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Narrative Review

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Potential Therapeutic Applications of Bentonite in Modern & Persian Traditional Medicine: A Review

Sara Salimi[1], Ali Moghadami[1], Moloud Fakhri[2], Majid Saeedi[3], Assie Jokar[2,4*]

[1]Student Research Committee, Faculty of Persian Medicine, Mazandaran University of Medical Sciences, Sari, Iran
[2]Traditional and Complementary Medicine Research Center, Addiction Institute, Mazandaran University of Medical Sciences, Sari, Iran
[3]Department of Pharmaceutics, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran
[4]Persian Medicine Faculty, Mazandaran University of Medical Sciences, Sari, Iran

*Corresponding Author: Assie Jokar, Email: a.jokar@mazums.ac.ir

Abstract

Introduction: Bentonite has been mentioned in Persian medicine books for its therapeutic uses. This study, which aimed to review traditional Persian medical sources related to bentonite and its effects as reported in the scientific literature, holds significant potential for enhancing our understanding of this clay's medicinal properties.

Methods: This narrative review uniquely combines Persian medicine with modern scientific research. It is an interdisciplinary library study conducted using traditional medical literature and searching via numerous information databases. Before discussing recent scientific discoveries concerning the qualities and applications of Bentonite in modern medicine, it was first examined in the sources of traditional Persian medicine and pharmaceutics, as well as the experiences of ancient sages, enriching the study with diverse perspectives.

Results: Most articles discussed bentonite's significant uses, including its local and skin, digestive, detoxifying, and antimicrobial. These findings aligned with those of Persian medicine, providing a robust foundation for further exploration. It can be determined that various medicinal products can be derived from Bentonite to treat multiple health conditions, including skin and gastrointestinal disorders.

Conclusion: Traditional Persian medical books provide information on the topical and oral applications of bentonite, which can be the basis for many new studies in modern medicine. Bentonite, an efficient and extensively utilized mineral substance, can also be used as a raw material or in the structure of combined medications to treat many diseases.

Keywords: Bentonite, Medicine, Persian, Pharmaceutical preparations, Clay

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Introduction

Natural products have developed distinct chemical diversity through millions of years of evolution, leading to various biological activities and therapeutic characteristics. Thus, natural ingredients had been a part of traditional treatments for many years before the development of contemporary chemical pharmacology. Due to financial constraints, religious convictions, or difficulty obtaining pharmaceuticals, many individuals worldwide now prefer traditional healing methods, such as Indian, Ayurveda, or traditional Chinese medicine. In recent years, the scientific community has been focused on natural products, and interest in them is steadily rising (1).

Since ancient times, individuals have utilized topical or internal clay applications to maintain physical health and address various medical conditions. There are limited studies on the physiological processes of clay. Bentonite clay is a naturally occurring clay used in many cultures for traditional medicine and healing. It has been used as a hair cleanser for centuries in Iran (2).

Bentonite often forms when volcanic ash undergoes weathering in the presence of water. This substance is a clay form of Montmorillonite, up to 85-90%. The term is derived from the name of an area in southern France named Montmorillon.

There are two primary varieties of bentonite: Calcium and sodium. The ability of sodium bentonite to absorb significant amounts of water is a characteristic, whereas calcium bentonite has a lower water absorption capacity (3,4).

Bentonite is a mineral that is widely distributed and mined around the world. Its physical and chemical characteristics vary depending on the source mine, leading to different applications. In the late 19th century, bentonite was used

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in small amounts, mainly for medical and skin-cleansing purposes. However, its usage and applications expanded significantly during the 20th century (5).

Bentonite is widely used in formulations and products for various purposes due to its availability, cost-effectiveness, and unique structural characteristics. Therefore, this review explored its uses in modern and Persian medicine.

Methods

Search Strategy

In a descriptive review of library studies, Traditional Persian medicine references were utilized alongside information gathered from databases such as Scopus, SID, Magiran, and PubMed. In this study, we conducted a comprehensive literature search using the keywords "Bentonite," "Montmorillonite," and "Clay" in various sources and databases from 2000 to 2022, including Web of Science, Scopus, PubMed, Magiran, and SID. Furthermore, we combined these keywords with "pharmacology," "modern medicine," "drug," "treatment," "shape," and "structure" to investigate the pharmacological characteristics of bentonite and its properties.

Study Selection

The study was selected based on its publication in scholarly and scientific journals, and its findings were contrasted with those of traditional medicine.

