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Prevention and treatment of skin infections and disorders: A novel water-based topical antidermatitic body lotion

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Poor nutrition is an issue in Nigeria, with the average daily calorie intake per capita of 2,000. This dictates unhealthy skin. To meet local demands, Nigeria imports, under different trade names, water-free dermatitic ointments indicated for the prevention and treatment of skin infections and disorders. The oily products are preferred in harmattan season and are unpopular with ladies who consciously avoid oily creams that procure sweat and attract dust. This study was aimed at formulating a topical water-based antidermatitic body lotion for the prevention and treatment of most skin disorders and infections, using the conventional body cream raw materials. The novel body lotion showed a negligible 0.03% cases of skin irritation and hypersensitivity reactions. It prevents and treats eczema, dandruff, psoriasis, acne, ringworm, after-shave rashes, heat rashes, napkin and urinary rashes, dermatitis, seborrhea, African beauty spots and crawl-crawl. It also treats bruises, burns and cuts, proving antipyretic, anti-inflammatory and preventive of post-healing skin discolouration. It does not treat pimples. It is more acceptable all-year round as a cosmetic moisturizing body lotion than the water-free antidermatitic ointment, which is preferred only in the harmattan period and is unpopular with ladies.

Key words: Water-based, topical, antidermatitis, lotion, prevention, treatment, skin, infections, disorders.

INTRODUCTION

Malnutrition, poor health and skin issues are common indicators of the low living standards in Nigeria, with an average daily calorie intake per capita of 2,000 (Eneh, 2011). To meet local demands, Nigeria imports, under different trade names, water-free antidermatitic ointments indicated for the prevention and treatment of skin infections and disorders. This dictates enormous demand on foreign exchange. To address this economic challenge, an earlier study formulated a topical antidermatitis ointment with a wider-spectrum of and additional

activities than familiar ointments, using over 90% local substitutes for foreign raw materials. The water-free oily cream product, which contains benzoic acid, salicylic acid and sulphur as active ingredients, paraffins as vehicle and body and solidifier, as well as colourant and perfume additives, prevented and treated eczema, dandruff, psoriasis, acne, ringworm, after-shave rashes, heat rashes, napkin and urinary rashes, dermatitis, seborrhea, African beauty spots and crawl-crawl. It also treated bruises, burns and cuts, proving antipyretic, anti-inflammatory

Table 1. Tests for benzoic acid, salicylic acid and precipitated sulphur powder.

S/No.	Material	Physical inspections	Chemical reactions
1	Benzoic acid	White crystalline solid Melting point: 121°C Sparingly soluble in cold water, but fairly soluble in hot water, alcohol and ether Faint aromatic odour Readily sublimates Volatile in steam	Dissolves in hot water, but separates as shining whites flakes on cooling Its natural solution gives a white precipitate with silver nitrate, AgNO ₃ Gives effervescence with sodium bicarbonate, NaHCO ₃ Gives a buff-colour precipitate with ferric chloride, FeCl ₃
2	Salicylic acid	White crystalline solid Melting point: 155°C Sparingly soluble in cold water, but fairly soluble in hot water, alcohol and ether Poisonous in nature Readily sublimates Volatile in steam	Dissolves in hot water, but separates as shining whites flakes on cooling Gives effervescence with sodium carbonate, Na ₂ CO ₃ , or sodium bicarbonate, NaHCO ₃ , releasing carbon dioxide, CO ₂ , to form sodium salt, sodium salicylate Gives a violet colour with ferric chloride, FeCl ₃ , in aqueous solution Gives 2,4,6-tribromophenol with bromine water, this reaction forming the basis of quantitative estimation of the acid in medicinal preparations
3	Sulphur	Yellow powder solid Melting point: 113-119°C	Gives characteristic sulphide odour with Mg as MgS is formed Vapour from melted sample gives pale yellow solid on contact with a cold surface

and preventive of post-healing skin discolouration. It showed 0.02% cases of skin irritation and hypersensitivity reactions (Eneh, 2007a). A further study improved the antibiotic properties of the oil-based antidermatitic ointment by incorporating neem powder which shortened the therapeutic periods by as much as half in some of the tested cases. The efficacy and local content were both further improved in another study by substituting the imported beeswax with local beeswax (2009). The oily product in each of the studies is more accepted in harmattan season and is unpopular with ladies who consciously avoid oily creams that procure sweat and attract dust. This work was, therefore, aimed at formulating a water-based moisturising body lotion for all seasons that prevents and treats these and other common skin

disorders and infections, using the same raw materials.

