An Experimental Study on *Mahehwar Dhoop* to Evaluate Fumigation Effect in Comparison with Bacillocid

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Abstract

Background: Ayurveda advocates fumigation as a method of sterilization and therapeutic tool for different infective diseases and mental disorders. However, it is not popular and proven scientifically hence there is great scope and prospects for research. For patient safety, fumigation is a regular protocol.

Aim and Objectives: It is the need of the hour to search a safe, cheap, effective and easily available drugs for fumigation hence *Maheshwar Dhoop*-MD was chosen and compared its efficacy with control- Bacillocid.

Material and Method: Study was performed in Shalakya (eye-ENT), *Panchkarma* procedure rooms and minor operation theatre by pre-post swab and Agar plate exposure on 2nd (MD) and 4th week (Bacillocid) monthly once each for total three months. The microbial load was estimated for different micro-organisms like bacteria, fungus etc and subjected to statistical analysis.

Observation and Results: The study revealed that the effect of *Dhoopana* was significant in comparison with Bacillocidto control both during study period and follow up period up to 6 days against bacterias and fungus. **Conclusion**: It was found that MD is safe, cheap and equally efficient as Bacillocid ($p<0.0001$) with one-week residual effect.

Keywords: *Bacillocid, Maheshwar dhup, fumigation, Sterilization, Dhoopan kalp, microbes, Agar plate and swab.*

Introduction

Ayurveda is a life science which is mainly well known for disease prevention[1]. *Dhoopan*imply fumigation or sterilization which is one of the approaches of prevention[2]. The decontamination of enclosed environment is an important consideration for the control of pathogens. Ayurveda recommends fumigation as a method of sterilization and therapeutic procedure for various human diseases including microbial infections and psychological disorders. However, due to the lacking scientific validation, these Dhoop kalpas are not popular, which brings attention to research opportunities and understand its safety and efficacy, anti-microbial activity with safe, economical and eco-friendly potential.[3] Fumigation is an age-old method of sterilization. There are few examples mentioned in Ayurveda compendia specially in *Kashyap samhita, Dhupkalpadhyay* for the use as *Rakshoghna* (antimicrobial*)* in treatment of various diseases. For the purpose of prevention of neonatal diseases, which are prone during neonatal period, *Kashyap* emphasized to fumigate the clothes of newborn after bath by antimicrobial drugs[4]. The soiled clothes with faeces, urine, sweat or dirt should be used only after

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washing, drying and getting them fumigated by Yava, Sarshap, Atasi, Hingu, Guggulu, Vacha etc. with ghee[5]. *Yogratnakar* advice that the child who is fumigated with the feathers of cock dipped with cow's ghee for seven days need not be afraid of any evil demons[6]. Probably the fumigation has disinfectant properties and protects the child and place by making them sterile. *Vagbhat* has suggested fumigation with feathers of a normally dead crow mixed with *Trivritta*, includes both disinfectant as well as deodorants. Various amulets, jwels, horn tip, *Vacha* are made into lockets to be tied to hands, neck for the longevity, increase intelligence and ward off the evil demons[7].

In Hindu mythology the concept of '*Raksha' and 'Bhuta'* is very important which can be compared with infectious agent having impact on health due to known or unknown causes. The scientific intelligence of ancient scholars regarding the infections gives importance to *Rakshoghna vidhi*. '*Dhupkalpa'* prepared by combination of several drugs which may have anti-infective properties producing fumes with aroma. *Dhoopn* is carried out by healthcare worker to prevent nasocomial diseases to society. There are three types of fumigation on the basis of action i. e. *Dhoop, Anudhoop and Pratidhoop* and on the basis of origin, two types are mentioned as *Sthavar* (Herbal) & *Jangam* (animal origin)[8]. *Maheshwar Dhoop* has been described in *Kashyap samhita* in *kalpasthana*. It is indicated for treatment of malaria and also for *Graharogas* (infectious diseases)[9]. There is overabundance of microbes everywhere in atmosphere hence, it is a protocol to fumigate operation theatres, minor procedure rooms prior surgery to prevent hospital acquired infections (HAI)[10]. Fumigationrequires to be performed as per the protocol to ensure patient safety[11]. Formalin fumigation which is outdated now, owing to its harmful and carcinogenic effects which was required 300 ml of 10% Ammonia to neutralize formalin vapours and open the OT to start surgery. Such formalin fumigation is required at weekly intervals. There are other disinfectants like Phenol-carbolic acid 2%, Bacillocid, Ethylene oxide, ultrasonic cleaner or ultra-violate, gamma radiation which are costly. It is the need of the hour to search a better option to make environment sterile. Standard fumigation should overcome all these lacunae and prove as a safe, cost effective, quick, easy method to avert hospital acquired infections (HAI) also useful to prevent vector-borne diseases, bugs, mites/ arachnida, insects etc.

