IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Formulation And Evaluation Of Anti-Acne Gel Containing Coriander And Garlic Using Natural Polymer

BaburaoN. Chandakavathe[1], Vikram A. Jadhav[2*], Suraj R. Chakre[3], M Kais S. Attar[4], Shrinath S. Diwate[5]

Abstract:

An inflammatory condition affecting the skin's sebaceous follicles called acne. The purpose of this study was to create and assess a topical aqueous coriander extract formulation for the treatment of acne. The disk diffusion method was utilized to examine the antibacterial activity of aqueous coriander and garlic extract against Propionibacterium acne and Staphylococcus epidermidis, while the agar dilution method was employed to ascertain the minimal inhibitory concentration (MIC). Physical characteristics, drug content homogeneity, spreadability, extrudability, and in vitro diffusion were evaluated during the development and testing of topical formulations. It was discovered that the MIC value of coriander extract for acne and s. skin was 1.9 mg/ml and 2.2 mg/ml, respectively. The formulation Fa1 had the highest drug content (94%), in vitro diffusion (93%), maximum stability, and zone of inhibition, according to the data.

Keywords: Acne, Coriander extract, Staphylococcus epidermidis, topical formulations, MIC value

INTRODUCTION:

A prevalent skin condition that primarily affects teens and young adults worldwide, acne vulgaris affects over 85% of the population. Propionibacterium acne, Staphylococcus epidermidis, and Malassezia furfur are the bacteria that cause this inflammatory disease of the sebaceous follicles in the skin, which is characterized by comedones, papules, and pustules in the follicular canal. Anaerobic P. acne is a necessary microorganism that lives as cutaneous flora on human skin.

This gram-positive bacterium thrives in an anaerobic environment, which is created by oxidative stress within the pilosebaceous unit. 7. Due to its ability to activate complement and convert sebaceous triglycerides into fatty acids, which chemically attract neutrophils, it is linked to the development of inflammatory acne. Within the sebaceous unit1, S. epidermidis is an aerobic organism that causes superficial infection. Consequently, P. Acne and

Pathogenesis of Acne vulgaris:

The illness of the sebaceous glands is acne. The pathophysiology of acne is caused by a number of variables, including sebum, aberrant follicular differentiation, hormones, Propionibacterium acnes, inflammation, and diet. Harmony: Androgens (testosterone and dehyrotestosterone) only have a major role in the onset of acne because they promote the growth and differentiation of sebocytes and infundibular keratinocytes. Elevated dehyrotestosterone (DHT) during puberty acts on infundibular keratinocytes, which can cause hyperkeratinization. One of the most crucial processes in the formation of acne lesions is hyperkeratinization in the sebaceous duct and follicular infundibulum.

Sebum: Secreted by sebocytes, which can function as skin immune cells when combined with keratinocytes, sebum is a lipid-rich secretory product of the sebaceous gland. Acne severity is directly correlated with

Inflammation One of the direct or indirect effects of P. acne growth is inflammation. The bacteria secrete an extracellular lipase that hydrolyzes sebum triglycerides into fatty acids with comedogenic and pro-inflammatory qualities, as well as glycerol, which the organism uses as a growth substrate. Moreover, P. acne can use TLR, CD14, and CD1 molecules to activate sebocytes and keratinocytes. In acne lesions, the surface of macrophages encircling pilosebaceous follicles expresses TLR2. When TLR2 is activated, the nuclear factor transcription factor is also activated, which in turn produces cytokines. These cytokines, when combined with IL8 and IL12 produced from TLR2-positive monocytes, result in inflammatory acne lesions. Pustules, papules, and nodules are the features of inflammatory acne.

