



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 8.4  
IJAR 2021; 7(8): 323-332  
www.allresearchjournal.com  
Received: 05-06-2021  
Accepted: 09-07-2021

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## Shilajit an elixir of Ayurveda: A literary review of traditional usage as well as modern findings

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DOI: <https://doi.org/10.22271/allresearch.2021.v7.i8e.8883>

### Abstract

Shilajit is being widely used to cure a number of diseases across the world. It has wide medicinal values in various traditional systems of medicine worldwide. Shilajit has an important place in the Ayurvedic classic texts and being used as like a panacea, as Acharya Charaka cited in their popular verse that there is no curable disease on the earth, which could not be treated with the proper administration of Shilajit Rasayana. In modern days a number of research have been conducted across the world on parameters as defined and established on modern paradigms, and it has been concluded that Shilajit may play an important Roles in curing various life style deceases or infectious deceases. The aim and objective of current study to summarize the modern findings available online or offline on resources like Pub-Med, Google Scholar, and Science direct and another database, and cross relate the same with the establishment and verses of classical Ayurvedic Texts. The physical and chemical properties of Shilajit has also been discussed and summarized with special reference to modern findings. After going through a number of literature it may be concluded that Shilajit obviously have miraculous property as described in classical text and folk lore, but there is a limitation when reviewed on modern parameters, and that limitations is definitely lack of appropriate numbers of double blinded clinical trials and efficacy evaluation. Maximum studies available now a days are either in-vivo or in-vitro study, only a few human clinical trials are present.

**Keywords:** Shilajit, Shilajit bhasma, mummiyo, review of Shilajit, Asphaltum punjabianum

### 1. Introduction

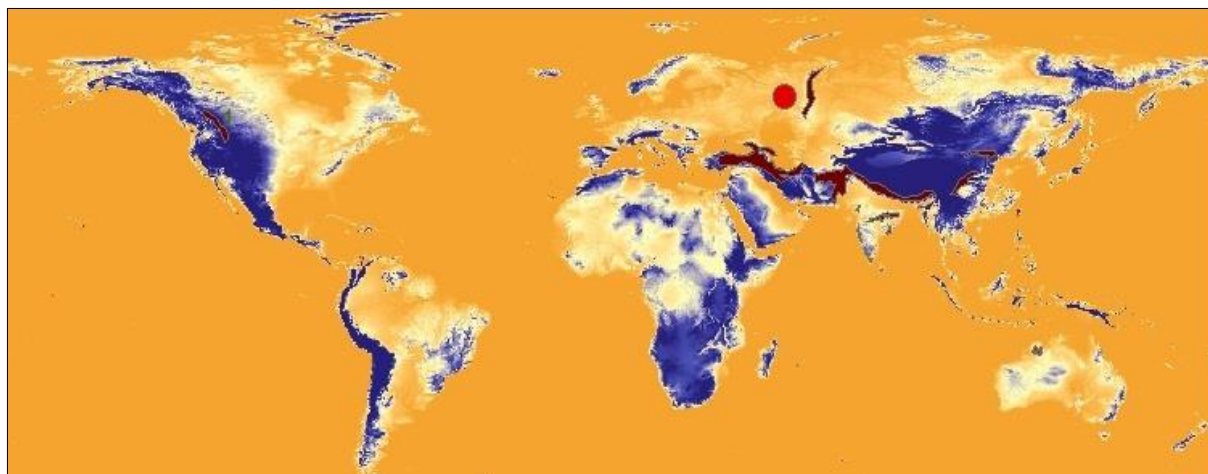
Shilajit is quoted as a panacea for all curable disease by Acharya Charaka. According to him; "There is no curable disease on earth, which cannot be cured with the help of Shilajit. When administered at right time, well prepared, and in the right manner, it will secure for the healthy subject the optimum measure of vitality <sup>[1]</sup>. Importance of Shilajit in traditional medicine may be visualised by the different names used for the same. As, The word 'Dhatu' is being used as a synonym of Shilajit which means 'Body tissue' just to emphasize its capability as Rasayana, one that increases the activity of the seven body constituents namely chyle, blood, muscle, fat, bone, bone marrow fluids of the body as per the traditional medicine of India <sup>[2]</sup>. Shilajit is being used since very old age in the different societies all over the world.

Shilajit is blackish-brownish, sticky matters exudates from stiff cliff of hills. It is physiologically active, and have special odour like gomutra. In other words, Shilajit is a tarry, solid or elastic natural product typically in the form of shapeless pieces with non-uniformly porous or smooth surface having a characteristic balsamic odour <sup>[2]</sup>. The aim of this paper is to summarize literary findings of different research works by the scholars around the world with modern techniques as well as emphasising the importance of Shilajit as described in classical texts.

Shilajit is a pale-brown to blackish-brown exudation of variable consistencies, found worldwide in sedimentary rocks of different formations, at altitude between 1000m to 5000m <sup>[3]</sup>.

