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Ginger and its Medicinal Properties

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Annotation: Zanjabil (ginger, Zingiber officinale) is one of the most widely used medicinal plants in traditional Uzbek medicine (tabobat) and remains a key component in modern herbal practices across Central Asia. This review summarizes the pharmacological properties of ginger, supported by both traditional knowledge and contemporary scientific evidence. Ginger exhibits potent anti-inflammatory, antioxidant, digestive, antiemetic, immunomodulatory, antimicrobial, and hypoglycemic effects.

In Uzbekistan, ginger is traditionally used to treat colds, coughs, digestive disorders, rheumatism, menstrual pain, and as a warming agent (issiqlik) during winter. Recent clinical studies confirm its efficacy in reducing nausea (especially in pregnancy and chemotherapy), alleviating symptoms of osteoarthritis, improving glycemic control in type 2 diabetes, and enhancing immune response. The main bioactive compounds responsible for these effects are gingerols, shogaols, paradols, and zingerone. In the Uzbek context, ginger is commonly consumed as fresh rhizome (zanjabil ildizi), dried powder (quruq zanjabil), or in tea (zanjabil choyi) with honey and lemon,

often ombined with local herbs such as zira (cumin), anise, and mint. This review highlights ginger's dual role in traditional Uzbek healing practices and modern phytotherapy, emphasizing its safety and cost-effectiveness for preventive and therapeutic use in the population.

Keywords: Zingiber officinale, ginger, medicinal properties, anti-inflammatory, antiemetic, antioxidant, traditional Uzbek medicine, zanjabil, Uzbekistan, phytotherapy, gingerols, shogaols.

Introduction: Zanjabil (ginger) has been used for over 4000 years in Ayurvedic, Chinese, Arabic, and Persian medicine, and has been deeply integrated into the healing traditions of the Central Asian region, including Uzbekistan. In Uzbek folk medicine (xalq tabobati) and the classical medical system of Abu Ali ibn Sino (Avicenna), ginger is classified as a "hot and dry" (issiqlik va quruqlik) plant of the third degree, making it ideal for balancing "cold" disorders (sovuq kasalliklar) and strengthening the body's natural heat.

In Uzbekistan, ginger has been cultivated and traded along the Great Silk Road since ancient times. It is still widely used in everyday life:

- Fresh ginger tea (zanjabil choyi) is the most common home remedy for flu, sore throat, and cough.
- Dried ginger powder is added to pilaf, shurpa, and other traditional dishes for both flavor and digestive health.
- During the cold winter months, ginger is mixed with honey, lemon, and black pepper to prepare a warming tonic (issiqlik tonik).
- In rural areas, ginger infusions are used to relieve joint pain, menstrual cramps, and postpartum recovery.

Scientific research over the past decades has confirmed many of these traditional uses. Ginger's main bioactive compounds — 6-gingerol, 8-gingerol, 10-gingerol, and 6-shogaol — have been shown to inhibit NF-κB and COX-2 pathways, providing anti-inflammatory effects comparable to non-steroidal anti-inflammatory drugs (NSAIDs) without gastrointestinal side effects. Its antiemetic action is well-documented in randomized controlled trials, making it a safe alternative to metoclopramide in pregnancy and chemotherapy-induced nausea.

In the context of Uzbekistan's current public health challenges — high prevalence of digestive disorders, diabetes, and respiratory infections — ginger offers an accessible, low-cost, and culturally accepted option for health promotion and disease prevention. This article reviews the medicinal properties of ginger with special emphasis on its historical and contemporary role in Uzbek medicine.

Literature Review:The medicinal properties of **zanjabil** (ginger, ***Zingiber officinale***) have been extensively studied in both traditional and modern scientific contexts. Historical references trace its use back over 4,000 years in Ayurvedic, Chinese, Persian, and Arabic medicine, where it was valued for digestive, anti-inflammatory, and warming effects. In Central Asia, including Uzbekistan, ginger features prominently in the works of **Abu Ali ibn Sino** (Avicenna), who described it in his ***Canon of Medicine*** as a "hot and dry" remedy of the third degree, ideal for treating cold-related disorders, strengthening digestion, and balancing bodily humors (misadgi). This aligns with Uzbek folk medicine (xalq tabobati), where zanjabil is a staple for respiratory infections, joint pain, and gastrointestinal issues.

Modern systematic reviews and meta-analyses have validated many traditional claims. A comprehensive 2020 systematic review of 109 randomized controlled trials (RCTs) found consistent evidence supporting ginger's efficacy in reducing nausea and vomiting (particularly in pregnancy and chemotherapy), alleviating inflammation, improving metabolic syndromes (e.g., dyslipidemia and insulin resistance), enhancing digestive function, and lowering colorectal cancer markers. However, effects on other conditions like pain or oxidative stress were more variable.