MATERIALS AND METHODS

The pharmaceutical grade chemicals and cans (glass or plastic) used for this study were purchased from Headbridge Market, Onitsha. Distilled deionized water was obtained from the Soil Science Laboratory of the University of Nigeria, Nsukka. Various equipment were available in science and engineering laboratories of the same university.

Procedure

Physical and chemical quality control tests for the active ingredients (benzoic acid, salicylic acid and sulphur) were

designed as outlined in Table 1 after consulting the literature. The quality of the petroleum jelly was ascertained following NIS 371: 1997 (SON, 1997). A common method for preparing body lotion was used. Varied concentrations of the active ingredients drawn from preparations earlier reported (British Medical Association (BMA) and TPSGB, 2011), were used to get three (3) preparations which were applied topically on different portions of approximately the same size of eczema of a patient. Consent of the patient had been sought and obtained. Application in this preliminary test was done twice daily (after morning and night baths) for 21 consecutive days. Results from the preliminary test informed which of the three (3) preparations had the best concentrations and proportions of active ingredients for further investigations. This sample was sent to a public analyst for analysis and examination for suitability as cosmetic product. The sample was next issued to about 10,000 students and parents (staff) of some secondary schools for girls and boys in Enugu metropolis, with a wide

Table 2. Summary of sample users' report.

S/NO.	Skin Infection/disorder	Number of users	Number that reported effective and satisfactory performance	Post-healing skin discolouration reported	Number that reported skin irritation	Anti-inflammatory effect reported	Smoothing effect reported	Number that reported compatibility	Average healing period (Days)
1	Acne	48	45	-	-	n.a.	n.a.	46	23.1
2	After-shave rashes	55	52	-	3	47	49	54	3.3
3	Napkin/Urinary Rashes	302	296	-	-	n.a.	266	286	3.9
4	Heat Rashes	412	387	-	-	n.a.	318	394	4.1
5	Craw-craw	994	869	-	-	838	888	946	26.2
6	Dandruff	1,996	1,761	-	-	n.a.	n.a.	1,934	3.8
7	Eczema	1,971	1,863	-	-	n.a.	n.a.	1,964	14.3
8	Psoriasis	11	8	-	-	7	8	8	29.7
9	Ringworm	1,898	1,770	-	-	1,761	1,666	1,716	13.5
10	Seborrhea	13	9	-	-	9	11	8	26.4
11	African beauty spots	28	21	-	-	18	26	23	42.6
12	Dermatitis	29	21	-	-	18	28	28	28.3
13	Pimples	2,333	-	-	-	1,856	-	2,236	-
14	Burns	34	26	-	-	26	31	29	12.7
15	Bruises	912	884	-	-	834	909	906	11.2
16	Cuts	444	392	-	-	382	404	396	13.9

Secondary schools involved: 1. Metropolitan Girls' Secondary School, Ogui-Enugu; 2. Queens School, Enugu; 3. Union Boys' Secondary School, Awkunanaw-Enugu; 4. Government Technical College, Enugu; 5. National Grammar School, Nike-Enugu; 6. City Girls' Secondary School, Ogui-Enugu; 7. Urban Girls' Secondary School, Ogui-Enugu. Number of Sample Users: 10,000 (male, female, youth, children, and infants).

range of dermatological differences assumed among them. Their consent had been sought and obtained. Sixteen most common skin disorders and infections were clearly explained to the literate sample recipients. They were instructed to apply the preparation after morning and evening baths daily for ten (10) weeks. They were to carry out daily observations of the prevention and treatment of eczema, dandruff, psoriasis, acne, ringworm, after-shave rashes, heat rashes, napkin and urinary rashes, dermatitis, seborrhea, African beauty spots, pimples and craw-craw. Also to be noted were its effects on cuts, bruises and burns, its effects on and compatibility with the skin during and after treatment of a skin disorder or infection as well as its prevention of post-healing skin discolouration. Report sheets were given out together with the samples. The preparation was stored on the shelf for observation/analysis and used for treatment at intervals for two (2) years.

