

A Powerful Molecule of Ayurveda Science

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ABSTRACT

Shilajit is naturally found substance, also termed as shilajatu, salajit, mummiyo, or mimie. It is blackish powder obtained from high mountain rocks, especially in the Himalayans mountains. It has been used by Ayurvedic medicines to cure several disorders and to improve the quality of life. To support its rasayana property, an effort has been made to review shilajit with respect to its origin, variations, physical properties, purification, medicinal properties, and significant biological properties. Shilajit has been demonstrated to offer different health advantages based on the area from where it was harvested. Antioxidant activity and immuno-modulatory activity were highlighted among the many biological characteristics of shilajit since they are strongly related to its rasayana potential. The present review finds the various types and qualities of biomarkers in shilajit which ensure the quality, safety and effectiveness of shilajit.

Keywords: Ayurvedic medicine, Bioactives, Shilajit, Traditional medicine.

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INTRODUCTION

Shilajit, a natural substance, has played an important role in folk medicine in the previous Soviet Union, as well as Indian traditional medicine and Tibetan pharmacology, for approximately 3000 years. It is also utilised as a growth promoter in plants.^[1] This resin was used to embalm corpses in ancient Egypt. This drug was utilised by Greek doctors as an antidote to poisons and to cure a variety of ailments, including arthritis and inflammation. Shilajit has the power to resorb pimples as well as tumours, according to Avicenna's Canon Medicine.^[2] Shilajit is now forbidden from being carry across from the Soviet Union since it is deemed a "national treasure".^[3] Fulvic acid and humic compounds are significant among Shilajit's many active principles. It's fascinating to learn about the positive effects of fulvic acid, which are mentioned in a 15th century Chinese pharmaceutical compendium. The compendium mentions a medication called 'Wujinsan,' which contains acids such as fulvic and humic. The above stated acids are blood clotting and anti-inflammatory agents.^[2]

Shilajit is a blackish, physiologically active and tacky organic substance that is found in rocks in many different parts of mountainous area^[3], and its antiquity is unknown^[1,4-6] Shilajit, to put it another way, is elastic in nature, solid, tarry and naturally obtained substance.^[7] It is found in undefined bits that have

a surface that is either non-uniformly porous and smooth and emits a smell that is reminiscent of balsamic vinegar. These bits also have no discernible shape.^[8] The color and content of organic exudate is very much dependant on the climatic conditions like the dominance of season in the region and also the geographic environment like elevation of the area from sea level. Generally it is in the shades of black and brown and very much looks like a rocky structure.^[3,9] It has a sour flavour and a smell that is similar to old cow pee.^[10] Shilajit may be found across the Himalayas, from Arunachal Pradesh to Kashmir in the east. Other nations where it may be found include Afghanistan (Hindukush), the Soviet Union (Tien Shan, Ural), Tsao – Shing,^[5] Australia,^[10] Mongolia, China, Bhutan, Nepal, Pakistan,^[11] Tajikistan (Zarafshan),^[12] and Tibet (Himalayan belt).^[4] In Japan, Algeria,^[3] and Saudi Arabia, it is also referred by the name momia, and it is believed to have originated in either Yemen or India.^[13]

SHILAJIT'S BACKGROUND IN HISTORY

Vedic Age: Hindu culture is the world's oldest and is preserved in the Vedas, which are a treasure trove of knowledge. Ayurveda is a branch of the Atharva Veda, which is the knowledge of living well. There are differing viewpoints about the Vedic era. There is no inscription of Shilajit during the time of the Vedic period, according to Bala Gangadhar Tilak.

Pauranic Age: The author of Brihat Rasaraja Sundara cites Shilajit, which is listed in Puranas as a mineral ore and a material of Mandarachala Parvat.

Gods and Demons utilised Mandarachala and Vasuki Naga for churning purposes during the Samudra Manthana period.



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Some minerals were created in Mandarachala Parvata due to friction, one of which being Shilajit, the precise date of which was unknown. The ancient literature^[14] contains several conceptual components of Shilajit.

