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STANDARDIZATION OF *SIDDHA* POLYHERBAL FORMULATION *ELAI ERUMAL CHOORANAM* FOR ITS QUALITY ASSURANCE BY MODERN ANALYTICAL TECHNIQUES

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ABSTRACT

Siddha system has numerous herbal and herbo mineral formulations for various diseases. For the globalization of *Siddha* system of medicine, the need for standardization of the prepared medicines is significant of the hour. The standardization is an essential part in whole of the medicine preparation process which is helpful in improving drug quality & efficacy, reduce adulteration, facilitating for global acceptance and export etc. Bronchial Asthma is a serious global health problem. *Siddha* system has numerous preparations in treating Asthma. One such effective poly herbal formulation is *Elai Erumal Chooranam* which is said to be cost effective, efficacious and simple when compared to other medications. In the present study an attempt has been made to standardize the formulation as per PLIM guidelines. The obtained results were with in normal limits in this study, which is elaborately described in this paper.

KEYWORDS: *Siddha*, Asthma, *Elai Erumal hooranam*, Standardization, Physicochemical- Phytochemical Analysis.

INTRODUCTION

Human race in different regions of the world have their own traditional or indigenous forms of healing which are firmly rooted in their culture and history.[1] India has a rich source of traditional medical systems and some of them date back to 5000 years BC.[2] *Siddha* system of medicine is one among them which is flourished in the southern part of India especially in Tamilnadu.[2,4] *Siddha* physiology is based on the equilibrium maintained between the three humours namely *Vali, Azhal* and *Iyyam* and any derangement in this lead to Disease or "*Noi nilai*".[3,5] So, the restoration of dearranged humour is the treatment. The imbalance of humours especially *kapham* and *vadham* in respiratory system modifies the air passage by secreting inflammatory mediators causing Bronchoconstriction. That Broncho constriction suddenly leads to breathing difficulty. This condition in *Siddha* literatures in named as ***Swasakasam* or *Eraippu Erumal*.** The symptoms of the disease "*Swasakasam"* related to Bronchial Asthma according to modern medicine. The Global Asthma report 2022, shows prevalence about 35 million people are suffer from asthma in India.[6] Asthma is an inflammatory disease of small airways characterised by episodic, reversible Bronchial obstruction due to hyper responsiveness of tracheobronchial tree to intrinsic or extrinsic stimuli. *Siddha* system has numerous preparations in treating Asthma. One such effective poly herbal formulation is *Elai Erumal Chooranam* (EEC) which is said to be cost effective, efficacious and simple formulaion. But scientific evidences for *Elai Erumal chooranam* have not been reported. So there is an urgent need to standardize the formulation technique by using PLIM guidelines.

MATERIALS AND METHODS

Selection of the drug

The polyherbal formulation *Elai Erumal chooranam* was taken as a trial drug. It has been taken from the *Siddha* literature "The Pharmacopoeia of Siddha Research Medicines (Chapter 1)", Page No-111.[7] indicated for Bronchial Asthma. Ingredients of EEC were tabulated in Table-1.

Ingredients of the *Elai Erumal chooranam*

Table no 1: Ingredients of the *Elai Erumal chooranam* (EEC).

S.No	INGREDIENT	BOTANICAL NAME	QUANTITY
1.	*Chukku*	*Zingiber officinale*	*1 palam* (35 gram)
2.	*Milagu*	*Piper nigrum*	*1 palam* (35 gram)
3.	*Thippili*	*Piper longum*	*1 palam* (35 gram)
4.	*Chittrarathai*	*Alpinia galanga*	*1 palam* (35 gram)
5.	*Elarisi*	*Elettaria Cardamomum*	*1 palam* (35 gram)
6.	*Thalisapathiri*	*Abies spectabilis*	*1 palam* (35 gram)
7.	White sugar	*Saccharum officinarum*	*6 palam* (175 gram)

Collection of Raw drugs

The Raw drugs were purchased from authorized country drug store RNR Traders, Parrys corner, Chennai.

Drug's Identification and Authentication

Botanists and experts from the PG Gunapadam (pharmacology) Department of the Govt Siddha Medical College, Arumbakkam, Chennai identified and validated all the drugs. Each Sample has been labelled and maintained in the PG Gunapadam laboratory for future references.