Recently, *Dhoopn* is seldom used as fumigation method, therefore, this study aimed to evaluate the efficacy *of Maheshwar dhoop* for fumigation purposeas *Rakshoghna* (antimicrobial/sterile) with safe and instant actioncompared with Bacillocid control. Currently, Bacillocid (liquid concentrated chemical) is in use for fumigation for sterilization[12].

Materials and Method

The study was carried outat Mahatma Gandhi Ayurved College, Hospital and Research centre, Salod after ethical clearance from institutional ethical committee. The pre-post swabs were taken from Shalakya (ENT, Ophthalmic) procedure room, Minor OT-operation theatre, male and female *panchkarma* procedure rooms and *Balpanchkarma* room. Main surgical operation theatre was kept away from this study to avoid the interference in protocol of sterilization.

Materials: Herbsrequired for *Dhoopan*/fumigation were collected and authenticated from taxonomist. Then *Dhoop* was prepared at institutional pharmacy and standardized at analytical lab of institute- M.G.A.C.H. & R.C. to see the fumigation effect by swab analysis which was tested by Microbiologists at Jawaharlal Nehru Medical College, Sawangi, Wardha.

Method of *Maheshwar Dhoop (MD)* preparation and Fumigation: The raw drugs were cleaned and made in to coarse powdered form (Mesh size 40-60)separately and homogenous mixture was prepared by mixing all the ingredients. Pre-swabs were taken to check the presence of organisms. Agargel plates were kept in each room. Then the coarse MD powder of 25 gms was sprinckled on burned cow-dung cake of size around 250 gms.,medicated fumes were produced till the area became full of fumes. Dhoopan/fumigation area of five rooms of 10x10 ft size was cleaned first and then window, doors were kept closed, AC, fans switched off till the process has been carried out[13]. *Maheshwardhoopan karma* was carried out like regular fumigation in OTand Panchkarma therapy rooms. Thereafter,post-swaband agar gel plates were received after 2 hours of *Dhoopan* to check the anti-microbial activity of MD on 2nd week of a month for four consecutive months after procedures at afternoon hours. Again regular fumigation by Bacillocid 500ml: water 1000ml for an area of 10x10 feet was done on every 4th week of four consecutive months. Fumigation was done after procedures and operative minor work as usual as per protocol. In all four months, fumigation by MD and

Bacillocid, the timings were same in the afternoon (2-4 pm). The swabs were taken from five sites (Procedure and preparation Table top, floor, east and west wall) from each therapy room and OT. Single agargel plate was kept in the center of the room. Every time swabs were taken and plate was kept at same places. Then *Maheshwar dhoop* efficacy was checked as compare to regular fumigation with Bacillocid by separate pre-post swabs and agar plates after Bacillocidfumigation also. Duration of *dhoopan* was continued up to filling of smoke in OT room and therapy rooms according to area and quantity calculation. It was observed that only one cow dung cake of around 250 gms and 25 gm coarse powder of MD formulation was sufficient to produce full of smoke in the room of 10x10 feet size. Initially sterlium (hand sanitizer) was used to burn the cake later due to ghrit the procedure of dhoopan was smoothly carried out without any problem.

Frequency: Total four consecutive months, *dhoopan* was done and same for Bacillocidfumigation for comparison by taking pre-post swabs and agargel plates exposure.

Laboratory Investigations: Pre-post swab and Agar gel plates culture reports were done at Microbiology Dept. JNMC, Wardha.

