

Anti microbial activity of different dosage forms of *Bakuchi* (*Psoralea corylifolia* Linn.) *taila*, An Ayurvedic formulation

Research Article

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Abstract

Psoralea corylifolia Linn. commonly known as “*Bakuchi*” used in Indian traditional medicine. Ayurveda for the treatment of leucoderma, scabies, leprosy, psoriasis, dermatitis etc. *Bakuchi taila* is one of the Ayurvedic formulation which is used externally in skin disease. Hence, an attempt has been made to convert *Bakuchi taila* into its different dosage forms and to evaluate anti microbial activity against gram positive and gram negative bacilli. *Bakuchi taila*, *Bakuchi gel*, *Bakuchi siktha taila* and *Bakuchi ointment* possess significant anti microbial activity against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella pneumonia*. These results confirmed that potential of *Bakuchi* seeds (*Psoralea corylifolia* Linn.) in the development of Ayurvedic topical skin formulations.

Keywords: *Psoralea corylifolia*, *Bakuchi*, Ayurveda, Topical dosage forms, Anti microbial

Introduction:

The use of plant and its products has a long history to treat various types of disorders in Indian traditional medicine Ayurveda. Medicinal plants have always been a good source to find new remedies for human health problems. Now days, many plants products used to treat various diseases caused by pathogens. Although extremely effective, antibiotics are able to induce resistance in bacteria. For 450 years, bacterial resistance has been the main factor responsible for the increase of morbidity, mortality and health care costs of bacterial infections (1).

Bakuchi is one of the important herbal resources known to the seers of ancient India. It occupied a prominent role in therapeutics. It is referred frequently in Ayurvedic scriptures as a component of formulations for different pathological conditions. The seeds are bitter, anthelmintic, stimulant, diuretic and diaphoretic. *Bakuchi* is conventionally used in Ayurvedic system of medicine for the treatment of various kinds of human disorders especially for treatment of skin disorders such as psoriasis, leucoderma and leprosy in the form

of internal medication(2) as well as external applications (3). *Psoralea corylifolia* Linn. seeds has been reported to contain several phytoconstituents including coumarins and flavone components such as psoralen, isopsoralen, psoralidin, neobavaisoflavone, bavachin, corylin, bavachalcone (4) and possess antibacterial, anti-inflammatory (5), antifungal (6), antioxidant (7,8), antiparasitic (9), estrogenic (10), antitumour (11) and immunomodulatory activity (12). *Tila taila* also possesses anti-inflammatory, wound healing etc. properties. The combination of these drugs possibly acts synergistically together to pacify the symptoms of a disease. *Lepa* (13), *Pralepa* (14) etc. are few dosage forms of external applications explained in classics of Ayurveda. In addition to this, many medicated oils were also mentioned in classics that have been advocated for external use. *Bakuchi taila* is mentioned in *Aryabhishak* for the treatment of *Kustha roga* especially leucoderma in the form of local application (15). Despite the fact that this form is beneficial; it possesses certain inconveniences while handling, packaging and transportation etc. Hence, an attempt has been made to convert *Bakuchi taila* into *Bakuchi siktha taila*, *Bakuchi ointment* and *Bakuchi gel* for better acceptability and compliance also evaluated anti-microbial activity of *Bakuchi taila* and its different dosage forms in gram positive and gram negative bacteria.

Materials and Methods

Procurement of Raw Material

Bakuchi seeds (*Psoralea corylifolia* Linn.), *Tila taila* (Sesame Oil), Aerosil and *Shikta* were purchased

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from Ayucare Pharmaceuticals, Ahmedabad and glycerine was procured from laboratory of Rasashastra & Bhaisajya Kalpana Dept IPGT&RA, Gujarat Ayurved University, Jamnagar. ATCC 6633 *Bacillus subtilis*, MTCC 3160 *Staphylococcus aureus*, MTCC 443 *Escherichia coli* and MTCC 7162 *Klebsiella pneumonia* were collected from Ayucare Pharmaceutical Ahmedabad, Gujarat.