Nutrition: Growth factors, particularly insulin-like growth factor [IGF-1], are known to produce acne. Due to the increased incidence of antibiotic resistance in acne-causing bacteria, an alternative system of medicine for treating acne has been explored and adopted. Among alternative systems of medicine, topical therapeutic substances are more suitable for application. It is rightly said that "for every disease, there is a plant on every continent." Herbs as ingredients in topical acne treatment occupy a top position because they are safe, diluted, and familiar to the patient, economical, readily available, and multifunctional. Figures from the World Health Organization indicate that 4 billion people, or nearly 70% of the world's population, use herbal medicine for some primary health care purposes. Medicinal herbs have always been used in one form or another in indigenous systems of medicine, including Ayurveda, Siddha, and Unani in India. An increasing number of companies are making forays into the herbal market segment. An example is Ranbaxy, which launched herbal medicines in India. According to the company, the size of the global herbal market is estimated at USD 20 billion, with a growth rate of 10–15 percent annually. The growth rate for the Indian market is pegged at 12% per annum in 19

MATERIALS AND METHODS:

We bought dried seeds and coriander leaves and garlic from the Modinagar local markets. A taxonomist at Modinagar verified the authenticity of the plant material, and the specimens were placed in the botanical department of M. M. PG College, Modinagar. The Microbial Culture Collection and Gene Bank, located in Chandigarh, India, provided the test organisms, P. acne (MTCC 1951) and S. epidermidis (MTCC 931). Hi-Media was the source of all media purchases. Every reagent that was utilized was analytical grade.

Obtaining coriander extract:

The green leaves were ground into a powder after being dried in the shade. This powder, weighing 200 g, was macerated for seven days at room temperature (25±2°C) in distilled water. The extraction process was made more efficient by reducing the occurrence of boundary layer phenomena and maintaining frequent stirring and circulation of the solvent. The extracted solution was filtered, and the pellets were crushed after seven days. The displaced liquid and the strained liquid were interconnected. Next, under lower pressure, the enhanced extract—known as miscella—was concentrated in a rotary vacuum flash evaporator. The process was followed in order to prepare the hydroethanolic extract, and distilled water-ethanol was the type of solvent utilized in the ethereal extract, which was used for the hydroethanolic extract.

Obtaining Garlic extract:

Garlic scales were cut into small pieces, dried and grinded to make fine powder. Specific quantities of herbal drug were weighed and added to the conical flask containing five times volume of 1:1 water-ethanol mixture. The contents were allowed to boil on water bath under reflux condition for about 30 min. The contents were filtered out and solid residues were again boiled with five times volume of 1:1 water-ethanol mixture in the water bath under reflux condition for about 15 min. The contents were filtered out and filtrates were combined. Filtrate was allowed to evaporate in evaporating pan until the desired concentration of the extract was obtained.

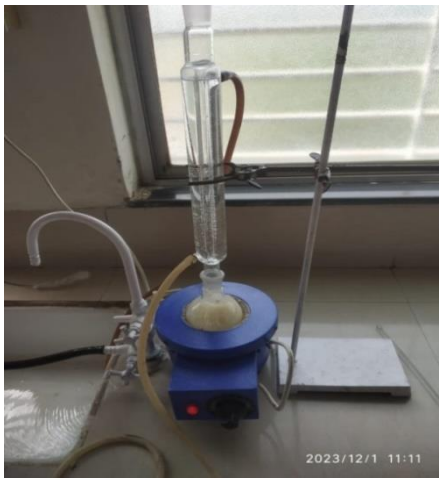


Fig no.1: Extraction of garlic

Fig no.2: Extraction of garlic

Fig no.3: Extraction of coriander

Determination of antibacterial activity:

The flask diffusion method was utilized to determine the antibacterial activity. With minor adjustments, this experiment was carried out using Hayes and Markovic's (2002) methodology. After 48 hours of anaerobic incubation in ASLA agar medium, Propionibacterium acne (P. acne) was adjusted to produce roughly 1x108 CFU/ml. The inoculum was wiped on agar plates. The test material (100 mg/mL extracts) was aseptically applied to a sterile filter paper disc with a 6 mm diameter and soaked with it. Before being incubated at 37°C for 72 hours under anaerobic conditions in an anaerobic bag (Hi-Media) with a gas envelope and indicator tablets, the plates were placed at room temperature for 30 minutes to allow pre-diffusion to pass. The bag was then stored in the

Determination of the minimum inhibitory concentration:

The agar dilution method was utilized to ascertain the values of the minimum inhibitory concentration (MIC). The test substance was aseptically added in the proper range (0.05 mg/ml to 5 mg/ml) to 20 ml aliquots of sterile molten agar. The resulting agar solutions were immediately put into sterile Petri dishes, vortexed at high speed for 15 seconds or until fully dispersed, and allowed to solidify for 30 minutes. Next, P. acne was injected into the plates. The inoculation plates were left until the inoculum solidified, and then they were incubated in a gas bag (Hi-Media) with a gas envelope and indicator tablets for 72 hours at 370 °C under anaerobic circumstances. The bag was kept in the incubator for a predetermined amount of time at a predetermined temperature.