The distribution of present exudation areas or potential areas is above the elucidated height or among the mountain ranges of tropic or to some extent of temperate zone, highlighted

areas with dark chocolate, or in circle light chocolate colour in below shown maps, between 40° S to 40°N latitude.



**Map 1:** Showing Shilajit exudation areas with chocolate colour shading, whereas dark blue colours are high mountains ranges



**Fig 1:** Raw Shilajit

**2. Categorisation of Shilajit:** Shilajit, in accordance to its property and other attributes such like origin, composition, odour are classified in various groups and classes by

different Acharya in classical texts. Brief Classifications are tabulated in table ‘1’.

**Table 1:** Classification of Shilajit According to the Different Acharya as Given in Classical Texts.

Name of The Acharya	Name of The classical Text	Classification base	Classes/Types
Charaka	Agnivesh Krita Charaka Samhita	Properties	1. Swarna 2. Rajat 3. Tamra 4. Lauha
Shushruta	Shushrut Samhita	Properties	1. Swarna 2. Rajat 3. Tamra 4. Lauha 5. Naga 6. Banga
Bhairavanand Yogi	Rasarnava	Origin	1. Patit 2. Apatit
Somadeva	Rasendra Chudamani	Odour	1. Gomutra Gandhi ▪ Sastva ▪ Nisatva 2. Karpoorgandhi
Rasa Vagbhata	Ras Ratna Sammucchay	Properties	1. Swarna Shilajit 2. Rajat Shilajit 3. Tamra Shilajit
Gopala Krishna	Rasendra Sar	Properties	1. Girija

Bhatta	Sangrah		<ul style="list-style-type: none"> <li>▪ Kanchana</li> <li>▪ Rajata</li> <li>▪ Tamra</li> <li>▪ Lauha</li> <li>▪ Banga</li> <li>▪ Yashada</li> </ul>
Madhvacharya	Ayurveda Prakasha	Origin	<ol style="list-style-type: none"> <li>1. Giri Shilajit (Rocks Origin)</li> <li>2. Kharbhumi Shilajit (Alkaline Soil origin)</li> </ol>
Datta Ram Chowbey	Vrihat Ras Raj Sundar	Odour	<ol style="list-style-type: none"> <li>1. Gomutra Gandhi <ul style="list-style-type: none"> <li>▪ Sastva</li> <li>▪ Nisatva</li> </ul> </li> <li>2. Karpoorgandhi</li> </ol>
		Origin	<ol style="list-style-type: none"> <li>1. Girisambhavam (Mountain origin)</li> <li>2. Usharodbhavam (originated from combination of water and soil)</li> </ol>
		Properties	<ol style="list-style-type: none"> <li>1. Swarna</li> <li>2. Rajat</li> <li>3. Tamra</li> <li>4. Lauha</li> <li>5. Nag</li> <li>6. Vanga</li> </ol>

Shilajit is placed in different varga by classical texts; brief of classification is tabulated in table '2'<sup>4</sup>.

**Table 2:** Placements of Shilajit in different groups by Ayurvedic Texts

Sr. No.	Group	Textbook
1	Maharasa	<ol style="list-style-type: none"> <li>1. Rasa Hridaya Tantra</li> <li>2. Rasarnava</li> <li>3. Rasendra Chudamani</li> <li>4. Rasa Prakasha Sudhakara</li> <li>5. Rasa Ratna Samucchaya</li> <li>6. Rasa Kamadhenu</li> <li>7. Rasa Jala Nidhi</li> <li>8. Rasa Kalpa</li> </ol>
2	Uparasa	Ayurveda Prakasha
3	Dhatu varga	Bhava Prakasha Kaidev Nighantu
4	Dhatvadvarga	Abhinav
5	Dhatu or adhatu varga	Shaligram Nighantu
6	Suvarnavadvarga	Raj Nighantu Madanpal Nighantu
7	Chandanaadi varga	Dhanvantari Nighantu Shodhan Nighantu
8	Paradadi varga	Siddha Bhaishjya Mani Mala
9	Arishadvarga	Sushruta

**3. Shodhan or Purification of Shilajit:** Shodhan or purification of Shilajit is an important aspects before the administration of the same as a drug. Being herbo-mineral products it is contaminated with various impurities at its

natural source of origin. Shodhana of Shilajit not only frees the Shilajit from impurities but also enhance efficacy of the drugs (Figure-2, Shodhit Shilajit).



**Fig 2:** Shodhit Shilajit

Various methods have been mentioned in different classic texts are summarised in table '3'. The purification methods

have various aspects and aim, such like types of Shilajit to be purified, and end usage.

