



Article available online at <http://www.jtim.biosci.in>

Journal of Traditional and Integrative Medicine

Journal homepage: <http://www.jtim.biosci.in>, Vol 4, Issue 1, 2021 (Jan-Mar)



Review Article

A Review on External and Internal Treatment for *Eli Kadi* (Rat Bite) in Selected Siddha Classical Literature.

Gunapriya K¹*, Thiruthani M², Rajarajeshwari A³

*¹PG Scholar, Department of Nanju Maruthuvam, ²Professor, Head, Department of Nanju Maruthuvam, ³Lecturer, Research Methodology & Biostatistics, Government Siddha Medical College, Palayamkottai, Tamilnadu, India.

ARTICLE INFO

Article history:

Received Dec 2020

Received in revised form

Jan 2021

Accepted Jan 2021

Keywords:

Eli kadi, Siddha Toxicology, Siddha management, External medicine, Internal medicine, Rat bite diseases.

Pages: 430-442

ABSTRACT

Siddha system of medicine is a unique system which has been flourished with a wide range of treatment methods and provide definite cure to vast number of diseases. The siddhars had provided us with the knowledge in the field of toxicology and provided the treatment and cure to a wide range of toxins ranging from plant biotoxins to animal biotoxins as such the bites of rats, dogs, spider, scorpion, monkey, snakes, cats etc., in the literature. According to survey report of India by NCBI, about 15 million people are bitten by animals every year and around 25000 - 30000 deaths occurs in India due to animal bites in a year. Rat bite is one among these animal bites, which encounter the rural India as victim. Not all the rat bites cause serious issues but some of the infected rat bites may cause infectious diseases like Rat-bite fever, Plaque, Hanta virus infection, Leptospirosis which may proven as fatal in the history. In this research to explore the world about the ancient Siddha management of Rat Bite. Rats are named as *Eli, Mooshika* which are 18 in types. This research result was recorded as; 70 plants listed as internal and external medicine by siddha management process. In internal medicine Hard paste (*Karkam*), Powder (*Chooranam*), Decoction (*kudineer*), Fresh juice (*Saaru*) was most commonly used and externally Paste (*Poochu*), Nasal medication (*Nassiyam*) were most commonly prescribed for the management of Rat bite. The most used plant parts are Root, leaves, barks, seeds, whole plant. Treatment of rat poisoning can be given in the diseases where the source of infection is rat since the symptoms are having similarity. This research concluded as to need a clinical assessment of siddha management in modern scientific way and introducing to global level in future.

© 2021 J Trad Integr Med, Hosting by Reverse Publications. All rights reserved.

* Corresponding author.

Peer review under responsibility of Reverse Publications. This is an Open access article under the Creative Commons Attributes of CC-BY-NC-ND license <https://creativecommons.org/licenses/by/4.0/>

Reverse Publications
SINCE 2010

© Reverse Publications 2020, Hosting by Reverse Publications. All rights reserved.
DOI: 10.1016/j.jtim.2020.

INTRODUCTION

Siddha system of medicine is a unique system which has been flourished with a wide range of treatment methods and provide definite cure to vast number of diseases. The siddhars had provided us with the knowledge in the field of toxicology as such how the toxins affect the human body and also provided the treatment and cure to a wide range of toxins ranging from plant biotoxins to animal biotoxins as such the bites of rats, dogs, spider, scorpion, monkey, snakes, cats etc., in the literature. According to survey report of India by NCBI, about 15 million people are bitten by animals every year and around 25000 - 30000 deaths occurs in India due to animal bites in a year. Rat bite is one among these animal bites, which encounter the rural India as victim. Not all the rat bites cause serious issues but some of the infected rat bites may cause infectious diseases like Rat-bite fever, Plague, Hanta virus infection, Leptospirosis which may proven as fatal in the history.

Rats are named as *Eli, Mooshika* mentioned in Visha Vaithiya Sindhamani and Visha Vaithiya Aaruda Noolgal the ancient Siddha literatures. Rat are eighteen in types as per Siddha text they are *Kathiri, Maniyan, Semmookkan, Valli, Kurattai, Karungkaatralaiyan, Vidaveli, Senthalaimuthi, Sevveli, Veengeli, Ularppeli, Thungeli, Pudaiyeli, Eraippeli, Sengkannan, Pulli, Kaadan, Kurungaleli*. There are five modes of spread of rat (*eli*) poison. Semen, faeces, urine, scratches by nails and bites with teeth of rat are poisonous. Rat (*eli*) semen is the most poisonous and contact with this secretion can cause ill effects by the contamination in semen.

Symptoms of Rat Bite:

Fever with rigor, cough, dysnea, vitiation of blood, wheezing, lumps, pallor, arthralgia, increased body temperature, horripilation, vomiting, salivation, giddiness, loss of taste, thirst, pain at bite site, hoarseness of voice, blackish discoloration, small eruptions on the body.

Incurable Symptoms of Rat Bite:

Fainting, oedema all over the body, skin discolouration, recurrent fever, heaviness of head, excess of salivation, exudation, loss of hearing, haematemesis, urine retention, small nodules over the body resembling rat, body emitting smell of rat.