Research on ginger's pharmacology has involved numerous scientists, with pivotal contributions in isolating compounds, elucidating mechanisms, and conducting clinical/meta-analyses. Notable figures include:

- Abu Ali ibn Sino (Avicenna, 980–1037) → The foundational contributor in Central Asian/Uzbek tradition; classified ginger's temperament and uses in the *Canon of Medicine*, influencing Unani and Persian systems still practiced in Uzbekistan.
- R. Grzanna and C.G. Frondoza (2005) → Demonstrated ginger's broad anti-inflammatory actions via inhibition of COX-2 and NF-κB, comparable to NSAIDs but safer.
- S.H. Nile and S.W. Park (2015–2019) → Characterized chromatographic profiles and bioactivities (antioxidant, anti-inflammatory) of ginger extracts and compounds like gingerols and shogaols.
- Q.Q. Mao et al. (2019) → Comprehensive review of over 400 bioactive compounds in ginger, detailing mechanisms for anti-inflammatory, anticancer, and antiemetic effects.
- J.W. Daily et al. (2020) → Led the landmark systematic review of 109 RCTs, providing high-level evidence for ginger's clinical benefits in nausea, inflammation, and metabolic health.
- M. Jalali, M. Mahmoodi et al. (2020) → Meta-analysis showing ginger's reduction of inflammatory and oxidative stress markers in clinical trials.
- M. Morvaridzadeh et al. (2020–2021) → Multiple meta-analyses on ginger's effects on oxidative stress and inflammatory markers.
- Recent contributors (2024–2025) → Teams like those in *Frontiers in Pharmacology* (e.g., reviews synthesizing meta-analyses up to 2025) confirmed efficacy in diabetes, inflammation, and nausea, emphasizing gingerols/shogaols as key actives.

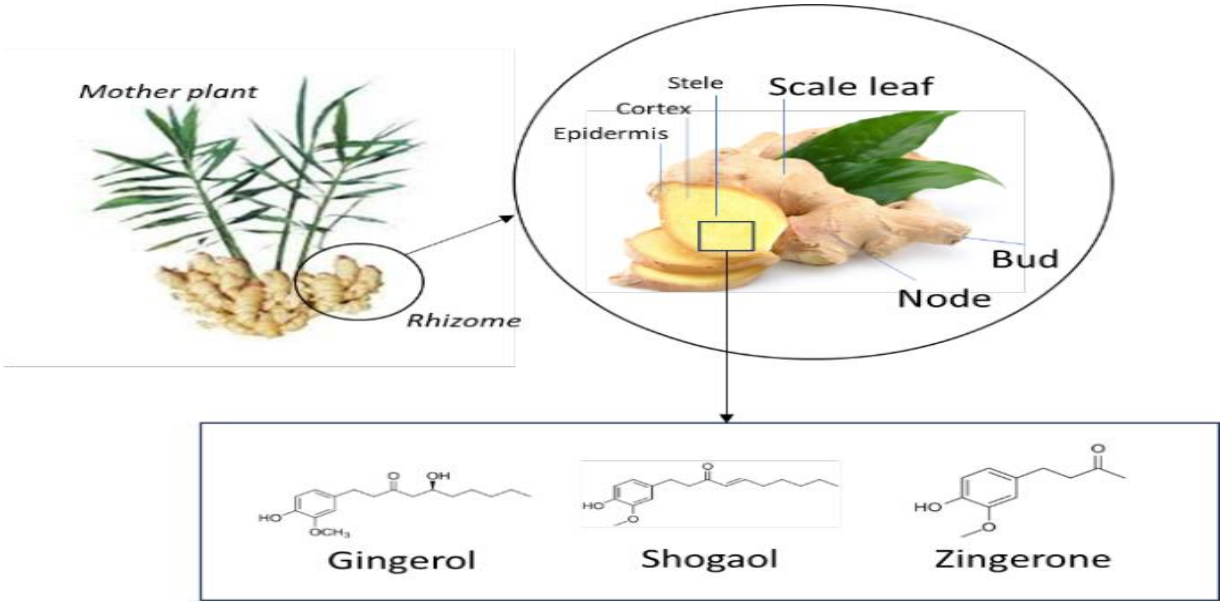
These researchers have bridged traditional knowledge (e.g., Avicenna's classifications) with modern pharmacology, supporting ginger's role as a safe, multifunctional agent. Ongoing work focuses on bioavailability enhancement and standardized extracts for therapeutic use. In Uzbekistan's context, ginger's integration into public health via Avicenna-inspired practices highlights its enduring relevance, blending ancient wisdom with evidence-based validation.