RESULTS AND DISCUSSION

Although, not all recipients of samples turned in reports, some recipients turned in multiple reports from using the samples on households with various disorders and infections. These made up for those who failed to return their reports. The use of samples on households also brought babies and children into the tests, besides the youth and adult male and female people with age variations who received the samples. A summary of the first 10,000 reports turned in is given in Table 2, where a factor not applicable to a particular skin infection or disorder is marked "n.a". The novel moisturising antidermatitic body

lotion had smoothing, pain-relieving and anti-inflammatory effects on cuts, bruises and burns, resulting in their healing within 11.2 to 13.9 days. This agreed with earlier reports that topical body creams incorporating benzoic acid and/or salicylic acid have a mild anti-inflammatory effects, soothe and smoothen the skin and are indicated for dry scaling disorders, such as eczematous disorders and psoriasis (BMA and TPSGB, 2011). Skin problems treated with nine similar products healed between 8.2 and 15.7 days (Tkac, 1990).

Benzoic acid, salicylic acid and sulphur have disinfecting effect, while salicylic acid has, in addition, antipyretic and analgesic effects (Tewari et al., 2007; Tedder et al., 2005). This disinfecting

Table 3. Public analyst's report.

Parameter	Sample	Universal standard
Physical inspection		
Appearance	Pink coloured water-based lotion with tiny air pores	White to any chosen-coloured water-based lotion with tiny air pores
Odour	Perfumed	Perfumed
Specific Gravity	0.9246	0.8190-0.9998
Colour	Pink	Pink
Texture	Soft to touch	Soft to touch
Chemical composition (%)		
Benzoic acid	6.00	4.5-7.5
Salicylic acid	3.00	2.5-6.0
Sulphur	3.00	2.5-6.0
Mineral oil	0.5	0.25-1.0
Emulsifying wax	6.00	3.0-6.5
Petroleum jelly	7.50	5.0-12.0
Cetyl alcohol	1.75	1.5-2.5
Citric acid	1.75	1.5-2.5
Glycerine	2.50	1.5-4.5
Propylene glycol	2.50	1.25-3.5
Lanoline	1.50	1.3-2.5
Stearic acid	0.75	0.35-1.5
Triethanolamine	0.75	0.35-1.5
Fragrance	2.25	1.5-3.5
Colourant	0.25	0.15-3.5
Water	60.00	48-82
Remarks		
The product is deemed suitable to be sold as cosmetic.		

Source: Public Analyst.

effect must have been responsible for the enhanced healing of cuts, bruises and burns (Leydon, 1990), as well as the prevention of post-healing skin discolouration. These findings support other reports on the medical and medicinal uses of the active ingredients in the preparation (Kirk and Othmer, 2002; Large, 2000).

Psoriasis, ringworm, napkin and urinary rashes, crawl-craw, heat rashes and acne cleared between 3.9 and 29.7 days. This agreed with earlier reports (Auld, 1986; Lucky, 1987). Dandruff on shaven scalp cleared within 3.8 days, but returned when scalp was overgrown with hair such that contact with novel topical preparation was difficult. Topical preparations are not expected to have a therapeutic effect (BMA and TPSGB, 2011) on dandruff and eczema, among others. Eczema cleared within 14.3 days but re-appeared about 3 months after the application was discontinued. It cleared again when treatment was restored for 14 to 23 days. This was not only cheaper than, but saved the discomforting side-effect of most systemic treatments of skin disorders and infections (Tedder et al., 2005; Burger, 2000; Liprot, 2008; Wolverton, 1991). Applying the preparation after

shaving prevented the development of after-shave rashes. Continued application till the next shaving exercise might be necessary. The application on the developed rashes got them cleared within 3.3 days. African beauty spots took longest duration, 42.6 days, to be treated and there was no report of successful treatment of pimples.