**Table 3:** Shodhana (Purification) process of Shilajit, as described in Ayurvedic texts

S. No.	Treatise	Process	Shodhana Drugs/Shodhana Process
1	Charaka Samhita	Maceration	Vataghna, Pittaghna, Kaphaghna drugs
2	Sushruta Samhita	Maceration	Salasaradi Gana.
3	Astanga Hridaya	Maceration	Kwath dravya according to disease.
4	Astang Sangraha	Soaking and maceration in different Kwaths.	<p><b>For Vataja Diseases</b></p> <ul style="list-style-type: none"> <li>Rasna, Dasamula, Bala, Punarnava, Erenda, Shunthi and Madhuka.</li> </ul> <p><b>For Pittaja Diseases</b></p> <ul style="list-style-type: none"> <li>Draksha, Abhiru, Patola, Trayanti, Guduchi and drugs of Jivaniya Gana.</li> </ul> <p><b>For Kaphaja Diseases-</b></p> <ul style="list-style-type: none"> <li>Krimijita, Vacha, Phala Traya, Karanja, Ghana, Mukhya Panchmula (Brihat Panchamoola), &amp; Panchakola.</li> </ul> <p><b>For Vataja-Pittaja diseases</b></p> <ul style="list-style-type: none"> <li>Laghu Panchamoola, Sunthi, Draksha, Kashmarya, Vajigandha, Guduchi, Sara &amp; Bala.</li> </ul> <p><b>For Vataja- Kaphaja diseases</b></p> <ul style="list-style-type: none"> <li>Ghana, Kushtha, Vacha, Triphala, Surdaru, Vidanga, Panchakola, Rajani, Maricha, &amp; Ativisa.</li> </ul> <p><b>For Pittaja-Kaphaja disease</b></p> <ul style="list-style-type: none"> <li>Patha, Patola, Nimba, Triphala, Ghana, Kutaja, Saptaparna, Trayanti, Amrita, Ativisa.</li> </ul>
5	Rasarnava	Cleaning (Prakshalan)	Kshara, Amla and Gomutra, Triphala Kwatha, Goghrt and Ginger.
6	Rasa ratna Samucchaya	Prakshalan (Cleaning), Bhavana (Maceration)	Cleaning with Ksara, Amla, Gomutra and Bhavana with each of the following: <ul style="list-style-type: none"> <li>Godugdha, Triphalakwatha, Goghrt &amp; Bhrngarajasvarasa.</li> </ul>
7	Rasa Paddhati	Maceration	Separation of Santanika from Gomutra, Gandhi Shilajatu & Bhavana with Asanadi Ganas & Salasaradi Gana Kwatha.
8	Rasendra Chintamani	Maceration	Tridosaghna drugs
9	Rasa Manjari	Maceration	Bhavana with each Godugdha, Triphala, Bhrngarajaswarasa
10	Vaidya Kalpadruma	Maceration	Gomutra, Triphalajala, Dasamula Kwatha Guduchiswarasa, yastimadhu Kwatha. Godugdha & hot water.
11	Rasa Kamadhenu	Cleaning (Prakshalan)	Wash With hot water
12	Ayurveda Prakasha	Cleaning (Prakshalan)	Cleaning with water to remove external Impurities.
13	Rasa Tarangini	Bhavana (Maceration), Prakshalan (Cleaning)	<ul style="list-style-type: none"> <li>For Ext. purification- only washed with water</li> <li>For int purification- levigate with Neem, Guduchi &amp; Goghrit</li> </ul> <p>Or</p> <p>Wash with Triphala Kwath or Bhringraj Kwath or only with hot water.</p>
15	Rasajalanidhi	Bhavana (Maceration), Swedana	<p><b>Method 1:</b> Rubbed with Triphala, Godugdha, Bhrngaraja and then dried.</p> <p><b>Method 2:</b> Dissolve Shilajatu stones in water and collect the supernatant portion of fluid, then it is subjected to the Dhuma of Agurvadi Gana and finally evaporate the liquid to get Santanika for increasing the strength of this Shilajatu. Shilajatu again levigate with Vataghna, Pittaghna and Kaphaghna Dravyas.</p> <p><b>Method 3:</b> Seven Bhavanas with each drug are selected according to disease.</p> <p><b>Method 4:</b> Dissolve Shilajatu in the hot decoction made up of Nimba, Guduchi, Ghrt then evaporate the liquid to get Santanika.</p> <p><b>Method 5:</b> 3times dissolved in Triphala kwatha. Same process is repeated again with each of the following drugs: Dashamula Kwatha, Guduchi Svarasa, Bala Kwatha, Patola Kwatha and Gomutra.</p> <p>Dry the above Bhavita Silajatu and give Bhavana with the following drugs as necessary, Astavarga, Satavari, Asvagandha, Vidari, Varahikanda, Draksa, Jiraka, Salaparni, Rasna, Puskaramula, Dantimula, Citraka, Pippali, Indrayava, Cavya, SugandhiBala, Katuki, Srngi, Patha, and Salasaradi gana.</p> <p><b>Method 6:</b> Shilajatu becomes purified when subjected to Bhavana with Ksara, Amla and Gomutra.</p> <p><b>Method 7:</b> Shilajatu is purified when dissolved in Godugdha, Triphala kwatha or Bhrngaraja Svarasa.</p> <p><b>Method 8:</b> Take Shilajatu with Guggulu, Ksara, Amla &amp; put them in Svedani yantra &amp; give Svedana for one hour.</p>

**4. Marana of Shilajit:** In modern days Shilajit Bhasma (Image 3 & 4) is not in use. However, incineration of Shilajit and preparation of its bhasma have been described in various texts. It also important mentioned here that

some of scholar advocates petroleum like origin of Shilajit, and prohibits placing Shilajit in direct contact of fire. Preparation of Shilajit Bhasma as described in classical text contradicts such postulates.