Preparationofgel:

The weighed amount of methyl paraben was dissolved in5ml of hot water and propyl paraben was added on slightcoolingofwater.Tothisbeakerchitosanwasdispersed with continous stirring for 20 min after additionof50mlofdistilledwater.Thisdispersionwaskeptovernightforsoaking.Inanotherbeakertherequiredquantity of propylene glycol and polyethylene glycol (PEG400)wereadded.Thismixturealongwithconcentrationofaqueousextractcorrespondingtoits MICwasincorporated to chitosan beaker with stirring. The volumewas made up with distilled water and stirring was donevigorously.

Physical Parameters

Physical Appearance: The physical appearance of the formulation was checked visually, which included:

Colour: The colour of the formulations was checked againsta white background**.**

Consistency: Consistency was checked by application to the skin. Oiliness: Oiliness was assessed by application to the skin.

Odour:

The odour of the gels was controlled by mixing the gel in water and measuring the ph. Approximately 20 mg of the preparation was taken into a beaker and subjected to pH measurement using a digital pH meter within 24 hours of production.

Viscosity:

The viscosities of the formulated gels were determined using a Brookfield Viscometer No. 7 spindle at 50 rpm and 25°C. The corresponding dial value on the viscometer was recorded. The spindle was then gradually lowered. The number has been multiplied by the factor listed in the catalog.

Extrudability:

Extrudability is defined as the weight in grams required extruding a 0.5-cm strip of formulation in 10 seconds. The gel formulation was filled intostandard collapsible aluminium tubes with a cap and crimped to the end. The tubes were placed between two glass slides and clamped. A 500-gram weight was placed over the glass slides, and the lid was removed. The length of the strip of formulation that came out in 10 seconds was recorded.

Spreadability:

Spreadability refers to the extent of the area over which the gel is easily spread after application to the skin or affected area. The bioavailability efficiency of the gel also depends on the spreadability value. Spreadability is defined as the time in seconds it takes the top slide to slide out the gel placed between the two slides under a certain load. The shorter the time it takes to separate the two slides, the better the spreadability. Approximately 500 mg of the formulation was sandwiched between two glass slides, each measuring 6 x 2 cm. A weight of 100 g was placed on the top slide so that the preparation between the two slides was evenly compressed to form a thin layer. The weights were removed, and the excess formulation adhering to the slides was scrapped. The lower slider was fixed on the instrument plate, and the upper slider was held on a rigid string to which a load of 20 g was applied using a simple pulley that was in a horizontal plane with the fixed slider. The time it took for the top slide to slide off the bottom slide was recorded.

Antibacterial activity:

Gel solutions were prepared using 100 mg of gel in 10 mL of dimethyl sulfoxide. Antibacterial activity was tested by the well diffusion method. P. acne was incubated in ASLA agar medium for 48 hours under anaerobic conditions and adjusted to yield approximately 1x108 CFU/ml. Solidified agar plates were smeared with the inoculum on the surface. Equidistant wells were cut in the boards using an 8-mm drill bit. Gel solutions in DMSO were placed in each of these wells, and the plates were left at ambient temperature for 30 minutes to allowforpre-diffusion before incubation at 37°C for 72 h under anaerobic conditions in an anaerobic bag (Hi-Media) with gas wrap. The bag was kept in an incubator for 72 hours at 37 ± 1°C. Gas packs containing citric acid, sodium carbonate, and sodium borohydride were used to maintain and control anaerobiosis. The methylene blue indicator tablet eventually changed from dark pink to blue to light pink, indicating that the anaerobic condition had been reached. A culture of S. epidermidis was prepared in a nutrient agar medium after 24 hours under aerobic conditions. The tested samples of this aerobic bacterium were incubated at 37°C for 24 hours under aerobic conditions. Antibacterial activity was estimated by measuring the diameter of the inhibition zone. All well diffusion assays were performed in three separate experiments and antibacterial activity was expressed mean ± standard deviationStabilitystudies. The stability of the formulations was assessed according to the guide lines issued by International Conference on Harmonisation (ICH)

