.09	748.87 ± 276.48	0.089
Pore score	27.53 ± 30.48	28.33 ± 27.29	0.905
FitSkin pores	**80.4 ± 9.36**	**74.47 ± 11.24**	**0.007 ***
Texture count	748.53 ± 460.91	677.07 ± 414.7	0.19
Texture score	62.00 ± 36.64	67.6 ± 30.75	0.348
UV-spot count	265.4 ± 71.25	221.93 ± 112.75	0.065
UV-spot score	21.73 ± 15.56	37.53 ± 28.2	0.04 *
Brown-spot count	297.27 ± 48.56	289.6 ± 52.5	0.607
Brown-spot score	32.20 ± 18.57	37.8 ± 24.87	0.292

* Indicates significant differences were found ($p \leq 0.05$); bolded text indicates significantly positive improvements.

Table 3. Facial-skin parameters for the äKwä group and the control group on day 30.

	Day 30 äKwä	Day 30 Control	*p*-Value
FitSkin moisture	65.4 ± 16.2	66.64 ± 23.31	0.874
Red-spot count	**64 ± 26.98**	**88.45 ± 33.33**	**0.0496**
Red-spot score	55.93 ± 27.14	27.45 ± 30.59	0.0194 *
Red vasculature count	**68.13 ± 33.3**	**109.36 ± 48.97**	**0.017 ***
Wrinkle score	41.87 ± 19.04	47 ± 28.37	0.585
Wrinkle count	17.13 ± 8.15	18.55 ± 7.46	0.655
Porphyrin count	**706.8 ± 604.01**	**1393.55 ± 832.14**	**0.022 ***
Porphyrin score	55.8 ± 35.93	27.27 ± 32.31	0.048 *
FitSkin lines	78.53 ± 9.51	79.64 ± 7.66	0.755
Pore count	748.87 ± 276.48	923.91 ± 428.08	0.217
Pore score	28.33 ± 27.29	22.82 ± 29.59	0.628
FitSkin pores	74.47 ± 11.24	76 ± 14.62	0.765
Texture count	677.07 ± 414.7	962.82 ± 384.13	0.086
Texture score	67.6 ± 30.75	44.27 ± 34.76	0.083
UV-spot count	221.93 ± 112.75	272.09 ± 66.36	0.201
UV-spot score	37.53 ± 28.2	25.45 ± 25.16	0.27
Brown-spot count	289.6 ± 52.5	323.64 ± 48.96	0.1061
Brown-spot score	37.8 ± 24.87	25.82 ± 11.15	0.15

* Indicates significant differences were found ($p \leq 0.05$); bolded text indicates significantly positive improvements.

The red-spot count was significantly reduced in the äKwä group on day 30 compared to that of the control group ($p = 0.0496$). However, the red-spot score in the äKwä group showed a significant increase compared to the control group over the same period ($p = 0.0194$), whereas no statistical differences were seen in comparison with day 0 ($p = 0.087$). The red vasculature count on day 8 in the äKwä group was compared to day 0 measurements, and significant reduction was reported ($p = 0.034$). Significance in the reduction of red vasculature count was also established in the äKwä group on day 30 in comparison with day 0 ($p = 0.007$) and the control group ($p = 0.017$).

A significant reduction in the porphyrin count was found between the äKwä group and the control group ($p = 0.022$) on day 30, and between day 30 and day 0 for the äKwä group ($p = 0.014$). Interestingly, the porphyrin score in the äKwä group on day 30 was significantly higher compared to the control group ($p = 0.008$) and day 0 of the äKwä group ($p = 0.048$). The same phenomenon was also observed in the UV-spot score in the äKwä group, as it was significantly greater on day 8 ($p = 0.045$) and day 30 ($p = 0.04$) compared to day 0, whereas no significant differences were seen compared to the control group ($p = 0.27$).

There was no significant reduction in wrinkle score or wrinkle count on day 30 in the äKwä group compared to the control group ($p = 0.585$, $p = 0.655$, respectively) or the day 0 baseline scores ($p = 0.063$, $p = 0.798$, respectively). There were also no significant differences in fine lines ($p = 0.75$) between the äKwä group and the control group on day 30 or in brown-spot count ($p = 0.1061$) and brown-spot score ($p = 0.15$). When comparing the results of the wrinkle score, wrinkle count, brown-spot count, and brown-spot score in the äKwä group on day 0 and day 30, we also did not find any statistical differences ($p = 0.063$, $p = 0.798$, $p = 0.607$, $p = 0.292$, respectively)

4. Discussion

Healthy skin is an important aspect of one's overall health and can help improve one's well-being and social confidence [22]. The present study showed that the äKwä skincare system significantly improved several key areas of skin health and beauty—red vasculature count, red-spot count, and porphyrin count—in the study group compared to the control group; it also provided improvements in skin hydration, though non-significantly. Pores, skin texture (smoothness), and wrinkles did not show significant differences over a 30-day period, largely due to the small study size and short study duration.

Skin hydration has been an important area of skin health and beauty. Maintaining sufficient hydration is critical to delaying the aging process of skin, as skin becomes less elastic and more prone to developing wrinkles and infections when it is dry. A systematic review on non-drug topical skin care in the aged population supported that leave-on products with the addition of functional ingredients such as glycerin, petrolatum, and paraffin would help prevent skin tears and improve overall skin health [23]. Glycerin, a common ingredient used in skincare products, is known as a humectant that retains moisture in skin [24] and prevents transepidermal water loss (TEWL) [25], and therefore is a primary ingredient in all äKwä products except Precious Pool Vitamin Essence. A total of 66.7% of the participants in the äKwä group showed an increase in skin hydration, which agrees with the studies mentioned previously [23,24].