Inclusion Criteria

Studies published between 2000 and 2024

Peer-reviewed scientific articles (in vitro, in vivo, or clinical studies)

Availability of full-text in English or Persian

Exclusion Criteria

Non-scientific sources (e.g., anecdotal texts)

Articles with no therapeutic focus on bentonite

Duplicate or irrelevant content

Data Extraction

Before discussing the latest scientific findings on the therapeutic properties of Bentonite, its prominence in Traditional Persian medicine, pharmacology, and the documented experiences of ancient sages were examined. The most reliable books of Iranian traditional medicine during the 13th and 14th lunar centuries (624-636 AD), including Makhzan al-Advia, Tohfat al-Momenin, Exir-e-Azam, and others, were discovered using the synonyms of be ntonite in Persian and Arabic, such as Gel-e-Sarshuy, Tiyn, and Tiyn Armanī. All of these books were consulted for information on this subject.

Critical Appraisal

The findings of selected modern studies were contrasted with those of traditional medicine sources to evaluate similarities and differences in therapeutic perspectives. Emphasis was placed on comparing the pharmacological properties of bentonite described in modern scientific literature with those documented in traditional Persian medical texts. This comparison aimed to identify areas of convergence, validate traditional uses through modern evidence, and highlight any contradictions or gaps that may warrant further investigation.

Results

The Uses of Bentonite From the Perspective of Iranian Traditional Medicine Sages

According to Aghili Shirazi in his book "Makhzan", oral administration of bentonite is suitable for alleviating mouth odor, reducing nausea and vomiting, preventing mouth drooling during sleep, relieving abdominal pain accompanied by vomiting and diarrhea, and preventing PND (6).

According to Hakim Azam Khan's book "Elixir Azam", smelling bentonite can effectively treat sneezing. This clay is also an excellent treatment for oral sores. Topical application of bentonite in the mouth may also help alleviate bad breath. Topical administration of an aqueous dispersion of bentonite can help treat itching and sores of the testicles and penis. The combination of bentonite and Alcea is a suitable dressing for treating rashes. Additionally, it can be used to treat insect bites, such as bees, flies, mosquitoes, stings, and burns from fire (7).

Razi mentions that chewing bentonite can treat the stomach's infectious ulcers. Topical preparation of bentonite can relieve the wounds and itchiness of the anus, and oral administration can treat dysentery. It also soothes itching and bleeding from the female genitalia. Bentonite is useful for genital itching and rashes. Applying to ulcers in areas where sweat is produced is also helpful, such as the inguinal area, axilla, periauricular, and neck folds. The mixture of this clay and Alcea efficiently treats rashes (8).

Heravi believed that bentonite is advantageous for swellings when combined with *Coriandrum sativum* (9). According to "Tohfa Al-Mominin," it is helpful to treat diarrhea. It is exhilarating and helps with fever, fainting, and heart palpitations (10). In the book "Mofarah al-Qulob," it is said that an Alcea root's mucilage and bentonite should be put into the area to alleviate internal or external irritation of the vulva. The mixture of bentonite, which has been diluted with rose water and a little vinegar, can ease nausea orally (11).

Rhazes (Razi) in his book, "Al-Mansouri Fi Tib," proposed its dressing for pain relief in all wounds, bee stings, and to stop drooling (12). "Rhazes," in his book "Daf Mazar Al-Aghzia," mentioned that oral administration of small amounts of this clay after a meal can decrease the adverse effects of sweet and fatty foods (13).

Bentonite in Modern Medicine

Montmorillonite is one of the smectite varieties found in "healing clays" and comprises comparable layers. Several elements and biological substances can replace these interlayer gaps. Positively charged elements are drawn to clay's enormous surface area of negatively charged interlayer sites (14).

Bentonite also contains the minerals feldspar, calcite, and quartz. Its medicinal use can be attributed to its high cation exchange, wide surface area, capacity to create thixotropic gels in water dispersion, and capacity to absorb significant amounts of gas.

The smectite group of bentonites, which has two octahedral alumina sheets sandwiched between two tetrahedral silica sheets, is the crystal structure that gives bentonite its therapeutic capabilities. This structure can interact with hazardous species, combine with cationic bioactive agents, exchange with Fe^{3+}, Cu^{2+}, Al^{3+}, Ca^{2+}, or Na^{+}, have antibacterial activity, and get the minerals your body needs. Numerous papers have discussed the multiple uses of bentonite for detoxification, the creation of bio-nano composites, and alternative and complementary treatments for various illnesses (15,16).

