

Full Length Research Paper

Preparation of new formulations of anti-acne creams and their efficacy

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Accepted 26 January, 2015

***Acne vulgaris* (commonly called acne) is a common skin condition, caused by changes in the pilosebaceous units, skin structures consisting of a hair follicle and its associated sebaceous gland via androgen stimulation. In the present study six new anti-acne compositions were made for the treatment of acne and their efficacy was studied on the volunteers of age group of 20 - 28 years via topical applications. Particular emphasis was placed on treating acne conditions without drying and irritating the skin.**

Key words: *Acne vulgaris*, pilosebaceous units, *Aloe vera*, bismuth subnitrate, stearic acid.

INTRODUCTION

Acne vulgaris may be defined as any disorder of the skin whose initial pathology is the microscopic microcomedo. The microcomedo may evolve into visible open comedones (blackheads) or closed comedones (whiteheads). Subsequently, inflammatory papules, pustules, and nodules may develop (White, 1999). The severity of acne varies greatly among individuals and genetic background plays an important role. Pathogenic factors include androgen-induced seborrhea, follicular hyperkeratosis, microbial population, and immunological and inflammatory processes. These factors influence each other, leading to the acne phenotype (Lehmann, 2009). It has been estimated that as many as 90% of all teenagers are affected by acne, with virtually 100% of teenagers experiencing some degree of comedone formation (Olutunmbi et al., 2008). Acne may be inflammatory or non-inflammatory. Non-inflammatory acne lesions include open and closed comedones. Inflammatory lesions include papules, pustules, and

nodules (Brown and Shalita, 1998). The initial event in the development of an acne lesion is abnormal desquamation of the keratinocytes that line the sebaceous follicle, which creates a microplug or microcomedo. An increase in circulating androgens at the onset of puberty stimulates the production of sebum into the pilosebaceous unit. These events combine to create an environment within the pilosebaceous unit that is favourable for the colonization of the commensal bacteria, *Propionibacterium acnes*. With proliferation, *P. acnes* secrete various inflammatory molecules and chemotactic factors that initiate and perpetuate the local inflammatory response and possibly induce keratinocyte hyperproliferation as well (Webster, 2005). Sebum plays a central role in the pathogenesis of acne. Acne begins just before puberty when the sebaceous glands enlarge and reaches a maximum prevalence in early adolescence when sebum output reaches its peak (Burton, 1971).

MATERIALS AND METHODS

Chemicals, plants and their extracts

All the chemicals involved in this study were obtained from Sigma

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Table 1. The compositions of sample # 1.

Ingredients	Wt. % age
Stearic acid	16.22
Paraffin oil	0.95
Cetyl alcohol	0.95
Triethanol amine	0.51
Propylene glycol	4.77
Isopropyl-myristate	0.95
Glycerin	1.90
Propyl paraben	0.095
Derma soft	1.90
Sulfur	0.38
Borax	0.76
Vitamin E (tocopherol)	0.56
Zinc oxide	0.76
Bismuth subnitrate	1.90
Extracts of <i>Aloe vera</i>	0.63
<i>Salix alba</i> bark	0.63
Sugar-cane	0.63
Distilled water	65.7
Fragrance	qs

Note: qs, stands for quantity sufficient.

Table 2. The compositions of sample # 2.

Ingredients	Wt. % age
Stearic acid	24.2
Cetyl alcohol	1.2
Triethanol amine	1.32
Propylene glycol	0.95
Isopropyl-myristate	1.2
Glycerin	2.0
Sulfur	1.90
Borax	1.90
Vitamin E (tocopherol)	0.56
Honey	3.5
Menthol	0.76
Distilled water	49.95
Extracts of <i>Azadirachta indica</i> (neem)	1.76
<i>Ocimum sanctum</i> (tulsi)	1.76
<i>Cucumis sativus</i> (cucumber)	1.76
<i>Mentha sylvestris</i> (wild mint)	1.76
<i>Mentha piperita</i> (mint)	1.76
<i>Aloe vera</i>	1.76
Fragrance	qs

Note: qs, stands for quantity sufficient.

Chemical Company Ltd. (USA). The plants and their extracts were purchased from the local market "Paaparr Mandi" Lahore in March 2008 and were identified by Muhammad Ajaib (Taxonomist), Department of Botany, Government College University, Lahore.