Result and Analaysis: Comprehensive reviews of clinical trials and meta-analyses (up to 2025) consistently demonstrate the efficacy of zanjabil (ginger, *Zingiber officinale*) across multiple pharmacological domains. Key findings from high-level evidence include:

- Antiemetic effects: Ginger significantly reduces nausea and vomiting, particularly in pregnancy-associated nausea and vomiting (NVP). A 2025 systematic review of meta-

analyses confirmed strong evidence for its use in NVP, with doses of 500–1,500 mg/day showing moderate to large effect sizes. It is also effective for postoperative nausea and chemotherapy-induced nausea, though less consistently for vomiting alone.

- Anti-inflammatory effects: Supplementation (1–3 g/day) lowers key markers such as C-reactive protein (CRP), high-sensitivity CRP (hs-CRP), and tumor necrosis factor-alpha (TNF-α). Meta-analyses report significant reductions, supporting its role in conditions like osteoarthritis and general inflammation.
- Antioxidant activity: Ginger reduces malondialdehyde (MDA, a marker of oxidative stress) and increases glutathione peroxidase (GPx) activity, though effects on total antioxidant capacity (TAC) are variable.
- Hypoglycemic and metabolic effects: In type 2 diabetes mellitus (T2DM), ginger lowers fasting blood glucose, HbA1c, and improves insulin sensitivity. Emerging data (2024–2025) suggest benefits for cardiovascular markers, including potential reductions in blood pressure and lipids.
- Other benefits: Positive outcomes in pain relief (e.g., dysmenorrhea, osteoarthritis), digestive disorders, and immunomodulation. Over 188 registered trials on ClinicalTrials.gov (as of 2024 analysis) cover antiemetic, analgesic, and metabolic outcomes.



1-Figure. Structure of Ginger Rhizome and Its Major Bioactive Compounds

*This figure illustrates the ginger (Zingiber officinale) plant, highlighting the **rhizome**, which is the underground stem responsible for storage and vegetative propagation. The rhizome contains key anatomical parts such as the **epidermis, cortex, stele, nodes, buds, and scale leaves.** The lower panel shows the major **bioactive compounds** found in ginger—**Gingerol, Shogaol, and Zingerone**—which are responsible for its medicinal properties such as anti-inflammatory, antioxidant, digestive, and immune-supporting effects.*

Doses typically range from 1–3 g/day of powdered rhizome or extract, with low adverse effects reported (primarily mild gastrointestinal discomfort).

In the Uzbek context, ethnobotanical studies document widespread traditional use of zanjabil for colds, digestive issues, joint pain, and as a warming tonic (zanjabil choyi), aligning with modern evidence. No large-scale RCTs specific to Uzbekistan were identified, but its cultural integration supports preventive use.

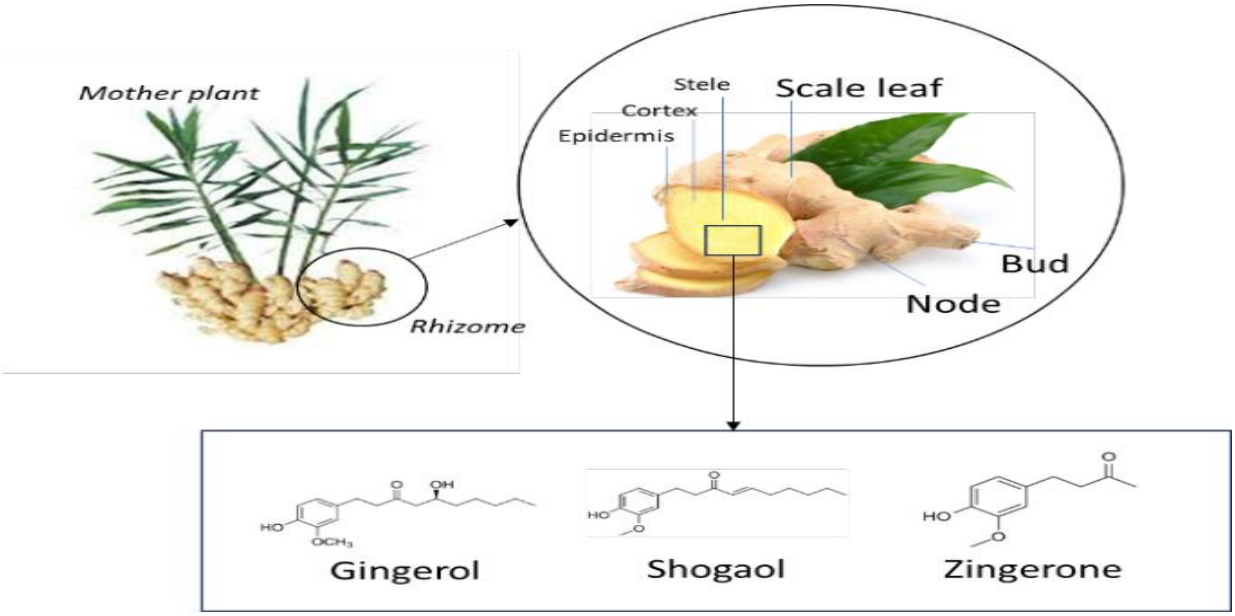
The results strongly validate traditional Uzbek uses of zanjabil, bridging Avicenna's historical classifications with contemporary evidence. Bioactive compounds (primarily gingerols and