Purification of Raw drugs

All the ingredients were purified as per classical siddha literature *Sarakkugalin suddhi seimuraigal*.[8]

Preparation of *Elai erumal chooranam*

Each 1 palam (35gram) of *Chukku (Zingiber officinale), Milagu (Piper nigrum), Thippili (Piper longum), Chittrarathai (Alpinia galanga), Elarisi (Elettaria Cardamomum), Thalisapathiri (Abies spectabilis)* were taken and pounded into powder and sieved in a thin cloth to get fine powder. Then purified by Pittaviyal method (steam cooking). Finally 175 gram of white sugar powder would be added to the above powder and dried and bottled up in an air tight container and labelled as *Elai Erumal chooranam* (EEC).

INDICATION

As per *siddha* literature, 650-975 mg of EEC should be administered twice daily with honey to treat bronchial asthma and eosinophilic lungs.

Analysis of qualitative investigation

The analysis of the trial drug EEC was evaluated as per the PLIM (Pharmacopoeial Laboratory for Indian Medicines) guidelines. Physio-chemical, Phytochemical analysis, Biochemical analysis, Heavy metal analysis, TLC and HPTLC analysis, Sterility test, Specific pathogen test, Pesticide residue analysis and Aflatoxins assay were done at Noble Research Institute, Perambur, Chennai.

Properties for organoleptic

The organoleptic characters of the sample drug were evaluated.1gm of the EEC was taken and the State, Nature, Appearance, Odour and other morphological characters were viewed by naked eye under natural light and results are noted.

Physio -chemical analysis[9]

- Finding loss on drying Was done
- Finding total ash was done
- Determination of acid-insoluble ash was done
- Water soluble extraction was done
- Alcohol soluble extraction was done
- pH determination also done.[10]
- Solubility test was done.[11]
- Particle size determination was done.[12]

Phyto-chemical analysis[13]

- Alkaloids analysis – was performed with Wagner's Test
- Carbohydrates - Benedict's test
- Tannins-Gelatin Test
- Saponin--Foam's Test
- Phenols – Ferric chloride Test
- Flavonoids- Reagent Test
- Diterpens- Copper acetate Test
- Quinones – Test For quinones
- TLC.[14]

➢ HPTLC was done.[15]

➢ Chromatogram development was done.

Biochemical analysis was done[16]

Heavy Metal Analysis by AAS Standard was done[17]

Test for sterility was done by pour plate method[18]

Specific pathogen test[19]

Test for pesticide residue was done

Test for Aflatoxin was done

3. RESULTS AND DISCUSSION

Results of Organoleptic characters

The Results showed that EEC is a fine powder, pale brownish colour, with chararcteristic odour and sweet taste. Test drug EEC is shown in fig.-1. The results are tabulated in table-2.

Fig. no.1: ***Elai Erumal chooranam.***

Table 2: Organoleptic Characters of EEC.

Parameter	Results
State	Solid
Nature	Fine
Odour	Aromatic odour
Touch	Soft
Flow Property	Non Free flowing
Appearance	Pale Brownish
Taste	Sweet

Results for physio chemical Assessment of EEC

The physiochemical parameters of EEC were determined and the results given in Table:3

Table No. 3: Physio chemical Assessment of EEC.

S.No	Parameter	Mean (n=3) SD
1.	Loss on Drying at 105 °C (%)	6.433 ± 1.10
2.	Total Ash (%)	9.83 ± 0.70
3.	Acid insoluble Ash (%)	0 ± 0
4.	Water soluble Extractive (%)	20.7 ± 0.721
5.	Alcohol Soluble Extractive (%)	4.9 ± 0.52
6.	pH	6.8

Particle Size Determination

Microscopic obedience of the particle dimensions examination indicates that the mean intermediate particle dimension of the sample was sized up to be 60.72 um which ensures the solubility, processing belongings, bioavailability, product uniformity, strength and the medicinal result of the EEC.

Solubility profile of EEC

The results showed that EEC was soluble in Water, Ethanol and DMSO and the results given in table no: 4.

Table no. 4: Solubility Profile of EEC.

S.No	Solvent Used	Solubility / Dispersibility
1	Chloroform	Insoluble
2	Ethanol	Soluble
3	Water	Soluble
4	Ethyl acetate	Insoluble
5	DMSO	Soluble

Results for Phytochemical analysis of EEC

The qualitative phytochemical analysis of EEC indicates that the drug shows the presence of alkaloids, flavanoids, Steroids, Triterpenoids, phenols, tannins, saponins and sugar. The outcomes were displayed in the table no: 5 and fig no.2

Table no. 5: Phytochemical assessment of EEC.