MODERN ASPECT

The *Rattus* genus has 64 species worldwide that make up a massive, uncountable population. Rats are from the order Rodentia which are characterized by an uncontrollable urge to gnaw. This is because the rats and others in this order have a pair of upper and lower teeth that grow nonstop, and the gnawing process files back the teeth to a manageable length. If they don't gnaw frequently, the teeth will grow until they starve to death or are too weak to flee a predator.

Rat, (genus *Rattus*), the term generally denotes numerous members of several rodent families having bodies longer than about 12 cm, or 5 inches. (Smaller thin-tailed rodents are just as often referred to as mice.) The brown rat, *Rattus norvegicus* (also called the Norway rat), and the house rat, *R. rattus* (also called the black rat, ship rat, or roof rat), live virtually everywhere that human populations have settled; the house rat is predominant in warmer climates, and the brown rat dominates in temperate regions, especially urban areas. The house rat most likely originated in India.

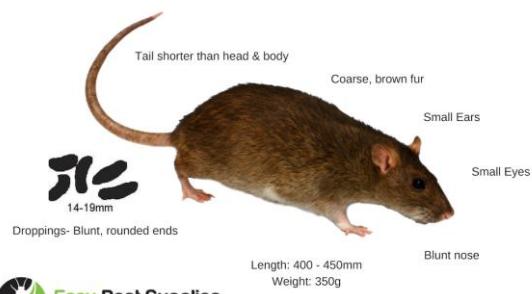
Roof or Black Rat

Rattus rattus



Norway or Brown Rat

Rattus norvegicus



Taxonomy

Kingdom: Animalia

Phylum: Chordata

Subphylum: Vertebrata

Class: Mammalia

Order: Rodentia

Superfamily: Muroidea

Family: Muridae

Subfamily: Murinae

Genus: Rattus

Rat Distribution:



Rats are found in all of the contiguous 48 states. They are also known to inhabit every land mass. The rat species is the most prolific invasive species worldwide.

Transmission of diseases

Mode of transmission of diseases:

- Faeces, Urine, Saliva, Nail scratch, Bite

Rats are an example of urban pest that transmit disease by several mechanisms, directly by contaminating food with their urine or faeces. Sometimes they transmit disease indirectly, as when fleas bite a disease infected rat, then a person or by biting people. Rat bites may cause local bacterial infection, which have good prognosis. Organisms recovered from bite wounds generally originate from the oral cavity of the biting animal, as well as from the patient's skin flora. Anaerobes have been isolated from bite wound infections, especially those associated with abscess formation.

Brown and house rat have been implicated in the spread of 40 diseases among humans, including bubonic plague, food poisoning, schistosomiasis, murine typhus, tularemia, and leptospirosis. On the other hand, the brown rat has been used in laboratories worldwide for medical, genetic, and

basic biological research aimed at maintaining and improving human health. Rats are also kept as pets.

Diseases caused by rats

The common diseases that are caused by rats are:

- Hantavirus Pulmonary Syndrome
- Hemorrhagic Fever with Renal Syndrome
- Lassa Fever
- Leptospirosis
- Lymphocytic Chorio-meningitis (LCM)
- Rat-Bite Fever
- Salmonellosis
- South American Arenaviruses (Argentine hemorrhagic fever, Bolivian hemorrhagic fever, Sabiá-associated hemorrhagic fever, Venezuelan hemorrhagic fever)
- Tularemia

Treatment:

- Antibiotics such as cephalosporins or penicillinase-resistant penicillins are usually adequate for treatment of infectious complications of rat bites. Immunization against tetanus and rabies is also indicated, though rabies is rare after a rat bite. Wound management includes cleaning, debridement of tissue.
- Penicillin is the treatment of choice for proven or highly suspected cases of rat bite fever. Tests of *S. moniliformis* antibiotic susceptibility by the disk diffusion method usually demonstrate sensitivity to penicillins, cephalosporins, carbapenems, aztreonam, clindamycin, erythromycin, nitrofurantoin, bacitracin, tetracycline, teicoplanin, and vancomycin; intermediate susceptibility to aminoglycosides, fluoroquinolones, and chloramphenicol; and resistance to trimethoprim-sulfamethoxazole, polymyxin B, and nalidixic acid.

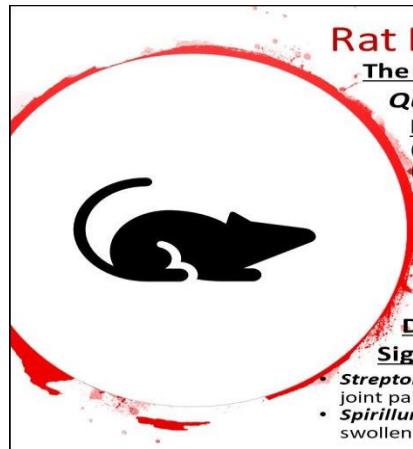
AIM

- This research work is aimed to explore the siddha management for Rat bite as per Siddha literature.

