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Hippocratic Journal of Unani Medicine

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Review Article

Phytochemical, Ethnomedicinal, and Pharmacological Aspects of *Alsi* (*Linum usitatissimum* L.) – A Critical Study

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Abstract

Flaxseed (FS) or *Alsi* (*Linum usitatissimum* L.) is a nutrient-rich seed with notable therapeutic potential owing to its content of alpha-linolenic acid (ALA), fiber, lignans, and proteins. These constituents contribute to cardioprotective, anti-inflammatory, neuroprotective, anti-thrombotic, and anti-arrhythmic effects, while lignans offer antioxidant, anticancer, immunomodulatory, and estrogenic properties. Its fiber supports digestive health and weight management. Traditionally utilized in Unani, Ayurveda, and Chinese medicine, FS is gaining recognition as a functional food. However, bioavailability of its phytoconstituents is influenced by processing and storage, affecting clinical outcomes. Major databases including PubMed, Scopus, and Web of Science were systematically searched using the combinations of keywords such as "*Linum usitatissimum* L.", "*Alsi*," "flaxseed," "ALA," "traditional medicine," "clinical trials," and "therapeutic effects." Initially, 368 articles were identified. Following title and abstract screening, 241 were excluded. Of the remaining 127, 42 clinical trials and 30 basic studies met inclusion criteria based on relevance to FS's health effects and study design. Limitations across studies included varied preparation methods, dosage inconsistencies, and short trial durations, complicating the generalization of outcomes. Long-term clinical studies on chronic disease prevention remain insufficient. Future research should address standardization in FS processing, optimize bioavailability, and establish effective dosage guidelines. Despite current challenges, FS continues to demonstrate promise across preventive and therapeutic domains (Prospero Registration No. 1105643).

Keywords: *Flaxseed, Linum usitatissimum L, traditional medicine, Unani medicine*

Introduction

Flaxseed (FS) (*Linum usitatissimum* L.), also called linseed or *Alsi* or *Tukhm-e Kātan*, is a member of the *Linaceae* family. This important annual plant is grown extensively across the globe. In the Indian subcontinent, it is recognized by names such as "*Alsi*", "*Jawas,*" and "*Aksebija*".[1] FS is an ancient cro*P* valued for its dual uses in food and fiber production. While "FS" is the common term in North America for human consumption, Europeans often refer to it as "linseed" for the same purpose. Historical evidence traces the presence of FS back to approximately 9000–8000 B.C. in regions such as Turkey, Iran, Jordan, and Syria. Although it is unclear whether FS was actively cultivated during that time, its seeds were discovered alongside domesticated grains like wheat and barley. The name *Linum usitatissimum* L. was given by Linnaeus in his work "Species Plantarum."[2,3] FS is recognized as a significant oilseed crop; valued for its nutritional properties, support uses, fiber production, and industrial applications. In India, FS is still being consumed as food and as well as for medicinal purposes. It enjoys a good status among oilseeds because of its versatile uses.[4] Every part of the FS plant is used commercially, either in its raw form or after processing. FS oil is renowned for its health benefits, primarily due to its distinct chemical composition, which includes a high level of polyunsaturated omega-3 fatty acids, linoleic acid, and alpha-linolenic acid as its key components. It also contains a range of antioxidants, including tocopherols, beta-carotene, phytosterols, polyphenols, and flavonoids. Tocopherols, which are lipid-soluble compounds, exist in four isomers (α, β, γ, and δ) and have antioxidant and anticancer properties.[5-10] This review aims to encompass the extensive history of FS, tracing its progression from ancient medicinal uses to a modern

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functional food. FS's phytochemical profile reveals a rich source of bioactive compounds, including lignans (secoisolariciresinol diglucoside), ALA, and dietary fibers, which contribute to its broad-spectrum health benefits. Numerous scientific studies have validated its therapeutic properties, highlighting its roles in managing diabetes, cardiovascular diseases, hypertension, and cancer, along with its hepatoprotective, nephroprotective, and skin-protective effects. By focusing on the outcomes of clinical research, this review highlights the potential of FS as an evidence-based resource for advancing healthcare and wellness.

Methodology

A comprehensive literature search was conducted to gather existing evidence on the ethnopharmacology, phytochemistry, traditional uses, and therapeutic applications of *Linum usitatissimum* L. (FS). The botanical nomenclature (*Linum usitatissimum* L.) was verified and authenticated using World Flora Online, an authoritative global plant database. This review was designed to systematically explore FS's multifaceted role in traditional medicine and contemporary healthcare, as well as its functional food properties. Major databases such as PubMed, Scopus, and Web of Science were systematically searched for studies published since their inception, reflecting the evolving understanding of *Linum usitatissimum* L. and its multifaceted role in traditional medicine, nutritional science, and modern therapeutics. To ensure a broad and inclusive search, multiple keyword combinations were used, including: "*Linum usitatissimum* L.," "flaxseed," "linseed," "flaxseed oil," Unani medicine, "phytochemicals," "lignans," "ALA," "traditional medicine," "Unani," "Ayurveda," "herbal pharmacology," "functional food," "clinical trials," and "therapeutic effects. Through a systematic screening process, 368 relevant articles were initially identified. After reviewing the titles and abstracts, 241 articles were excluded due to nonrelevance to therapeutic and nutritional profile of FS. Subsequently, 127 articles were thoroughly reviewed and based on their relevance to FS and its health benefits and study design (including clinical trials and basic studies), 42 clinical trials and 30 basic studies were ultimately included. The study has been registered in Prospero with Prospero no. 1105643. This study explores the potential of FS as a functional food and medicinal agent, highlighting its role in traditional medicine and evidence-based modern healthcare. Particular emphasis is placed on analyzing the pharmacological actions of its key active components, including lignans, omega-3 fatty acids, and polyphenols, across a range of clinical and experimental studies [Figure 1].

Plant Description and Distribution

Geographical distribution

The flax plant, native to Egypt, is not found in its wild form, and its exact origin remains uncertain. Some theories suggest that it is indigenous to regions between the

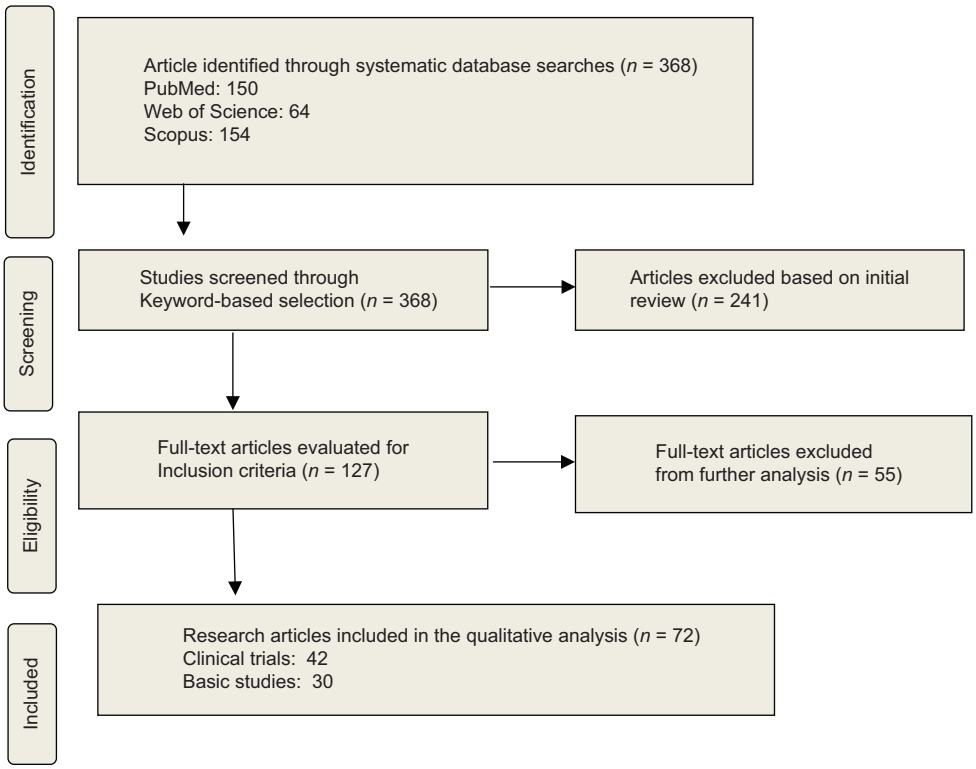

Figure 1: Literature search methodology

Persian Gulf, Caspian Sea, and Black Sea, while others propose India as its place of origin. Two main geographical groups, reflecting the earliest regions of cultivation and centers of diversity, have been identified. In the Mediterranean coastal regions, including Asia Minor, Egypt, Algeria, Tunisia, Spain, Italy, and Greece, linseed has been cultivated since ancient times, primarily for fiber production. The second group, comprising South-West Asia, including Turkestan, Afghanistan, and India, focuses exclusively on oilseed varieties.[11] The important FS growing countries are Canada, China, United States, India, and Ethiopia. Canada is the world's largest producer and accounts for nearly 80% of the global trade in FS, while India ranks 4th.[9] In India, Uttar Pradesh and Madhya Pradesh contribute nearly two-thirds of the country's total linseed production. Uttar Pradesh is the leading producer, accounting for over 35%, with major cultivation areas in Manipuri, Amirpur, and Allahabad districts. Madhya Pradesh follows with just over 29% of the total production, with key regions including Raipur, Bilaspur, Rewa, and Balaghat.[11]

Plant profile

Linum usitatissimum L. is an annual herbaceous plant that grows to a height of 60–120 cm. It produces small flowers that are blue, bluish-violet, or white, arranged in terminal panicles. The fruits are capsule-shaped, with five compartments, each housing two seeds. The whole FS is round and flat, with pointed tips. It has two embryos, an embryo axis, a thin endosperm, and a seed covering, also known as the true hull. All the parts of the FS plant are used for commercial purposes, either unprocessed or processed. FSs come in two main types: Brown and yellow (or golden). Both varieties have similar nutritional profiles and contain comparable amounts of short-chain omega-3 fatty acids. However, a specific yellow flax variety known as solin (marketed as Linola) has a distinct oil composition and contains very low levels of omega-3 fatty acids. Brown FS is more commonly used in industrial applications such as paints, varnishes, fiber production, and cattle feed. Instead of the seed, which contains lignans, digestible proteins with vital amino acids, and oil rich in omega-3 fatty acids, the shell yields high-quality fiber with low density and mechanical qualities.[9,12]

