ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 7, Issue 4, 2014

ISSN - 0974-2441

Research Article

TO STUDY THE EFFECT OF SNAKE GOURD, REETHA AND SHIKA KAI HERBAL ANTI-DANDRUFF SHAMPOO AND COMPARISON WITH MARKETED SHAMPOOS

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Received: 07 July 2014, Revised and Accepted: 31 July 2014

ABSTRACT

Reetha and shika kai possess the anti-dandruff activity; the present study involves studying the effect of reetha, shika kai and snake gourd on the anti-dandruff activity. This work reveals the potency of each herbs anti-dandruff activity and it change in anti-dandruff action when they are used in combination with each other in a different concentration. These works conclude, in the formulation of good anti-dandruff shampoo, does individual herbs are enough to formulate shampoo or are there necessary to be use the herbs in a combination to get better effect. In the present study effort also taken to compare the formulated preparation with the marketed preparation, so as to get an idea about impact of herbs anti-dandruff activity. Already many scientific study reveals that, usage of alkalonamides in many synthetic shampoos are the carcinogenic and have some side-effects so, in the present work effort has been taken to eliminate alknolanamide containing ingredients to formulate the natural anti-dandruff shampoo.

Keywords: Anti-dandruff, Reetha, Shika kai, Snake gourd.

INTRODUCTION

Hair follicle many times coat with the surface grease and dirt, because of this nutrients essential for the hair growth unable to reach the hair root, so dead cell generation from the scalp increases, this dead cells are known as dandruff [1,2]. Removal this dead cell from scalp is very essential, and hence that many anti-dandruff shampoos were formulated. The primary function of the shampoo is the cleansing or detergent action, but removal of dandruff also one of the important characteristics of a good shampoo [3]. The character of a good shampoo is, it has to possess good foaming character as it gives esthetic effect as well as good cleaning sensation. In current practice, most of the shampoos containing synthetic chemicals, which give side-effect mainly because of usage of surfactants, more frequently alkanol amides, which are the potential carcinogenic agents because of its nature of producing nitrosamine [4]. Most of the marketed preparation produces the stable foam because they often contain alkanolamides [5].

By using natural raw material to formulate a cosmetic, mainly shampoo is a challenging task. The main challenge in the formulation of the shampoo is the selection of the material and various excipients, and it has to justify rationally as a natural and formulate them into cosmetics and its functionality has to be compared with the synthetic equivalent [6].

The aim of the present work is to assess the anti-dandruff activity of shika kai, reetha and snake gourd individually as well as in combination with each other. Functionality of all herbal preparations are compared with the marketed preparation and to find possible functional aspect to improve the quality so as to bring it near to marketed preparation.

The aim also includes to eliminate alkanolamides material from shampoo and to put effort on the formulation of natural anti-dandruff shampoos, their evaluation and comparison with marketed shampoos. In the present work, plant snake ground, *Sapindus trifoliatus* (Reetha), and *Acacia concinna* (Shika kai) is used to formulate the anti-dandruff shampoo and comparatively evaluate the anti-dandruff activities in combinations and with the marketed antidandruff shampoo.

MATERIALS AND METHODS

Specimen collection

The plant specimen's shika kai and reetha were collected from Shirpur, Dhule District, Maharashtra, during December month and Snake gourd is collected from Surat, Gujarat and identified and authenticated.

Preparation of aqueous extract

Shika kai and reetha were cracked. Grind them in a fine powder with the help of mortar and pestle. Powders are passed through #100 sieve to get a fine powder. The dried powdered shika kai and reetha were kept in a round-bottom flask fitted with a reflux condenser and extracted with distilled water for 6 hrs. The obtained extract was concentrated under reduced pressure and stored in the refrigerator until use.

Formulations development of herbal antidandruff shampoo

Eleven formulations (F1-F7) were prepared. Different proportions of the ingredients were taken the mill and blended until to get a good consistency and uniform distribution and volume was made up to 100 ml. The composition of the formulation is shown in Table 1 [5,7,8].

Evaluation test parameters

Evaluation is very essential to access the quality of formulated herbal anti-dandruff shampoo. Mainly five different type of evaluation has been done, namely:

A. Organoleptic evaluation
B. Physico-chemical evaluation
C. Rheological property evaluation
D. Anti-dandruff activity evaluation.