General procedure for preparing anti-acne creams

For preparing various samples the required quantity (as mentioned below) of stearic acid was melted in a double-jacketed vessel and then required quantity of paraffin oil was added to it at a temperature of 70 - 80°C, preventing it from boiling. After mixing acetyl alcohol as a whitening agent, was added and the contents were homogenized. With continuous stirring, triethanol amine, propylene glycol, isopropyl myristate, glycerine, *n*-propyl-*p*-hydroxybenzoate or any combination of these and various anti-acne agents used were added in this mixture according to the underneath mentioned percentage and the whole material was kept warm during the manufacturing process. In another vessel, sulphur dissolved in the essential oil, borax and required extracts were mixed in distilled water and this suspension was heated at 80 - 90°C. This suspension was added into the above oily phase mixture of stearic acid and the contents were thoroughly homogenized. An equivalent vigorous high shear type of mixing is equally effective. Stirring with the help of electrical stirrer was kept on until a homogenous cream was formed. After, the cream was allowed to cool at room temperature and then perfumes were added below 35°C. By varying the ingredients and their amounts taken, different samples formed were checked to confirm that pH, viscosity, specific gravity, colour, odour and product texture were within the specification necessary for anti-acne creams (Lee, 2003). The compositions of different sample made are shown in Tables 1 - 6.

RESULTS

Six samples of anti-acne cream with different compositions were prepared, keeping in mind all the conditions and circumstances faced during acne problem. The composition of all these samples was shown in the experimental part. In these, anti-acne agents were added to give relief of pain and also the redness caused during inflamed acne formation. The sample #1 and #2 exhibited much better potential with negligible side effects although other samples also showed well results for the treatment of acne (Table 7). The test results of sample #1 and #2 are also sketched in Figures 1 and 2, respectively.

DISCUSSION

In these formulations, sulphur was used as the anti-fungal agent while bismuth subnitrate to relief from the redness caused due to acne and also it lightens the scars. Triethanol amine was used as the pH adjuster in most of the compositions. The pH for all compositions was maintained near to the skin that is, pH 6.0 - 6.5 to avoid any irritation on the skin. Vitamin E was added as an antioxidant and emollient. In sample # 1, the extracts of *Aloe vera*, *Salix alba* (white willow) bark and sugar-cane were used to sooth the ruptured skin area. Similarly, in the sample #2, the extracts of *Azadirachta indica* (neem), *Ocimum sanctum* (tulsi), *Cucumis sativus* (cucumber), *Mentha sylvestris* (wild mint), *Mentha piperita* (mint) and *A. vera* were used to attribute the cream with more natural ingredients and to enhance its efficacy and make it devoid of side effects. In sample #3, benzoyl peroxide was added for antibacterial action

Table 3. The compositions of sample #3.

Ingredients	Wt. % age
Stearic acid	22.2
Cetyl alcohol	1.5
Triethnol amine	0.67
Isopropyl-myristate	1.5
Methyl paraben	0.02
Benzoyl peroxide (5% soln)	8.0
Mineral oil	1.90
Vitamin E	0.56
Distilled water	63.65
Lemon essence	qs
Fragrance	qs

Table 4. The compositions of sample #4.

Ingredients	Wt. % age
Stearic acid	22.2
Cetyl alcohol	1.5
Triethnol amine	0.67
Propylene glycol	6.5
Isopropyl-myristate	1.5
Propyl paraben	0.02
Derma soft	1.90
Glycerin	1.90
Sulphur micronized	0.38
Erythromycin	12.0
Zinc oxide	1.9
Ditilled water	50.03
Fragrance	qs

Table 5. The compositions of sample #5.

Ingredients	Wt. % age
Stearic acid	22.2
Cetyl alcohol	1.5
Triethnol amine	0.67
Propylene glycol	1.5
Isopropyl-myristate	1.5
Glycerin	1.90
Propyl paraben	0.2\
Borax	0.51
Lactic acid	10
Salicylic acid	5.0
Sodium hydroxide	1.8
Disodium EDTA	0.75
Distilled water	53.1
Fragrance	qs

Table 6. The compositions of sample #6.