Taxonomic classification

The taxonomical classification is represented in Table 1.[3,13]

Morphological Characteristics

FS is an upright annual herb that attains a height of 0.6–1.2 m. The stem is solitary or occurs in a few numbers, branching in a corymbose manner with ascending branches toward the apex. Its leaves are green, slender, and lanceolate, measuring 20–40 mm in length and about 3 mm in breadth, with smooth margins, tapering ends, and a pointed apex that imparts a gray-green appearance. The plant bears mainly pale blue flowers, although other shades may occur, each flower measuring 15–25 mm in diameter and composed of five delicate petals. The fruit is a round, dry capsule, 5–9 mm in diameter, usually containing up to ten seeds when filled. The seeds are glossy and brown, about 4–7 mm long, with crisp, chewy kernels having a pleasant nutty flavor but lacking any distinctive odor. The root system consists of a short, fusiform taproot that is light yellow in color and may extend to a depth of about 92–122 cm in coarse-textured soils.[3]

Composition of Flaxseed

FS is available in three primary forms suitable for human consumption: Whole seeds, ground seeds, and FS oil. FS consists of a smooth, glossy outer shell that varies in color from deep gold to reddish-brown and contains approximately 15% mucilage. Rich in ω-3 fatty acid, i.e., ALA and lignans (phytoestrogens), fats, complete proteins, dietary fiber, and phenolic compounds, FS's nutritional profile is influenced by several factors, including genetic traits, environmental conditions during growth, and methods of seed processing. The proximate composition of FS is detailed in Table 2.[11,12]

Vernacular Names of Flaxseed

The vernacular names of FS are mentioned as follows:[13-19]

- English: Blaebows, Common Flax, Flax, Flix, Linseed, Lint Bells
- French: Lin chaud, Lin commun, Lin cultive, Grins de Lin
- Hindi: Alsi, Tisi
- Sanskrit: Atasi, Atima, Chanaka, Devi, Haimwati, Kshauma, Kshaumi

Table 1: Taxonomical classification of *Linum usitatissimum* L.

Taxonomic Rank	Classification
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Malpighiales
Family	Linaceae
Genus	Linum
Species	*Linum usitatissimum*

Table 2: Proximate composition of flaxseed

Parameters	Values (approximately)
Weight (g)	100
Energy (kcal)	450
ALA (g)	23.0
Total fat (g)	41.0
Protein (g)	20.0
Dietary fiber (g)	8.0
CHO (g)	29.0

ALA: Alpha-linolenic acid

- Persian: Bazarug, Kuman, Tukhm-e-Katan, Zaghir, Zaghu
- Arabic: Bazrul Katan, Buzruk, Bazen, Katan
- Kashmiri: Alish, Kenu
- Malayalam: Agastha, Cheruchana-Vittintevilta
- Punjabi: Alish, Alsi, Tisi
- Bengali: Masina, Tisi, Alasi
- Greek: Linon.

Temperament of *Linum usitatissimum* L.

Traditional medical practitioners have classified the *Mizāj* (temperament) of *Linum usitatissimum* L. as predominantly *Garam wa Khushk* (Hot and Dry), primarily in the first degree, although some references suggest classification in the second degree.[20,21]

Dosage of *Linum usitatissimum* L.

The recommended dosage as per traditional medicine varies slightly across sources, generally ranging from 5 to 12 g per day**,** depending on the condition being treated and the method of preparation.

- 5–12 g[21]
- 6–12 g[22]
- 10.5 g.[23]

Therapeutic Applications and Benefits of Flaxseed described in Unani Medicine

In Unani system of medicine, FS is highly valued for its diverse pharmacological properties and is utilized both as a food and as a therapeutic agent. The medicinal applications of FS have been documented since antiquity, with references found in the writings of Hippocrates (460–377 BC), Qantes and Dioscorides (40–90 AD), as well as in classical Unani and medieval herbal texts across Asia and Europe.[9] A wide range of medicinal and therapeutic uses of FS have been documented by eminent Unani physicians like Hippocrates (460–377 BC), Galen (129–216 AD), Ibn Sina (980–1037 AD), Al-Razi (854–925 AD), Ibn al-Baitar (1197–1248 AD), etc. These include:

- Diseases of the respiratory system: The *Bakhūr* (incense) prepared from FS is used in Unani medicine for the relief of *Sudda'-i-Khayshūm* (nasal obstruction) and is considered beneficial in the management of *Zukām Ḥārr* (acute coryza). Roasted FSs combined with honey can help relieve *Su'āl* (cough) and *Nafth al-Dam* (hemoptysis)[24-26]
- Diseases of the eye: Soaking FS in cold water releases its mucilage, forming a jelly-like substance that is used as eye drops for relieving *Surkhī-i-Chashm* (redness of eye)[24,27]
- Diseases of the liver and spleen: A poultice made with *Alsi* and honey is beneficial in treating *Waram al-Kabid* (inflammation of liver) and *Waram-i-Ṭiḥāl* (inflammation of spleen)[24,26,27]
- Diseases of the kidney and bladder: FSs are helpful for *Qurūḥ al-Kulya* and *Qurūḥ al-Mathāna* (renal and bladder ulcers).[24] Boiling 12 g of FSs in water produces a mucous-like solution that is effective in removing *Ḥaṣā al-Kulya* (kidney stones) when consumed orally.[27,28]

Apart from these, FS is employed in Unani medicine for the management of *Waja' al-Mafāṣil* (arthritis), *'Irq al-Nasā* (sciatica), *Niqris* (gout), *Qurūḥ al-Raḥim* (uterine ulcers), *Ikhtināq al-Raḥim* (hysteria), *Kalaf* (melasma), and other related conditions.[16,21,26,27]

Toxicity of Flaxseed

FS, despite its recognized health and dietary benefits, contains significant levels of antinutritional factors that may reduce nutrient bioavailability or cause adverse health effects.[28] The main phytotoxic compounds found in FS include linatine, phytic acid, protease inhibitors, and cyanogenic glycosides. Secondary metabolites of plants known as cyanogenic glycosides include lotaustralin, neolinustatin, linustatin, linamarin, and amygdalin. These cyanogenic glycosides may be degraded to toxic HCN upon ingestion.[29] Compared to other cyanogenic glycosides, the FS compounds neolinustatin and linustatin generate less cyanide due to their high stability. In addition, the human body is capable of detoxifying cyanide at levels of up to 100 mg per day. However, research indicates that excessive consumption of FS can lead to the symptoms such as appetite suppression, fatigue, and neurological disturbances. Thiocyanates inhibit the thyroid gland's ability to absorb iodine and prolonged exposure can exacerbate iodine-deficiency disorders such as goiter and cretinism. To ensure FS is safe for consumption, it is essential to remove or deactivate these anti-nutritional factors to levels that are physiologically insignificant.[28]

Phytochemistry

The active phytochemical constituents of *Linum usitatissimum* L. are described in Table 3. The structures with their stereochemistry are noted in Figure 2.[33]

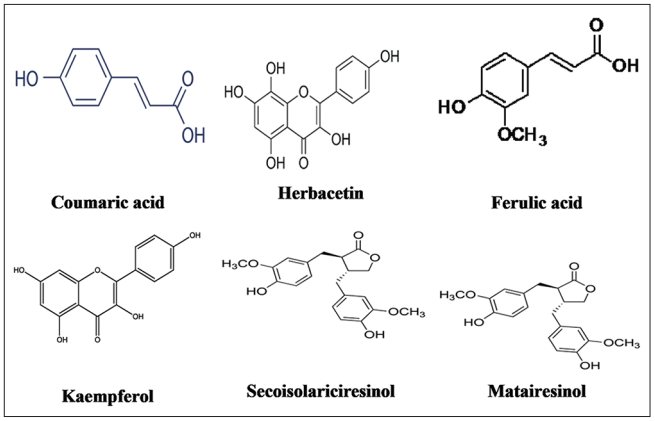

Figure 2: Structure of active phytochemical constituents of Linum usitatissimum L

Table 3: Active phytochemical constituents of *Linum usitatissimum* L

Group	Active constituent	References
Phenolic compounds (phenolic acids and lignans)	Chlorogenic acid, p-hydroxy benzoic acid, ferulic acid, vanillic acid, and coumaric acid Matairesinol, pinoresinol, diphyllin, and secoisolariciresinol	[12,30]
Flavonoids	Flavones (luteolin and apigenin), flavonones (eriodictyol and naringenin) and flavonols (quercetin, kaempferol, herbacetin, and quercetagetin)	[12,31]
Minerals	Magnesium, potassium, sodium, zinc, manganese, copper, and iron	[12,29]
Carotenoids	β-carotene, lutein, and zeaxanthin	[30,32]

Scientific Reports/Studies Conducted on *Linum usitatissimum* L.

Linum usitatissimum L. has long been recognized for its unique nutritional profile and therapeutic potential, making it a focus of extensive scientific inquiry. Over the years, numerous studies have explored its multifaceted benefits, including cardiovascular health, diabetes management, etc., and its role as a functional food in promoting overall wellness. This section delves into the key scientific reports and studies that elucidate the evidence-based advantages of FS.

Anti-hyperglycaemic and anti-hyerlipidemic activity

An experimental study was conducted to evaluate the anti-hyperglycemic effects of ethanolic extracts derived from *Linum usitatissimum* L. seeds and Glycyrrhiza glabra roots. The study compared these extracts to standard medications, including metformin and glimepiride, within a streptozotocin-induced diabetic rat model.[34] FS supplementation significantly reduced glycated hemoglobin (15.6%) and fasting blood glucose (19.7%), alongside improvements in lipid profiles, including reductions in apolipoprotein B, low-density lipoprotein cholesterol, total cholesterol, and triglycerides.[12] The findings revealed that the combination of *L. usitatissimum* and *G. glabra* extracts demonstrated significant anti-hyperglycemic and anti-hyperlipidemic properties in diabetic rats.

Nephro-protective activity

A study was conducted to investigate the nephroprotective effects of ethanolic extracts of *Linum usitatissimum* L. (EELU) in a gentamycin-induced nephrotoxicity model using Wistar rats with acute kidney injury. The research demonstrated that the administration of EELU significantly mitigated renal damage, which was evident through the improvement in biochemical markers such as reduced serum creatinine and urea levels. This nephroprotective effect is largely attributed to the potent antioxidant properties of EELU, which play a crucial role in combating oxidative stress induced by gentamycin.[35] Another study investigated the protective effects of FS-oil on diazinon-induced nephrotoxicity in male Wistar rats. Results showed that FS-oil improved kidney function by reducing markers such as blood urea nitrogen, creatinine, and malondialdehyde (MDA) while enhancing antioxidant activity (GPX and CAT) and mitigating histological damage.[36]

These findings pave the way for future research on developing FS-based formulations as potential nephroprotective agents, particularly for individuals at high risk of acute kidney injury.