Shilajit has a number of synonyms, each of which communicates a trait and describes Shilajit. *Asphaltum punjabinum* is the Latin name for it. It has got different names from different countries. Some say 'saving body' or 'protective organism' (Greek), arakul-dzhibol (sweat of the mountain) in Arabic, juice of the rock' (in Tibet), and Burmese call it as blood of the mountains'.^[8] Persian has named as Momio, myemu is the Russian name, and mumie or salhumin is the German name.^[10,15] Shilajit means 'destroyer of weakness' in Sanskrit.^[1]

There are two types of shilajit: Karpura Shilajit, a white kind with a camphor odour, and Gomuthira Shilajit, a semi-hard, brownish black to dark, oily resin with a strong coniferous odour and bitter taste similar to cow's pee. Based on the frequency of metal ore found in the highlands where shilajit exudates, as recorded in ancient texts, Gomuthira Shilajit is categorised into four kinds; gold, silver, copper and iron ores. As the names suggest the color of respective shilajit matches to the names given. Even the availability is also similar to the names; iron is most common and gold is rare. The healing property of each type is different.^[16,10]

Shilajit's Molecular Composition

Shilajit is primarily constituted of humic compounds, such as fulvic acid, which account for 60 to 80 percent of the total nutraceutical component, as well as certain oligoelements, such as selenium, which has anti-aging characteristics.^[19,20] Humic compounds are the byproducts of the decomposition of organic matter, mostly vegetative matter, caused by the work of many microbes. The most studied and effective compound is fulvic acid. The small structure and weight makes it easy to absorb systemically. It very well soluble in water and its solubility is not affect by pH change. Fulvic acid impart antioxidant property to shilajit.^[21,22] It is observed that shilajit contains many different phytochemicals which make it a potent antioxidant agent.^[19,24,25] Newer research using high-performance size exclusion chromatography (HP-SEC) has shown that shilajit includes unique polysaccharide and lignin molecular species.^[10]

Purification

In ayurveda purification is specific process of different drug. If the active is very potent or toxic than the purification process is carried out before use. When shilajit is obtained it is always accompanied with different material like metals mud which can lower its potency and also can cause adverse effect. Thus, purification process is carried out before using shilajit. In this ayurvedic process shilajit added to decoctions triphala and bhringraja in a iron container each separate days. It is also purified with cow milk.^[26]

Physical Characteristics

One of the most important and required tests for standardisation is physical qualities such as solubility and pH. Solubility in water shows that about 30-50 percent of the weight of Shilajit goes into the supernatant liquid, with minerals and plant residues remaining in varying amounts depending on Shilajit purity. Shilajit is a sticky, tenacious substance with a gleaming, polished surface that is readily soluble in water, alcohol, and acetone. Simultaneous thermal analysis curves changed across several heating runs when Shilajit samples were exposed to thermal analysis, demonstrating that Shilajit samples are not homogenous and exhibit batch dependency. The changes in intensity and signal were particularly noticeable at higher temperatures. Except in the dehydration region up to 150°C, only exothermal processes occur in an oxidising environment (about 7 percent water). This implies that Shilajit is mostly composed of biological stuff, with a total mass loss in air of 67.6%. A entirely different behaviour is seen in an inert environment.^[27-30]

TRADITIONAL USAGE

Tajikistanis consume Shilajit as part of their daily diet. Shilajit, a patented and produced in Tajikistan ingredient, is included in a variety of bioactive dietary supplements and food additives. Shilajit is utilised as an immunostimulant and anabolic food ingredient in the form of an aqueous extract.^[31] Shilajit is used in Russia to treat a wide range of illnesses, such as genito-urinary conditions, diabetes, angina, jaundice, digestive issues, nervous system issues, chronic bronchitis, asthma, anaemia, amenorrhoea, dysmenorrhoea, menorrhagia, dermatitis, anorexia, bone fractures, and osteoporosis.^[2] According to conventional Indian knowledge, it has tonic, laxative, expectorant, diuretic, anti-bilious, lithotriptic, and anti-hypertensive properties when taken internally.^[16] It also has antiseptic, analgesic, deo-obstruent, and germicidal properties when applied topically.^[17] To treat diabetes, Shilajit is taken with milk. To cure fractures, Shilajit is used with frankincense. It is thought to go to the joints and soon produce a callus.^[10]

If we take 130 mg of Shilajit twice a day with the juice of *Zizyphus jujuba* Lam., or water, or honey, or a combination of honey and milk, the allergic cough will go away.