S.no	Test	Observation
1	Alkaloids	+
2	Flavanoids	+
3	Glycosides	-
4	Steroids	+
5	Triterpenoids	+
6	Coumarin	-
7	Phenol	+
8	Tanin	+
9	Protein	-
10	Saponins	+
11	Sugar	+
12	Anthocyanin	-
13	Betacyanin	-

(+) -> Indicates Positive and (-) -> Indicates Negative

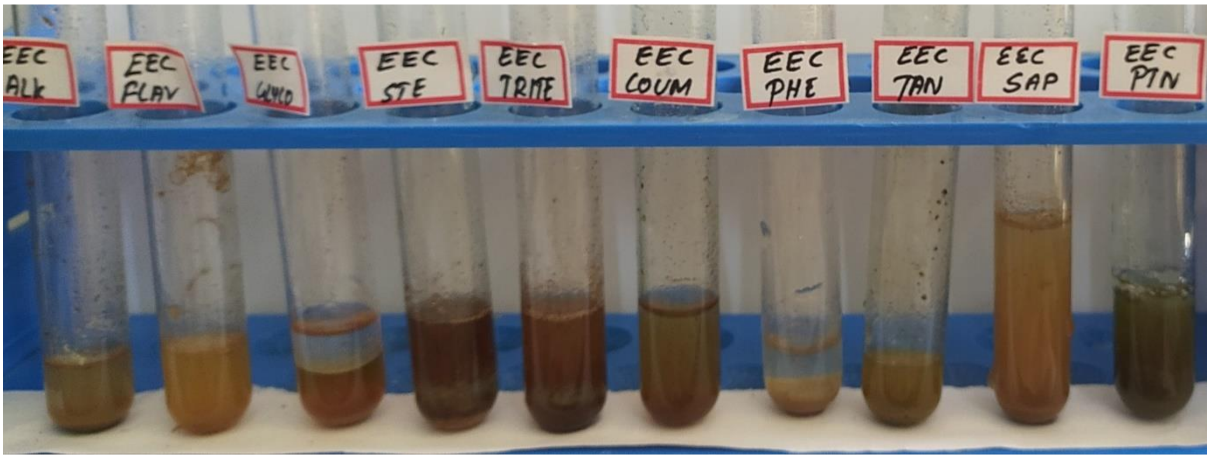

Figure no. 2: Qualitative Phytochemical Investigation.

HPTLC

Fig. no 3: TLC Visualization of EEC at 366 nm.

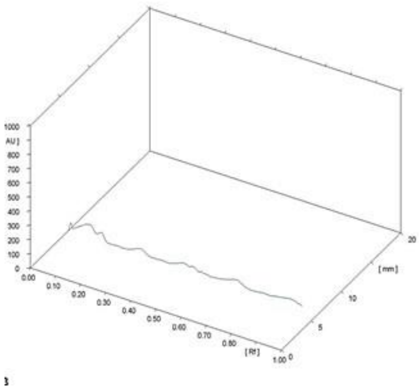

Fig. no.4: 3D- Chromatogram.

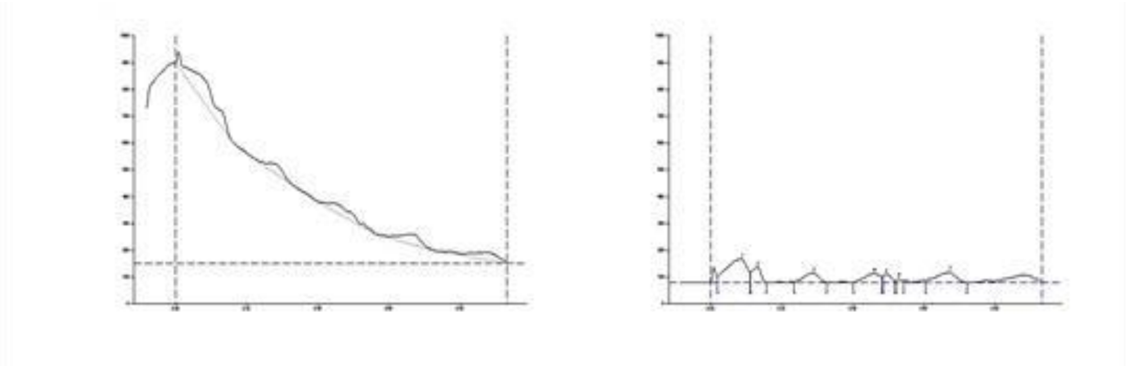

Fig. no.5: HPTLC finger printing of EEC.

