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Ela Arka (Water Distillate of *Eletteria Cardamomum Linn.* Maton) as a Potential Ayurvedic Hand Sanitizer in Medical Professionals

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Abstract

Introduction: Hand asepsis is a fundamental quality to a healthy individual. Hand hygiene is the most effective measure for interrupting the transmission of microorganisms which cause infection both in the community and in the healthcare setting. Health Care professionals are more prone to dealing with pathogenic microbes and hand hygiene is an important aspect. Alcohol has been foremost of fluids used for non-foaming, anti-microbial fluid. An attempt done to study a potential Ayurvedic non-alcoholic hand sanitizer called *Ela arka*.

Objective: To assess reduction factor (RF) in microbial load before and after treatment with test drug and Standard drug.

Method: Quantitative analysis of microbial load by in-vitro evaluation by estimation of the reduction factor.

Result: The essential oil of *Ela arka* exhibits strong antimicrobial activity against micro-organisms.

Conclusion: Under the given specifications and ambit of study, *Ela arka* was found to be effective, superior to standard drug.

Keywords: *Ela arka*, hand sanitizer, micro-organisms, standard drug

Introduction

Hand hygiene is the most effective measure for interrupting the transmission of microorganisms which cause infection both in the community and in the healthcare setting [1]. Doctors and nurses have slightly greater threat as their nature of job itself is in contact or exposure to pathogenic microbes in the form of direct contact with the patients and contaminated surfaces. Improper hand hygiene by healthcare workers (HCWs) is responsible for about 40% of nosocomial infections resulting in prolonged illness, hospitals stays and long-term disability. There are two types of microbial flora; transient and resident. The transient bacterial flora reaches the hand by direct skin-to-surface contact [2].

Alcohol Based Hand Sanitizer (ABHS) has been propagated by World Health Organisation (WHO) as the most efficient preventive measures against pathogenic microbes. In hospitals, health care workers (HCWs) mainly use ABHS as a hand aseptic precaution because they require less time than hand washing, act quickly to kill microorganisms on hands, more effective than hand washing with soap and water, reduce bacterial counts on hands. Downgrade to alcohols is that they do not confer sustained anti-microbial properties and causes: Excessive dryness and sweating, incidences of Blood Alcohol Level (BAL) increase has been reported due to sustained use, substance abuse with alcohol-based sanitizers is well documented, deaths reported due to alcohol intoxication where ABHS was source, accelerated keratinization, thickening of palmar surface, peeling off of epidermis is also recorded usually in regular use of alcohol.

Development of an Ayurvedic non-alcoholic hand sanitizer is therefore one of the newer scopes of research. Principle drug to be studied should have to be a single in order to understand the working better. The drug *Sukshma Ela* (*Eletteria cardamomum Linn.* Maton) was selected for this particular purpose. The drug *Sukshma Ela* was selected for this particular purpose which is easily available. The essential oil present in *Ela* exhibits strong antibacterial activity against the micro-organisms. *Arka* is the form of water distillate obtained by simple distillation of drugs pre-soaked overnight. It is easy to administer and has more shelf life. *Arka* is employed when drugs contain volatile components which can be extracted using water as a solvent.

Materials and Method

Material

For Sample Collection: EDTA Sterile Swab, Distilled water, Sterile Gloves (Surgical grade), Markers, Ela Arka, Standard drug (Propan-2-ol and Propan-1-ol), Stop Watch.

For Serial Dilution: Sterile Test tubes (Autoclaved twice), Distilled water, marked 1 ml and 10 ml Pipette, Suction cup,

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Laminar Air Flow Chamber. Tissue Papers, Ethyl alcohol (for workspace sanitation), Spirit Lamps, Tongs/Tweezers, Test Tubes, Test tube holders, Test Tube stand.
For Testing Microbial Load: Calibrated Conical Flask, Sterile Petri dishes, Calibrated and functional Incubation chamber, Markers, Sterile Gloves (Surgical Gloves).