Anti-cancerous activity

A study conducted to examine the anti-cancer effects of FS lignans, particularly Enterolactone (ENL), on acute myeloid leukemia (AML) cell lines. ENL showed a significant, selective cytotoxic effect on AML cells, inducing apoptosis through DNA fragmentation and activation of the intrinsic apoptotic pathway.[37] Another study examined the anticancer effects of FS in a nude mice model with estrogen receptor-negative human breast cancer cells (MDA-MB-435). Mice fed a diet supplemented with 10% FS showed significant reductions in tumor growth rate, lung metastasis, and lymph node metastasis compared to the basal diet group. FS also reduced metastatic tumor load, down regulated insulin-like growth factor I and epithelial growth factor receptor expression, and demonstrated promising potential in inhibiting breast cancer growth and metastasis.[38]

Hypotensive properties

FS, rich in ALA, lignans, and dietary fiber, has shown potential in managing hypertension. In a study with 99 prediabetic participants, two groups consumed either 40 g or 20 g of FS powder daily for 12 weeks, while a control group received no supplementation. Blood pressure measurements revealed that the 40 g group experienced a significant reduction in systolic blood pressure (12.24 ± 23.08 mmHg) compared to the 20 g group (2.56 ± 5.99 mmHg) and the control group (−1.5 ± 6.3 mmHg), highlighting FS's hypotensive benefits.[39] The meta-analysis, comprising 11 studies and 14 trials, revealed that FS supplementation significantly reduced systolic blood pressure (−1.77 mm Hg; 95% confidence interval [CI]: −3.45, −0.09 mm Hg; P = 0.04) and diastolic blood pressure (−1.58 mm Hg; 95% CI: −2.64, −0.52 mm Hg; P = 0.003), with notable effects observed in those consuming whole FS (−1.93 mm Hg) and over a duration of ≥12 weeks (−2.17 mm Hg). These reductions were consistent regardless of participants' baseline blood pressure levels, emphasizing FS's potential as a dietary intervention for managing hypertension.[40]

Analgesic and anti-inflammatory activity

Study conducted by Rafieian-Kopaei *et al*., evaluated the analgesic and anti-inflammatory effects of *Linum usitatissimum* L. in mice. The extract demonstrated dose-dependent analgesic activity, comparable to morphine, with higher effects at 200 mg/kg ($P < 0.05$), though naloxone reduced its efficacy ($P < 0.001$). Anti-inflammatory activity was observed at 170 mg/kg ($P < 0.05$). The extract's effects were attributed to its phenolic, flavonoid, and flavonol content with antioxidant properties, suggesting its potential as an analgesic and anti-inflammatory agent.[41]

Hepatoprotective effects

The study investigated the hepato-nephroprotective effects of FS lignan in a rabbit model of paracetamol-induced hepato-nephrotoxicity. Paracetamol treatment led to elevated levels of serum Alkaline phosphatase(ALP), alanine transaminase (ALT), aspartate aminotransferase (AST), bilirubin, blood urea, and creatinine, along with reduced total protein and albumin levels. Treatment with lignan extracts (25 and 50 mg/ml) significantly improved these biochemical markers ($P < 0.05$). The findings suggest that FS lignan, in both pure and partially purified forms, can mitigate liver and renal damage, highlighting its potential as a therapeutic agent for hepato-nephroprotection.[42] Another study demonstrated that FS chutney (15%, w/w) exhibited significant hepatoprotective effects in rats with carbon tetrachloride (CCl4)-induced hepatotoxicity. It effectively reduced elevated serum marker enzymes (GOT, GPT, and ALP) and mitigated liver damage, showcasing its antioxidant potential in protecting against hepatotoxic injury.[43]

Skin-protective benefits

A study assessed the effects of daily FS oil and safflower seed oil supplementation on sensitive skin in healthy female volunteers over 12 weeks. FS oil significantly reduced skin sensitivity, transepidermal water loss, roughness, and scaling while enhancing smoothness and hydration, along with a decreased plasma n-6/n-3 FA ratio. Safflower seed oil improved roughness and hydration but showed milder and delayed effects, accompanied by an increase in the plasma n-6/n-3 FA ratio. FS oil demonstrated more pronounced benefits for sensitive skin.[44] The study examined the effects of FS gel on skin elasticity in New Zealand rabbits, comparing it to Fucidin cream and a non-treated control group. FS gel significantly improved skin elasticity, reducing Young's modulus to (2.46 ± 1.02) after 14 days ($P = 0.003$), outperforming both Fucidin and the control group. These findings demonstrate FS's therapeutic potential for enhancing skin elasticity and tissue distensibility.[45]

Flaxseed in polycystic ovary syndrome management

The study investigated the effects of FS extract on a polycystic ovary syndrome (PCOS)-induced rat model. FS extract significantly increased progesterone levels and decreased testosterone levels ($P < 0.05$) without notable changes in estrogen or DHEA. Histomorphometric analysis revealed improvements in ovarian structure, including an increase in preantral follicles, antral follicles, and corpus luteum, along with a decrease in cystic follicles and antral follicle diameter. In addition, the granulosa layer thickness increased, while the theca layer and tunica albuginea thicknesses decreased ($P < 0.05$), highlighting FS's potential therapeutic benefits for PCOS.[46]

Flaxseed as Functional Food

FS is widely recognized as a valuable functional food due to its rich composition, including ALA, lignans, high-quality protein, soluble fiber, and phenolic compounds.[4] Records show that the human race has eaten this seed since early times.[9] It serves as a versatile ingredient in various food products. Notably, the FS-water mixture can act as a substitute for eggs in vegetarian diets, particularly in baked goods such as pancakes, muffins, and cookies. For one egg, approximately 15 g (one tablespoon) of milled FS mixed with 45 milliliters (three tablespoons) of water provides an effective replacement. FS can be supplemented in bread and other goods such as cookies and muffins including gluten free products.[47] Various products use FS including salad toppings, ready-to-eat breakfast cereals, meat extenders, bagels, biscuits, salad dressings, drinks, formed with cold-pressed FS oil, fiber bars, crackers, cakes, and soups.[48]

Overview of Clinical Trials Evaluating Flaxseed in Human Health

Over the past two decades, numerous clinical trials have investigated the health effects of FS in human populations. These studies have primarily focused on its potential roles in managing cardiovascular diseases, metabolic disorders, hormonal imbalances, and inflammation. The trials vary in terms of population, dosage, form of FS (whole, ground, oil, or lignan extract), and duration. Despite this variability, many have reported favorable outcomes such as improved lipid profiles, reduced inflammatory markers, enhanced insulin sensitivity, and alleviation of certain symptoms associated with chronic conditions. A summary of key human clinical trials on FS is presented in Table 4.

Discussion

FS or *Alsi* (*Linum usitatissimum* L.) represents a convergence of traditional healing systems and modern clinical research, offering therapeutic promise across a spectrum of chronic conditions. Its phytochemical richness, particularly lignans, flavonoids, polyphenols, omega-3 fatty acids, and phytosterols, has demonstrated multiple health benefits, including anti-inflammatory, antioxidant, hepatoprotective, nephroprotective, and

Table 4: Summary of key human clinical trials conducted on flaxseed

Study	Population	Intervention	Duration	Key findings	References
Khandouzi *et al*., 2018	50 patients with CAD	Flaxseed (30 g/day)	12 weeks	Improved endothelial function (FMD); reduced hs-CRP, IL-6, TNF-α	[49]
Dodin *et al*., 2005	199 postmenopausal women	40 g/day flaxseed	12 months	Modest cholesterol reduction; no major effect on symptoms or BMD	[50]
Haidari *et al*., 2020	41 women with PCOS	30 g/day flaxseed powder	12 weeks	Improved insulin sensitivity, ↓ triglycerides, ↑ HDL and adiponectin	[51]
Ma *et al*., 2022	68 elderly patients with functional constipation	50 g/day Flaxseeds	1 month	Increased the frequency of defecation and decreased abdominal distension	[52]
Morshedzadeh *et al*., 2021	70 patients with mild-to-moderate ulcerative colitis	30 g/day ground flaxseed powder	12 weeks	Significant reductions in insulin, HOMA-IR, triglycerides, total cholesterol, TNF-α, and CRP; increased HDL levels; improved SCCAI scores; no significant change in body weight, BMI, waist circumference, or blood pressure	[53]

BMI: Body mass index, HDL: High-density lipoprotein, CAD: Coronary artery disease, HOMA-IR: Homeostatic model assessment of insulin resistance, SCCAI: Simple Clinical Colitis Activity Index, hs-CRP: High-sensitivity C-reactive protein, TNF-α: Tumor necrosis factor-α, BMD: Bone mineral density, FMD: Flow-mediated dilation, ↑: Increased, ↓: Decreased

cardiometabolic effects. Traditional uses in Unani, Ayurveda, and Chinese medicine further validate its long-standing role as a functional food. However, considerable variation in extraction techniques, dosage forms, and processing practices influence the consistency and reproducibility of its effects. Challenges remain in optimizing bioavailability, especially for compounds such as phytosterols and ALA, where therapeutic outcomes depend heavily on formulation science. Novel approaches like nano-formulations and sustained-release systems may help overcome these limitations. Furthermore, integrating insights from traditional medicine with modern pharmacological frameworks could facilitate culturally sensitive, globally relevant applications of FS-based therapies.

Conclusion

FS or *Alsi* continues to emerge as a multifaceted dietary and therapeutic agent with relevance across both traditional and evidence-based systems of medicine. Its diverse bioactive profile supports its use in managing chronic illnesses, yet inconsistencies in clinical outcomes underscore the need for standardized preparation and delivery strategies. Future research should prioritize the isolation and characterization of key phytochemicals, development of targeted delivery systems, and rigorous clinical trials assessing long-term efficacy and safety. Bridging traditional medical paradigms with scientific validation will be critical to harnessing FS's full therapeutic potential and advancing its role in integrative healthcare.

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Conflicts of interest

There are no conflicts of interest.