Table no. 6: Peak Table.

Peak	Start Rf	Start Height	Max Rf	Max Height	Max %	End Rf	End Height	Area	Area %
1	0.02	20.6	0.09	89.6	28.86	0.11	40.9	3172.6	39.82
2	0.11	41.2	0.13	59.7	19.25	0.16	0.1	921.2	11.56
3	0.23	1.5	0.29	36.3	11.68	0.33	0.3	971.7	12.20
4	0.40	0.5	0.46	35.9	11.58	0.48	23.3	953.2	11.96
5	0.49	24.4	0.49	31.6	10.17	0.52	6.4	446.1	5.60
6	0.52	7.6	0.53	17.0	5.47	0.54	9.1	141.6	1.78
7	0.61	7.5	0.67	40.3	12.99	0.72	0.2	1361.7	17.09

REPORT

HPTLC finger printing analysis of the sample reveals the presence of seven prominent peaks corresponds to the presence of seven versatile phytocomponents present with in it. Rf value of the peaks ranges from 0.02 to 0.61.

Heavy metal analysis of EEC

Results of the present investigation have clearly shows that the sample EEC has no traces of heavy metals such as Cadmium, Lead, Arsenic and Mercury as listed in the table no.7.

Table no. 7: Heavy metal analysis of EEC.

Name of the Heavy Metal	Absorption Max Λ max	Result Analysis	Maximum Limit
Lead	217.0 nm	BDL	10 ppm
Arsenic	193.7 nm	BDL	3 ppm
Cadmium	228.8 nm	BDL	0.3 ppm
Mercury	253.7 nm	BDL	1 ppm

BDL- Below Detection Limit

Test for Sterility Using the Pour Plate Method

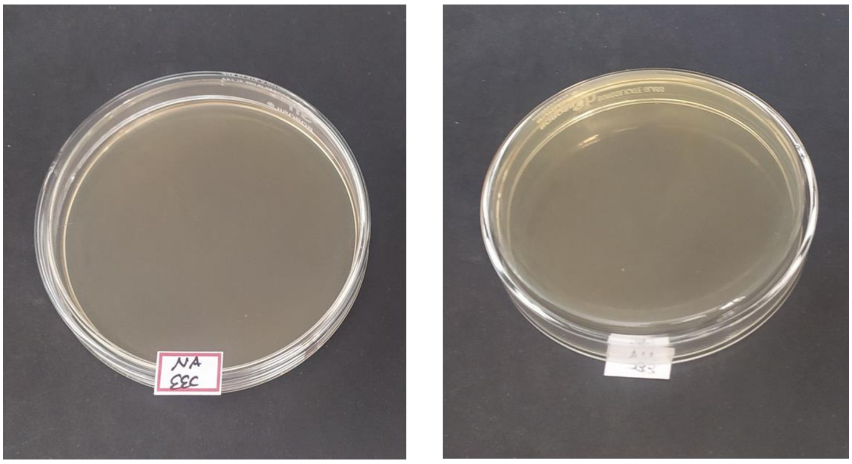

Fig. no.6: Sterility test results of EEC.

OBSERVATION

No growth was observed after incubation period reveals the absence of specific pathogen.

RESULT

No growth / colonies was observed in any of the plates inoculates with the test sample.

Table no. 8: Sterility test results of EEC.

Test	Result	Specification	As per AYUSH/WHO
Total Bacterial Count	Absent	NMT 10^5CFU/g	As per AYUSH specification
Total Fungal Count	Absent	NMT 10^3CFU/g	

Results for Specific Pathogen

The test results of specific pathogen for E.coli, Salmonella, Staphylococcus Aureus and Pseudomonas Aeruginosa in test drug EEC reveal no traces of the four mentioned specific pathogens. The results were tabulated in Table-9—culture plates in Fig 7,Fig 8, Fig 9,Fig 10.

Table 9: Results of specific pathogen of EEC.