MATERIALS AND METHODS

- **STUDY TYPE :** Literature review

Rat Bite Fever



The Guilty Rodents: Rats, possibly mice

Quick Facts:

Infectious agent: *Streptobacillus moniliformis* (North America and Europe) or *Spirillum minus* (Asia and Africa)

Transmission:

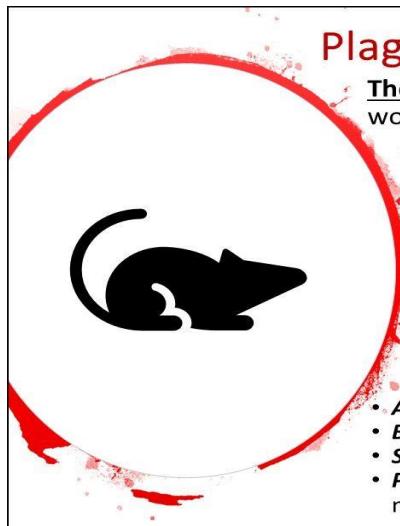
- Bite or scratch from infected rodent or handling infected rodent
- Eating or drinking contaminated food or water (*S. minus* infections almost always caused through a bite)

Distribution: Worldwide

Signs and Symptoms:

- **Streptobacillus infection:** Fever, vomiting, headache, muscle pain, joint pain/swelling, rash
- **Spirillum infection:** Fever, swelling at bite wound (if bitten), swollen lymph nodes, rash

Plague



The Guilty Rodents: Squirrels, chipmunks, wood rats, prairie dogs

Quick Facts:

Infectious agent: *Yersinia pestis* bacterium

Transmission: Through the bite of a flea or through direct contact with infected animals

Distribution: Western US, South America, Africa, Asia (modern day)

Signs and Symptoms:

- **All cases:** Fever, chills, weakness
- **Bubonic:** Painful, swollen lymph nodes
- **Septicemic:** Shock, internal bleeding, tissue death
- **Pneumonic:** Cough, chest pain, bloody or watery mucous, respiratory failure, shock

Hantavirus in brief

How the virus spreads to humans



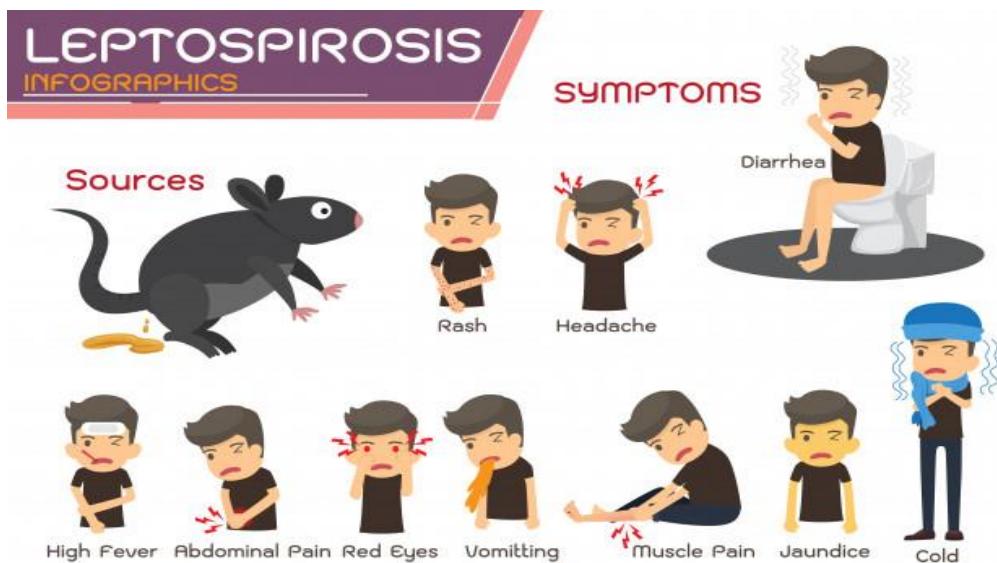
Symptoms

Early Later, 1-2 days

- Chills
- Fever
- Muscle aches
- Dry cough
- Headache
- Nausea, vomiting
- Shortness of breath

Characteristics

- Most prevalent in rural areas
- Campers and hikers more likely to catch the virus, because tents rest on the ground
- Cannot be spread between humans



REFERENCES :

From the ancient Siddha literature texts are, Sarabendrar Vaithiya Muraigal¹, Visha Vaithiya Aaruda Noolgal², Pulippaani Vaithiyam 500³, Visha Vaithiya Sindhamani⁴ , Visha vaithiyam (vaithiya kalanidhi)⁵, Agasthiyar Mani 4000 (part 2)⁶

TREATMENT OF RAT (ELI) BITE

Siddha classical literature had a wide collection of medicines ranging from herbal, herb mineral, herbometallic, herbo animal drugs to treat rat bites. Various drug preparations said in Siddha literature such as *Karkam* (hardpaste of drug), *Kudineer* (decoction), *Saaru* (Juice), *Thailam*(medicated oil), *Nei*(medicated ghee), *Chooranam*(Powder), *Nasiyam*(nasal medication), *Poochu*(paste), *Kalikkam*(collyrium) for rat bite.