Fig 3: Bhasma of Shilajit

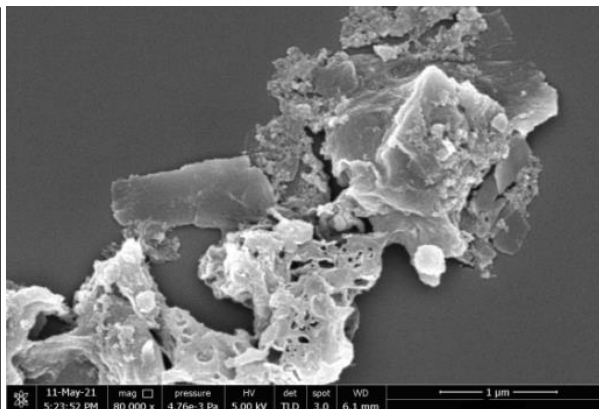


Fig 4: SEM Image of Shilajit Bhasma

Same method ascribed in various classical texts is being summarised below in table '4' with reference.

**Table 4:** Marana (Incineration) process as described in classical Ayurvedic texts

Sr. No.	Name of the reference books/Acharya	Reference Verse	Method of Incineration
1.	Rasendra Chudamani	10/104	Take pure Shilajatu – 1part, pure Gandhak – 1 part, pure Hartaal (As <sub>2</sub> S <sub>3</sub> )- 1 part, pure Manahshila (As <sub>2</sub> S <sub>3</sub> ) – 1part, levigate with juice of Matulunga ( <i>citrus medica</i> ) and there after prepare Chakrika put on fire of 8 Upala.
2.	Ras Prakash Sudhakar	5/101-103	
3.	Ras Ratna Sammucchay	2/119	
4.	Ayurveda Prakasha	4/131	
5.	Rasa Jal Nidhi	Chapter-1	
6.	Brihad Ras Raj Sundar		

Maharasa chapter of Ras Raj Sundar, in verse 120-121 ascribed usage of Shilajit Bhasma. According to the verse, Shilajit Bhasma, Kanta lauha Bhasma and Vaikrant Bhasma will be taken in equal proportion, along with anupana of Triphala, Trikatu or Ghrita in 1 Valla quantity, and administered. The drugs might be used in Pandu, Yakshma, Agnisara, Prameha, Arsha, Gulma, Pliha, Udara Roga, yoni Roga. However, study with modern scientific paradigms is not yet been done on the aspects as described above.

**5. Traditional Usage of Shilajit around the World:** Mummiyo was extensively being used by Hakims in the treatment of inflammatory and genitor-urinary disorders, and as an aphrodisiac [6]. Shilajit is widely used in routine diet by people of Tajikistan. Various food supplement products either available in market or being patented could easily be found in the market of Tajikistan [12]. Shilajit is being widely used as immuno stimulants anabolic food

additive [7]. Myemu is being used widely in Russia and another republics once a part of USSR, to treat diabetes, to slow down aging process, and in treatment of arthritis [6]. It is also being prescribed for genitourinary diseases, angina, jaundice, digestive disorders, nervous diseases, chronic bronchitis, asthma, anaemia, amenorrhoea, dysmenorrhoea, menorrhagia, eczema, anorexia, fracture of bones, and osteoporosis [8]. In recent days Shilajit also found place in phytotherapy in Germany to treat a number of disease [6]. Apart from the above, Shilajit being widely used in gulf countries, Pakistan, and Iran as like Vajikaran Dravya.

**6. Physical Properties:** Various Ayurvedic texts describe the Ras, Guna, Virya, Vipaka of Shilajit in accordance to their own system of classification. Ras Jalnidhi description of properties of Shilajit as described in chapter-1 is being tabulated in table '5'.