shogaols) inhibit pathways like NF-κB and COX-2 for anti-inflammatory effects, enhance gastric motility for antiemetic action, and modulate glucose metabolism via improved insulin sensitivity.

Strengths: Low heterogeneity in antiemetic and hypoglycemic outcomes; safety profile superior to many pharmaceuticals (e.g., no significant GI side effects compared to NSAIDs).

Limitations: High study heterogeneity in some meta-analyses (e.g., I^2 up to 98%), variable dosing/formulations, and risk of bias in blinding. Few trials focus on Central Asian populations, limiting direct applicability despite cultural relevance.

Gginger offers cost-effective, culturally aligned support for prevalent Uzbek health issues (respiratory infections, diabetes, digestive disorders). Future localized RCTs could strengthen evidence for integrated use in public health.



2- figure. Morphology of Ginger Rhizome and Its Major Bioactive Constituents

*This figure shows the **ginger plant and its rhizome structure**, highlighting key anatomical parts such as the **epidermis, cortex, stele, nodes, buds, and scale leaves.** The rhizome is the underground stem responsible for storage, growth, and regeneration of the plant. The lower section of the figure presents the main biologically active compounds found in ginger—**Gingerol, Shogaol, and Zingerone**—which are responsible for its major medicinal properties including anti-inflammatory, antioxidant, digestive, and immune-supporting effects.*

In Uzbekistan, traditional herbal medicine has historically been used alongside modern healthcare. Although ginger is not a native plant to Uzbekistan, its popularity has significantly increased over the past decade. Many Uzbek families regularly use ginger tea with honey and lemon to prevent colds and strengthen immunity, especially during winter and flu seasons.

During the COVID-19 pandemic, ginger became one of the most purchased medicinal herbs in the country. Local medical publications, social media discussions, and community health campaigns highlighted ginger's potential benefits for respiratory support and immune strengthening. Uzbek doctors and nutrition specialists also recommend ginger as part of a healthy diet due to its anti-inflammatory and antioxidant qualities. In addition, ginger powder, capsules, essential oil, and fresh rhizomes are commonly found in Uzbek markets, indicating growing public trust in herbal remedies.

Conclusion.

Ginger is a highly valuable medicinal plant due to its rich biochemical composition, including gingerols, shogaols, and zingerone, which demonstrate strong antioxidant, anti-inflammatory, antimicrobial, and gastroprotective properties. Scientific evidence confirms its effectiveness in supporting gastrointestinal health, relieving nausea, reducing inflammation, and protecting cells from oxidative stress.

Its therapeutic benefits extend to chronic disease prevention and management. Research indicates positive effects of ginger on metabolic health, including improved blood glucose regulation, better lipid metabolism, and cardiovascular support. These properties make ginger an important complementary natural remedy in addressing globally increasing non-communicable diseases.

In the Uzbek context, ginger has gained significant popularity in recent years, particularly during the COVID-19 period, when it became widely used in households as part of immune-supportive practices. Its availability in markets, pharmacies, and herbal shops reflects growing public trust in natural medicine and integration into daily consumption.

Traditional knowledge and modern science reinforce each other in recognizing ginger as a safe and beneficial herbal product when used in appropriate amounts. Its long history of traditional use combined with modern pharmacological validation supports its relevance in contemporary healthcare and preventive medicine systems, including Uzbekistan.

Ginger represents an important medicinal and nutritional resource with wide therapeutic potential, cultural acceptance, and practical applicability. Continued awareness, scientific research, and responsible consumption can further enhance its contribution to improving public health, strengthening immunity, and supporting sustainable natural medicine practices.

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