Organoleptic evaluation

Prepared anti-dandruff shampoo's organoleptic characters were examined. The characters of shampoos are color, odor, texture, and physical appearance were observed and recorded in Tables 2 and 3 [1].

Physico-chemical evaluation

i. Foam formation: Shake test: About 50 ml of 2% solution of formulated anti-dandruff shampoo were taken in 100 ml measuring

Table 1: Optimization of formula for shampoo

S. No.	Ingredients	F1	F2	F3	F4	F5	F6	F7
1	Shika kai	30 g	-	-	15 g	-	15 g	10 g
2	Reetha	-	30 g	-	15 g	15 g		10 g
3	Snake gourd	-	-	30 ml	-	15 ml	15 ml	10 ml
4	Glycerine (%)	5	5	5	5	5	5	5
5	Sodium chloride (%)	1	1	1	1	1	1	1
6	Methyl paraben (%)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
7	Propyl paraben (%)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
8	EDTA (%)	0.15	0.15	0.15	0.15	0.15	0.15	0.15
9	Water (q.s.) to	100 ml	100 ml	100 ml	100 ml	100 ml	100 ml	100 ml

EDTA: Ethylene diamine tetraacetic acid

Table 2: Organoleptic evaluation of herbal shampoo from batch F1 to F4

S. No.	Specification	F1	F2	F3	F4
1	Physical appearance	Semi solid	Semi solid	Semi solid	Semi solid
2	Texture	Greety	Greety	Greety	Greety
3	Color	Dark brownish	Pale brownish	Light green	Dark brown
4	Odor	Characteristic	Characteristic	Characteristic	Characteristic

Table 3: Organoleptic evaluation of herbal shampoo from batch F5, F6, F7 and marketed preparation

S. No.	Specification	F5	F6	F7	Marketed
1	Physical appearance	Semi solid	Semi solid	Semi solid	Semi solid
2	Texture	Greety	Greety	Greety	Soft
3	Color	Pale brownish	Buff	Pale brown	Violet
4	Odor	Characteristic	Characteristic	Characteristic	Lavender

cylinder and shake the cylinder about 10 times and the volume were recorded in Table 4 [9]

ii. Foam retention: After the foam formation from the shake test, reduction volume of foam at 1 minute intervals for 4 minutes was recorded in Table 4 [9]

iii. Cleaning action: By the barnet and powers method, the formulated anti-dandruff shampoos were evaluated to access the anti-dandruff activity. About 5 g of soiled human hair is placed in the flask at 35°C in 200 ml of water that contains 1% shampoo solutions. The flask containing hair is shaken about 50 times a minute for 4 minutes. After shaking hair, sample was once again washed with a sufficient amount of water, then hair was made to dry and weighed and recorded in Table 4. Amount of soil removed after cleaning is calculated

Collection of hair: Uniform sized human hairs were collected. Collected hairs were washed with a sufficient amount of water and then dried. Weigh the accurate amount of hair (3 g) and soiled with standard soil (2 g) then dried. These soiled hairs were used to determine cleaning action of shampoo [9]

Preparation of standard soil: Combination of carbon black and mineral oil

iv. Total solids: In a tarred evaporated dish accurately weighed quantity of shampoo (4 g) is placed, shampoo was evaporated at as low temperature as possible until the solvent was removed. Calculate and recorded the weight of shampoo solids after drying in Table 4 [1]

v. Wetting action: Canvas disk sinking test: A mount veron cotton duck # 6 canvas disks 1 inch in diameter is floated on the surface of the solution, and the time required for it to sink is measured accurately and recorded in Table 4 [9]

vi. Determination of pH: Formulated anti-dandruff shampoos were diluted using distilled water to prepare a sample of 10% concentration pH of the prepared samples were determined in the pH meter at room temperature 30±2°C and recorded in Table 4 [1].