**Table 5:** Properties of different types of Shilajit, as per Ras Jalnidhi

Type of Shilajatu	Colour	Rasa	Guna	Virya	Vipaka	Indication
Swarna Shilajatu	Jasva pushpa, Gairikabhm	Madhura, slightly Tikta	Snigdha, Ghana	Sita	Katu, Tikta	Alleviates Vata- pitta
Rajata Shilajatu	Shashi Shankha varna.	Sakshar mixed with Katu and Amla	Vidahi	Sita	Madhur	Alleviates pittaj diseases.
Tamra Shilajatu	Mayur kanth, Chas paksh.	Tikta- Katu	Lekhan	Tikshna		Alleviates Meha, Amlapitta, Jwar, Sosa.
Lauha Shilajatu	Guggulu like	Tikta, Lavana	Rasayana	Sita	Katu	Alleviates Tridosha.
Naag Shilajatu	Kusum varna	Tikta, Katu.		Ushan		
Vang Shilajatu	Trapu varna, Trapugandh	Tikta, Katu	Sandra, Mritsna			Alleviates Shotha, Prameha, Jwar, Shosa, Amlapitta

Shilajatu is neither sour nor astringent. It turns pungent after it is digested in the stomach. It has the merit of increasing the properties of the substance with which it is mixed and taken internally. It prevents and cures senile decay. It

produces neither a heating nor a cooling effect on the system. It has the property of removing mucus and other dirt from the system. Chemistry of Shilajit is tabulated below.

**Table 6:** Chemical Properties of Shilajit

Material	Primary Chemical Units <sup>9</sup>	General Composition <sup>10</sup>	Elements in g/Kg <sup>10</sup>	Radioactivity Analysis <sup>10</sup>	Additional Phytochemical present <sup>10</sup>	Composition of Mumiyo Shilajit in brief <sup>12</sup>
Purified Shilajit or Mumiyo	1. Low and medium molecular weight non-humic organic compounds comprising free and conjugated (e.g. fatty acyl, aminoacyl, lipoidal), dibenzo-pyrones. 2. Medium and high molecular weight DCPs (dibenzo-pyrones-chromoproteins), containing trace metal ions and colouring matter such as arotenoids and indigoids. 3. Metallo-humates like fulvic acids and fusims with dibenzo-pyrones in their core nuclei.	<ul style="list-style-type: none"> <li>▪ Humidity: 14-20%</li> <li>▪ Minerals: 18-20%</li> <li>▪ Proteins: 13-17%</li> <li>▪ Lipids: 4-4.5%</li> <li>▪ Steroids: 3.3-6.5%</li> <li>▪ Nitrogen free compounds: 18-20%</li> <li>▪ Carbohydrates: 1.5-2%</li> <li>▪ Alkaloids, Amino Acids &amp; Other compound of Nitrogen: 0.5-0.8%</li> </ul>	<ul style="list-style-type: none"> <li>▪ Potassium : 60</li> <li>▪ Calcium: 27</li> <li>▪ Magnesium : 14</li> <li>▪ Sulphur: 6</li> <li>▪ Sodium: 40mg/Kg</li> <li>▪ Strontium : 145 mg/Kg</li> <li>▪ (Presumed to be cause behind Radioactivity level of Shilajit)</li> </ul>	Low level Radioactivity observed in Shilajit, approx. 14 min g <sup>-1</sup> Kg <sup>-1</sup> , It has been concluded that this level of Radioactivity is not due to Strontium, but due to presence of <sup>39</sup> K is found naturally with <sup>40</sup> K isotopes (0.0118%), unstable in nature.	<ul style="list-style-type: none"> <li>▪ Shilajityl acetate</li> <li>▪ Shilajitol</li> <li>▪ shilacatechol</li> <li>▪ Shilaxanthone</li> <li>▪ Shilanthranil</li> <li>▪ Naphsilajitonealongn</li> <li>▪ With pyrocatechol and their stereostructures.</li> </ul>	1. water soluble extractive 51.54% <ul style="list-style-type: none"> <li>▪ Fulvic Acids 58.85%,</li> <li>▪ Dilbenzo-<math>\alpha</math>-pyrones chromoprotein 25.22%</li> <li>▪ Dilbenzo-<math>\alpha</math>-pyrones 0.2%,</li> <li>▪ Fullerene-Dilbenzo-<math>\alpha</math>-pyrones adducts 12-18 <math>\mu</math>g/g</li> <li>▪ free fullerene 1-1.5 <math>\mu</math>g/g.</li> </ul>

**7. Use of Shilajit in Ayurved:** Ayurvedic texts describes Shilajit as miracle drug. Shilajit has specific effect with action like Chhedan Karma, Vrishya, Balya, Lekhana,

Yogavahi, Rasayana. Action of Shilajit on doshas can be summarised below.

**Table 7:** Action of different types of Shilajit on doshas

Sr. No.	Type of Shilajatu	Action on Doshas
1	Swarna Shilajeet	Vata pitta shamaka
2	Rajata Shilajeet	Kapha pitta shamaka [exception kaphavata shamaka BRRS, pittashamaka RSS, pittavatashamaka RJN].
3	Tamra Shilajeet	Kapha shamaka
4	Lauha Shilajeet	Tridoshghna.
5	Sadharana Shilajeet	Kaphahara [A.S; R.J.N]; Vatahara (RT)

Therapeutic use of Shilajit with different anupana as given in Ashtang sangrah, verse 49/303-306 would be summarized in table '8'.