Therapeutic Uses of Bentonite

Gastrointestinal Effects

Bentonite was once thought to be a treatment for diarrhea. 97% of instances of diarrhea from varied causes were treated with oral bentonite in one trial (viral infection, food allergy, spastic colitis, mucosal colitis, and food poisoning). The outcomes of trials demonstrate Montmorillonite's value and safety in treating pediatric diarrhea (2). In one study, bentonite alleviated IBS patients' bowel patterns, which were characterized primarily by constipation (17).

In another trial, adding zinc and Montmorillonite to the diet boosted intestinal mucosal integrity and digestive enzyme activity in pigs' pancreatic and small intestine contents, improved development, and reduced post-weaning diarrhea. Rats receiving bentonite orally for 28 days produce excessive colonic yeast microbiota. The increased activity of the gut flora caused by bentonite may then facilitate nutritional absorption. Additionally, clay has a long history of use in treating the stomach and intestines, and it is a critical ingredient in antacids, digestive system protectors, and anti-diarrhea medications (2,18,19).

Bentonite may influence metabolic disorders by preserving mucus, eliminating oxidants, and absorbing cholesterol. It can also adhere to the mucosa, extending medication half-life in the gastrointestinal tract and serving as a potential method for GI drug delivery. Additionally, it can reduce NSAID side effects by protecting the mucosa (20). Bentonite powder, with unequal charging properties and a potent ability to coat the intestinal mucosa, can efficiently eliminate harmful bacteria, protect the digestive system, and encourage the formation of intestinal epithelial cells. Patients with acute enteritis brought on by radiotherapy can benefit from the combination of bentonite powder and dexamethasone because it efficiently reduces mucosal damage and inflammation and speeds up patient recovery. Clay minerals can bond to positively charged pollutants in the stomach's acidic environment and function as a detoxifier stabilizing agent (14,21).

Dermal Effects

Bentonite has diverse dermal applications in both traditional and modern medicine. To enhance clarity and structure, this section is divided into the following subcategories:

Cosmetic Use

Bentonite is widely used in cosmetic products due to its absorbent, cleansing, exfoliating, and astringent properties. Due to its layered structure and high surface activity, bentonite binds to skin surface impurities such as sebum, dead keratinocytes, and environmental toxins. These effects have been demonstrated in product formulations and in vitro assays. Sunscreen formulations containing bentonite show superior UV protection and skin adherence compared to conventional lotions. It is also used in anti-aging products to improve skin texture and reduce wrinkles (22-24)

Wound Healing

In Persian traditional medicine, bentonite was recommended topically for treating burns, insect bites, skin ulcers, and rashes. Recent in vivo studies in rats have shown that sterile gauze containing bentonite and halloysite significantly enhances wound healing and reduces coagulation time. These effects are primarily due to bentonite's thixotropic gel-forming ability, high surface area, and absorption of wound exudate, which together promote platelet aggregation and create a moist, protective environment for clot formation (25-27).

Antimicrobial Activity

Although bentonite does not exhibit strong intrinsic bactericidal or fungicidal activity, it can adsorb microbial membranes and toxins due to its surface charge. Recent research has led to the development of bentonite-based nanocomposites that possess enhanced antimicrobial activity and can be used to manage complex wound infections (14,28,29)

Systemic Detoxification (Topical)

In traditional medicine, bentonite has been used to draw toxins and "heat" from the skin. In modern practice, calcium bentonite powder is applied as an antiseptic and detoxifying agent to treat conditions such as contact dermatitis, eczema, and chemical skin irritation. Its detoxifying action is attributed to its high adsorptive surface area and non-toxic mineral profile (7,27)

General Effects

In a hyperthyroid rat model, bentonite has been shown to lower thyroxine and tri-iodothyronine and sequester them in vivo. It increases hypoxia tolerance, lengthens sleep, and curbs the rats' spontaneous behavior (2). A study showed that montmorillonite could have anti-hyperthyroid effects by absorbing T3 and T4 hormones in rats (30).

Research on how bentonite affects cancer cells' growth has revealed that bentonite and cell surfaces interact precisely to prevent cancer cell formation (31). Bentonite might control how the body reacts to immunological stimuli.

Bentonite particles avoid the growth of red blood cells and the antibody response induced by lipopolysaccharide in laboratory settings (2).