Shilajit may be used to treat joint problems such as arthrosis of the joints, spine, and hands. Shilajit is mixed with egg yolk and used as a plaster to the affected area, and Shilajit is taken orally by combining Shilajit with rose water, cardamom potion, or gingili oil.

A tiny quantity of Shilajit (130 mg) is cooked in ghee and administered to treat a bone fracture till it heals.

To treat gastrointestinal problems, 130 mg of Shilajit is used with a potion made from cumin seeds and anise seeds.

In order to treat deep fissures with cracks, 65 mg of Shilajit should be heated in ghee and used both internally and topically.

Shilajit, when combined with mica oxide generated from calcinations, may be used to treat diabetes. Polyuria (excessive flow of urine) and thirst (polyphagia) are common diabetic symptoms that may be managed.

BIOACTIVITY

Antioxidant Activity

Fulvic acids are recognised to be strong antioxidants with superoxide and hydroxyl radical scavenging properties^[4]. In the peritoneal macrophages of mice, Shilajit's fulvic acid caused more reactive oxygen species and nitric oxide to be made.^[31] Depending on the amount of PS, it has been shown to help get rid of free radicals and act as an antioxidant against superoxide (SO), hydroxyl radicals, and paramagnetic nitric oxide (NO). With and without processed Shilajit, the process of free radical chemical polymerization was looked at. Processed Shilajit almost completely stopped the polymerization of MMA (methyl methacrylate) caused by hydroxyl radicals and slowed down the polymerization of MMA caused by SO free radicals. A processed shilajit effectively captures NO free radicals. The relationship between the antioxidant effects and concentration was linear. Processed Shilajit at higher quantities gave better free radical protection. Processed shilajit was compared to vitamin C in terms of antioxidant properties (ascorbic acid). Processed shilajit was shown to have considerable antioxidant activity and the capacity to regenerate (recycle) ascorbic acid after neutralising free radicals.^[10,32]

Processed Shilajit also protected methyl methacrylate (MMA) against hydroxyl radical-induced polymerization and worked as a reversible NO-captodative agent in adult male^[33]. Similarly, in rat liver homogenates, the impact of shilajit on lipid peroxidation and glutathione concentration.^[34] Shilajit reduced cumene hydroperoxide and ADP/Fe⁺⁺ complex-induced lipid peroxidation in a dose-dependent manner. Shilajit also suppressed continuing lipid peroxidation that was caused by these drugs immediately after their addition to the incubation system.^[10,35] Shilajit was tested in 61 diabetic patients of both sexes, ranging in age from 31 to 70 years. Shilajit was taken twice a day for 30 days in the form of two 500 mg capsules (Dabur, India). Malondialdehyde levels were much lower after Shilajit therapy compared to their higher pretreatment levels, but catalase levels in diabetic patients were significantly greater after Shilajit treatment.^[36] Shilajit also helps to keep lipid peroxidation at bay. This suggests that processed Shilajit might be useful as a dietary supplement for controlling diabetes and preventing diabetic complications. Shilajit's antioxidant actions also resulted in a reduction in free radical damage caused by superoxide. Shilajit extract has antiradical effects due to the presence of dibenzo-pyrones and fulvic acid.^[2]