**Table 8:** Therapeutic use of Shilajit with different Anupana (Ashtang Sangrah)

Sr. No.	Shilajatu+ Anupana	Indication
1.	Shilajatu + decoction of Ambuda, Parpata	Fever
2.	Shilajatu + Madhuyashti	Bleeding disorder
3.	Shilajatu + meat soup of Kravybhujja	Sosa
4.	Shilajatu + Peacock meat, Milk	Karsya (emaciation)
5.	Shilajatu + Madhoodaka	Obesity
6.	Shilajatu + Milk	Mental disorder
7.	Shilajitu + Buffalo's urine	Pandu, Udara Rog
8.	Shilajatu + Decoction of Virtarvadigana	Urinary stones
9.	Shilajatu + Decoction of Khadira and Visa	Leprosy, skin diseases.
10.	Shilajatu+ Trikatu, Honey, KshudraDhatu and after its digestion partakes food along with milk will not be troubled.	Yakshma

While Rastarngini ascribed administration of Shilajit with different anupana have various properties, verse 22/88-109, tabulated in table '9'. The dosage form for administration of

Shilajit with different anupana has been described in different text in accordance to the vyadhi adhikar and prakriti of the patients.

**Table 9:** Therapeutic use of Shilajit with different Anupana (Rastarngini)

Sr. No.	Anupana	Disease
1	Honey	Mutrakricchra
2	Dashamula Kvatha + Sugar	Asthilika, Vatabasti

3	Varunadi Kvatha	Mutraghata&Asmari
4	Guduchi Kvatha	Mutraghata & Mutrakricchra
5	Sugar + Camphor	Mutatita, Mutra Jathara
6	Gokshura Kvatha	Mutrakricchra
7	Kakolyadi Gana	Klaibya
8	Lauha Bhasma, Swarnamakshika bhasma Ghee, Haritaki, Vidanga	Rajayakshma
9	Viratarvadi gana kvatha	Mutrakricchra
10	Sugar + milk	Pain due to prameha
11	Guggulu + Sunthi + Pippali + Gomutra	Uruhstambha
12	Lauha + Swarnamakshika bhasma	Raktavridhhi
13	Arjuna Kvatha for 2 months	Hridroga
14	Agnimantha Swarasa for 2 months	Sthaulya
15	Bhavana with Salasaradi Gana Kwatha for 21 days and use with same decoction for 2 months	Madhumeha, Asmari, Mutrasarkara
16	Pippali, Pashanabheda	Prameha
17	Ela churna + Tandulodaka	Mutraghata, Mutrakricchra
18	Kapoor (Ext. Appl.)	Wounds / Bruise
19	Haridrachurna	Kumbha kamala
20	Lauha + SvarnaBhasma bhavana with Sarjakavatha (1ratti).	MasurikaJvara etc.

**8. Bioactivity of Shilajit:** Findings of various study indicates that Shilajit have various bioactivity such likes anti-oxidant, anti-inflammatory, anti-viral and Immunomodulatory properties. The finding supported by one or more animal study, in-vitro study, or in clinical models is being discussed here. However some of the conclusions or findings needs further evaluation and focussed study.

**8.1 Immunomodulatory Property:** Fulvic Acid, present as major component of Shilajatu, has a positive impact on immuno modulation. Fulvic acid extracted from Shilajatu, enhanced the production of reactive oxygen species (ROS), nitric oxide in murine peritoneal macrophages. Murine splenic lymphocytes treated with FA1 showed a dose dependent increase in [3H] Thymidine uptake [10]. Pure shilajit was found to supplement the lytic potential of activated lymphocytes and produced T-cell mediated cytotoxicity [13]. The administration of Shilajatu, extract in the dose of 0.5 g/kg from the 1st to the 20th day after g-irradiation (180–220 r/min, dose 600r) stimulates lymphopoietic erythropoiesis in acute radiation disease. This is manifested by a more rapid restoration of the number of lymphocytes in peripheral blood, bone marrow, and spleen<sup>14</sup>. Shilajatu has a positive impact on the WBC activity, and positivity is dose dependent and has a positive correlation with exposure time [15].

**8.2 Antioxidant Property:** Free radicals scavenging activity of Shilajatu was assessed in case of CCL<sub>4</sub> induced oxidative stress, on rat liver homogenate. Parameter taken for study was Lipid peroxidation, which indicates the level of oxidative stress. In this study it has been found that Shilajatu potentiates the antioxidants activity in rat body [16]. The antioxidant activity of the Asphaltum punjabinum was evaluated by quantifying the ability of different solution of samples to suppress iron (Fe<sup>2+</sup>) induced lipid peroxidation in rat liver homogenates. It has been concluded that administration of dosage 300 mgKg<sup>-1</sup>Day<sup>-1</sup> have significant potency of anti oxidative effect [17]. Processed extract of Shilajit is able to trap NO<sub>2</sub> & SO<sub>2</sub> radicals [18]. The native Shilajatu obtained from Bahr Aseman Mountains, exhibited moderate antioxidant potential [19], while similar study with Shilajit from Pakistan and Afghanistan shows a high anti-oxidative property [20]. Shilajatu provided complete protection to methyl methacrylate (MMA) against hydroxyl radical-induced polymerization and acted as a reversible NO-captodative agent [21].