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Original Research Article

Perceptions and Practices Surrounding the Revised National Commission for Indian System of Medicine Curriculum: A Knowledge, Attitudes, and Practices Study among Students and Faculty at Ayurvedic and Unani Tibbia College

Abstract

Background: The recent revision of the Bachelor of Unani Medicine and Surgery (BUMS) Competency-based Dynamic Curriculum by the National Commission for Indian System of Medicine marks a strategic shift toward competency-based medical education. **Aims and Objectives:** This study evaluated the knowledge, attitudes, and practices of students and faculty at Ayurvedic and Unani Tibbia College regarding the new curriculum. **Materials and Methods:** A cross-sectional study was conducted among 80 students and 20 faculty members using structured questionnaire. **Results:** The results revealed high awareness (100%) among faculty and 90% among students. While 77.5% of students reported, being only somewhat familiar with the learning objectives, faculty expressed confidence in the curriculum's clarity and purpose. Clinical readiness, integration of traditional and modern medicine, and interdisciplinary teaching were generally well received; however, challenges such as inadequate infrastructure, language barriers, and documentation burdens were noted. **Conclusions:** This study provides critical insights into the implementation of the new curriculum and recommends targeted training, simplified documentation, and structured orientation programs to enhance effectiveness.

Keywords: *Bachelor of Unani medicine and surgery curriculum, competency-based education, knowledge, attitudes, and practices study, National Commission for Indian System of Medicine, Unani medicine*

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Introduction

Unani medicine, a classical healing system rooted in the Greco-Arabic tradition, has continuously evolved to address the changing healthcare needs of society and is currently undergoing significant modernization. The creation of the National Commission for Indian System of Medicine (NCISM) marked the beginning of a fundamental change toward organized, skill-focused, and competency-based education. The introduction of the revised curriculum[1] for the Bachelor of Unani Medicine and Surgery (BUMS) program by the NCISM is a landmark initiative, aimed at integrating traditional knowledge with clinical and research skills in alignment with contemporary healthcare standards.

However, the success of this initiative depends on the acceptance and adaptability of its stakeholders. Students are required to internalize new learning approaches and objectives, while teachers must recalibrate their teaching strategies. Understanding their perceptions of the revised curriculum can provide actionable insights into strengthening teaching methodologies, refining assessment strategies, and enhancing institutional support mechanisms. The present Knowledge, Attitude, and Practices study was undertaken at Ayurvedic and Unani Tibbia College and Hospital, Government of NCT of Delhi to assess the reception and early outcomes of the revised curriculum. This study aims to provide a comprehensive evaluation of its impact and offer data-driven recommendations for future improvements, thereby optimizing educational outcomes.

Materials and Methods

A cross-sectional, descriptive study design was used to assess the perspectives of

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students' and faculty members' on the revised curriculum. The study population consisted of students enrolled in the BUMS program, specifically those in the first and second professional years at Ayurvedic and Unani Tibbia College and faculty members involved in teaching the BUMS first and second professional subjects in the same institution. A total of 100 participants were included in the study, comprising 80 students (40 each from 1st and 2nd professional BUMS) and 20 faculty members. Stratified random sampling and purposive sampling techniques were used to enrol students and faculty members, respectively. Data were collected using a structured questionnaire (separate for students and teachers) disseminated through Google forms. Participants' email addresses were recorded to authenticate responses and avoid duplication. Questionnaire consisted of five main sections: demographic information, knowledge of the curriculum, attitudinal assessment, practical implementation, and open-ended

Table 1: Questionnaire used in the study

Questionnaire for students	Questionnaire for teachers
Section-1: Demographic details	**Section-1: Demographic details**
Age	Age
Gender	Gender
Year of study (first/second prof)	Years of teaching experience
Prior knowledge about Unani Medicine before admission	Subject(s) taught
Section-2: Knowledge	**Section-2: Knowledge**
1. Are you aware of the new NCISM curriculum for BUMS? Yes/no	1. Are you aware of the key changes introduced in the new NCISM curriculum for BUMS? Yes/no
2. How familiar are you with the learning objectives of the new curriculum? Not at all/somewhat familiar/very familiar	2. Do you feel that the new curriculum provides a clear structure for student learning outcomes? Yes/no/not sure
3. Do you think the curriculum covers all essential aspects of Unani Medicine in the first and second years? Yes/no/unsure	
4. Which subjects do you feel are most clearly outlined in the new curriculum? (open-ended)	
Section-3: Attitude	**Section-3: Attitude**
5. How do you feel about the new curriculum's approach to integrating traditional and modern medical knowledge? Excellent/good/average/poor	3. How do you perceive the new curriculum's balance between classical Unani concepts and modern medical knowledge? Excellent/good/average/poor
6. Do you believe the new curriculum is preparing you well for future professional practice? Yes/no/not sure	4. Do you think the revised curriculum will help in improving the competence of students in clinical practice? Strongly agree/agree/neutral/disagree/strongly disagree
7. What is your opinion on the inclusion of clinical exposure in the early years of the curriculum? Strongly support/support/neutral/oppose/strongly oppose	5. How do you feel about the integration of interdisciplinary subjects in the new curriculum? Strongly support/support/neutral/oppose/strongly oppose
Section-4: Practices	**Section-4: Practices**
8. How often do you refer to the new curriculum's learning objectives during your study? Never/sometimes/frequently/always	6. How often do you incorporate the new curriculum changes into your teaching practices? Never/rarely/sometimes/often/always
9. Do you find it easy to follow the new curriculum structure in your daily study routine? Yes/no/partially	7. Do you find the curriculum's assessment methods (e.g., formative and summative assessments) helpful in evaluating student progress? Yes/no/partially
10. How do you keep up with the changes in the curriculum (lectures, reading materials, peer discussion, etc.)? (open-ended)	
Section-5: Suggestions for improvement	**Section-5: Challenges and suggestions**
11. What changes/suggestions, if any, would you recommend for the current curriculum? (open-ended)	8. What challenges have you faced while implementing the new curriculum? (open-ended)
	9. What improvements would you suggest for better implementation of the curriculum? (open-ended)

NCISM: National Commission for Indian System of Medicine, BUMS: Bachelor of Unani Medicine and Surgery

suggestions. Questionnaire used in the study is presented in Table 1.

The quantitative data obtained from closed-ended questions were analyzed using descriptive statistics such as frequencies, percentages, and mean values, using Microsoft Excel, and qualitative data from open-ended responses were analyzed through thematic analysis.

Results and Discussion

Demographics

A detailed analysis of the demographic distribution of the study participants revealed that students' ages ranged between 19 and 24 years, of which 54% were female and 46% were male. The faculty members' ages ranged from 32 to above 60 years, with significantly varied teaching experiences, reflecting a mix of young and experienced faculty members.

Knowledge

A structured set of questions separate for students and faculty was designed to evaluate the awareness and understanding of the new NCISM curriculum among both students and faculty. The data revealed 90% and 100% awareness of the new NCISM curriculum among students and teachers, respectively. 77.5% of students were "somewhat familiar" with learning objectives of new curriculum. 62.5% students agreed that new curriculum covered all essential aspects of Unani Medicine, whereas all 20 teachers agreed that the new curriculum provided a clear structure for student learning outcomes. According to the students, the Anatomy subject curriculum was most clearly outlined/covered in the new curriculum, followed by *Umūr-i-Tabī'yah*, and Physiology. *Ilmul Advia*, *Tārīkh-e-Ṭibb*, and Forensic Medicine were also highlighted, but to a lesser extent.

Attitude

To evaluate attitudes toward the newly introduced NCISM curriculum, a structured set of questions was designed separately for students and teachers. In the new curriculum, 58.8% of students and 90% of teachers rated the integration of traditional and modern medicine positively. Moreover, 62.5% of students felt that the new curriculum would prepare them well for future professional practice. More than 70% of the students supported early clinical exposure in the curriculum. Meanwhile, 55% of teachers rated the balance between classical Unani concepts and modern medical knowledge as good, showing a positive perception that the curriculum successfully integrates both domains. A total of 95% of teachers agreed on the curriculum's competence-improving potential.

Practices

To evaluate how well the new NCISM curriculum is being practiced and integrated into students' study habits and teachers' instructional methods, a structured set of questions was formulated for both groups. The question "How often do you refer to the new curriculum's learning objectives during your study" revealed partial adoption of the outcome-based structure. Most students appear to be aware of their learning goals but may not fully integrate them into their routines. 53.8% students found the curriculum "partially easy" to follow, suggesting that while structural updates are visible, they may lack clarity or coherence in some areas. Sixty-five percent faculty reported that they "always" incorporate new curriculum updates into teaching practice. Eighty percent faculty agreed that assessment methods in new curriculum were effective.

Challenges

Main students' concerns were overload of theory, loading their cognitive load, and exam stress, putting them in a learned helplessness situation postulated by Seligman.[2] Other student concerns were limited clinical exposure, unclear subject outlines, and language barriers (Urdu/Arabic terminology). These limitations create a disengagement, as suggested by psychological theories such as the Self-Determination Theory[3] and Cognitive Load Theory,[4] which explain students' disengagement under academic and linguistic stress.

The Challenges faced by faculty were mainly infrastructure and resource scarcity (labs, smart classrooms), which hindered the effective use of modern pedagogical tools advocated in the new curriculum. Challenges such as excessive documentation and administrative burden detract from the time available for innovation in teaching and one-on-one student mentoring. Teachers have experienced that the shift in assessment patterns, from theoretical exams to practical and problem-based evaluations, has not been easy to implement; however, when implemented, studies show firm evidence that innovations designed to strengthen the frequency of feedback that students receives about their learning yield substantial learning gains.[5] Other challenges mentioned were difficulty in managing nonlecture hours and lack of standardized formats. While participants endorsed the curriculum ideologically, their ability to act on it was limited by systemic barriers such as lack of resources, insufficient training, and language barriers. This suggests that behavior is influenced not only by attitude but also by perceived behavioral control and social norms and aligns with Ajzen's Theory of Planned Behavior.[6]

Suggestions

To address potential gaps, suggestions were solicited from both students and teachers.

Students' suggestions included greater clinical exposure from the second year onward, with increased hands-on clinical experience, participation in outpatient department/inpatient department sessions, and early hospital visits. This reflects that learners are most motivated when they experience autonomy, competence, and relatedness.[3] Additional

recommendations were to simplify the curriculum structure, reduce examination stress, and minimize syllabus overload.