Anti-diabetic Effects

Shilajit extract is an anti-diabetic medication that may boost growth hormone levels in diabetic people.^[2] Streptozotocin (STZ) was used to experimentally create diabetes mellitus in albino rats. Shilajit (50 and 100 mg/kg, p.o.) was given concurrently to the other two groups for 28 days. Normal blood sugar levels were unaffected in Shilajit-treated groups. With statistically significant changes in the 100 mg/kg dosage, Shilajit was able to arrest the course of hyperglycemia. From day 14 onwards, both shilajit dosages decreased the STZ-induced decline in superoxide dismutase activity, with the lower dose having a statistically negligible impact. Shilajit reduces both of these effects of STZ, potentially as a free radical scavenger (Antioxidant), implying that Shilajit may prevent diabetes mellitus at maturity.^[37] Shilajit's impact on blood glucose in euglycaemic and alloxan-induced diabetic rats was also investigated. Shilajit (50, 100, and 200 mg/kg, orally) reduced blood sugar levels significantly in all three dosages. Shilajit (100 mg/kg) in combination with Glibenclamide (5 mg/kg/day) or Metformin (0.5 gm/kg/day) considerably improved glucose lowering abilities.^[38] Shilajit also protected nonobese diabetic (NOD) mice from developing diabetes and against the effects of several low-dose (10mg/kg, i.v., 5 times) streptozocin treatments. Shilajit's preventative effect was mostly focused on the activities of Th1 and Th 2 cells, since Th 2 cell activity was shown to be highly elevated.^[39] In euglycaemic rats, Transina (TR), an ayurvedic herbal formulation containing Shilajit, *Eclipta alba*, *Picrorrhiza kurroa*, *Withania somnifera*.

Activity against Tumours

Antioxidants protect cells from free radical damage, which is a primary defence against radical-mediated toxicity. Inhibition of free radical production may be used to quickly find cancer-preventive drugs.^[40] Shilajit extract effectively suppressed the growth of Ehrlich ascites tumour cells in this study.^[2] Shilajit and its components also evoked and activated murine peritoneal macrophages and stimulated splenocytes in tumor-bearing mice, to varying degrees, during early and late stages (unresponsive) of tumour development. Shilajit from the Soviet Union, as well as its mixed fractions, served as cell-growth factors in both normal and tumour cells by preserving membrane integrity.^[5] Shilajit also had no effect on the incidence of micronucleated polychromatic erythrocytes (PCE) in mice's bone marrow cells. A modest fall in the PCE/NCE (normochromatic erythrocyte) ratio, followed by a moderate loss in RNA content. Shilajit therapy inhibited the growth of micronucleated PCE produced by cyclophosphamide, demonstrating its anti-tumour potential.^[13]

Immunomodulatory Effects

The significance of reactive oxygen species (ROS) in limiting pathogen development is critical. Recent research also shows that they may act as immune system modulators and second messengers.^[41] As a result, [3H] thymidine uptake in murine

splenic cells treated with Fulvic acid fraction (1) increased in a dose-dependent manner. This suggests that Shilajit-derived fulvic acid has immunomodulatory properties.^[31] Shilajit and its combined constituents elicited and activated murine peritoneal macrophages and activated splenocytes of tumor-bearing animals to varying degrees at early and late stages of tumor growth, according to the experimental activity, which was dose dependent and also related to the time of exposure.^[10,42] Shilajit stimulates the formation of lymphocytes in the cortical thymus layer, as well as their rapid migration into lymph node and spleen thymus-dependent zones. Shilajit promotes phagocytosis and hence releases cytokines in mice peritoneal macrophages, as shown by the event.^[5,43] Shilajit extract was studied as a possible inhibitor of morphine analgesic tolerance. The injection of processed Shilajit with morphine in Swiss mice from day 6 to day 10 significantly inhibited the development of tolerance to morphine-induced analgesia.^[43] There are several research investigations that support the concept that the immune system and the CNS have bi-directional pathways.^[44] In this context, it's important to remember that processed Shilajit's immunomodulatory properties may play a role in preventing the development of morphine analgesic tolerance.^[43]

Anti-Inflammatory Properties

Shilajit's acute anti-inflammatory effect was investigated in albino rats given injections of potassium carrageenan prepared in normal saline into the sub-plantar area of the hind paw to cause inflammation. The degree of oedema in the hind paws was monitored using a plethysmograph before and after carrageenan injection at scheduled intervals. Shilajit decreased chemically induced inflammation by 76 percent at a dosage of 50 mg/kg, which is equal to 0.25 mg/kg betamethasone.^[10,45] Shilajit has also been shown to have a sub-acute and chronic anti-inflammatory impact in rats in the Granuloma pouch model and adjuvant-induced arthritis model.^[46] Shilajit has a significant anti-inflammatory impact on osteoarthritis, rheumatoid arthritis, ankylosing spondylitis, and cervical spondylosis in people.^[2]