**8.3 Anti-microbial activity/effect:** UV treated Shilajatu showed potentially good anti-microbial activity against all available bacterial strain, while anti-fungal activity only against *Penicillium chrysogenum* [22]. In an in-vitro study Shilajatu inhibited the growth of both types of bacteria, among them some potential human pathogens [23]. Shilajit extraction in different ratio inhibited *S aureus in vitro*, while having no effect on *E coli* [24]. While in another study Shilajatu extract showed good activity against different microbes. The *E coli* were most effected organism [35]. A study has found that diet enriched with Shilajit at 2 g kg<sup>-1</sup> or 4 g kg<sup>-1</sup> positively enhances the antioxidant activity, immunity, and disease resistance in *M. rosenbergii* against *A. Hydrophila* [36], while another study found that administration of Shilajit shortened the treatment period in patients with pulmonary tuberculosis [8].

**8.4 Anti-Viral property of Shilajatu:** Shilajatu has a dose dependent inhibitory potency against HSV1, HSV2, HCMV and RSV infectivity (EC50 values: 31.08µg/ml, 12.85µg/ml, 34.54µg/ml, and 30.35µg/ml, respectively), but inactive against HRV and VSV<sup>27</sup>. In another in-vitro study efficacy of Shilajit extract Fulvic acids has been established against influenza\*31 and other viruses [28]. In a clinical study it has been observed that Shilajit decrease the recurrent resistance of HIV to ART, and increase outcome of the ART [29]. In an *in vitro* study, combination of Shilajatu with An officinalis showed a good inhibition potential of HIV virus viral enzyme [30].

**8.5 Anxiolytic, Adaptogenic and anti-depressant and memory enhancer, anti-catalepsy effect of Shilajatu:** In an *in vitro* study on swiss albino mice (20-30g), Shilajit has found effective in withdrawal of ethanol induced anxiety in a dose dependent manner ( $P < 0.001$  for 10mgKg<sup>-1</sup>, 25mgKg<sup>-1</sup>, and 50mgKg<sup>-1</sup>) [31]. In an animal study, it has been observed that processed Shilajatu and its active constituents, like Fulvic Acids, EE etc, significantly augmented learning acquisition and memory retrieval in battery tests, designed for this purpose in accordance with the accepted tenets [32]. In a clinical study on Alzheimer disease patients, analysis of data showed that there is a tendency towards less cognitive deterioration in patients administered with Shilajatu in comparison to the placebo administered group [33]. Water purified Shilajatu, Triphala and Guduchi Kwath Bhavitha Shilajatu possess a significant anxiolytic and antidepressant activity on rat's behaviour [34]. The pre-treatment with extract of Shilajatu with a dose regimen 2.5, 6.25 & 12.5



mgKg<sup>-1</sup>, protected the mice from catalepsy induced by haloperidol as effectively as standard drug scopolamine and in fact better than scopolamine on repeated administration. This study suggests that the Shilajatu extract might be explored to be used in clinical practice as an adjuvant drug in preventing and treating the extrapyramidal side effects of antipsychotic agents [35].

**8.6 Shilajatu as Anabolic Agents:** The administration of Shilajit with different dose regimen in sportsperson, it has been observed that anabolic processes at different cell and tissues level has been activated [36]. Administration of 500 mg/day shilajatu has elicited favourable muscle and connective tissue adaptation [37]. Experiments shows that Shilajatu extract (0.5 g/kg, per os, daily, for 10 days) administration has accelerated processes of protein and nucleic acid synthesis, stimulated the energy providing reactions in liver, and promoted transportation of minerals especially calcium, phosphorus and magnesium to the muscles and bone tissues [8].

**8.7 Shilajatu Effect on Endocrine system/Anti-diabetic Role:** In an animal study it has been observed that combination of traditional drugs with shilajatu 100 mg/kg/day could put an enhancing effect on control of blood sugar [48]. In another study, it has been found that the administration of Shilajatu with 100 mg/kg/day has attenuated a hyperglycaemic response of streptozotocin, from day 14 and onwards of consecutive and regular administration [39]. A clinical study on a group of patients of diabetic mellitus, a significant improvement in fasting blood sugar ( $P < 0.001$ ) and PP blood sugar level ( $P < 0.001$ ) has been observed while administered with Shilajatu, OS [40]. In Shilajatu,  $\alpha$ -Lipoic Acid, 1, 2-dithiolane-3-pentanoic acid is present to an extent of 10-12 mg/100g. In a study it has been found that lipoic acid has shown a good potency in the treatment of type-2 diabetic mellitus. This seems to justify the use of Shilajit in Ayurveda in treatment of diabetes [41].