Method
An Open labelled, double arm, interventional trial was carried out in Split-Body Design with convenience sampling to evaluate the comparative efficacy of drug Ela Arka (Aqueous distillate of *Elettaria cardomomum Linn.* Maton) and standard drug propan-2-ol and propan-1-ol in hand sanitization of medical personnel. This was followed by an in-vitro analysis of microbial growth before and after contact. Serial dilution method was employed to estimate the amount of microbial growth at 7 concentrations of 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6} and 10^{-7}.

Table 1: Details of intervention of trail drug and standard drug

Criteria	Trial Drug Group (*Ela arka*)-Left Hand	Standard Group (Alcohol)-Right Hand
Sample size	10*	10*
Dose	3 ml	3 ml
Contact period	2 mins	2 mins
Number of administrations	Single	Single
Number of follow up	None	None

Collection of Samples for Evaluation
Wet Swab Method
- Medical professionals were asked to rub their palms for 10 seconds to ensure uniform distribution of flora on both hands.
- 1 ml Normal saline was pipetted onto the individual 4 swabs to enable it to be wet swab before actual swab collection.
- One swab was collected before any application from both the palms from the same volunteer at the same time by the scholar under maximum possible aseptic precautions which was marked as before treatment sample
- Left palm was treated with 3 ml of *Ela Arka* by Scholar for 30 seconds and allowed to air dry for 2 mins.
- Right palm was treated with 3 ml of Standard by Scholar for 30 seconds and allowed to dry for 2 mins.
- One swab was collected from each palm following exposure to Aqueous distillate of *Eletteria cardomomum Linn*. Maton (*Ela Arka*) and Propan-2-ol and Propan-1-ol in sterile swab cover itself and labelled appropriately.

In-Vitro Evaluation
1. Serial Dilution method
- Each Swab content will be inoculated in a test tube and the stock solution is prepared and subjected to serial dilution method.
- 1ml of inoculum was added with 9ml of normal saline to have 10^{-1} concentration.
- Subsequently dilutions will be done for 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6} and 10^{-7}.by proportionately increasing physiological saline.
- The same procedures are repeated for before & after swab and for Aqueous distillate (*Arka)* and Propan-2-ol and Propan-1-ol.

2. Preparation of Media
- The apt media selected for this study were Mueller-Hinton's Agar medium and the Nutrient Agar Medium.
- Freshly Media was prepared every single time by the standard methods.
- Sterile, thrice autoclaved warm distilled water was used to prepare media.
- Media substrate was added to warm, thrice autoclaved distilled water under maximum possible aseptic precautions, along with the stipulated amount of Agar Agar: Type-I and subjected to the autoclave with ~ 100o C at nearly 16 bar pressure for exactly 30 mins.

Microbial Load Assessment
- 0.1 ml-each dilution was freshly pipetted onto a sterile, appropriately labelled Petri dish
- Warm media is poured over the 1 ml sample and shaken in all directions on the planar surface to ensure uniform spread and distribution of media.
- Vacuum shunting was ensured to minimalize cross-contamination from external sources.
- Incubation-standardized to 24 to 36 hours in the incubation chamber.
- The samples were taken out.
- Distinct Colony Forming Units (CFU) were subjected to photo documentation as well as counting by identifying unique colonies.

Assessment Criteria
Calculation of Reduction Factor (RF): Conversion of number of bacterial units counted per 1000 into Log_{10} units for easier statistical calculations and comparisons. Every 1,000 microbes counted would be 1X Log_{10} 3 (expressed in terms of power. i.e., 1 X 10^3). Thus 1000 microbes will be **3.** Hence,
RF would be:
RF = log_{10} (baseline microbial count) – log_{10} (post wash/treatment microbial count)
RFE = log_{10} (baseline microbial count) – log_{10} (post treatment with *Arka*)
RFS = log_{10} (baseline microbial count) – log_{10} (post treatment with Standard)
Smaller RF signifies smaller reduction in microbial colonies.