EXTERNAL TREATMENT:

- Cauterization and blood letting from bite should be done.
- Paste of manjal (*Curcuma longa*), parpadagam (*Mullugo cerviana*) grinded with ghee should be applied on bite site.
- Paste of thagarai (*Senna tora*) seeds grinded with milk should be applied on bite site.
- Paste of amukkara (*Withania somnifera*) tuber grinded with water should be applied on bite site.

- Bark of aadhalai (*Jatropha curcas*) grinded with cow milk made as paste and applied on the bite site.
- Paste of pirandai (*Cissus quadrangularis*) should be applied on bite site.
- Leaf of vaeliparuthi (*Pergularia daemia*) along with latex of erukku (*Calotropis gigantean*) should be applied on the bite site.
- Medicated oil: Ramabana Thylam external application⁴.
- Nasal Medication(Nasiyam):
 - extract from the leaf of midhipagal (*Momordica dioica*), poondu (*Allium sativum*), vasambu (*Acorus calamus*) are used for nasal administration.
 - Juice from paruthi (*Gossypium herbaceum*) leaves and gingilly oil used for nasal administration.
- Collyrium (kallikam):
 - Thurusu (*Copper sulphate*), seeds of azhingil (*Alangium salviifolium*) and murungai (*Moringa oleifera*), oil cake of iluppai (*Madhuca longifolia*), juice of lemon (*Citrus limon*) are used for making collyrium.
 - Paranjodhi mai⁴

Table 1. Symptomatic management of Rat Bite

S.NO	SYMPTOMS OF RAT BITE	MANAGEMENT	TYPE OF MEDICINE
1	Fever with rigor	Powder of Sensanthanam (<i>Santalum album</i>) and Thippili (<i>Piper longum</i>) along with honey	Internal
2	Cough	Powder of Koraikizhangu (<i>Cyperus rotundus</i>) with honey	Internal

3	Wheezing	Hard paste of Nayuruvi (<i>Achyranthes aspera</i>) whole plant	Internal
4	Breathlessness	Hard paste of Sankan (<i>Azima tetracantha</i>) root and kakkatan (<i>Clitoria ternatea</i>) root with milk	Internal
5	Bleeding gums and Toothache	Hard paste of Avuri (<i>Indigofera tinctoria</i>) root with milk for 7 days	Internal
6	Lumps	Powder of Perumaram (<i>Ailanthus excelsa</i>) bark and leaves with butter for 12 days	Internal
7	Increase of body temperature	Powder of Saaranai (<i>Trianthema portulacastrum</i>) root with milk	Internal
8	Arthritic pain of limbs	Powder of Amukkara (<i>Withania somnifera</i>) with honey	Internal
9	Paralysis of limb	Powder of Avuri (<i>Indigofera tinctoria</i>) root and sankan (<i>Azima tetracantha</i>) root	Internal
10	Inflammation of the body and fever	Hard paste of kaakattan (<i>Clitoria ternatea</i>) with butter milk	Internal
11	Oedema over the body	Palm jaggery with 7 drops of vellerukkam (<i>Calotropis gigantean</i>) milk for 7 days	Internal
12	Swelling	Fresh juice of Avuri	External
13	Blackish discoloration, patches	Powder of Aadutheenda paalai (<i>Aristolochia bracteolata</i>) root and sankan (<i>Azima tetracantha</i>) root for 12 days	Internal
14	Development of tumour, Constriction of eye, Ulceration, Itching	Powder of Chitramoolam (<i>Plumbago zeylanica</i>), Sivanarvembu (<i>Indigofera aspalathoides</i>), Kudasappaalai (<i>Holarrhena pubescens</i>), Vellarugu (<i>Enicostema axillare</i>)	Internal
15	Cough, Bronchitis, Congestion, Vomiting	Hard paste of Azhingil (<i>Alangium salviifolium</i>) rootbark for 8 days	Internal
16	Halitosis	Bark and seed of Vaazhai (<i>Musa paradisica</i>) grinded with honey should be given	Internal
17	Hematuria	Manjal (<i>Curcuma longa</i>) and Parpadagam (<i>Mullugo cerviana</i>) grinded with ghee made as hard paste should be given	Internal
18	Stomatitis, Stomach ache, Toothache	Palm jaggery with 8 drops of vellerukkam (<i>Calotropis gigantean</i>) milk for 7 days	Internal
19	Whitish discolaration of body and weakness of the body	Powder of Vaagai (<i>Albizia lebbeck</i>) seeds with honey	Internal
20	Salivation, Burning sensation, Swelling	Powder of Kadugu rogini (<i>Picrorhiza kurroa</i>) and crystal sugar	Internal
21	Blurring of vision	Root of Sirukeerai (<i>Amaranthus tricolor</i>) along with honey	Internal