Organism	Specification	Result	Method
E-coli	Absent	Absent	As per AYUSH specification
Salmonella	Absent	Absent	
Staphylococcus Aureus	Absent	Absent	
Pseudomonas Aeruginosa	Absent	Absent	

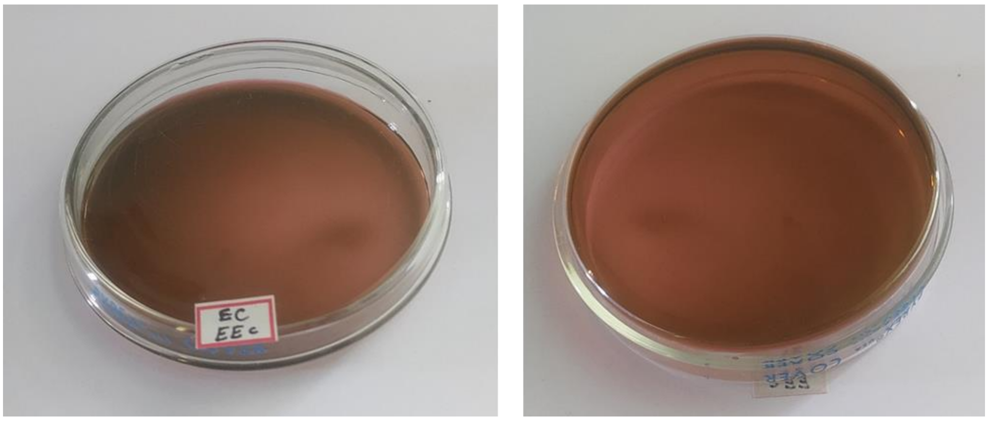

Fig. no. 7: Culture plate with E-coli (EC) specific medium.

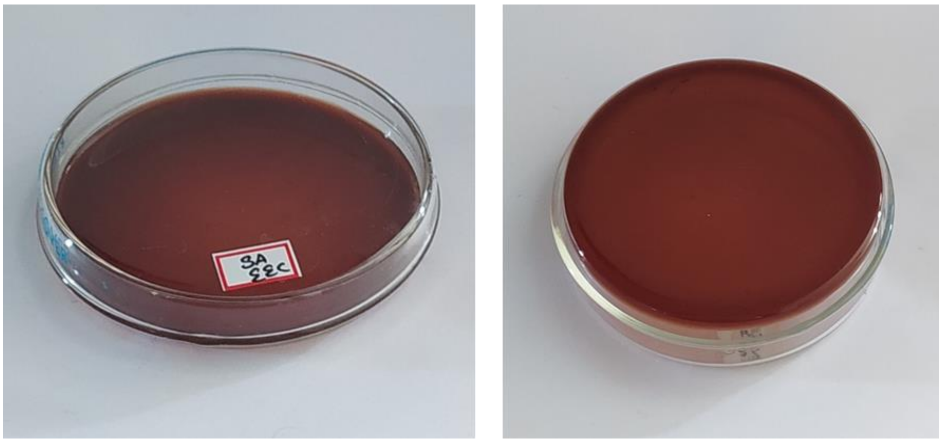

Fig. no. 8: Culture plate with Salmonella (SA) specific medium.

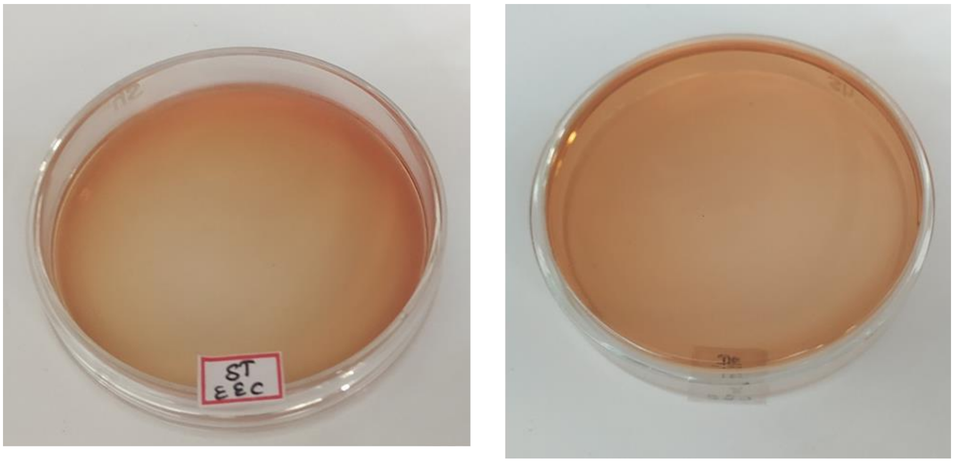

Fig. no. 9: Culture plate with Staphylococcus Aureus (ST) specific medium.