Rheological evaluations

Rheological property like viscosity and surface tension was measured. The viscosity of the shampoos was determined by using viscometer. The viscosity of the shampoos was measured with the temperature and sample container's size was kept constants during the study.

i. Viscosity: Viscosity of the anti-dandruff shampoo was determined using a Brooke field viscometer, Spindle 62S.200 g of the shampoo was taken in a beaker, and the spindle was dipped in it then the reading was taken and recorded in Table 5 [1].

ii. Surface tension measurement: Measurements were carried out with a 10% shampoo dilution in distilled water at room temperature. The stalagmometer was cleaned using chromic acid and purified water because surface tension will be highly affected with grease or other lubricants. The data were calculated and recorded in Table 5, by following equation given below:

$$\frac{\gamma^2}{\gamma^1}=\frac{1\rho^2}{2\rho^1}$$

Where, γ^1 and γ^2 are surface tension of the water and shampoo preparation respectively, 1 and 2 are a number of drops of water and the shampoo preparation respectively, ρ^1 and ρ^1 are density of water and shampoo preparation respectively.

Anti-dandruff activity evaluation

Preparation of pre-inoculum: Take the loopful culture of *Candida albicans* aseptically and transfer to sterilized and cooled 25 ml Stabourd dextrose (broth) and mixed well. Incubate the broth at 25°C for 24 hrs.

Preparation of pour plates: A Stabourd agar (150 ml) is autoclaved and poured to the already autoclaved plate and cooled in room temperature and allows the setting. By the help of sterilized cotton take a culture of *C. albicans* and aseptically swabbed on the agar surface.

Making the wells on agar plates: The wells are dig on agar plates with sterilized well digger aseptically and transferred 100 µml of each shampoo sample to well aseptically. Incubate the plates at 25°C for 24-48 hrs. Observe the effectiveness of sample on culture growing on an agar plate and we can see the effectiveness of sample in the form of zone of inhibition around each well containing different sample and compared with standard recorded in Tables 6 and 7.

Table 4: Physico-chemical evaluation of herbal shampoo

S. No.	Parameters	F1	F2	F3	F4	F5	F6	F7	Marketed
1	Foam formation (%)	11.11	63.22	0	37.77	33.33	4.44	24.44	73.33
	Foam retention (seconds)	60	270	10	180	150	60	150	300
2	Cleaning action (%)	34	71	19	50	42	27	40	84
3	Total solid (%)	22.19	24.88	9.97	24.02	19	17.15	16.05	28.17
4	Wetting action (time in seconds)	18	19	11	16	14	13	15	29
5	pH	5.48	5.56	5.72	4.96	4.77	5.62	5.18	7.71

Table 5: Rheological evaluation of herbal shampoo

S. No.	Parameters	F1	F2	F3	F4	F5	F6	F7	Marketed
1	Viscosity (cps)	2602 (62S)	3325 (62S)	294 (62S)	2893 (62S)	1821 (62S)	1452 (62S)	1338 (62S)	10,102 (62S)
2	Surface tension (dyne/cm)	58.74	33.16	43.23	40.63	47.49	52	44.78	29.31

RESULTS AND DISCUSSION

It's a really tough job to formulate the anti-dandruff shampoo by using absolutely natural sources. In the present study effort has been taken to formulate shampoo by using reetha, shiaka kai and snake gourd. As anti-dandruff activity of reetha and shika kai had been already reported for anti-dandruff activity. Formulated anti-dandruff shampoo solutions were evaluated by several parameters such as organoleptic characters, physico-chemical evaluation, rheological parameter, Anti-fungal activity and finally accelerated stability study. The results of the present study showing that ingredients and herbs give a stable product with considerable anti-dandruff activity.

Organoleptic character

All formulations are in semi-solid consistency. As the decoction of the herbs is used so the formulation F1-F7 showing great feels in comparison with the marketed preparation. Odor of formulations are characteristic's and marketed preparation having a lavender odor, so incorporation of fragrance in the formulation gives the good esthetic effect.

Physico-chemical property evaluation[10,11]

Foam formation and foam retention

It is known fact that, good foam formation not only cleans hair, remove dandruff, but also give good esthetic feel to the user.

Results are showing that the reetha have a very good foaming characteristic in comparison with the shika kai and snake gourd preparation. Snake gourd preparation doesn't show any foaming characteristic's, so alone snake gourd can't be used to prepare the shampoo, it has to mix with either reetha, shika kai or other to get the foaming character. In F2 batch shampoo, it's giving not only very good foaming nature but also good foam retention time. In F2 batch amount of reetha used was more so it's giving greety feel to the user, so amount of reetha should be reduces in spite of good foam formation and retention.