Table.2 List of Medicinal plants used for Rat Bite

S.NO	PLANT NAME	BOTANICAL NAME	PART USED	FORMULATION OF MEDICINE	TYPE OF MEDICINE
1	Oomathai	<i>Datura metel</i>	Leaves	Karkam	Internal
2	Amukkara	<i>Withania somnifera</i>	Root	Karkam	Internal
3	Pungam	<i>Pongamia pinnata</i>	Bark	Ooral neer	Internal
4	Murungai	<i>Moringa oleifera</i>	Leaves	Karkam	Internal
5	Naaval	<i>Syzygium cumini</i>	Root	Ooral neer	Internal
6	Paavattai	<i>Pavetta indica</i>	Root	Karkam	Internal
7	Peenari	<i>Sterculia foetida</i>	Bark	Karkam	Internal
8	Kaakkanam	<i>Clitoria ternatea</i>	Root	Karkam	Internal
9	Naralai	<i>Cyphostemma setosum</i>	Tuber	Chooranam	Internal
10	Avuri	<i>Indigofera tinctoria</i>	Root	Chooranam	Internal
11	Malligai	<i>Jasminum grandifloram</i>	Root	Chooranam	Internal
12	Erukku	<i>Calotropis gigantea</i>	Root	Ennai	Internal
13	Oomathai	<i>Datura metel</i>	Unripe fruit	Karkam	Internal
14	Alinchil	<i>Alangium salviifolium</i>	Bark	Chooranam	Internal
15	Kalapai kizhangu	<i>Gloriosa superba</i>	Rhizome	Ennai	Internal
16	Pirkku	<i>Luffa acutangula</i>	Seed	Ennai	Internal
17	Marudham	<i>Terminalia arjuna</i>	Bark	Pongal	Internal
18	Sivanvembu	<i>Indigofera aspalathoides</i>	Whole plant	Chooranam	Internal
19	Piraai	<i>Strebulus asper</i>	Bark	Kudineer	Internal
20	Veliparuthi	<i>Pergularia daemia</i>	Root	Karkam	Internal
21	Aadutheenda Paalai	<i>Aristolochia bracteolata</i>	Whole plant	Poochu	External

22	Iluppai	<i>Madhuca longifolia</i>	Oil cake	Karkam	Internal
23	Korai	<i>Cyperus Rotundus</i>	Rhizome	Chooranam	Internal
24	Kudasapalai	<i>Holarrhena pubescens</i>	Bark	Chooranam	Internal
25	Katrazhai	<i>Aloe vera</i>	Gel	Kudineer	Internal
26	Sandhanam	<i>Santalum album</i>	Wood	Karkam	Internal
27	Parpadagam	<i>Mullugo cerviana</i>	Whole plant	Poochu	Internal & External
28	Erukku	<i>Calotropis gigantea</i>	Latex	Karkam	Internal
29	Thagarai	<i>Senna tora</i>	Seed	Karkam	Internal
30	Vaazhai	<i>Musa paradisiaca</i>	Fruit	Karkam	Internal
31	Vaagai	<i>Albizia lebbeck</i>	Seed	Chooranam	Internal
32	Punnai	<i>Calophyllum inophyllum</i>	Seed	Chooranam	Internal
33	Kaatamanakku	<i>Jatropha curcas</i>	Leaves	Karkam	Internal
34	Kodiveli	<i>Plumbago zeylanica</i>	Root	Kudineer	Internal & External
35	Veliparuthi	<i>Pergularia daemia</i>	Leaves	Saaru	Internal & External
36	Kadugurogini	<i>Picrorhiza kurroa</i>	Seed	Chooranam	Internal
37	Perunkayam	<i>Ferula asafoetida</i>	Resin	Poochu	Internal & External
38	Thippili	<i>Piper longum</i>	Seed	Karkam	Internal
39	Chukku	<i>Zingiber officinale</i>	Rhizome	Poochu	External
40	Saaranai	<i>Trianthema portulacastrum</i>	Tuber	Chooranam	Internal
41	Pirandai	<i>Cissus quadrangularis</i>	Root	Chooranam	Internal & External
42	Marul	<i>Sansevieria roxburghiana</i>	Tuber	Chooranam	Internal
43	Karuvelampattai	<i>Acacia nilotica</i>	Bark	Kudineer	Internal

44	Thavasu murungai	<i>Sauvopus androgynus</i>	Leaves	Karkam	Internal
45	Sirukeerai	<i>Amaranthus tricolor</i>	Root	Karkam	Internal
46	Alinchil	<i>Alangium salviifolium</i>	Bark	Poochu	External
47	Kuppaimeni	<i>Acalypha indica</i>	Leaves	Poochu	External
48	Viizhi	<i>Cadaba fruticosa</i>	Root	Poochu	External
49	Midhipagal	<i>Momordica dioica</i>	Leaves	Saaru	External
50	Paruthi	<i>Gossypium herbaceum</i>	Leaves	Ennai	External
51	Kovai	<i>Coccinia grandis</i>	Bark	Karkam	Internal
52	Muththerukkan Sevi	<i>Helicteres isora</i>	Leaves	Poochu	External
53	Uruthiratcham	<i>Elaeocarpus serratus</i>	Seed	Karkam	Internal
54	Nal velai	<i>Cleome gynandra</i>	Root	Saaru	External
55	Ilavangam	<i>Syzygium aromaticum</i>	Flower	Chooranam	Internal
56	Aththi	<i>Ficus racemosa</i>	Leaves	Saaru	Internal
57	Elumitchai	<i>Citrus limon</i>	Whole plant	Kudineer	Internal
58	Vembu	<i>Azadirachta indica</i>	Seed	Chooranam	Internal
59	Vellarugu	<i>Enicostema axillare</i>	Whole plant	Chooranam	Internal
60	Vasambu	<i>Acorus calamus</i>	Root	Karkam	Internal
61	Ulli	<i>Allium sativum</i>	Rhizome	Karkam	Internal
62	Perumaram	<i>Ailanthus excels</i>	Root	Chooranam	Internal
63	Sankan	<i>Azima tetracantha</i>	Root	Karkam	Internal
64	Naayuruvi	<i>Achyranthes aspera</i>	Whole plant	Chooranam	Internal
65	Vetrilai	<i>Piper betle</i>	Leaves	Karkam	Internal