Ingredients	Wt. % age
Stearic acid	22.2
Paraffin oil	1.5
Cetyl alcohol	1.5
Triethnol amine	1.5
Propylene glycol	1.5
Isopropyl-myristate	1.5
Glycerin	2.0
Sulphur	0.67
Zinc oxide	2.0
Glycolic acid	16.0
Almond oil	4.0
Distilled water	45.63
Fragrance	qs

because with its broad-spectrum antimicrobial activity, it is among the most widely used topical agents in the treatment of inflammatory acne. The specific advantages of benzoyl peroxide is particularly in decreasing follicular counts of *Propionibacterium acnes*, the anaerobic bacterium implicated in the pathogenesis of acne (Taylor and Shalita, 2004). In the sample #4, erythromycin and zinc oxide were used.

Topical erythromycin is a standard regimen for inflammatory *A. vulgaris* because of its action against *P. acnes* (Korting et al., 1993). Zinc, which basically targets inflammatory acne, is a possible option for pregnant women and during the summer (Drèno, 2005). In sample #5, salicylic acid was added. Its peels are effective and safe therapy for *A. vulgaris* (Lee and Kim, 2003). In sample #6, glycolic acid was used, because the creams with glycolic acid as one of the ingredient are reported as efficient in preventing and treating acne scarring in patients with moderate acne (Dreno et al., 2007).

Application and efficacy studies

A method of random study was chosen to study the efficacy of these samples while applying topically on the infected skin. All the six samples were tested on a group of 60 volunteers, 30 males and 30 females, of the age group from 20 - 28 years. The main objective of this study was to check the efficacy of different anti acne agents in the suitable vehicles depending upon skin types. The criterion of the efficacy of different preparations was based on the duration of curing the acne without any side effects, irritation or causing dryness to the skin. According to the following research, 60 volunteers out of whom 25% had non-inflammatory acne (comedones), they were advised to use the sample #3 and sample #4. These samples were allotted to stop the microbial penetration maintaining aerobic environment into the

Table 7. Prepared anti-acne samples and the data showing the type of acne, distribution, healing time, efficacy criteria and their percentage efficacy on the volunteers of age group of 20 - 28 years.

Groups	Type of acne	Distribution of volunteers	of	Samples allotted	Healing time	Efficacy criteria/ reason	Questioning results form volunteers	Percentage efficacy (%)
A	Non-inflammatory (comedones)	8 volunteers (4 males, 4 females)		Sample # 3	3 - 4 days	This sample having benzoyl peroxide as one of ingredients provided aerobic environment and was good to decrease bacterial count and hence reduced the acne.	7 volunteers got reduced their acne within the estimated time without any irritation or side effect but one felt irritation.	87.5
		7 volunteers (3 males, 4 females)		Sample # 4	3 - 4 days	Erythromycin, an antibiotic, with zinc and sulphur antifungal agent proved to be a suitable composition.	6 received good results while it was causing irritation to one of them and we met refusal to complete the course.	85.71
B	Inflammatory (papules, pustules)	9 volunteers (5 females, 4 males)		Sample # 1	6 - 7 days	This product showed quite good results in treating acne before expected healing time, the reason was to use the bismuth subnitrate in combination with natural products.	This product almost satisfied all the volunteers and did not cause any sort of side effect except a very minor irritation in one.	93.00
		6 volunteers (3 males, 3 females)		Sample # 5	6 - 7 days	This product was specially designed for oily skin and acne and it was success full in treating acne in the estimated time.	This product was helpful in reducing acne counts of 5 volunteers. The remaining one volunteer could not be healed.	83.33
C	Inflammatory (nodules, cysts)	15 volunteers (8 females, 7 males)	(8)	Sample # 2	8 - 9 days	This product had many natural products and was allotted to those having sensitive skin. This product also proved to be very helpful in treating acne.	This product satisfied almost all the volunteers and was quite soothing to them except a very little irritation in one of them.	92.00
		15 volunteers (6 females, 9 males)	(6)	Sample # 6	8 - 9 days	This product was excellent lino, not just reducing the acne but also lightened the spots which usually this type of acne leaves.	This product was also good but was the cause of irritation to 2 of the volunteers.	86.66