Cleaning action

Cleaning action determine the potency of the shampoo's cleaning property. F2 batch is showing very good cleaning action in comparison with other batches, though it is having cleaning action less than marketed preparation. In comparison with other batches snake gourd containing F3 batch showing very less cleaning action, so this formulation cannot alone useable.

Total solid

Solid content in the shampoo shouldn't be more as it lead to difficulty in the washing. In the present work, percentage solid content of the formulations was 9-28% so that they are easily washable.

Table 6: Zone of inhibition of herbal shampoos formulations

Zone of inhibition							
F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**Marketed**
11 mm	13 mm	9 mm	14 mm	12 mm	11 mm	15 mm	28 mm

Table 7: Zone of inhibition of standard ketoconazole sample

Zone of inhibition of standard ketoconazole		
0.15 µg/ml	0.25 µg/ml	0.5 µg/ml
11 mm	20 mm	34 mm

Wetting action

Wetting action determines the spread ability of the shampoo on the hair. The results show that, wetting action of the shampoo formulations were less than the marketed preparation.

pH

The pH of shampoos must be well regulated, or else it leads to the irritation to the eye. pH of the shampoo must be within the range to enhance the quality of hair and to stabilizing the ecological balance of the scalp. Results shows F4 and F5 lower pH, which are not in acceptable range and other formulations, are in the range of 5.1-5.7. The pH of the formulations was needed to increase lightly to get best shampoo preparation.

Rheological property[10,11]

Viscosity

Viscosity of the shampoo must be optimum, as it has great impact on the aesthetic effect and spread ability of shampoo. The result shows that F3 batch viscosity too less in comparison with the marketed preparation. All formulated preparations viscosity are less than the marketed preparation. There is a need to build the viscosity of all formulated shampoo preparation.

Surface tension

It's a known fact that, ideal shampoo should decrease the surface tension of pure water. The results show that F2 batch formulation is showing a very good reduction of the surface tension from the 72.8 to 33 dynes/cm, indicating its good detergent action. Batch F3 doesn't show any reduction of the surface tension, so it's been clarified that, snake gourd preparation don't have any detergency action. Other formulation also considerably lowers the surface tension, so it indicating formulated preparation possesses good detergency except F3 batch.

Anti-fungal activity[12-15]

Anti-fungal activity of the prepared shampoo is very essential to assess the potency of the shampoo to remove the dandruff. As for the formation of the dandruff fungal infection also, one of the main reason, so in the present work by using *C. albicans* fungal strain anti-fungal evaluation was done. The results reveal that, all herbs used for shampoo possess the anti-fungal activity, among these three herbs, reetha shows the good anti-fungal action then shika kai and snake gourd. Anti-fungal activity showed by the herbs is lightly less than the minimum inhibitory concentration (MIC_{50}) of ketoconazole, as MIC_{50} of ketoconazole (0.25 µg/ml) showed 20 mm inhibition. Amongst the formulated shampoo, F7 batch shows the good anti-fungal activity, but still it is less than the marketed preparation. Marketed preparations MIC are slightly less than the MIC_{90} of ketoconazole (0.5 µg/ml).

CONCLUSION

Conclusion can be made from the present study that, herbs used for preparation of anti-dandruff shampoo such as reetha, shika kai and snake gourd possess the considerable anti-dandruff activity. Among the herbs, reetha possess the more anti-fungal activity then the shika kai and snake gourd. Snake gourd possesses the anti-fungal activity less than the other two herbs. Even though all herbs possess the anti-fungal activity, but its anti-fungal activity is slightly less than the MIC_{50} of ketoconazole. When formulated shampoos are compared with the marketed preparation, it shows less anti-fungal activity, so conclusion can be made that, along with these three herbs, there is a need of other anti-fungal activity possessing herbs in the shampoo. The study reveals that, combination of all three herbs possess better anti-fungal activity then the other. F7 batch formulation shows considerably good results; its foam formation can be increased by addition of the other natural surfactants.

ACKNOWLEDGMENT

We are thankful to Dr. U. K. Patil, Department of Microbiology, R.C. Patel Science College, Shirpur, India for providing the facility of anti-fungal activity.

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