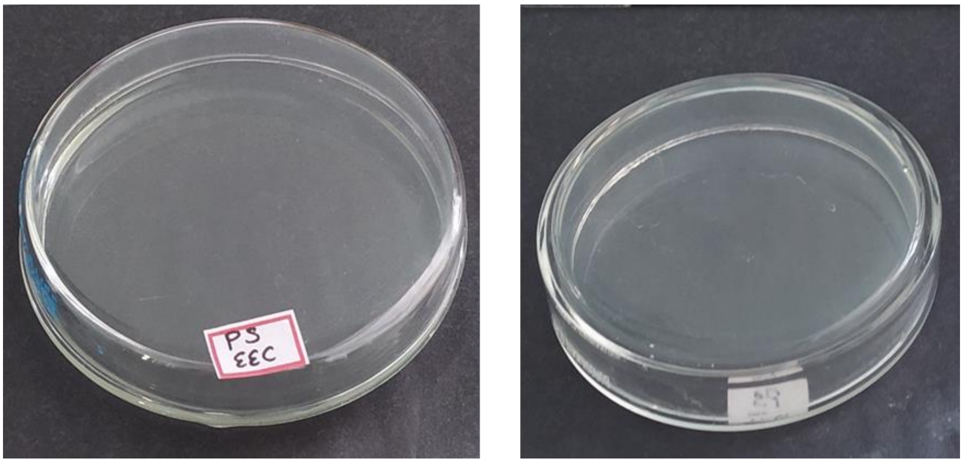

Fig. no. 10: Culture plate with Pseudomonas Aeruginosa (PS) specific medium.

Observation

No growth was observed after incubation period. Reveals the absence of specific pathogen.

Result

No growth / colonies were observed in any of the plates inoculated with the test sample.

Results for Pesticide Residue

Analysis of pesticide residues reveals that EEC contains no traces of residues of organo chlorine, organo phosphorus, Organo carbamates and Pyrethroids. The observed results of pesticide analysis were tabulated in table-10.

Table no 10: Result of Pesticide Residue of EEC.

Pesticide Residue	**Sample EEC**	**AYUSH Limit (mg/kg)**
I.Organo Chlorine Pesticides		
Alpha BHC	BQL	0.1mg/kg
Beta BHC	BQL	0.1mg/kg
Gamma BHC	BQL	0.1mg/kg
Delta BHC	BQL	0.1mg/kg
DDT	BQL	1mg/kg
Endosulphan	BQL	3mg/kg
II.Organo Phosphorus Pesticides		
Malathion	BQL	1mg/kg
Chlorpyriphos	BQL	0.2 mg/kg
Dichlorovos	BQL	1mg/kg
III. Organo carbamates		
Carbofuran	BQL	0.1mg/kg
III.Pyrethroid		
Cypermethrin	BQL	1mg/kg

BQL- Below Quantification Limit

Result for Aflatoxin by TLC (B1, B2, G1, G2)

The results showed that no spots were identified when EEC loaded on TLC plates compared to the standards, indicating that the EEC was free from Aflatoxin B1, Aflatoxin B2, Aflatoxin G1, and Aflatoxin G2.

Table 11: Aflatoxin Assay for EEC.

Aflatoxin	Sample EEC	AYUSH Specification Limit
B1	Not Detected - Absent	0.5 ppm (0.5mg/kg)
B2	Not Detected - Absent	0.1 ppm (0.1mg/kg)
G1	Not Detected - Absent	0.5 ppm (0.5mg/kg)
G2	Not Detected - Absent	0.1 ppm (0.1mg/kg)

Result for Acid and Basic Radicals

Result for Acid Radicals

The biochemical analysis reveals the presence of carbonates, Sulfates and phosphates in EEC listed in the Table no.12.

Table no. 12: Test for Acid Radicals of EEC.

S.No	Specific Radical	Test Report
1.	Test for carbonates	Positive- Indicates Presence
2.	Test for sulfates	Positive- Indicates Presence
3.	Test for phosphates	Positive- Indicates Presence

Results for Basic Radicals

The biochemical analysis of the EEC reveals the absence of essential radicals.