66	Seenthil	<i>Tinospora cordifolia</i>	Leaves	Karkam	Internal
67	Malaiveppillai	<i>Melia azedarach</i>	Leaves	Saaru	Internal
68	Palaasu	<i>Butea monosperma</i>	Leaves	Karkam	Internal
69	Manjal	<i>Curcuma longa</i>	Rhizome	Poochu	External
70	Vaazhai	<i>Musa paradisiaca</i>	Bark	Saaru	Internal

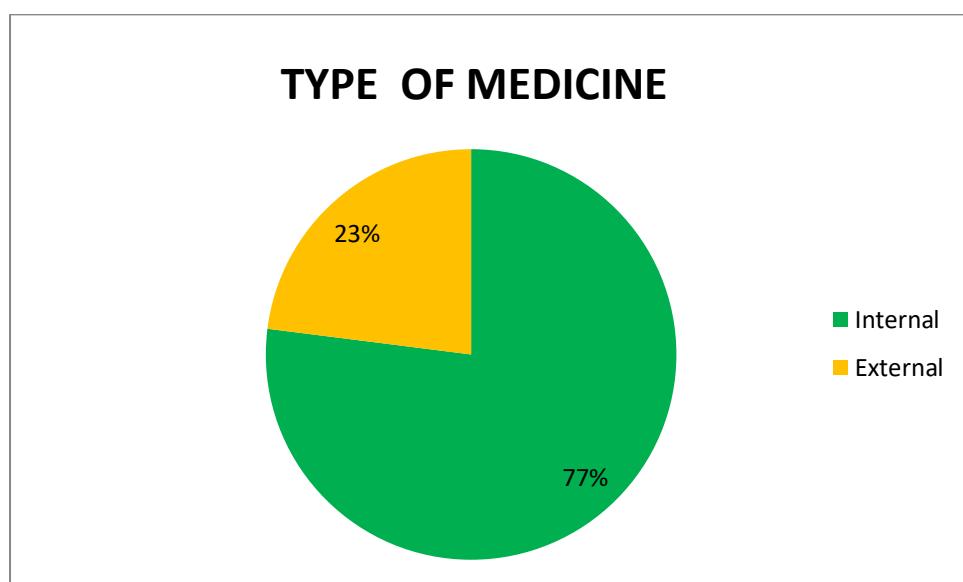


Figure.1. TYPE OF MEDICINE

Figure. 2. PLANT PARTS USED FOR MEDICNE

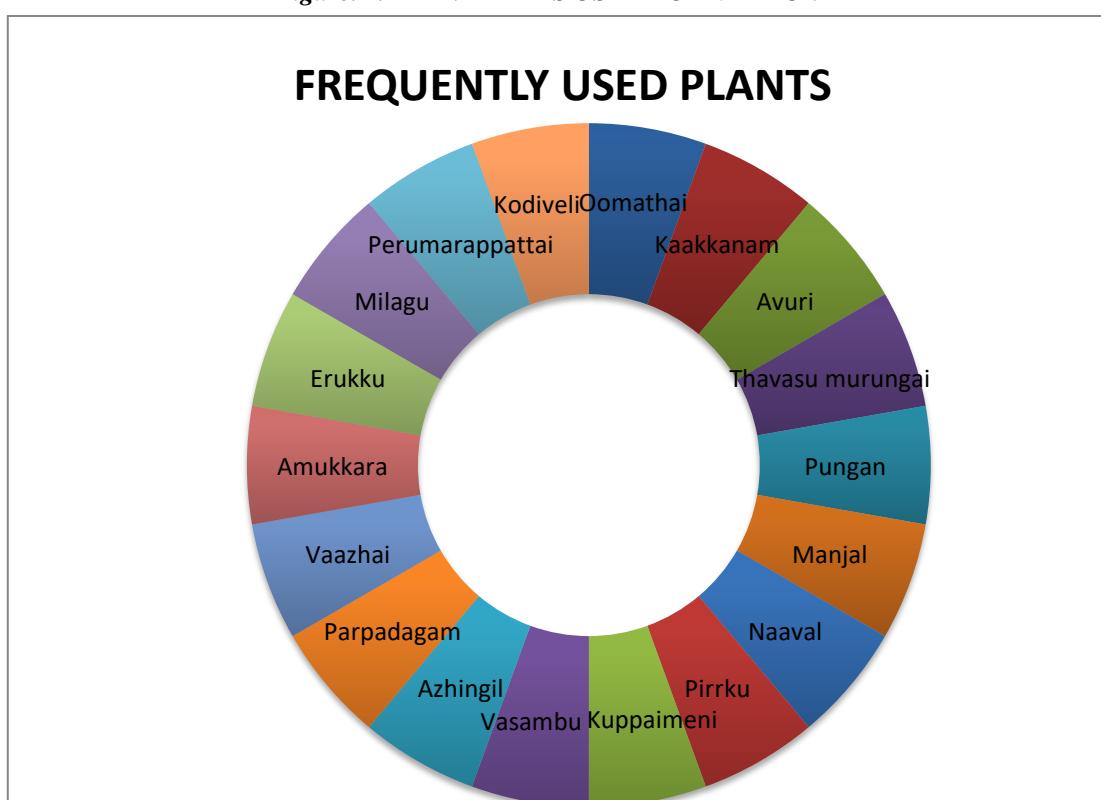
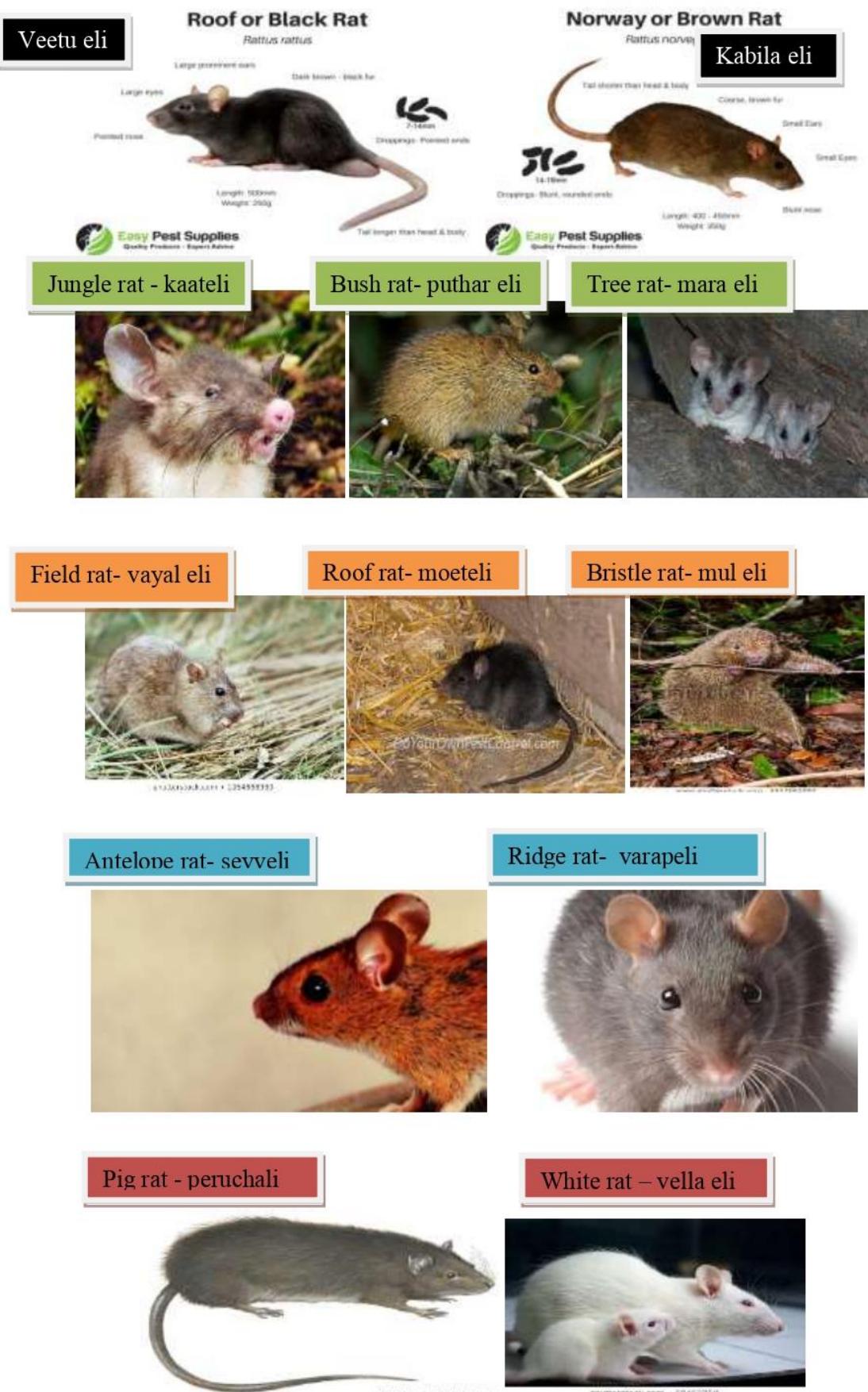
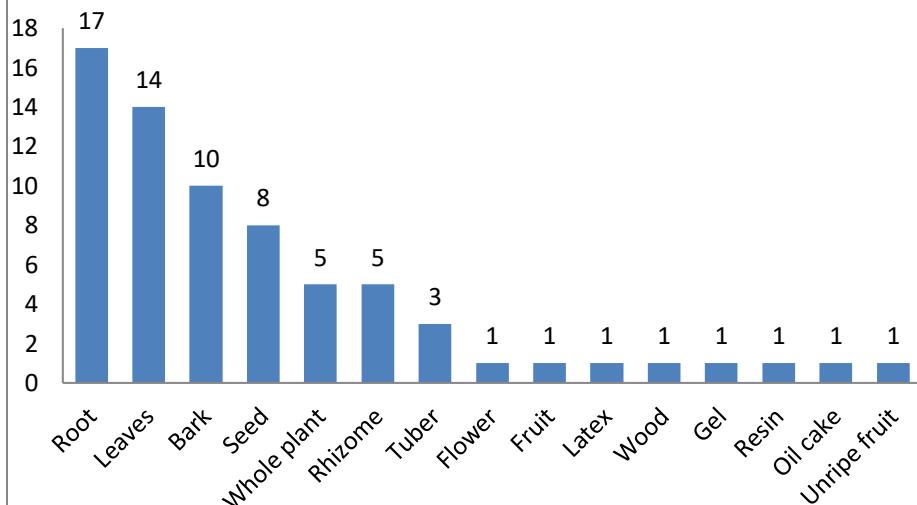