Some studies showed that osteoporosis can be treated with bentonites due to their high calcium content (32).

Research indicates that bentonite reduces blood cholesterol levels in mice and lab settings by preventing micelle formation, which is essential for cholesterol absorption in the intestine (33).

Bentonite in the Pharmaceutical Industry

Clay minerals are commonly used in pharmaceuticals as excipients and active agents. Their large storage capacity, swelling, and colloidal properties make them beneficial for modifying drug administration, targeting drug release, managing absorption, and enhancing drug stability. A study has amply demonstrated the advantages of mixing phenytoin and bentonite to increase phenytoin's bioavailability (34).

Bentonite clay has been used to deliver cancer medications and has recently been shown to inhibit the growth of human cancer cell lines, particularly glioblastoma, when combined with 5-mercaptopurine. Its levels help regulate metabolic growth components (2).

Bentonite can absorb excess metronidazole in the body, preventing overdose or facilitating gradual release. This occurs through cation exchange on its surface, where metronidazole molecules are replaced by water. Bentonite can also absorb other medications, such as digoxin, using the same process (35).

In one study, clay particles improved the efficiency of methotrexate and curcumin in destroying cancer cells (18). Bentonite nanocomposites offer an enhanced oral controlled drug delivery system that reduces drug dose frequency, possibly improving patient compliance (14).

Bentonite in Combination with Other Herbal Medicines

A combination of bentonite with other herbs can be used to treat conditions like tonsillitis, oral rashes, bad breath (halitosis), smallpox wounds, heat-related wounds beneath the armpits and in the groin, itching of the anus, burns, and insect bites, easing colic, diarrhea, and the foul odor of the armpits (7,8,36).

Side Effects

Numerous studies have shown that bentonite has no adverse side effects (33,37). Calcium bentonite is essentially non-toxic, with a lethal dose of more than 5000 mg/kg of body weight, according to a study on the lethal dose of bentonite in rats (20).

Bentonite is commonly used in cosmetics, such as masks and cleansers, with no reported side effects. It was found in 78 US cosmetic products in 1998, usually at concentrations of 1% to 10%, but in some masks, its concentration was up to 80%. As a food additive, bentonite is considered safe in the US. However, for medical and cosmetic uses, it's important to assess the presence and bioavailability of any potentially toxic substances to ensure public safety (38).

Discussion

The data analysis in texts on traditional medicine reveals that bentonite has a wide range of therapeutic applications (Table 1). Most of bentonite's therapeutic benefits have been demonstrated in scientific studies and even tested on humans and animals. These qualities include treating skin conditions, cleaning and softening skin and hair, treating wounds, absorbing pollution and toxins, reducing inflammation, treating diarrhea and irritable bowel syndrome, and protecting the digestive system's mucous membrane (6).

The FDA approves the use of bentonite as a food additive. However, to protect the general public, it is advised to confirm clay's safety before using it for medicinal and cosmetic purposes (38).

The high absorption capacity of clay, brought on by its layer charge and ion exchange, accounts for a large portion of the well-known mechanisms of bentonite. Clay's utilization in the formulation of facial masks is attributed to its remarkable properties, including cleansing, astringent, exfoliating, and lifting effects. Additionally, it is a valuable resource with several mineral elements for various purposes (6,15,23).

Further pharmacological, laboratory, and clinical investigations emphasizing effectiveness and safety are necessary to comment on Bentonite's therapeutic characteristics and uses. Also, given the oral applications of bentonite in traditional Persian medical literature and the numerous studies demonstrating the safety of topical bentonite usage, further studies are essential on the edible applications of bentonite and its safety.

Conclusion

This review highlights the broad therapeutic potential of bentonite as evidenced by both Persian medicine and modern scientific studies. In traditional texts, bentonite is noted for its benefits in treating gastrointestinal disorders, skin conditions, wound healing, detoxification, and systemic complaints such as nausea, fever, and heart palpitations.

Modern pharmacological studies have confirmed several of these traditional claims, particularly bentonite's roles in gastrointestinal protection, skin detoxification, and drug delivery systems.

Given the historical and scientific evidence, bentonite emerges as a promising natural agent for topical and oral therapeutic formulations. However, further controlled clinical trials and safety evaluations are essential, especially for its internal applications. Integration of traditional insights with modern scientific methods can pave the way for novel and evidence-based therapeutic uses of this natural clay.