4. DISCUSSION

Standardization of herbal formulations is essential to assess the drug's grade, effectiveness, and potency. The standardization of *Elai Erumal chooranam* was acquired via numerous methods by dissecting the organoleptic characters, physicochemical qualities, Phytochemical screening, Heavy metal analysis, microbial load etc.

The drug EEC is a fine powder, pale brownish colour, aromatic odour and sweet taste so it can be consumed easily. The drug EEC soluble in specific solvent like Water, Dimethyl sulfoxide, Ethanol thereby it proves its efficiency of solubility increasing in bio-availability in the stomach.[18] The mean intermediate particle dimension of the sample was sized up to be 60.72 um which ensures the solubility, processing belongings, bioavailability, product uniformity, strength and the medicinal result of the EEC.

The loss on drying was found to be 6.433 ± 1.10 which indicates the moisture content of the drug. Total ash value was found to be 9.83 ± 0.70 which notes the presence of inorganic components. Acid insoluble ash was 0 which indicates that the drug does not contain siliceous matter. The water soluble extractive and Alcohol soluble extractive values were found to be 20.7 ± 0.721 and 4.9 ± 0.52 which proof that the secondary metabolites are extractable with above solvents and it shows the high polar secondary metabolites such as alkaloids, flavanoids, Steroids, triterpenoids, phenols, tannins, saponins and sugar.

Phytochemical screening indicates that the formulation EEC indicates the presence of **Alkaloids** which possess anti-inflammatory, anti-tumour and used as a pain relief and local anesthetic.[20] Presence of **Tannin** helps to reduce inflammation of mucous membrane and inhibition of carcinogenesis.[21] Presence of **Saponin**s acts as an immunological adjuvant by increasing the immune response.[22] Presence of **phenols** act as antioxidant activity and phenolic compounds is attributed to the capacity of Scavenging free radicals, donating hydrogen atoms, chelate metal cations. The trial drug contains **Flavonoid**s which exhibits anti-oxidative, anti-inflammatory and anti- Tumour Activity. Thus presence of Flavonoids in the test sample it may protect cells from oxidative stress and reduces inflammatory levels.

HPTLC finger printing analysis of the sample reveals the presence of seven prominent peaks corresponds to the presence of seven versatile phytocomponents present with in it. Rf value of the peaks ranges from 0.02 to 0.61.

Heavy metal screening shows that the sample has no traces of heavy metals such as Cadmium, Lead, Arsenic and Mercury. These results indicate that the trial drug is very safe to consume.

Results obtained from the test for specific pathogen reveals that No growth / colonies were seen in any of the plates inoculated with the test sample EEC which confirms the absence of E-coli, Salmonella, Staphylococcus Aureus and Pseudomonas aeruginosa in the sample.

Analysis of Pesticide residue is an important parameter for quality control of drug and the results obtained further confirms that there were no traces of pesticides residues such as Organo chlorine, Organo phosphorus, Organo carbamates and Pyrethroids in the EEC.

The results obtained from the test for Aflatoxin shown that there were no spots were been identified in the EEC loaded TLC plates when compare to the standard, which denoted that the sample was free from Aflatoxin B1, Aflatoxin B2, Aflatoxin G1, Aflatoxin G2 which proof that the trial drug is free from toxicity and does not perform any carcinogenic activity.

The Biochemical analysis for Basic radicals of EEC reveals the presence of Carbonates, Sulfates and Phosphates. In particular, carbonate derivatives are used to treat asthma patients and suppress coughs.[23,24] Through the sulfation of numerous endogenous and exogenous compounds, sulfates play a significant role in biological processes such as biosynthesis and detoxification. As the bronchial muscles are relaxed and the airways are expanded, more air can enter and exit the lungs.[25] Basic radical revealed the absence of essential radical and other heavy metals were absent. Due to the presence of Phosphates, it performs physiological functions in various systematic activities and possess beneficial activity towards healthy lifestyle.

5. CONCLUSION

Even though many of the drugs mentioned in *Siddha* literature have been proven to be successful in treating asthma, standardization is very important to prove its efficacy, safety and global acceptance. Results obtained from the above discussion; Finally concluded that the *Siddha* polyherbal formulation EEC possess biologically active components which prove its efficacy and which is free from Heavy metals, microbial contaminations, pesticides, aflatoxins which prove its safety. This establishes that the above trial drug *Elai Erumal chooranam* was safe to use as internal medicine to treat asthma.

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