Drug content:

One gram of precisely weighed gel was dissolved in one hundred millilitres of solvent (phosphate buffer pH 6.8 plus ethanol in a 40:60 ratio) to ascertain the drug content of the formulations. For the formulations to completely dissolve, the solutions were shaken for four hours and then left for six hours. Subsequently, the solutions underwent spectrophotometric analysis after being filtered via 0.45 mm membrane filters and appropriately diluted. Using calibration data and a linear regression equation, the drug content was determined. Diffusion Studies in vitro A Franz diffusion cell was used for all of the formulations' (Fal-Fa4) in-vitro diffusion investigations. The local fabrication of the diffusion cell device resulted in a cylindrical tube with an area of

Drug release kinetics:

To study the release kinetics of the optimized formulation, the data obtained from invitro release studies were plotted in various kinetic models.

Table1:Antibacterialactivityofcorianderand garlic extract.

Testsample	**Zoneofinhibition (mm),mean ±SD**		**MIC**	
	P.acne	***S.epidermidis***	***P.acne***	***S.epidermidis***
Coriander Aqueousextract	23.5±1.4	22.6±1.09	1.4mg/ml	2.3mg/ml
Garlic Hydroethanolicextract	21.1±1.0	19.1±1.9	2.6mg/ml	3.3 mg/ml
Etherealextract	13.6±1.4	13.6±1.6	4.8mg/ml	5.2 mg/ml

Table 2: Composition of topical formulations

Ingredients	**Mass(mg)**			
	Fa_1	**Fa_2**	**Fa_3**	**Fa_4**
Coriander extract	2	3	4	5
Garlic extract	2	3	4	5
Chitosan	0.5	1	1.5	2
PEG400	5	5	5	5
Propyleneglycol	15	15	15	15
Methylparaben	0.15	0.15	0.15	0.15
Propylparaben	0.03	0.03	0.03	0.03
Distilledwaterq.s	100	100	100	100

Table 3 physicochemical properties of semisolid formulation of coriander and garlic extract.

formulation	ph	consistency	spreadability	extrudability	viscosity
Fa1	6.2	***	40.5	534.5	32.5
Fa2	6.8	**	43.3	545.5	35.3
Fa3	6.9	**	45.7	549.7	35.4
Fa4	7.3	**	46.1	554.3	36.4

Table4:Drugcontentand*in-vitro*release

Formulation	**Drugcontent(%, m/m)**	**% cumulativerelease**
Fa_1	94.5	93
Fa_2	93.4	92
Fa_3	90	88
Fa_4	88.5	87

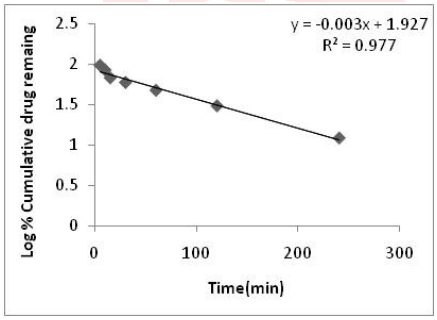
Table5:Antibacterial activityofformulations

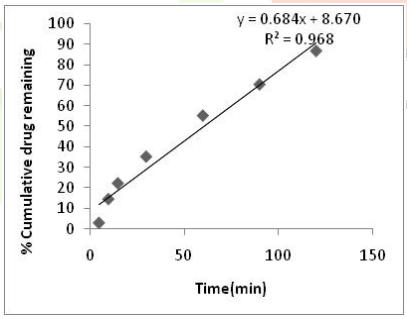
Formulation	Zoneofinhibition(mm),mean±SD	
	P.acne	***S.epidermidis***
Fa_1	23.5±1.4	20.6±1.06
Fa_2	23.4±.1.0	20.5±1.02
Fa_3	22.3±0.9	20.4±1.0
Fa_4	22.3±.1.2	20.4±0.8
MH	21.4±0.6	20.4±0.9
Clin	28.8±2.6	30.9±2.4

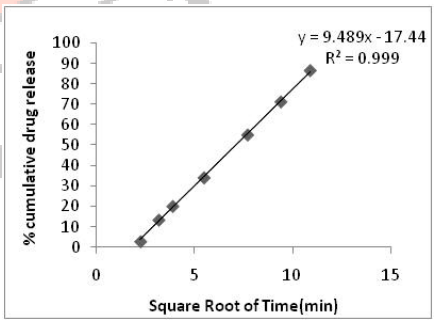
Allexperimentswereperformedintriplicate.MH=marketedformulation,Clin =Clindamycinphosphate.