**8.8 Anti-Ulcerogenic Effect of Shilajatu:** In a clinical study, where in two groups, one has been administered with normal saline and wound dressing, while another group received 20% concentration of Shilajit with water, it has been observed that intervention group has shown prominent healing of wound [42]. Shilajatu has increased the carbohydrates/protein ratio and decreased gastric ulcer index, indicating an increase mucus barrier. Shilajit was found to have significant anti-inflammatory effect in carrageenan-induced acute pedal oedema, granuloma pouch and adjuvant-induced arthritis in rats [43]. In a study, it has been found that the Fulvic Acids and 4'-methoxy-6-carbomethoxybiphenyl in combination decrease the incidence of duodenal ulcer in experimental model [44]. The processed Shilajatu could have a significant positive impact on wound healing and in treatment of related inflammatory states, while administering with a carefully selected dose regimen [45].

**8.9. Shilajatu effect on Infertility and Testosterone:** In a study, It has been observed that the treatment with purified Shilajit, for 90 days periods, has significantly increased free testosterone and dehydroepiandrosterone (DHEAS) with comparison to placebo. Gonadotropic hormones levels are well maintained [46]. In an animal study on adults Lohi rams, administration of Shilajit may lead to increase significantly

( $P < 0.05$ ) in volume, numbers of sperms, motility percentage, mass activity and scrotal circumference of the testes and decrease in pH and dead percentage of sperms [47]. In a clinical evaluation, significant improvement in spermia (+37.6%), total sperm count (+61.4%), motility (12.4-17.6%), normal sperm count (+18.9%), with concomitant decrease in pus and epithelial cell count, compared with baseline value, has been observed [48]. In another animal study it has been estimated that Shilajit have both Spermatogenic and ovogenic effect in mature rats [49]. Another study published in *Andrologia* claimed that Shilajatu have a potent androgenic effect [50].

**8.10 Cardioprotective Effect of Shilajatu:** During an animal study, where myocardial injury has been induced by injecting Isoproterenol (85 mg-k<sup>-1</sup>), it has been concluded that shilajatu has maintained  $\pm dp/dt$  maximum, attenuated the serum cardiac troponin, and reduced the severity of cardiac lesions [51]. In a clinical double-blind placebo trial where half of the group has been placed on administration of Shilajit 250 mg, two capsules twice daily for 12 weeks or on placebo, positive impact of Shilajatu in improvement of endothelial function has been observed [52]. In another animal study, it has been found that Shilajit has more beneficial effect on lipid profile in comparison to simvastatin [53]. Positive impact of Shilajatu on Lipid profile control has also been confirmed by another animal study [54].

**8.11 Miscellaneous:** In a study on rat model it has been observed that the shilajatu attenuate the behavioural symptoms of chronic fatigue syndrome possibly through the modulation of hypothalamus-pituitary-adrenal (HPA) axis and preservation of mitochondrial function and integrity [55]. In an experimental study on effect of shilajatu administration on experimentally induced osteoarthritis in rats, it has been observed that the group of rats which has been treated with shilajatu aqueous extract, has less cartilage degenerative changes than the group which has not been administered with the same [56]. In a study on dogs, researchers have concluded that Shilajatu has significant anti-arthritis properties including reduction of pain and inflammation [57]. In a study where 30 female rats have been induced with poly-cystic ovarian syndrome by injecting letrozole, positive significant effect of shilajatu has been observed [58].

**Source of Support:** NA

**Acknowledgement:** NA

**Ethics Committee Approval letter No:**

**Conflicts of Interest:** None

## 9. Conclusion & Discussion

Findings of modern studies supports the Acharya Charaka verse that no curable disease on the earth, which could not be cured with proper administration of purified Shilajit. But, there is a limitation to the prospering hopes, and the same is the facts that, there is relatively few peer-reviewed, human, controlled, and published research studies have been conducted. Many reports are poorly controlled, of an anecdotal, observational nature, and involve the use of non standardized material [59]. However it should be noted here those numbers of un-published research work related to effect of Shilajit, in Russia itself have a significant number, which were came to knowledge of world only after downfall of USSR. It has been observed that Shilajit was being widely used in USSR by Olympic athletes and in Army, as



study supports physical and mental revitalizing effect of Shilajit<sup>[60]</sup>. There are no events of adverse effects has been noted during course of animal as well as human study in available text<sup>[69]</sup>. Shilajit although being a miracle drug is not to be administered randomly or without proper administration, as course of action and effects are totally depends upon the prakriti of patients, anupana, dose selection, and purification methods used in shodhan of Shilajit. It should also be noted here that, although there are several references for preparation of Shilajit bhasma and its usage in disease like Yakshma, Pandu etc., no study are yet being found on the available materials on Google Scholar, Pub-Med or any other reference source. This might be due to the limited availability of Shilajit. But, this field might be explored to add positive dimensions in research about Shilajit usage.

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