Figure.3. FREQUENTLY USED PLANTS



PARTS USED



DISSCUSSION

The review showed that there are 18 types of Rat found in Siddha literature. The most common symptoms are fever, cough, breathlessness, salivation, wheezing, fainting, shivering, arthralgia, vomiting, headache, thirst, skin discolartion, swelling as per siddha text. The symptoms of rat poisoning found in siddha text is correlated with the transmission of diseases to humans caused by rat such as Leptospirosis, Rat bite fever etc. The treatment of Rat poisoning can be given in the diseases where the source of infection is rat. From this research, the result was recorded as; 70 plants listed as internal(77%) and external medicine(23%) by siddha management. In internal medicine Hard paste (*Karkam*), Powder (*Chooranam*), Decoction (*kudineer*), Fresh juice (*Saaru*) was most commonly used and externally Paste (*Poochu*), Nasal medication (*Nassiyam*) were most commonly prescribed for the management of Rat bite. The most used plant parts are Root, leaves, barks, seeds, whole plant. From the literature the more number of treatment said in siddha text of Sarabendra vaithiya muraigal, Visha vaithiya sindhamani, Visha vaithiya aaruda noolgal.

CONCLUSION

From this research Siddha classical literature had a many therapeutic formulation ranging from herbal, herbomineral, metallic drugs to treat rat bites. This documentation will help as a reference for emergency need and management care in case of rat bite. This study also provides valuable information for further research purpose and antidote studies. Therefore this research concluded as to need a clinical assessment of siddha management in modern scientific way and introducing to global level in future.

BIBLIOGRAPHY

1. Venkatarajan.S, L.I.M, *Sarabenthira Vaithiya Muraigal (visha roga sigichai)*, 6th Edition, Saraswathi Mahal Noolagam, Thanjavur, 2014.
2. Mohan, R. C, *Visha Vaithiya Aaruda Noolgal*, 2nd Edition, Thamarai Noolagam, Chennai, 2013.
3. Mohan, R. C, *Pulipaani Vaithiam 500 moolamum uraiyum*, 2nd Edition, Thamarai Noolagam, Chennai, 2013.
4. Sirumanavur Munusamy mudhaliyar, *Vishavaithiya Sindhaman*, 1st Edition, South Indian Book Depot, Chennai, 1931.
5. Sridharan, D. K. BSMS (SL). M.Phil (Jaffna), *Visha Vaithiam(vaithia kalanithi)*, 1st Edition, srisai printers, Yaazhpaanam, 2009.
6. Prema MD(S), *Agasthiyar Mani 4000 ennum vaithiya sindhamani venba 4000*, 1st Edition, Volume 2, Thamarai noolagam, Chennai, 1996.
7. Sambasivam pillai, T.V. *Tamil - English Dictionary of Medicine, Chemistry, Botany & ailed science (based on Indian Medical Science)*, 1994.
8. Narayana Reddy. K. S, The Essential of Forensic Medicine and Toxicology. 33rd Editon, Jaypee Brothers Medical Publishers(P) Ltd., 2014, New Delhi.
9. Chougule Savita Bhupal, Ayurvedic aspect of rat bite and its management- a review, Unique Journal of Ayurvedic and Herbal Medicines. 2015 July,03(04):112-115.

10. Elliott SP. Rat bite fever and *Streptobacillus moniliformis*. Clinical microbiology reviews. 2007 Jan 1;20(1):13-22.
11. Sethi SK, Saha A, Karela M, Dubey NK. Infantile trauma due to a rat bite. Journal of emergencies, trauma and shock. 2011 Jul;4(3):409.
12. Kingcounty.gov. 2020. *Diseases From Rodents, Pocket Pets And Rabbits - King County*.
13. Patterson BD, Velazco PM. Phylogeny of the rodent genus Isothrix (Hystricognathi, Echimyidae) and its diversification in Amazonia and the eastern Andes. Journal of Mammalian Evolution. 2008 Sep 1;15(3):181.
14. Haake DA, Levett PN. Leptospirosis in humans. In *Leptospira and leptospirosis* 2015 (pp. 65-97). Springer, Berlin, Heidelberg.