Table6:ReleaseKineticparametersforoptimizedformulation ofcorianderand garlic extract.

Formulation	Zeroordermodel		First ordermodel		Higuchimodel	
Fa_1	R^2	K_0 (min^{-1})	R^2	K_1 (min^{-1})	R^2	K_H ($min^{-1/2}$)
	0.9686	0.684	0.9776	0.0036	0.9995	9.489







A:Fa_1FirstorderreleasekineticmodelB:Fa_1Zero order releasekinetic model C:Fa_1Higuchimodel.

RESULT AND DISCUSSION:

Theaqueous extractofcoriander and garlicshowedthezoneofinhibition of 23.5±1.4 and 22.6±1.09 mm as well as theMICvaluesof1.4 mg/ml and2.3 mg/ml against*P.acne*and*S.epidermidis*respectively.Thisactivityoftheaqueousextractwasmorethanthatofthehydroethanolicandetherealextract(Table1).
TheformulationsweredevelopedwithCorianderaqueousextractusingchitosanasgellingagentintheconcentration of 0.5% (Fa_1), 1% (Fa_2), 1.5% (Fa_3) and 2%(Fa_4)w/w.

Alltheformulationswerebrownincolourandhadcharacteristicodourofcoriander.Allformulationswere glossyandtranslucent.FormulationFa_1wasfoundtohave excellent consistency and Fa_2 had good consistency.As indicated in thetable 3, the pHoftheformulationranged from 6.2-7.3, which may be suitable for topicalapplication without discomfort. The apparent viscosity ofthe formulations ranged from 32.5 to 36.4 cps. Theviscosityofformulationincreasedwithincreaseintheconcentration of chitosan content. The

spreadability andextrudabilityoftheformulationswerefoundtorangefrom40.5to46.1 g/secandfrom535.5 to554.3 gm.respectively.Theviscositywasobservedtoincreasewithdecreaseinthespreadabilityandvice-versa.

CONCLUSION:

The coriander aqueous extract was found to have potency against acne inducing bacteria. The formulations developed from it also showed the same activity. So it can be further developed and sued commercially for treatment of acne.

REFERENCES:

1. Chomnawong Mullika Traidej, Surassmo Suvimol. Antimicrobial effects of Thai medicinal plants against acne inducing bacteria. J Ethanopharmacology 101:2005; 330- 333.
2. Gallarher A.M., Flatt. P.R., Duffy. G. The effect of traditional antidiabetic plants on in vitro glucose diffusion. Nutrition Research 23:2003; 413-4
3. Chithra V., Leelamma S. Coriandrum sativum changes the levels of lipid peroxides and activity of antioxidant enzymes in experimental animals. Indian J Biochemistry and Biophysics 36:1999; 59-61
4. Melo A De Enayde, Filho M Jorge. Characterisation of antioxidant compounds in aqueous coriander extract. Lebensm Wiss u Technol 38:2005; 15-19
5. Matasyoh J.C.,Maiyo Z.C. Chemical composition and antimicrobial activity of the essential oil of coriandrum sativum. Food Chemistry 113:1999; 526-529
6. Luangnarumitchai. S., Lamlertthon.S., Tiyaboonchai. W. Antimicrobial activity of essential oils against five strains of Propionibacterium acnes,J Pharma. Sci. 34: 2007; 60-64.
7. Bowe P Whitney, Logan C Alan. Clinical implication of lipid peroxidation in acne vulgaris: old wine in new bottles. Lipids in Health and Disease 9:2010;
8. Determination of minimum inhibitory concentrations (MICs) of antimicrobial agents by agar dilution. EUCAST Definitive Document E. Def 3.1. 2000
9. Andrews M. Jennifer. Determination of minimum inhibitory concentrations. J Antimicrobial Chemotherapy 48:2001; 5- 16
10. Kanlayavattanakul. M., Lourith N. Therapeutic agents and herbs in topical application for acne treatment. Int. J Cosmetic Sci. 33:2011; 289-29