Results
Colony-forming unit (CFU or cfu) is a measure of viable bacterial or fungal cells. In direct microscopic counts, all cells include dead and living cells are counted. But CFU measures only viable cells. CFU/mL-for liquids and CFU/g-for solids. The CFU/ml can be calculated using the formula:

cfu/ml = (no. of colonies x dilution factor)/volume of culture plate

Here, all numbers are expressed as the numerical value of Log_{10}. Positive number shows that ela arka fared better than standard drug. Negative result shows standard fared better than ela arka. If difference is zero, it is opined that both had equal reduction.
Remarks Legend: E >S-Ela arka fared better than standard, S> E-Standard fared better than Ela arka and E=S-Both had equal reduction or no reduction at all.

Table 2: Percentage of the reduction factors of *ela arka* and standard drug.

		10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	
1	RFE-RFS	-0.085	-0.014	0.004	0.030	0.051	0.000	0.076	
	INFERENCE	E<S	E<S	E>S	E>S	E>S	E=S	E>S	57.14%
2	RFE-RFS	-0.008	0.021	0.038	-0.012	-0.021	0.028	0.029	
	INFERENCE	E<S	E>S	E>S	E<S	E<S	E>S	E>S	57.14%
3	RFE-RFS	0.080	0.051	0.060	0.079	0.092	-0.051	-0.183	
	INFERENCE	E>S	E>S	E>S	E>S	E>S	E<S	E<S	71.41%
4	RFE-RFS	0.114	-0.079	0.222	0.289	0.271	0.125	0.000	
	INFERENCE	E>S	E<S	E>S	E>S	E>S	E>S	E=S	71.42%
5	RFE-RFS	0.028	0.067	-0.046	0.046	0.058	0.046	-0.046	
	INFERENCE	E>S	E>S	E<S	E>S	E>S	E>S	E<S	71.42%
6	RFE-RFS	0.019	0.020	0.046	-0.005	0.025	-0.009	0.097	
	INFERENCE	E>S	E>S	E>S	E<S	E>S	E<S	E>S	71.42%
7	RFE-RFS	-0.042	0.031	-0.024	0.017	0.072	0.176	0.272	
	INFERENCE	E<S	E>S	E<S	E>S	E>S	E>S	E>S	71.42%
8	RFE-RFS	0.039	-0.025	0.048	0.046	-0.046	0.125	0.049	
	INFERENCE	E>S	E<S	E>S	E>S	E<S	E>S	E>S	71.42%
9	RFE-RFS	-0.040	-0.043	-0.032	0.048	0.222	0.234	-0.222	
	INFERENCE	E<S	E<S	E<S	E>S	E>S	E>S	E<S	42.85%
10	RFE-RFS	-0.096	-0.076	0.041	0.052	0.046	0.000	0.029	
	INFERENCE	E<S	E<S	E>S	E>S	E>S	E=S	E>S	57.14%
		50%	50%	70%	80%	80%	60%	60%	

Summary of the study can be understood by taking the percentage of the reduction factors of *ela arka* and standard drug of all 10 samples with all 7 concentrations. By keeping the concentration as constant that is 10^{-1} concentration is kept constant and inferences are observed in all 10 samples, it showed 50% overall remark. This provides an information that *ela arka* showed same potency as the standard drug have. By keeping the sample as constant that is sample 1 is kept constant and inferences are observed in all 7 concentrations, it showed 57.14% overall remark. This provides an information that *ela arka* showed more potency than the standard drug has.

Discussion

The essential oil of *Ela* was found to contain 71 compounds. The major components were α-terpinyl acetate (44.3%), 1,8-cineole (10.7%), α-terpineol (9.8%) and linalool (8.6%). The essential oil α-terpineol is having anti-oxidant, insecticidal properties and also enhance skin penetration. 1,8-cineole shows anti-microbial effect against micro-organisms. Linalool act as cleansing agent and α-terpinyl acetate acts as a flavoring agent[3]. Various chemical constituent has been established in context of antimicrobial activity. Among those are the anti-bacterial activity[4], anti-microbial activity[5] and Anti-fungal assay[6]. Hence, it could be stated that *ela arka* act as potential hand sanitizer in medical professional.

Conclusion

Ela called species of queen has already been reported to have been effective as an anti-microbial in various extract forms. Under the given specifications and ambit of study, scope of this research and in this particular sample and sample size, *Ela arka* was found to be effective, superior to standard drug.

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