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Table 1. Therapeutic Applications of Bentonite in Modern & Persian Traditional Medicine

Applications	Traditional Persian medicine (TPM)	Modern medicine
Gastrointestinal	1. Improving digestion 2. Stabilizing LES and helpful in treating reflux. 3. Useful for treating dyspepsia (39) 4. Helpful in smelling the mouth 5. Strengthening the stomach 6. Helpful in treating nausea and vomiting, 7. Preventing mouth drooling while sleeping, 8. Relieving abdominal pain accompanied by vomiting and diarrhea 9. Prevent PND (6) 10. Helpful in treating oral sores (7) 11. Helping to digest fatty and sweet food (40) 12. Helpful in treating peptic ulcers (41)	1. Anti-diarrhea (viral infection, food allergy, spastic colitis, mucosal colitis, food poisoning, and pediatric diarrhea) 2. Absorbing creatinine in the digestive system and hastening its elimination from the gut 3. Increased activity of the gut flora (2,18,19). 4. Useful for the treatment of IBS (17). 5. Preserving mucus 6. Eliminating oxidants and absorption of cholesterol (20). 7. Acute enteritis brought on by radiotherapy (21) 8. Elimination of all types of harmful bacteria from the GI 9. Detoxification from the intestine (14) 10. Decreasing aflatoxin B1 in the digestive tract (42)
Dermal and topical	1. Helpful in treating genital itching and sores 2. Alleviating internal or external irritation of the genitalia 3. Treatment of rashes, insect bites like bees, flies, mosquitoes, stings, and burns from the fire (7) 4. Helpful in treating ulcers in body folds caused by heat and sweat (8) 5. Helpful in treating swelling with inflammation (9) 6. Cleansing and renewing the skin's surface and hair, wrinkle-reducing, anti-aging (8)	1. Cleansing and renewing the skin's surface and hair, wrinkle-reducing, anti-aging, and sun protection. 2. Elimination of sebum, pollutants, and dead cells 3. Reducing local imperfections (23,24,27) 4. Treating allergic contact dermatitis, skin lesions, and wounds (26,28,29)
general	1. Useful for the treatment of fever 2. Useful for the treatment of faintness 3. Useful for the treatment of heart palpitations (43) 4. Useful for the treatment of genitalia bleeding (8) 5. Helpful in treating sneezing by sniffing bentonite (7)	1. Absorption of Mycotoxins and Aflatoxins 2. Remedy for metal toxicity (lead, copper, cadmium, etc.) (1,27,42) 3. Antibacterial qualities (28,29) 4. Speed up wound healing and coagulation time in rats (14) 5. Correction of a hyperthyroid in rats because of the absorption of thyroxin and tri-iodothyronine adjustment immunoreaction (2)
Bentonite, in combination with other herbal medicines	Useful for treatment: 1. Tonsillitis, oral rashes, 2. Bad breath (halitosis) 3. Smallpox wounds and scars 4. Heat-related wounds beneath the armpits and in the groin 5. Itching of the anus 6. Burn injury 7. Insect bites 8. Easing colic diarrhea And the foul odor of the armpits (7,8,36)	
Bentonite in the Pharmaceutical Industry		1. To release the drug, delay or target medication absorption, and eventually improve drug stability (44) 2. Increasing phenytoin's bioavailability (34) 3. Used as a vehicle for the delivery of medications in the treatment of cancer (2) 4. Absorbing the extra metronidazole and digoxin in the body, bentonite can stop an overdose from occurring or aim for its gradual release (35) 5. Improvement in the efficiency of methotrexate and curcumin in destroying cancer cells (18), An enhanced oral controlled drug delivery system that reduces drug dose frequency, possibly improving patient compliance using nanocomposites (27)

Authors' Contribution

Conceptualization: Assie Jokar
Data Curation: Sara Salimi, Ali Moghadami, Assie Jokar
Formal Analysis: Moloud Fakhri
Funding Acquisition: Assie Jokar
Investigation: Sara Salimi, Ali Moghadami
Methodology: Assie Jokar, Moloud Fakhri, Majid Saeedi
Project Administration: Assie Jokar
Supervision: Assie Jokar
Validation: Majid Saeedi, Moloud Fakhri, Assie Jokqr
Writing–Original Draft: Sara Salimi, Ali Moghadami

Competing Interests

The authors declare that they have no conflict of interest.

Data Availability Statement

All necessary data will be available from the corresponding author upon reasonable request.

Ethical Approval

Not applicable.

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