Action of above drugs has been proved the efficacy for maintenance of health as well as prevention of diseases by the action of anti-microbial[14-18]. In original text of Kashyap Samhita (from where *Maheshwar dhup* reference has chosen), there is *Nameru* drug also mentioned along with above drugs but it is not taken due to not clear identification and availability of it.

Assessment Criteria: For standardization of *Dhoopan dravyas*, following Specific criteria were assessed to check each drug's quality separately and together in combination of *MD dravyas*.

Table No. 1: Organoleptic parameters of Maheshwar Dhoop

Parameters	Pharmacopoeia standard	Committee standard	Observations	Inference
Color	Not available	Brown	Brown	Acceptable
Odor	Not available	Aromatic and pleasant	Aromatic and pleasant	Acceptable

Table No. 2: Physico-chemical parameters of Maheshwar Dhoop

Parameters	Pharmacopeia standard	Committee standard	Observations (Avarage of three batches)	Inference
Loss on drying at 105°C	Not available	Not more than 13%	8.25%	Acceptable
Total ash	Not available	Not more than 9%	6.6%	Acceptable
Acid insoluble ash	Not available	Not more than 2%	1.2%	Acceptable
Alcohol soluble extractives	Not available	Not less than 13%	16.4%	Acceptable
Water soluble extractive	Not available	Not less than 11%	14 %	Acceptable
pH	Not available	-	5.2 (10% aqueous solution)	Acceptable
Hardness	Not available	4–6 kg	4.2 kg	Acceptable
Tablet Disintegration time	Not available	5 to 20 minutes	14 minutes	Acceptable

Table No. 3: Microbiological specification of Maheshwar Dhoop formulation

Parameters	Pharmacopeia standard	Observations	Inference
Total viable count	Maximum 105/gm	No growth	Acceptable
Enterobacteriaceae	103/gm	Absent	Acceptable
Total fungus count	Maximum 103/gm	Absent	Acceptable
E-coli	Maximum 10/gm	Absent	Acceptable

Parameters	Pharmacopeia standard	Observations	Inference
Salmonella	None	Absent	Acceptable
Staphyliococus aureus	Absent	Absent	Acceptable
Psudomonas aueruginosa	Absent	Absent	Acceptable

Organo-leptic characters such as Color, Odor, Touch then **Identification** was done by Microscopy. **Physico-Chemical Parameters:** were assessed by loss on drying at 110°C, Total ash, Acid soluble ash, Water soluble extractive, pH and particle size with Microbial contamination also noted. Assessment was carried out on the basis of swab reports by microbiologist with the help of comparison in mean pre - post swab reports and statistics.

The cow dung two cakes and MD formulation coarse powder 100 gms including ghrit were required to fill up the full of smoke of 10x10 feet area rooms. The cakes were kept opposite to each other to spread the smoke fast. Observations were noted and inference drawn after swab reports of pre and post *Dhoopan* versus Bacilosid fumigation from *Shalakya* procedure room, Minor OT, procedure room*s* of *Balrog,* male and female *panchkarma*. Alternate Dhoopan and fumigation was done on every fortnight up to three months in all these rooms and OT. Then average % with statistical reports, the efficacy of substantial changes in bacterial and fungal count were seen after Dhoopan up to 15 days, when compared with control which is depicted in table no.2. This indicates that the effect of *Dhoopan* was reserved up to one week. On the basis of the result of the present study, it may be said that the microbial concentration will be under control by procedure of *Dhoopan*.

Table No. 4: Statistical analysis of microorganisms pre vspost Maheshwar Dhoopan

Parameter	Group Name	Mean	Std Dev	SEM	t value	P value
Shalakya	Pre MD	28.00	3.367	1.683	8.981	P = <0.001
	Post	6.00	3.559	1.780		
Shalya OT	Pre MD	65.500	35.351	17.675	2.627	<0.039
	Post	16.000	13.038	6.519		
Male PK PR	Pre	46.250	5.965	2.983	8.648	<0.001
	Post	12.250	5.123	2.562		
Female PK PR	Pre	20.250	6.898	3.449	2.535	0.044
	Post	9.500	4.933	2.466		
Balrog PKPR	Pre	25.500	5.802	2.901	4.800	0.003
	Post	11.250	1.258	0.629		