Preparation of Bakuchi taila

The preparation of Bakuchi taila was carried out following the procedure described in the Sarangadhar samhita (16). The taila paka process involves three different media i.e. kalka (paste), taila and drava (kwatha/milk etc.) in the ration 1:4:16 respectively. Bakuchi kwatha was prepared by taking Bakuchi seeds 1 part and 16 part of water was adding into it. They were kept for overnight (12 hours) and next day heating process was carried out in Mandagni i.e. 95 – 1000C till the volume reduced to 1/4th and material was filtered with the help of cotton cloth and Bakuchi kwatha was collected. For Bakuchi kalka, fine powder of Bakuchi was prepared with the help of mortar and pestle. After that, it was triturated with sufficient quantity of water and kalka was prepared. For taila paka process, tila taila (Sesame oil) was taken in a stainless steel vessel and heated in Mandagni till the moisture completely evaporates. Bakuchi kalka was added in it followed by addition of Bakuchi kwatha. Heating was continued maintaining the temperature between 95 – 1000C with occasional stirring to avoid sticking of the paste in the bottom of the vessel. Heating was continued till Sneha siddhi lakashana like Varti-vat, Sneha kalka (wick-like shape), Sabdhinoagni nikshipto (does not produce crackling sound on fire) etc was obtained. When Sneha siddhi lakashanas was obtained, Taila was filtered with the help of cotton cloth. This filtered Taila was known as Bakuchi taila.

Preparation of Bakuchi Gel

Bakuchi taila was taken in a porcelain mortar and small quantity of aerosil was added in it. The contents were homogenized by the action of stirrer. Stirring was done continuously aerosil was added till desired consistency of product was obtained and stored in air tight container.

Preparation of Bakuchi siktha taila

Bakuchi siktha taila was prepared by modifying the reference of Siktha taila of Rasatarangini (17). In this method, Tila taila was replaced by Bakuchi taila. Siktha and Bakuchi taila were taken in the ration 1:5 respectively. Bakuchi taila was heated in stainless steel vessel till temperature reaches at 800C and then Siktha was added in it. Continuous stirring was done for homogenous mixing of Siktha. Heating was stopped

after uniform mixing and the material were filtered through a cotton cloth. The filtered material is known as Bakuchi siktha taila.

Preparation of Bakuchi Ointment

Bakuchi ointment was prepared by following the general reference of ointment preparation in which two phases i.e. oil and water phases were mixed together. Firstly for oil phase, Bakuchi taila and Siktha were heated in a stainless steel vessel with continuous stirring till the contents are uniformly mixed. Simultaneously, the contents of water phase i.e. RO water and Glycerin were also heated in another vessel till uniform mixing was obtained. Then, both the phases were filtered and shifted in a clean mortar followed by continuous stirring to obtain uniform ointment. The finished product obtained was known as Bakuchi ointment.

Anti-microbial activity

Anti-microbial activity was studied by Agar well diffusion assay (18) method against two gram positive *Bacillus subtilis* ATCC 6633 & *Staphylococcus aureus* MTCC 3160 and two gram negative bacteria *Escherichia coli* MTCC 443 & *Klebsiella pneumoniae* MTCC 7162. Mueller-Hinton agar (Mh agar) was used as media. All the samples were dissolved in hexane (control). 5mm well were prepared using sterile cup borer. 20 µl of diluted sample were added in the well and incubated at 37°C for 24 hours. Results were observed at zone of inhibition, measured in mm. Ampicillin (antibiotic) was used as standard drug and its sensitivity was 11mm. Bakuchi and its different forms are compared with sensitivity of Ampicillin. If the drug posses 11.5 mm or more means it is highly sensitive, if it around 8mm then it is intermediate and if less than 8mm i.e. low sensitive. If the drug doesn't respond then, it is resistant.

Results

For Bakuchi taila, 100 g of Bakuchi seeds Kalka (Paste) were mixed in 400 ml of Tila taila followed by addition of 1600 ml of Bakuchi seeds Kwatha (Decoction). Total duration of heating process required for preparation of Bakuchi taila was 18 hrs. Total quantity 388 ml of Bakuchi taila was obtained. In Bakuchi gel preparation, 3 g of aerosil is sufficient to make Bakuchi gel from 50 ml Bakuchi taila. Final gel obtained was 46.4 g in weight. During preparation of Bakuchi siktha taila it was observed that Siktha was easily mixed in mild hot Bakuchi taila, but continuous stirring was done and final weight was 46.9 g. For Bakuchi ointment 30 ml of Bakuchi taila was mixed in 6 g of Siktha for oil phase and in water phase 4 g glycerine and 15 ml of RO water is added in previously prepared Bakuchi siktha taila. Final weight of Bakuchi ointment was 45.3 g. The results obtained during preparation of Bakuchi taila and its different dosage forms are in table 1-2.