Antiuclerogenic properties

The classic shay model of pylorus ligation for stomach ulcer was used to assess Shilajit's antiuclerogenic impact. Shilajit was given orally via an oro-gastric tube twice daily for three days to albino rats of either sex, or pylorus ligation (PI) was done on the fourth day. The volume, acid production, and peptic activity of gastric juice were measured 4 hr after PI. After histological confirmation, the ulcer index was determined. Shilajit at a dosage of 200 mg/kg considerably lowered the ulcer index.^[45] Shilajit has a propensity to reduce acid pepsin production and create a considerable rise in mucin secretion in rats and guinea pigs, according to research in Aspirin-induced gastric ulcer in rats and Cysteamine and Histamine-induced duodenal ulcer in rats and guinea pigs.^[47]

Shilajit's phenolic and triterpenoid components, as well as its fulvic acids, have shown to be effective against ulcers caused by constraint stress. The combinations offered strong resistance to ulcerogens' effects on mucosa, as well as preventing mucosal cell shedding.^[2,5] Shilajit also improved the carbohydrate/protein ratio and reduced the stomach ulcer score, indicating a stronger mucus barrier.^[46] Non-steroidal anti-inflammatory medications (NSAIDs) limit the synthesis of prostaglandins, which reduces pain and edoema. This is accomplished by suppressing the activity of the cyclooxygenase (COX)-1 and -2 enzymes. However, since prostaglandins are important mediators of multiple components of GI mucosal defence, inhibiting their production with NSAIDs decreases the mucosa's resilience to damage while also interfering with healing processes. Selective COX-2 inhibitors, which were predicted to decrease prostaglandin production at sites of inflammation but not in the GI tract, were supposed to be the answer to this problem.^[48] Shilajit is unusual in this regard since it has both antiuclerogenic and antiinflammatory properties and may be safely used in clinical settings as GI sparing anti-inflammatory medicines.^[10,45]

Analgesic Effects

An anti-inflammatory medicine may also act as an analgesic and antipyretic. Non-selective non-steroidal anti-inflammatory medication (NSAID) therapy is now the most common treatment for pain and discomfort associated with chronic and acute inflammation. The development of selective COX-2 inhibitors with maximum anti-inflammatory and analgesic effect while minimising gastrointestinal toxicity might be a huge step forward in the treatment of pain sufferers.^[49] The hot wire generated tail-flick response in albino rats was also used to assess the analgesic impact of Shilajit pre-treatment. Shilajit was shown to have substantial analgesic efficacy at 200mg/kg, i.p. The impact was strongest for the first 60 min and then faded by the 90th min.^[45] A method using electrophoresis with 2 percent lidocaine and 4 percent Shilajit solution (in water) was used 10–12 times to treat trigeminal nerve pain. The findings were overwhelmingly favourable, especially in the neuritic stage of neuralgia with central origin and in neuralgia with peripheral genesis.^[2]

Cardioprotective Effect

Shilajit lowers cholesterol levels in the blood and promotes bile elimination of cholesterol.^[2] Shilajit's influence on lipid profile was investigated in euglycaemic and alloxan-induced diabetic rats. Shilajit at all three dosages (50, 100, and 200 mg/kg, orally) resulted in a substantial decrease in lipid profile. Shilajit (100 mg/kg) combined with Glibenclamide 5 mg/kg/day or Metformin 0.5 gm/kg/day resulted in a substantial improvement in lipid profile.^[38] Earlier studies have mentioned the therapeutic usage of Shilajit aqueous solution in hypertension.^[45] The Shilajit treated group demonstrated substantial alterations in cardiac markers and other enzymes such as aspartate transaminase, alanine

transaminase, creatinine kinase, and lactate dehydrogenase when cardio protective efficacy in rodents was evaluated using the Isoproterenol paradigm. This suggests that shilajit prevents myocardial necrosis by acting as a cardioprotective agent.^[50] According to recent research, a novel family of nonsteroidal anti-inflammatory medicines (NSAIDs) known as Cyclooxygenase (COX)-2 selective inhibitors has grown in therapeutic relevance. Furthermore, COX-2 is a significant generator of prostacyclin in the vasculature under normal laminar flow circumstances and has been demonstrated to be cardioprotective in ischemia-reperfusion damage.^[51] Shilajit's cardioprotective properties will need to be proven in further research.