Products containing the same active ingredients at the chosen concentrations are non-toxic and the skin irritation and hypersensitivity reactions reported by three (3) out of 10,000 users is acceptable (BMA and TPSGB, 2011). There was no change in the concentration, colour and potency of the preparation for the two (2) years of investigation. Expiry or "best before" or "use before" date of two (2) years from date of manufacture was, therefore, recommended. The preparation was found compatible, confirming the report of earlier workers (Tkac, 2000; Tewari et al, 2007). The report of the Public Analyst is shown in Table 3. The characteristic of the sample is shown side-by-side with that of the universal standard. Both had tiny air pores, were perfumed and had similar texture (soft to touch).

The specific gravity of the sample of the water-

Table 4. Assessment (%) of sample's performance.

Skin infection/ disorder	% Effective and satisfactory performance	% Compatibility	% Smoothing effect	% Anti-inflammatory effect
Acne	93.75	95.83	n.a	n.a
After-shave rashes	94.55	98.18	89.09	85.45
Napkin/urinary rashes	98.01	94.70	88.08	n.a
Heat Rashes	93.93	95.63	77.18	n.a
Craw-craw	87.42	95.17	89.34	84.31
Dandruff	88.23	96.89	n.a	n.a
Eczema	94.52	99.64	n.a	n.a
Psoriasis	72.73	72.72	72.73	63.64
Ringworm	93.26	94.41	87.78	92.78
Seborrhea	69.23	61.54	84.62	69.23
African beauty spots	75.00	82.14	92.86	64.29
Dermatitis	72.41	96.55	96.55	62.07
Pimples	-	95.84	-	79.55
Burns	76.47	85.29	91.18	76.47
Bruises	96.93	99.34	99.67	91.45
Cuts	88.29	89.19	90.99	86.04

free antidermatitic preparation was 0.9246, whereas the universal range was 0.8190 to 0.9998. The sample contained 6% benzoic acid, against the universal range of 4.5 to 7.5%; 3% salicylic acid, whereas the universal range was 2.5 to 6.0%; 3% sulphur, against the universal range of 2.5 to 6.0%; 0.5% mineral oil, whereas the universal range of 0.25 to 1.0%; 6% emulsifying wax, against the universal range was 3.0 to 6.5%; 7.5% petroleum jelly, whereas the universal range of 5 to 12%; 1.75% cetyl alcohol against the universal range was 1.5 to 2.5%; 1.75% citric acid, whereas the universal range was 1.5 to 2.5%; 1.75% cetyl alcohol, against the universal range of 1.5 to 2.5%; 2.5% glycerine, whereas the universal range was 1.5 to 4.5%; 2.5% propylene glycol,

against the universal range of 1.25 to 3.5%; 1.5% lanolne, whereas the universal range was 1.3 to 2.5%; 0.75% stearic acid, against the universal range of 1.3 to 2.5%; 0.75% triethanolamine, whereas the universal range was 1.3 to 2.5%; 2.25% fragrance, against the universal range of 1.3 to 3.5%; 0.25% colour, whereas the universal range was 0.15 to 2.5%; and 60% distilled deionised water, against the universal range of 48 to 82%. The analyst also remarked that the product was deemed suitable to be sold as cosmetic.

Table 4 contains the data on percentage assessment of the performance of the novel topical moisturising antidermatitic body lotion. The product rating ranged between satisfactory

(61.54%) and excellent (99.67%) for the various performance criteria assessed. The novel topical moisturising antidermatitic body lotion was even more acceptable as a cosmetic than water-free ointment, which is more desirable only in the hammattan period and for scaling disorders (BMA and PSGB, 2011). It promised to be popular among ladies, who consciously avoid oily creams that procure sweat and attract dust.

CONCLUSION AND RECOMMENDATIONS

About sixteen (16) different skin infections and disorders are prevented and/or treated with water-free ointments containing benzoic acid, salicylic

acid and sulphur as active ingredient and other ingredients as additives. The product was more acceptable in the harmattan period and for scaling disorders, but unpopular among ladies, who consciously avoid oily creams that procure sweat and attract dust. This work has successfully formulated an all-season novel water-based topical moisturising antidermatitic body lotion for the prevention and/or treatment of all the sixteen (16) skin infections and disorders. The product promised to be popular among ladies as well, who consciously avoid oily creams that procure sweat and attract dust. From the bench-scale production, economic viability of the commercial-scale production could easily be established to make for the commercialization of the product. Further work to establish the longest shelf-life is also recommended.

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