Anti-microbial activity

Bakuchi ointment shows greater inhibitory activity against Gram +ve *Bacillus subtilis* and Gram -ve *E. coli* whereas Bakuchi taila shows greater inhibitory activity against both Gram +ve *Bacillus subtilis* and *S. aureus*. Bakuchi gel shows greater inhibitory activity against Gram +ve *S. aureus* and Gram -ve *Klebsiella pneumoniae*. Bakuchi siktha taila shows greater inhibitory activity against Gram -ve

Klebsiella pneumoniae. All the dosage forms of Bakuchi show remarkable inhibitory against Gram +ve and Gram -ve. Although, inhibition was more against Gram +ve bacteria, the highest zone of inhibition was of Bakuchi gel 15mm at only 20 µl drug concentration against *S. aureus* (Gram +ve) which is highly sensitive, then the standard drug Ampicillin which has 11.5 mm inhibition (Table 3-4).

Table 1: Results obtained during preparation of *Bakuchi taila* and its different dosage forms

Dosage forms	Initial quantity of <i>Bakuchi kalka</i>	Initial quantity of <i>Tila taila</i>	Initial quantity of <i>Bakuchi kwatha</i>	Initial quantity of <i>Bakuchi taila</i>	Initial quantity of aerosil	<i>Siktha</i>	Glycerine	RO water	Final quantity	Loss
<i>Bakuchi taila</i>	100 g	400 ml	1600 ml	-		-	-		388 ml	12 ml
<i>Bakuchi Gel</i>	-	-	-	50 ml	3 g	-	-	-	50.4 g	2.6 g
<i>Bakuchi siktha taila</i>	-	-	-	50 ml	-	10 g	-	-	55.9 g	4.1 g
<i>Bakuchi Ointment</i>	-	-	-	30 ml	-	6 g	4 g	15 ml	50 g	4 g

Table 2: Organoleptic characteristics of *Bakuchi taila* and its dosage forms

Parameters	<i>Bakuchi taila</i>	<i>Bakuchi siktha taila</i>	<i>Bakuchi Ointment</i>	<i>Bakuchi Gel</i>
Color	Yellowish brown	Yellowish Cream	Cream	Golden
Odour	Characteristic	Characteristic	Characteristic	Characteristic
Touch	Oily	Greasy	Greasy	Greasy
Consistency	Smooth, Non gritty	Smooth, soft, homogenous	Smooth, semi solid, homogenous	Smooth, soft, homogenous
Texture	--	Smooth, Creamy, Non gritty	Smooth, Non gritty	Smooth, Jelly, Translucent, Non gritty

Table no. 3: Results of Zone of Inhibition in Gram positive bacteria

Strain	Sample	Conc. of Drug	Zone of Inhibition	Sensitivity Against Ampicillin
<i>Bacillus subtilis</i> ATCC 6633	<i>Bakuchi taila</i>	20 µl	10 mm	S
	<i>Bakuchi siktha taila</i>	20 µl	9 mm	S
	<i>Bakuchi Gel</i>	20 µl	Nil	R
	<i>Bakuchi Ointment</i>	20 µl	11 mm	S
<i>Staphylococcus aureus</i> MTCC 3160	<i>Bakuchi taila</i>	20 µl	13 mm	HS
	<i>Bakuchi siktha taila</i>	20 µl	11 mm	S
	<i>Bakuchi Gel</i>	20 µl	15 mm	HS
	<i>Bakuchi Ointment</i>	20 µl	12 mm	HS

S, Sensitive; R, Resistant; I, Intermediate; HS, Highly sensitive.