Other Actions

Shilajit has considerable anti-anxiety effect at a dosage of 10 mg/kg, p.o, as shown by an enhanced plus-maze test that is equivalent to diazepam (1 mg/kg, p.o).^[52,53]

Shilajit, an aphrodisiac in India, has spermatogenic and ovogenic effects. Shilajit is widely recognised for restoring a person's libido to that of a teenager. Shilajit boosts the inner energy that gives you sexual and spiritual strength. Shilajit is used to re-energize the body. Shilajit treatment to rats resulted in a significant increase in the quantity of epididymus sperm in male rats and ovulation induced rats in female rats.^[54]

Antifungal Action

Shilajit methanolic extract has remarkable inhibitory activity against *Alternaria cajani* (95.12 percent spore inhibition) at a dose of 5000g/ml.^[55]

Protection of Mast Cells from Degranulation

The effects of fulvic acids, 4-methoxy-6-carbomethoxy biphenyl, and 3,8-dihydroxy-pyrone on mast cell degranulation in response to unpleasant stimuli were investigated. Shilajit and various combinations of its components protected sensitised mast cells against antigen-induced degranulation, significantly increased antigen-induced spasmin in sensitised guinea pig ileum, and prevented mast cell disruption caused by compound 48/80.^[56]

Shilajit has antiviral effects that include immunopotentiating^[57] and viral load reduction.^[58]

Shilajit has anti-AIDS effects that include immunopotentiality and viral load reduction.^[59] Clinical trials in AIDS patients were undertaken using a polyherbal product formulation that included three essential and three supporting substances, including shilajit as one of the essential elements.

Energy and Physical Activity

The findings revealed that the shilajit groups had a nine to thirteen percent increase in activity time ($P= 0.0028$), whereas

the placebo group had no significant increases in exercise time. The metabolic equivalents were also assessed in this investigation (METs). METs are a measurement unit for the quantity of oxygen used by the body during exercise. The more oxygen absorbed and the greater the MET level, the harder the body works during the exercise. After three weeks of shilajit medication, the METs value increased significantly as compared to placebo treatment at the same time points. The rise in METs, according to the researchers, explains the increase in activity duration caused by shilajit intake. The PrimaVie shilajit has been shown to have no side effects. Six healthy human volunteers were given 200 mg of PrimaVie shilajit and subsequently performed aerobic activity in another study. The patients took shilajit for 15 days before returning to aerobic activity. The goal was to see whether shilajit might increase biochemical energy production indices. Supplementing with shilajit resulted in a considerable increase in energy levels. The amount of ATP (the body's "energy currency") in the blood rose by roughly 14%. Similarly, the degree of fitness rose by roughly 15%, which was surprising given that the research participants were not sports-trained. Shilajit also stabilised the coenzyme Q10 levels in whole blood while lowering uric acid levels, suggesting its usefulness as an energy enhancer.^[61,62]

Genes Coding for Collagen and Other Extracellular Matrix (ECM) Proteins are Upregulated: Collagen is often discussed in the dietary supplement business in the context of its function in maintaining healthy skin and joints. Collagen, however, is a connective tissue protein that is essential for the preservation and healing of other tissues, including muscle tissue.^[62,63]