Panthenol and butylene glycol also possess humectant properties [26,27] and are functional ingredients in the majority of äKwä products. Occlusives such as beeswax and oils function as a skin barrier to prevent moisture loss [25]. To reach the optimal effectiveness of skin hydration, a combination humectants and occlusives is often recommended in moisturizers [25]. These functional humectant ingredients present in äKwä skincare products support their positive effects on improving skin hydration and water retention.

Green tea (*Camellia sinensis*) is rich in bioactive compounds: polyphenols, catechins, pigments, caffeine, polysaccharides, L-theanine, and others [28]. The presence of these active compounds assists in many reactions that are beneficial to human skin. In an in vitro study conducted by Wei et al., tea polysaccharides (TPS) and tea polyphenols (TPP) provided protection to skin as well as water retention, especially in dry environments [29]. The authors also suggested the use of TPP as an ingredient in sunscreen because of its capability to absorbing UV-A and UV-B, which have been proven to accelerate aging of the skin. Based on the positive results seen in TPP and TPS extracted from green tea, the authors concluded that the application of those compounds may promote skin health if used in topical skincare products. Green-tea extract and green-tea leaf water are among the major functional ingredients in äKwä skincare products. The present study showed that daily use of äKwä skincare products improved key parameters of skin health and beauty. In light of the protective effect of TPS and TPP in green tea on skin hydration and skin redness against UV-A and UV-B [29], it is speculated that green-tea extract and green-tea water partially contributed to the positive effects of äKwä skincare products on skin hydration, red vasculature count, red-spot count, and porphyrin count reported in the present study.

A polyphenolic compound in green tea called catechin has become a research hotspot in recent years due to its antioxidant effect, anti-inflammatory activity, and UV protection activity, among many others [28,30]. Epigallocatechin-3-gallate (EGCG), the major catechin in green tea, has been shown to have protective effects on the skin and moisture retention, and an anti-melanogenesis effect [31]. Recently, Ud-Din et al. found that EGCG may also be beneficial for wound healing [32]. The study compared the healing effects of topical treatment between immediate application (zonal priming) after the injury versus after the formation of a scar (delayed application), and the results suggested that zonal priming had the greatest effect on reducing inflammatory activity, which has been linked to decreasing the possibility of abnormal scarring. Consistent with the finding that äKwä skincare products improved red vasculature count, red-spot count, and porphyrin count in the present study, these studies support the contribution of green-tea extract and green-tea leaf water to such improvements.

In addition to green-tea extract, other antioxidant-providing materials such as plant extracts can also benefit human skin health in a similar fashion by absorbing UV and blocking UV-induced damage [33]. Utilization of antioxidants in topical products has been shown to inhibit UV-induced erythema and pigmentation in some skin types [34]. A review by Petruk et al. provides ample evidence for why the use of antioxidants in exogenous creams and products could be beneficial, suggesting UV absorption properties to prevent damaging effects of UV exposure [35]. The äKwä skincare products contain various plant extracts and oils that have been documented to contain a variety of bioactive compounds and help skin health and beauty.

Niacinamide has a long-standing history of benefits for human skin health. It is well-established in its relationship in preventing the disease pellagra, which can cause severe cases of dermatitis [20]. Supplementation of niacin assists the body in restoring energy stores, minimizing oxidative stress, controlling the inflammatory response, and enhancing the skin barrier while slowing the process of pigmentation [36]. Moreover, niacinamide-containing moisturizers were found to improve stratum–corneum-barrier function, which is correlated to lowering skin sensitivity [37]. Because of niacinamide's role in regulating the redox status of cells, it is thought to be useful as a cosmeceutical ingredient that can slow skin aging and control pigmentation [36]. Supported by abovementioned studies, niacinamide might also contribute to the skin-health-promoting effects of the äKwä skincare products reported in the present study.

In summary, green-tea (*Camellia sinensis*) leaf water, green-tea extract, niacinamide, humectants, and occlusives are among the main functional ingredients in äKwä skincare products. Consistent with existing literature, it was expected that daily application of äKwä skincare products could improve one's facial-skin health. The current study provides direct clinical evidence supporting the effectiveness of äKwä skincare system in improving facial-skin health and beauty, specifically skin hydration, skin porphyrin count, red vasculature count, and red-spot count.

5. Limitations

The study necessitated concurrent use of all products in the äKwä skincare system. As such, it is not feasible to distinguish the impact of a specific ingredient or product on the endpoints. The small sample size (15 in treatment, 11 in control) in the study was also less than ideal, and might have affected the validity of the results, both significant and non-significant. The variability in skin types and conditions might also have had an impact on the results due to the small sample size. The instruments used in this study have only been used in a limited number of studies [38–40], which might be seen as a disadvantage. The data lack the skin measurements of the control group on day 0 and day 8, and therefore direct comparisons with the treatment group on day 0 and day 8 were impossible. The participants' diets or lifestyles were not closely monitored, nor were the routine products used in the control group, which could also have confounded the skin condition at baseline and the end of study. The relatively short time frame may partially explain why significant improvements in pores, skin texture, and wrinkles were not observed, as these parameters typically require more time to be able to see any effects. Therefore, a longer-term study with a bigger sample size and better controlled design is needed to be able to see any long-term effects of the äKwä skincare system on one's facial-skin health.

6. Conclusions

The formulas of individual products within the äKwä skincare system are extensive, and therefore any significant positive effects must be attributed to the entire regimen, instead of individual components or products. Though it has some limitations, the study shows that the äKwä six-step skincare system used daily over a 30-day period may improve various markers of facial-skin health and beauty, including skin moisture, skin porphyrin count, red vasculature count, and red-spot count.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors were employees of 4Life Research, LLC, Sandy, UT, USA.

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