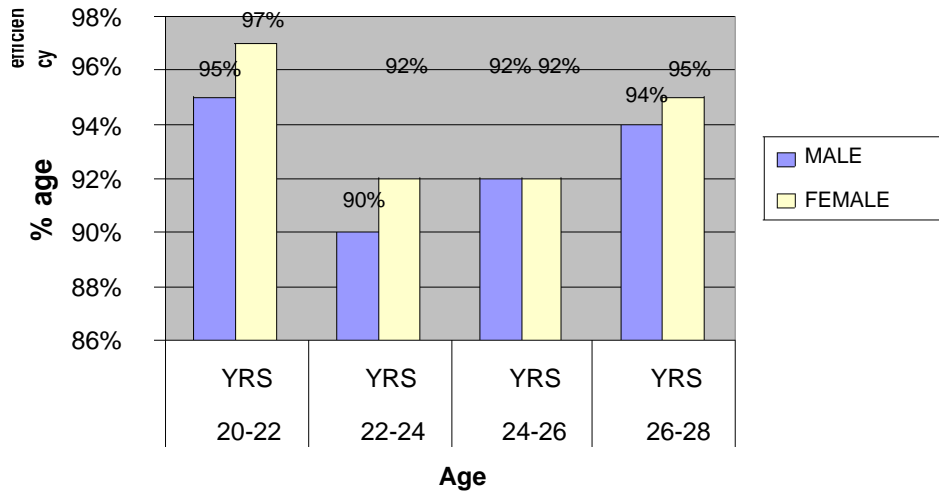


Figure 1. Percentage efficacy of sample #1 on the age group of 20 - 28 years.

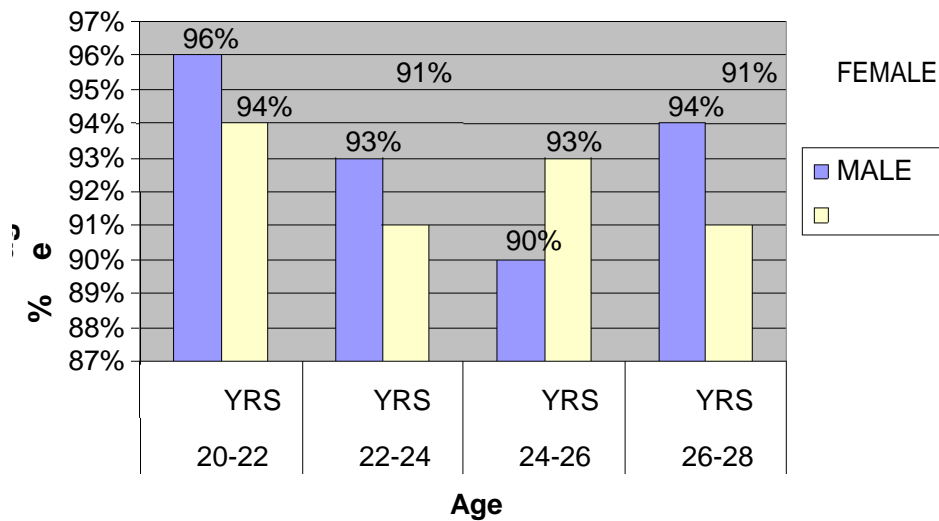


Figure 2. Percentage efficacy of sample # 2 on the age group of 20 - 28 years.

comedones so that they do not result in severe acne forms. The volunteers of this group got rid of comedones in 3 - 4 days cream course. No side effect or visible irritation was noted on the skin of these volunteers except one in each case who felt irritation and hence could not be healed.

Among the remaining 25% of volunteers had inflammatory acne showing pustules and papules as a dominant acne form. These acne forms were larger, of 3 - 6 mm in diameter as compared to comedones, painful, red and fairly hard. These volunteers were allotted sample #1 and sample #5. These volunteers required at least 6 - 7 days cream course. The sample #1 having natural extracts of sugar cane and *A. vera* and bismuth subnitrate proved to be a very good combination to combat against acne. The remaining 50% of volunteers

were those who were also suffering from inflammatory acne including nodules and cysts forms which were pus filled and were more painful and lasted for longer time. These forms of acne usually left scars. The volunteers were advised to use the sample #2 and sample #6 topically. They were advised to use for 8 - 9 days and in case of scars the duration was extended up to 2 weeks. The sample #2 showed tremendous results having a good mixture of natural extracts of anti-inflammatory and anti-toxic properties.

Statistical analysis

All the statistical analysis was performed by Microsoft excel 2003 to calculate the percentage efficacy of these samples.

Conclusion

This study depicted that these prepared new formulations are very good therapeutic compositions for acne. Especially, the sample #1 and 2 exhibited much higher potential with negligible side effects so they seem most suitable to be used commercially.

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