Teachers' suggestions emphasized the need for increased faculty recruitment and the organization of regular Faculty Development Programs grounded in adult learning principles, which prioritize relevance, self-direction, and experiential learning.[7] Another significant recommendation was to provide bilingual study materials or introduce Urdu bridge courses, applying scaffolding techniques[8] to progressively build students' understanding from familiar to complex concepts by simplifying instructional materials. Teachers also suggested conducting structured orientation programs employing dual coding strategies,[9] which combine visual and verbal formats to support mental model development. Furthermore, they advocated for upgrading infrastructure, reducing paperwork, and adopting standardized documentation formats across institutions to ensure quality assurance and comparability.

The findings of this study indicate broad awareness but varying levels of functional familiarity with the revised curriculum. While faculty members appreciated the structured approach, students expressed uncertainty, highlighting disconnect in implementation and communication. The integration of traditional and modern knowledge was positively received, aligning with the objectives of NCISM's reform. However, readiness for clinical application remains uneven because of limited exposure, infrastructural constraints, and inadequate mentorship. In contrast, teachers reported role strain caused by administrative overload and insufficient resources, which may contribute to burnout. Moreover, the shift in assessment patterns poses challenges in execution.

Conclusion

The revised BUMS curriculum is conceptually robust and has been positively received by both faculty and students. However, its effective implementation requires comprehensive student orientation, the provision of bilingual learning resources to overcome linguistic barriers, structured faculty development initiatives, and adequate infrastructural and administrative support. Addressing these systemic challenges is essential for the curriculum to achieve its core objective of producing clinically competent and ethically grounded Unani professionals. This underscores the need for holistic reform, one that not only modernizes curricular content but also empowers both educators and learners to ensure meaningful and sustainable outcomes.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

Association of Anemia with Socioeconomic Factors among Adolescent Girls in a Selected Area of Southeast Delhi: A Cross-sectional Study

Abstract

Background: Anemia remains a significant health concern among adolescent girls, with socioeconomic status (SES) playing a pivotal role in its prevalence. This study investigates the association between anemia and different SES strata among adolescent girls in Southeast Delhi. **Methodology:** A cross-sectional study was conducted among 371 adolescent girls aged 10–19 years in Zakir Nagar, Southeast Delhi. Hemoglobin (Hb) levels were measured using a digital hemoglobinometer, and SES was assessed using the modified Kuppuswamy scale. Statistical analysis was performed to evaluate the relationship between SES and anemia prevalence. **Results:** The overall anemia prevalence was 53.37%. Distribution across SES categories showed the highest prevalence in the lower middle class (63.1%), followed by the upper lower class (47.01%). The association between SES and anemia was statistically significant (χ^2 = 12.15, P = 0.016). Girls from lower middle socioeconomic backgrounds exhibited the highest prevalence of anemia. **Conclusion:** The findings reveal a strong link between lower SES and increased anemia prevalence among adolescent girls. Effective interventions should target nutrition, health education, and accessibility to healthcare services in economically disadvantaged groups.

Keywords: *Adolescent girls, anemia, nutrition, public health, socioeconomic status*

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Introduction

Anemia, as defined by the World Health Organization (WHO), is a condition marked by insufficient red blood cells or hemoglobin (Hb) levels. This deficiency impairs the blood's ability to transport oxygen to various tissues in the body. Without adequate Hb, oxygen delivery is compromised, leading to symptoms such as weakness, fatigue, dizziness, and shortness of breath.[1]

Anemia can result from various factors, including low dietary intake or poor absorption of nutrients, infections like human immunodeficiency virus, tuberculosis, parasites, and malaria, inflammation, chronic illnesses, gynecological and obstetric conditions, and genetic conditions that impact red blood cell production or function. The most common nutritional cause of anemia is iron deficiency, although folate, Vitamin B12, and Vitamin A deficiencies all play a major role.[2,3]

According to the WHO, anemia is a significant global public health issue that mostly affects young children, teenage girls, and women who are menstruation in addition to pregnant and postpartum women. According to the WHO estimates, 40% of children aged 6–59 months, 37% of pregnant women, and 30% of women aged 15–49 years worldwide are affected by anemia.[4]

Anemia is a significant global health challenge impacting both developing and developed nations, with far-reaching effects on health, society, and economic development. While it can affect people of all ages, pregnant women and young children are particularly susceptible. Adolescents experience a heightened need for iron due to rapid growth and menstrual blood loss. In many developing countries, this increased demand is often not met due to inadequate diets, poor iron absorption, and frequent parasitic infections, resulting in a higher prevalence of anemia among women and girls. As a result, adolescents who become pregnant shortly after menarche are likely to begin pregnancy with low iron stores, putting them at greater risk of anemia.[5,6]

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It is directly or indirectly responsible for 40% of maternal mortality in underdeveloped nations. According to the World Health Report 2002, anemia is one of the top 10 hazards for preterm birth, maternal mortality, and infant mortality. Because of their growth spurts, both boys and girls are more susceptible to anemia during adolescence. This is especially true for girls who are more likely to encounter anemia as menarche approaches. Anemia can affect people from a wider range of socioeconomic backgrounds, and it is more prevalent among underprivileged populations.[7,8]

Although existing programs have targeted this critical developmental time, there is a requirement for ongoing improvements to address additional challenges, such as menstrual blood loss, which can exacerbate anemia. In developing countries, the prevalence of parasitic infections and other infectious diseases further heightens the body's demand for iron.[8,9]

As stated by the WHO classification, Hb levels below 8 g/dL are classified as severe anemia, levels between 8 and 10.99 g/dL are considered moderate anemia, Hb levels between 11 and 11.9 g/dL are classified as mild anemia, and levels of 12 g/dL or above are considered normal.[10-12]

In India, anemia has become more common in teenage girls in recent years. They are more susceptible to nutritional anemia during this stage of life, when menstruation starts. Many females in rural India marry and become pregnant in their late teens, increasing their risk of anemia and the chances of giving birth to underweight children.[13,14]

Methodology

This community-based cross-sectional study aimed to investigate the association between anemia and socioeconomic status (SES) among adolescent girls aged 10–19 years in Zakir Nagar, a residential area in Southeast Delhi known for its diverse socioeconomic population. The study included girls who provided informed consent and met the inclusion criteria.

Participants were thoroughly briefed on the study's objectives, and written consent or assent was obtained to confirm their willingness to participate. Data were collected through face-to-face interviews using a semi-structured, pretested questionnaire, which was translated into Hindi to ensure comprehension in the local language. Participants were also interviewed after providing informed consent. Participation was voluntary, and those who declined consent were excluded from the study. Strict measures were taken to maintain data confidentiality, ensuring that no identifying information about participants or their guardians would be disclosed in any study-related publications.

The Kuppuswamy's SES Scale was used to assess the participants' socioeconomic standing. Three important elements were considered by this scale: the household head's income, occupation, and degree of education. The participants were categorized into three groups – SES groups based on these criteria: high, middle, and low. The categorization shed light on the living circumstances, resource availability, and possible health consequences of the participants, enabling a thorough comprehension of how SES may affect anemia in the study's teenage girls.[15]

The digital Hb meter (Sensa core Hemo spark) was used to check the Hb levels of all participants. The Hb level of every individual was categorized according to the WHO classification, which stated that Hb levels below 8 g/dL were considered severe anemia, levels between 8 and 10.99 g/dL were classified as moderate anemia, and levels from 11 to 11.9 g/dL were defined as mildly anemic. Hb levels of 12 g/dL or above were considered normal.[10]

The research protocol, informed consent form, and undertaking form were approved by the Jamia Hamdard Institutional Ethics Committee. Statistical analysis was performed using IBM SPSS statistics 25 (2017, IBM Corporation, USA), with the Chi-square test employed to evaluate the association between anemia and SES. A significance level of $P < 0.05$ was used to determine statistical significance.

Results

The study included 371 adolescent girls aged 10–19 years from Zakir Nagar in Southeast Delhi. The overall prevalence of anemia among the participants was 53.37% (198 out of 371), with varying levels of anemia severity based on Hb measurements. Mild anemia (Hb 11–11.9 g/dL) was observed in 24.53% of anemic girls, moderate anemia (Hb 8–10.99 g/dL) in 27.22%, and severe anemia (Hb <8 g/dL) in 1.62% [Table 1 and Figure 1].

Socioeconomic status and anemia prevalence

- Upper class: Among the 12 participants classified as upper class, 5 (41.67%) were anemic, while 7 (58.33%) were nonanemic
- Upper middle class: Of the 41 participants in the upper middle class, 17 (41.46%) were anemic, and 24 (58.54%) were nonanemic
- Lower middle class: This group had the highest representation with 168 participants. Among them, 106

Table 1: Prevalence of anemia according to socioeconomic status of the adolescent girls

Socioeconomic status	Anemic, *n* (%)	Nonanemic, *n* (%)	Total, *n* (%)
Upper	5 (41.67)	7 (58.33)	12 (100)
Upper middle	17 (41.46)	24 (58.54)	41 (100)
Lower middle	106 (63.1)	62 (36.9)	168 (100)
Upper lower	63 (47.01)	71 (52.99)	134 (100)
Lower	7 (43.75)	9 (56.25)	16 (100)
Total	198 (53.37)	173 (46.63)	371 (100)

χ^2=12.15, with a *P*-value of 0.016, indicating a significant association (P<0.05)

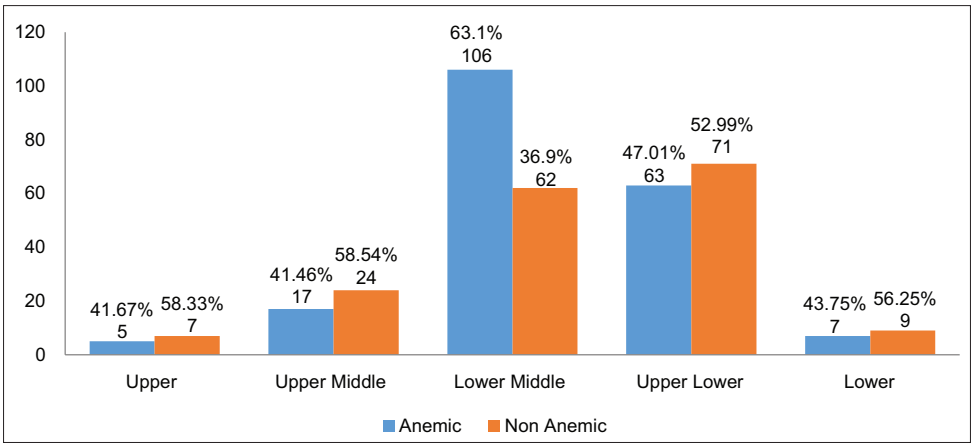

Figure 1: Prevalence of anemia according to the socioeconomic status of the adolescent girls

(63.1%) were anemic, and 62 (36.9%) were nonanemic
- Upper lower class: Out of 134 participants in this category, 63 (47.01%) were anemic, and 71 (52.99%) were nonanemic
- Lower class: In the lower class, 7 out of 16 participants (43.75%) were anemic, while 9 (56.25%) were nonanemic.