TOXICITY STUDIES

Shilajit extract did not cause death in mice when administered intraperitoneally at doses up to 1 gram per kilogram.^[45] During the course of the toxicological study, the preparation was given to the test animals on a daily basis in the form of an aqueous solution having a concentration ranging from 1 to 10 percent. The daily amounts of shilajit extract that were administered to the rabbits and mice were 0.05, 0.1, 0.15, 0.2, 0.3, 0.4, and 0.5 g/kg respectively. In contrast to the group that served as the control, the researchers did not find any morphological or histological abnormalities in the internal organs of the animals, no matter how many times the substance was applied (the total dosage ranged from 1.5 to 15 g/kg). The Ukrainian Gerontology Institute conducted research on the toxicological properties of Shilajit, which was obtained from mountainous regions of Central Asia (Kiev). It was discovered that the treatment, when administered at dosages of 0.2 and 1 g/kg for a period of three months, did not have any negative effects on the function of the cardiovascular system, the liver, the kidneys, the blood cells, or the neurological and endocrine systems. According to the findings of the study, administering Shilajit to pregnant rats did not have any embryotoxic or teratogenic effects on the offspring

of the animals. The postnatal development of the offspring of rats whose parents were given the preparation was unaffected.^[2] It was also investigated whether or not shilajit had any effect on the development of an embryonic mouse. Orally through needle tubes, dosages of 250 and 500 mg kg⁻¹ of shilajit were delivered to 71 pregnant female mice between the eighth and twelfth days of their pregnancies. At the 17th day of gestation, there were no differences found between the treated animals and the control animals in terms of the number of litters, the placenta, the body weight of the embryos, or the number of embryos that aborted themselves. There were not many outliers in either the treatment or the control group. Despite this, the results of this investigation demonstrate that Shilajit can be used without risk.^[13] A daily dosage of 0.1–0.3 g of Shilajit taken internally was reported by almost all of the researchers to have no adverse effects. Shilajit is a traditional Ayurvedic medicine. A few of the participants who suffered bone fractures reported experiencing a burning sensation in the area of their fractures. Only a small number of people reported feeling hot,^[16] but those with chronic colitis who used Shilajit extract experienced burning, weakness, and sweating for forty-five to sixty minutes after taking it. At higher dosages (0.9-1.5 g/d), it may cause an increase in body temperature to 37.50 degrees Celsius, as well as perspiration and headache. The duration of the response ranged anywhere from twenty minutes to two to three hours.^[2] The amounts of lead, mercury, and arsenic (g/g) in a Shilajit formulation made by Syncom firm in India and sold in the Boston area of the United States were determined with the help of X-ray fluorescence spectroscopy. The fact that there was lead present at a concentration of 8 g/g is cause for concern given that the maximum allowable concentration of lead is less than 5 g/g.^[64]

CONCLUSION

Shilajit is a resin rich in minerals. Ayurvedic medicine has made use of it for many decades. As, the research suggests that it is very much effective in various vital aliment of mankind.

To comprehend the effects and dosage levels, more human clinical trials must be conducted.

To ensure the quality, effectiveness, and safety of shilajit, it is important to have a comprehensive grasp of the various types and the qualities that serve as distinctive markers for identification. Shilajit formulations should be required to be purified and standardised based on their bioactive and associated ingredients. Studies utilising *in vitro* assays have minimal relevance, hence it is vital to examine shilajit for the immunomodulatory as well as antioxidant properties with appropriate doses and positive and negative controls through *in vivo*. Systematic investigation is needed to determine the precise mode of action of shilajit acts as a rejuvenator. To establish the efficacy and safety of processed and standardised shilajit formulations, additional large-scale trials including both humans and animals are required.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

NSAIDs: Nonsteroidal anti-inflammatory medicines; **HP-SEC:** High-performance size exclusion chromatography; **ROS:** Reactive oxygen species; **COX:** cyclooxygenase; **ECM:** Extracellular Matrix; **PI:** pylorous ligation; **NCE:** normochromatic erythrocyte.

SUMMARY

Shilajit, also known as salajit, mummiyo, or mimie, is a naturally occurring chemical. It is a dark powder made from high mountain rocks, particularly those in the Himalayas. Ayurvedic treatments have used it to treat a variety of illnesses and enhance quality of life. An effort has been made to review shilajit with regard to its origin, variations, physical qualities, purification, therapeutic properties, and significant biological properties in order to support its rasayana property. It has been shown that shilajit has various health benefits depending on the region from which it was obtained. Among the many biological properties of shilajit, antioxidant activity and immuno-modulatory activity were highlighted since they are closely related to its rasayana potential. The biomarkers that ensure the quality, safety, and efficacy of shilajit are found in diverse types and qualities in the current review.

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