Table No. 5: Statistical analysis of microorganisms Bacillocid before & after study

Parameter	Group Name	Mean	Std Dev	SEM	t value	P value
Shalakya	Pre fumigation	33.750	5.315	2.658	5.974	<0.001
	Post	10.500	5.686	2.843		
Shalya OT	Pre	62.750	31.700	15.850	2.751	<0.001
	Post	18.750	4.272	2.136		
Male PK PR	Pre	47.500	3.512	1.756	7.289	<0.001
	Post	21.750	6.131	3.065		

Parameter	Group Name	Mean	Std Dev	SEM	t value	P value
Female PK PR	Pre	25.500	5.745	2.872	1.436	0.201
	Post	14.500	14.201	7.100		
Balrog PKPR	Pre	31.00	7.348	3.674	4.477	0.004
	Post	13.00	3.266	1.633		

AS per the data is shown in Table no 2 and 3, both the groups post counts are significant as compared to pre colonies count of micro-organisms but the post MD count when compared by Paired t test with post Bacillocid group, it was observed that in some procedural rooms, MD count was not significant over Bacillocid group count as depicted in table no. 4.

Table No. 6: showing statistical outcome of post MD vs post Bacillocid fumigation

Parameter	Number	Mean difference	Std Dev	SE	t value	P value
Shalakya	04	4.500	6.952	3.476	1.295	P = 0.286
Shalya OT	04	2.750	8.995	4.498	0.611	P = 0.584
Male PK PR	04	9.500	1.915	0.957	9.922	P = 0.002
Female PK PR	04	5.000	18.074	9.037	0.553	P = 0.619
Balrog PK PR	04	1.750	3.096	1.548	1.131	P = 0.340

It was observed that the post fumigation, residual effect was good than Bacillocid and it remained up to one week.

Discussion

There are 3 types of *Dhoopan- Dhoop, Anudhoop & Pratidhoop*, total *Dhoopas* mentioned by *Acharya Kashyap* are 40 for different indications such as to, progeny to human beings, to cure all diseases & to eradicate grahas means *Rakshoghna*efficacy i.e. bacteriocidal or antimicrobial function8,9. Inspite of age-old method of fumigation, traditional *Dhoopan* is a neglected method for sterilization thus taken for this study as comparative experiment with popular Bacillocidinstead of prior reputed formalin which is banned recently. In this study, both the groups were highly significant in pre-post comparison of individual group but when compared to post MD with post Bacillocid control group, MD which is a trial group was not much significant.

Probable Action of MD: All ingredients of MD are showing the evidence of *Krimighna* properties, so after burning the ingredients of MD, smoke was filled in the tight closed room and later room was kept closed overnight to disinfect the microbial load by its *Rakshoghna* characteristic. As per the study by Ananthakumar and Dahikar in 2009 the same result was achieved. According to Tambekar in 2010, Sumitha et al -2015 and Rathi et al in 2020 all these ingredients are having virucidal, bactericidal, fungicidal, mycobactericidal and non-toxic compounds. On the other hand, Bacillocid is a broad spectrum microbicidal, corrosion inhibitor and cleanser. It has long residual effect,used diluted solution and microorganisms are non-resistant to it but the main concern is that it contains 30 % formaldehyde which is a carcinogenic chemical. Therefore, in spite of not much significance with bacillocid, MD is safe, cost-effective and having a good residual action also.

Conclusion

In the nut shell, the study performed up to four consecutive months, MD is more effective as compared to Bacillocid fumigation in different procedure rooms and minor operation theatre as both groups are highly significant ($P<0.001$) but post study residual effect was more than Bacillocid. Also, MD is safe, economic and very effective solution in sterilization to protect from microbial load as well as nosocomial infection. Time has come to change the chemical based synthetic and toxic agents with herbo-mineral or animal origin safe

compounds for sterilization the high-risk area of hospital. The double benefit is that these *Dhoop dravyas* are also beneficial in therapeutic aspect.

Ethical Clearance: Taken from institutional ethics committee.

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Conflict of Interest: Nil.

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