The Chi-square test for the association between SES and anemia prevalence yielded a value of $\chi^2 = 12.15$, with $P = 0.016$, indicating a statistically significant relationship ($P < 0.05$). This suggests that SES significantly influences anemia prevalence among adolescent girls in the study area.

Additional observations

- The lower middle class exhibited the highest prevalence of anemia, suggesting that economic challenges in this group may contribute to inadequate nutrition and limited healthcare access
- Despite better socioeconomic conditions, the prevalence of anemia in the upper and upper middle classes was still notable, indicating that factors beyond economic status, such as dietary habits or health education, might also play a role.

Discussion

This study highlights the significant impact of SES on the prevalence of anemia among adolescent girls. The majority of the participants (45.28%) were from the lower middle class, followed by the upper lower class (36.12%). Smaller proportions belonged to the upper middle class (11.05%), with only 4.31% from the lower class and 3.23% from the upper class. This distribution underscores that a substantial portion of the study population comes from lower socioeconomic backgrounds, which are often characterized by limited access to adequate nutrition, health care, and education. These factors are critical determinants of health outcomes, including undernutrition and anemia.

The prevalence of anemia was notably higher among participants from the lower middle class (63.1%), followed by the upper lower class (47.01%) and the upper middle class (41.46%). These findings suggest that adolescents from lower socioeconomic backgrounds are at a greater risk of anemia, likely due to insufficient dietary intake of iron-rich foods, poor healthcare access, and lower health literacy. The significant association between SES and anemia, as indicated by a Chi-square statistic of 12.15 and $P = 0.016$, emphasizes the role of economic disparities in health outcomes.

These findings align with previous research, such as the study by Chandrakumari *et al*., which also identified a higher prevalence of anemia among adolescent girls from lower socioeconomic groups. This correlation suggests that interventions aimed at reducing anemia must address the broader socioeconomic determinants of health. Strategies should include improving access to affordable and nutritious food, enhancing healthcare services, and promoting health education, particularly in lower socioeconomic communities.[8]

A study by Chaudhary *et al*. aimed to estimate the prevalence of anemia among adolescent girls and explore the sociodemographic factors contributing to its occurrence. The findings revealed a significant correlation between anemia and both socioeconomic status and parental literacy levels, closely mirroring the results of the research.[16]

A study by Gore *et al*. assessed the prevalence of anemia and its association with socioeconomic factors. The study found that anemia was more common among younger adolescent girls (aged 10–14 years) and was particularly prevalent in families with low income, illiterate and unemployed parents, and those belonging to the lower-middle and upper-lower socioeconomic classes, reflecting findings similar to the research.[17]

Moreover, the persistence of anemia in higher socioeconomic groups, although less prevalent, points to the need for comprehensive public health initiatives that not only focus on economic factors but also consider cultural practices, dietary patterns, and healthcare behaviors.

Addressing these multifaceted contributors is crucial for effectively reducing the burden of anemia among adolescent girls.

Conclusion

This study highlights the critical role of SES in determining the prevalence of anemia among adolescent girls. The findings clearly show that girls from lower socioeconomic backgrounds face a disproportionately higher risk of anemia, a health issue that significantly affects their well-being and development. The strong association between lower SES and increased anemia rates calls for targeted interventions that go beyond nutritional supplementation.

To effectively combat anemia, it is essential to address the broader socioeconomic factors that contribute to its prevalence. Public health strategies should focus on improving access to affordable and nutritious food, enhancing healthcare infrastructure, and promoting health education in disadvantaged communities. Moreover, addressing socioeconomic disparities in education and income will play a pivotal role in reducing anemia rates and improving overall health outcomes.

Addressing anemia among adolescent girls requires a multi-faceted approach that tackles both immediate nutritional needs and the underlying socioeconomic factors. By implementing comprehensive and targeted strategies, we can reduce the burden of anemia, ensuring healthier, more empowered adolescent girls who can thrive and reach their full potential.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

Measles and Rubella Vaccination Status in a Locality of Delhi and Impact of Socioeconomic Status

Abstract

Background: Measles is a highly contagious viral disease that carries a substantial risk of severe illness, long-term complications, and even death. It spreads swiftly through airborne droplets expelled when an infected individual coughs or sneezes, making its transmission extremely efficient. This study aimed to evaluate the status of measles and rubella (MR) booster vaccination coverage among children and its association with socioeconomic status (SES) in an urban area of Southeast Delhi. **Methodology:** A cross-sectional study was conducted on 210 children. The children were categorized by SES, and their MR booster vaccination status was assessed. **Results:** Overall, out of the 210 children studied, 65 (30.95%) were immunized, while 145 (69.05%) were nonimmunized. The immunization rates varied across different socioeconomic groups: 0% in the upper class, 25.45% in the upper middle class, 35.64% in the lower middle class, 29.27% in the upper lower class, and 27.27% in the lower class. However, statistical analysis indicated no significant association between SES and MR booster vaccination coverage (Chi-square = 1.85; P = 0.60). **Conclusion:** The study revealed low MR booster vaccination coverage across all socioeconomic groups. Findings emphasize the need for enhanced public health interventions targeting immunization awareness and accessibility, regardless of socioeconomic background.

Keywords: *Ḥaṣbā, immunization, measles, socioeconomic status*

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Introduction

Measles is a highly contagious viral disease with significant risks of severe illness, long-term complications, and mortality. It spreads rapidly through airborne droplets, making transmission highly efficient. This study aimed to evaluate the coverage of measles and rubella (MR) booster vaccination among children and its correlation with socioeconomic status (SES) in an urban area of Southeast Delhi. Prior to the widespread availability of the measles vaccine, more than 90% of children globally contracted the disease by the age of 15 years. This resulted in over two million deaths annually and between 15,000 and 60,000 cases of blindness each year. These alarming statistics highlight the critical need for vaccination as an effective strategy to curb the spread of measles and protect public health.[1] Patients with measles often suffer from secondary infections and co-infections caused by pathogens such as parainfluenza virus, *Staphylococcus aureus*, adenovirus, *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Streptococcus pyogenes*.[2] Global measles cases dropped by 84% between 2000 and 2016, thanks to extensive vaccination campaigns spearheaded by the World Health Organization (WHO) and its partners. However, a significant resurgence occurred between 2016 and 2019, with cases surging by 556% to nearly 870,000 – the highest number reported since 1996.[3]

The Unani system of medicine places great importance on the health and well-being of children, emphasizing that proper care and preventive measures during childhood can help avert numerous diseases in later stages of life. Recognizing the natural delicacy and vulnerability of children to infections, Unani scholars have historically given special attention to their illnesses.[4] Prevention and prophylaxis, known collectively as *Hifz-e-Ma-Taqaddum*, are central to Unani medical philosophy. Unani physicians also understood the concept of Tadiah (infection) and acknowledged that environmental factors, such as the quality of air and water, play a significant role in the transmission of diseases.[5] In Unani medicine, measles is

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referred to as "Ḥaṣbā" and is commonly called "*Khasra*" in everyday language. It is described as a highly contagious disease associated with a *Safrawi* (bilious) temperament. Measles are most prevalent during hot and dry seasons, particularly when the environment is characterized by heat and dryness.[4] The renowned Unani scholar Najeebuddin Samarqandi depicted measles rashes as scattered, reddish spots resembling millet grains, slightly elevated above the skin. Unani literature also notes that measles often leave scars after recovery.[6] Additionally, some Unani texts classify measles as a variant of smallpox.[7]

India has been making concerted efforts to enhance immunization coverage for its annual birth cohort of 27 million children through the Universal Immunization Programme. This initiative has achieved remarkable progress in safeguarding children, particularly those under 5 years of age, against preventable and life-threatening diseases. However, while coverage for individual vaccines has been commendable, overall immunization rates have plateaued at approximately 65% in recent years (Rapid Survey on Children 2013–2014).[1] This stagnation continues to contribute to significant levels of morbidity and mortality among children from vaccine-preventable illnesses, highlighting the need for renewed focus and strategies to close the immunization gap.[8] Prior to the COVID-19 pandemic, the coverage for the first dose of the measles–rubella combined vaccine (MRCV1) peaked at an impressive 95% in 2019. However, the pandemic caused a decline, with coverage dropping by 6 percentage points to 89% in both 2020 and 2021. Similarly, the second dose of the measles-containing vaccine (MCV2) experienced a slight decrease, falling from 84% in 2019 to 82% by 2021.[9]

Methodology

Study design

A cross-sectional study was conducted on 210 children. Participants were categorized based on SES, and their MR booster vaccination status was assessed.

Study area and population

The study was conducted in Zakir Nagar, Okhla, situated in the southeastern region of Delhi. This area is relatively less affluent compared to other parts of South Delhi. Zakir Nagar comprises eight blocks, labeled A to H, and contains 45 streets. It is bordered by nearby residential localities such as Khizrabad, Jamia Nagar, Jogabai Extension, Batla House, and Abu Fazal Enclave. With an estimated population of around 80,000, the area is predominantly Muslim, with smaller communities of Hindus, Christians, and Sikhs. A significant portion of the residents consists of migrant workers and landless laborers originating from northern Indian states such as Uttar Pradesh, Rajasthan, Bihar, and parts of Madhya Pradesh.

Sample and sampling technique

The study employed stratified random sampling using the WHO 30-cluster method, encompassing a total of 210 children aged 2–5 years. To ensure fairness and eliminate bias, a computerized random number list was created through an online random number generator using the simple random sampling technique. Once the children were selected, researchers visited their homes to collect data. Crucially, parental consent was obtained beforehand to ensure ethical compliance and transparency in gathering information about the children.[10]

The SES of participants was determined using the Kuppuswamy's SES Scale, which evaluates three key factors: the household head's income, occupation, and educational level. Based on these criteria, participants were classified into three socioeconomic groups: high, middle, and low. This classification provided valuable insights into their living conditions, access to resources, and potential health outcomes.[11]

Inclusion criteria

The study included boys and girls aged 2–5 years to evaluate immunization coverage. Participation was based on the willingness of the children or their guardians and required the parents' or guardians' informed consent through a signed agreement, ensuring ethical compliance and voluntary involvement.