Table no. 4: Results of Zone of Inhibition in Gram negative bacteria

Strain	Sample	Conc. of Drug	Zone of Inhibition	Sensitivity Against Ampicillin
<i>Escherichia coli</i> MTCC 443	<i>Bakuchi taila</i>	20 µl	7 mm	LS
	<i>Bakuchi siktha taila</i>	20 µl	7 mm	LS
	<i>Bakuchi Gel</i>	20 µl	7 mm	LS
	<i>Bakuchi Ointment</i>	20 µl	8 mm	I
<i>Klebsiella pneumoniae</i> MTCC 7162	<i>Bakuchi taila</i>	20 µl	8 mm	I
	<i>Bakuchi siktha taila</i>	20 µl	10 mm	S
	<i>Bakuchi Gel</i>	20 µl	9 mm	S
	<i>Bakuchi Ointment</i>	20 µl	8 mm	I

LS, Low sensitive; I, Intermediate; S, Sensitive.

Discussion

Ayurveda, the science of life uses natural resources in fulfilling the fundamental objectives i.e. *Swasthya rakshanam* and *Vyadhi prashamanam*. Plants occupy a significant seat of these resources. The use of plants and its products are useful to treat several ailments from 5000 years ago. *Bakuchi* (*Psoralea corylifolia* Linn.) is one of the most popular Indian Traditional Medicine and officially listed in Ayurvedic Pharmacopoeia of India (19). As per classical literature, *Bakuchi* is useful to treat various disorders like *Kushtha* (skin disorders), *Keshya* (hair treatments), *Krumi* (as a germicidal), *Shwasa* (Bronchial Asthma), *Kasa* (Cough), *Pandu* (Anemia), and *Shotha* (Oedema) (20). In our present study, *Bakuchi taila* was prepared by following the standard method of *Sneha paka* which is described in *Sarangdhar samhita* (21). Further, it was converted into different dosage forms like *Bakuchi siktha taila*, *Bakuchi gel* & *Bakuchi ointment*. In preparation of *Bakuchi taila* our results demonstrate that minimum 18 hrs of heating is necessary to get desired quality of *Bakuchi taila*. *Kalka dravya* used for preparation was made in to fine powder so that maximum percentage of active constituents goes in to preparation. The weight of *Kalka dravya* after preparation was increased and found 110 gm. This increase the amount of *Kalka dravya* due to absorption of *Taila* and *Dravya dravya* used in preparation. Final weight of *Bakuchi taila* was decreased than that of *Tila taila* because of absorption of *Kalka dravya*. Preparation of *Bakuchi taila* was done in *Madhyam agni* at temperature between 95-100°C because at higher temperature *Kalka dravya* gets burned and all liquid material will evaporate quickly and no *Drava dravya* would be available for preparation. In case of *Bakuchi gel* for 50 ml of *Bakuchi taila*, 3 gm of aerosol is sufficient to make gel. *Bakuchi siktha taila* was prepared by modifying the reference of *Siktha taila* of *Rasa tarangini*. *Bakuchi ointment* was prepared by

following the protocol of mixing of oil and water phase homogenously and continuous stirring was done.

In the present study, different dosage forms of *Bakuchi* i.e. *Bakuchi taila*, *Bakuchi gel*, *Bakuchi siktha taila* and *Bakuchi ointment* were evaluated for their anti microbial activity. The bacilli are grossly divided as gram positive and gram negative bacteria. So, as to test the anti microbial activity, a gram positive and gram negative bacteria bacilli are selected for the study. *Staphylococcus aureus*, *Bacillus subtilis* (gram positive) and *Escherichia coli*, *Klebsiella pneumonia* (gram negative) which are the most common causes of diseases in human beings were selected for the study. Our results demonstrates that all the dosage forms of *Bakuchi* shows good inhibitory activity against both gram positive and gram negative bacteria. However, inhibitory activity against gram positive bacteria was comparatively more than gram negative. Out of all dosage forms, *Bakuchi gel* was giving highest zone of inhibition against *Staphylococcus aureus* a gram positive bacterium. *Bakuchi* contain active component as psoralen, angelicin, and bakuchiol (22, 23). Psoralen shows strong inhibition of bacteria, such as *Microsporium canis*, *Microsporium gypseum*, *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *S. aureus*, *Candida albicans*, *Escherichia coli*, *P. aeruginosa*, and others (24). Chopra et al. also reported that anti microbial activity of *Bakuchi* was due to the presence of bakuchiol (25).

Conclusion

This study revealed that *Bakuchi taila* and its different dosage forms possess significant Anti microbial activity against gram positive and gram negative bacteria. So, it can be used as bioactive anti microbial ingredients in various topical skin formulations.

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