Exclusion criteria

Children above the age of 5 years, regardless of gender, were excluded from the study. Furthermore, individuals whose parents or guardians either refused to participate or did not provide written consent for their involvement were also excluded from the study.

Study tools

1. Data were recorded through a well-structured questionnaire by visiting the subjects
2. Subjects were explained about the study procedures and their consent will be taken after full explanation
3. The questionnaire was in (Hindi, English, and Urdu)
4. Kuppuswamy's socioeconomic scale.

The procedure of the study

The study followed ethical guidelines and received approval from the institutional ethics committee. Data collection was conducted through door-to-door visits within the designated area, targeting children aged 2–5 years. On average, the researcher surveyed 4–5 children daily until a total of 210 children were included. The study's objectives were thoroughly explained to the parents, guardians, or caregivers of the children, and written informed consent was obtained before participation. A structured and validated questionnaire was used to gather information about the sociodemographic, economic, and

educational backgrounds of the caregivers. The child's age was recorded based on caregiver-provided information, along with details regarding measles–rubella vaccination coverage. Additionally, information on the ages of siblings, birth certificates, and vaccination status, as confirmed by vaccination cards, was collected. The study ensured strict confidentiality for all participants, and they were informed of their right to withdraw at any point without any consequences.

Ethical considerations

The study protocol, including the informed consent form, was approved by the Jamia Hamdard Institutional Ethics Committee. At the beginning of each interview, written informed consent was obtained from the parents or guardians of the children involved. They were informed that participation was entirely voluntary, and they had the right to withdraw from the study at any time without any consequences. All personal information was kept confidential. Participants were also given a copy of the information sheet and the signed consent form. The study adhered to Good Clinical Practices throughout its implementation.

Statistical analysis

The collected data were organized and entered into Microsoft Excel. After cleaning and coding the data, advanced statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 26 (IBM SPSS statistics 25 (2017, IBM Corporation, USA)). Descriptive statistics, including frequency, percentage, mean, and median, were calculated using both MS Excel and SPSS.

Results

Among the 210 children, 65 (30.95%) were immunized, while 145 (69.05%) were nonimmunized. Immunization rates varied across different socioeconomic groups: 0% in the upper class, 25.45% in the upper middle class, 35.64% in the lower middle class, 29.27% in the upper lower class, and 27.27% in the lower class. However, statistical analysis indicated no significant association between SES and MR booster vaccination coverage (Chi-square = 1.85; P = 0.60) [Table 1 and Figure 1].

- In the upper middle class, 25.45% of children were immunized, while 74.55% were not
- In the lower middle class, 35.64% were immunized, and 64.36% were not
- Among the upper lower class, 29.27% were immunized, while 70.73% were not
- In the lower class, 27.27% were immunized, whereas 72.73% were not
- The upper class had no immunized children, with 100% not immunized.

These results indicate that there is no statistically significant relationship between SES and MR booster vaccination rates among the children in this study. Despite variations in immunization percentages across different socioeconomic groups, the differences were not significant, suggesting that factors other than SES may influence vaccination uptake.

Discussion

This study was conducted in the Zakir Nagar area of Southeast Delhi to assess the coverage of MR vaccinations and identify the factors influencing vaccination rates. A 30-cluster sampling method, as recommended by the WHO, was employed to evaluate the vaccination status of 210 children. Of the children surveyed, 65 (31%) were vaccinated, while 145 (69%) remained unimmunized.

In the present study, the vaccination coverage of MR was evaluated across different socioeconomic groups. Among the 210 children surveyed, a significant variation in vaccination rates was observed based on socioeconomic status. In the upper-middle-class group, 6.6% of children were vaccinated, while 19.5% remained unimmunized. This indicates a relatively low vaccination coverage, despite the higher socioeconomic status that generally correlates with better access to healthcare services. The lower-middle-class group showed slightly higher vaccination coverage, with 17.2% of children vaccinated, while 31% were not immunized. This suggests that although there is some progress, barriers to vaccination still exist in this socioeconomic category, possibly due to financial constraints or lack of awareness. In the upper-lower-class group, vaccination rates were even lower, with only 5.7% of children vaccinated and 13.8% remaining

Table 1: Status of measles and rubella booster vaccination of children by socioeconomic status (n=210)

Socioeconomic status	Immunized, *n* (%)	Nonimmunized, *n* (%)
Upper class	0	2 (100)
Upper middle class	14 (25.45)	41 (74.55)
Lower middle class	36 (35.64)	65 (64.36)
Upper lower class	12 (29.27)	29 (70.73)
Lower class	3 (27.27)	8 (72.73)
Total	65 (30.95)	145 (69.05)

The Chi-square statistic is 1.85 with a P-value of 0.60, indicating no significant association (P>0.05)

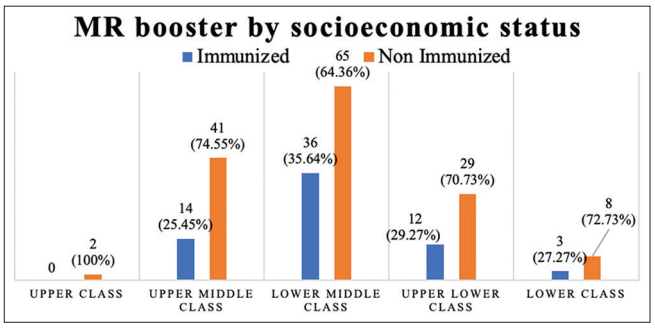

Figure 1: Status of measles and rubella booster vaccination of children by socioeconomic status. MR: Measles and rubella

unimmunized. This highlights the significant challenges faced by families in this socioeconomic bracket, which could include limited access to healthcare facilities, lower levels of education, or financial difficulties. The lowest vaccination coverage was seen in the lower-class group, where only 1.4% of children were vaccinated, and 3.8% were not immunized. This group faces considerable barriers to vaccination, which may be attributed to factors such as extreme poverty, lack of awareness, and insufficient healthcare infrastructure.

A study conducted by Devasenapathy *et al*. in economically disadvantaged urban areas of Delhi reported significantly lower immunization rates compared to the regional average. The findings identified key barriers, including low SES, limited female literacy, and inadequate health awareness. The study emphasized the importance of enhancing education, health literacy, and maternal-child healthcare infrastructure to boost vaccination rates among low-income populations. Furthermore, only 64% of mothers in these areas were found to possess immunization cards, underscoring critical gaps in awareness and access that must be addressed to improve immunization coverage.[12]

A study by Priyadharshini and Jasmine also explored the factors influencing childhood immunization in underserved urban areas of Delhi, reaffirming the significant impact of SES, female literacy, and health awareness on vaccination rates. The research highlighted the necessity of addressing these fundamental challenges while enhancing healthcare infrastructure to guarantee access to life-saving vaccines for children in these communities. Both studies underscore the critical need for targeted interventions to close these gaps and ensure equitable access to essential immunizations for all children, regardless of their socioeconomic background.[13]

These findings suggest that socioeconomic factors play a critical role in determining vaccination coverage, with families from lower socioeconomic backgrounds experiencing greater challenges in accessing vaccination services. The data underscore the need for targeted interventions, including awareness campaigns and improved healthcare access, to bridge these gaps and increase vaccination rates across all socioeconomic groups.

Conclusion

The study revealed low MR booster vaccination coverage across all socioeconomic groups. Findings highlight the need for improved public health initiatives aimed at increasing immunization awareness and accessibility, irrespective of socioeconomic background, with only 30.95% of children being immunized. Despite examining the association between SES and vaccination rates, no significant correlation was observed (Chi-square = 1.85; P = 0.60). The findings emphasize that low vaccination rates persist across all socioeconomic groups, including the upper middle class, lower middle class, and lower class, with immunization rates remaining suboptimal.

These results underscore the urgent need for targeted public health interventions to address barriers to vaccination. Efforts should focus on increasing awareness about the importance of MR booster doses, improving healthcare accessibility, and ensuring equitable vaccine distribution. Enhanced community engagement, maternal education, and outreach programs could play a pivotal role in bridging the gap. Addressing these challenges is essential to achieving higher immunization coverage and reducing the risk of measles outbreaks, ultimately safeguarding children's health and contributing to the goals of the national immunization program.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

Development of a New Dosage Form: Effervescent Tablet of *Qurs Alkali* (a Unani Pharmacopoeial Formulation)

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Abstract

Background and Objectives: Unani system of medicine possesses some very effective antacids, anti-flatulent, and anti-dyspeptic medicines. *Qurs Alkali* (QA) is one of them. It helps to give relief in the fullness of the abdomen, accumulation of gas, chronic stomach pain, constipation, diarrhea, and other gastric ailments. It helps to prevent the bloating sensation and excessive gas formation and also helps to treat the inflammation of the stomach and intestinal lining. Although it is good in action, it is not as fast acting as needed to relieve these types of problems. Effervescent tablets could be a good option for fast action in these acute disorders. Effervescent tablets are solid dosage forms that contain acids (like citric or tartaric acid) and carbonates or bicarbonates, which react in water to release carbon dioxide, producing a fizzy solution that enhances dissolution and palatability of the drug. Hence, an attempt has been made to convert a good-acting tablet into an effervescent one, which must be faster than traditional QA. **Methodology:** Effervescent granules composed of ingredients of QA were prepared into ten batches using different excipients, these batches were analyzed for their physicochemical properties such as effervescent cessation time and solubility and the batch which fulfilled all the criteria was selected as the final batch, which was compressed into effervescent tablets by using direct compression method. Later, these tablets were standardized physico-chemically and were also evaluated for their antimicrobial properties/microbial load. **Observations and Results:** The effervescent cessation time of effervescent tablets was 1.13 ± 0.17, friability was 0.50 ± 0.035 and tablet hardness was found to be 2.13 ± 0.066. Moreover, the physicochemical data regarding standardization have been produced the microbial and fungal count was also found to be nil. **Conclusion:** Redesigning of The Unani pharmacopoeial formulation, QA was achieved by optimization of some appropriate excepeints. The modified dosage form is more elegant, convenient, palatable, and easy to use.

Keywords: *Antacid, effervescent granules, effervescent tablet, Qurs Alkali*

Introduction

From the earliest times, herbs have been prized for their safe and effective healing abilities; today, we also rely on the curative properties of plants in about 75% of our medicines.[1] According to the World Health Organization, about 80% of the population in these countries still relies on traditional or herbal medicines for their primary health-care needs.[2]

In the Unani system of medicine (USM), dosage forms are broadly classified into four categories according to their state, for example, (1) solid dosage forms such as *Ḥabb* (pills), *Qurṣ* (tablet), and *Safūf* (powder). (2) Semi-solid dosage forms such as *Ma'jūn, Jawārish,* and *Iṭrīfal*. (3) Liquid dosage forms such as *Sharbat, Sikanjabīn, 'Araq*. (4) Gaseous dosage forms such as *Bakhūr, Shamūm,* and *Inkibāb*.[3] According to the site and disease, different dosage forms are used. The stomach is a complex organ capable of secreting a great variety of substances into the gastric lumen, vasculature, and interstitium. The most common disorder associated with increased acid secretion is a chronic duodenal ulcer and the most common manifestation of reflux esophagitis is the symptom of heartburn.[4,5]

People with reduced or increased acid levels frequently suffer from the symptoms of elevated stomach acid, including heartburn, peptic ulcer, belching, bloating, nausea, and frequent burping. As a result, they reach for over-the-counter acid-reducing remedies, which can actually encourage greater imbalance and increase the risk of

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developing peptic or duodenal ulcers and even pancreatic or gastric cancer.[5,6]

USM offers several highly effective antacids, anti-flatulent, and anti-dyspeptic medicines. One of them is *Qurs Alkali* (QA), a tablet with antacid, anti-flatulent, and anti-dyspeptic properties.[7] QA is an excellent Unani formulation for managing digestive disorders. It helps relieve abdominal fullness, gas accumulation, chronic stomach pain, constipation, diarrhea, and other gastric complaints. It also helps prevent bloating and excessive gas formation, as well as soothe inflammation of the stomach and intestinal lining.

It is a fact that effervescent tablets are superior to conventional tablets or powders in the specific cases mentioned above because they act more rapidly. In view of this, the following study aims to develop a Unani antacid effervescent tablet of QA to reduce gastric acidity more quickly than traditional QA formulations. Modifications are required in all the three phases of pharmaceutical processing – before, during, and after preparation.[8]

In this study, a Unani dosage form QA mentioned in the National Formulary of Unani Medicine (NFUM) part V was selected to redesign into a more convenient and palatable form, i.e., effervescent tablet. QA is an antacid used for belching *(Al-Jushā')* and heartburn. Ingredients of QA are mentioned in Table 1.[7] Effervescent tablets are those tablets which are designed to disintegrate, when it comes in contact with water or another liquid, releasing carbon dioxide.[9,10] According to the European Pharmacopeia, effervescent tablets are defined as "uncoated tablets generally containing acid substances and carbonates or hydrogen carbonates", which react rapidly in the presence of water to release carbon dioxide.[11]

The manufacture of effervescent tablets is similar to that of conventional tablets, but special care must be exercised to protect the formulation from humidity. A common combination is soda with a weak acid such as citric acid (take citric acid as HA). These react to give carbon dioxide:

$Na_2CO_3 + 2HA \rightarrow 2NaA + CO_2 \uparrow$.

If the tablet is not well designed, the gas may block the pores which retards the entry of water and can suppress disintegration. Formulation of the effervescent tablets by using ingredients of QA, which show delayed disintegration time resulting in delayed effects, may be a good approach. Moreover, effervescent tablets are convenient, attractive, fast in relief, and easy to use.

Composition of the effervescent tablet of *Qurs Alkali*

The composition of the effervescent tablet of QA is given in Table 2. The active ingredient is required to be soluble in water, and the other ingredients used, such as sweeteners, coloring agents, and flavoring agents, are expected to be water-soluble as well.[12]

Table 1: Ingredients of *Qurs Alkali*

Unani name	Scientific name	Quantity
Soda khurdani	Sodium bicarbonate	1 kg
Paste Ararote	*Maranta arundinacea* Linn. (Paste)	300 g
Sang-e-Jarahat Saeeda	Silicate of magnesia	20 g
Magnesia Fahmi	Magnesium carbonate	5 g
Roghan podina	*Mentha piperita* (oil)	1/2 mL
Shamaeen	Liquid paraffin	5 mL

Table 2: Composition of effervescent *Qurs alkali*

Ingredient	Property
QA ingredients	Active ingredient
Sodium bicarbonate	Alkalizing agent
Magnesium carbonate	Alkalizing agent
Citric acid	Acidifying agent
Tartaric acid	Acidifying agent
Gum Acacia	Binder
CMC	Binder and disintegrant
SSG	Disintegrant
Color (Orange Red)	Coloring agent
Flavor (Lemon)	Flavoring agent

CMC: Carboxymethylcellulose, SSG: Sodium starch glycolate, QA: *Qurs Alkali*

Methodology

Initially, ten different batches of effervescent granules composed of ingredients of QA were formulated and named as B1, B2, B3, B4, B5, B6, B7, B8, B9, and B10. The batches that fulfilled the required criteria for granules were selected for preparing tablet. The selected batches of tablets were again evaluated on hardness, friability, and effervescent cessation time to select a final batch. Later final batch of effervescent tablets was physicochemically evaluated.

Design and development of the effervescent tablet of QA were carried out in the following phases.

The study was carried out in four phases. Phase I involved the preparation of effervescent granules. The raw drugs required for the formulation were procured from the pharmacy of the National Institute of Unani Medicine, Kottigepalya, Bengaluru, while all the necessary excipients were obtained from local chemical shops in Bengaluru. The collected ingredients were then used for the preparation of effervescent granules. Phase II focused on the preparation of effervescent tablets, which included the selection of a suitable batch followed by the formulation of the tablets. Phase III comprised the physicochemical evaluation of the prepared effervescent tablets to assess their quality and consistency. Finally, Phase IV involved the determination of the microbial and fungal counts of the effervescent tablets to ensure their safety and compliance with standard microbiological limits.

Before preparing the effervescent granules, the QA granules were made by passing sodium bicarbonate

through an 80-mesh sieve. A paste of arrowroot was then added to the sodium bicarbonate and passed through a 16-mesh sieve. The mixture was dried, and the dried mass was further passed through a 20-mesh sieve. Liquid paraffin was subsequently added to the granules, followed by Mentha piperita oil, magnesium carbonate, and ground soapstone. Preformulation studies were also conducted, and various batches were prepared by optimizing the concentrations of tartaric acid, citric acid, and sodium bicarbonate. The batch that provided the best effervescence and solubility was selected for the final study.[12] Different batches of effervescent granules were then prepared with the varying concentrations of excipients based on these observations.

Formulation of different batches of effervescent granules of *Qurs Alkali*

A total of ten batches (B1 to B10) of effervescent granules were made by using QA ingredients with different concentrations of excipients such as sodium bicarbonate, citric acid, tartaric acid, *Acacia*, CMC, SSG, color, and flavor which is mention in Table 2, while the different batches of effervescent granules are mention in Table 3.

Each batch was prepared by first weighing all the required ingredients separately in appropriate quantities and reducing them to a fine powder. The acidic excipients, along with sodium bicarbonate and magnesium carbonate, were sieved through an 80-mesh sieve to ensure uniform particle size, after which all the powdered ingredients were thoroughly mixed. Due to the presence of the binder and liquid flavor, the mixture formed a small damp mass, which was passed through a 16-mesh sieve to obtain granules. These granules were then dried in a hot air oven at 60°C for 30 min and re-sieved through a 16-mesh sieve to achieve uniform size. The dried granules were stored in a desiccator and later transferred to an air-tight glass container with humidity maintained below 30%. All ten prepared batches, as mentioned in Table 3, were physically evaluated for batch finalization based on parameters such as effervescence cessation time, bulk density, tapped density, Carr's index, Hausner's ratio, and angle of repose.

In Phase II, for the development of effervescent tablets, five batches of effervescent granules (B3, B5, B6, B7, and B8) were selected based on the above evaluation parameters for tablet formulation. Tablets were prepared using a rotary press machine, which was thoroughly cleaned and dried before use. The same procedure was applied for all five batches. Among these, one batch was chosen based on tablet hardness, friability, and effervescence cessation time; batch B5 was found to meet all criteria and was finalized as the QA effervescent tablet (QAET) for further physicochemical evaluation.

In Phase III, the physicochemical studies of QAET were carried out in the laboratory of the Department of Ilmul Saidla, NIUM, Bengaluru. These studies included the determination of organoleptic properties, tablet hardness,[13-15] friability,[13-15] weight variation,[16] effervescence time,[17] CO_2 gas content,[17] water content,[17] and equilibrium moisture content.[14]

In Phase IV, microbial analysis of the effervescent tablets was conducted at Azyme Biosciences Private Limited, Bengaluru, which included total microbial count, total bacterial count analysis, and total fungal count analysis to ensure the microbial safety and quality of the final product.[18]

Observations and Results

A total of ten batches of effervescent granules were prepared by using ingredients of QA and excipients were added which are necessary for effervescent granules. All the batches were assessed on various parameters such as effervescent cessation time [Table 4], bulk density [Table 4], tapped density [Table 4], Carr's index [Table 4], Hausner's ratio [Table 4] and angle of repose [Table 4]. After keen observation of the values, found in different batches, one batch with suitable results was finalized based on the values which were found to be nearer to the standard values prescribed for granules.

Tablets were formulated by five selected batches i.e. B3, B5, B6, B7, and B8.

Table 3: Batches of effervescent granules (%)

Ingredients	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
QA ingredients	20	20	20	20	20	20	20	20	20	20
Sodium bicarbonate	20	30	30	-	25	30	30	25	30	20
Citric acid	23	28	-	25	10	-	-	10	-	25
Tartaric acid	30	-	43	35	36	35	40	36	40	25
Magnesium carbonate	-	10	-	8	-	3	-	-	-	5
Acacia	5	10	5	8	-	-	5.5	-	-	5
CMC	-	-	-	-	5	10	-	5	5.5	-
SSG	-	-	-	2	2	-	2.5	2	2.5	-
Color	1	1	1	1	1	1	1	1	1	1
Flavor	1	1	1	1	1	1	1	1	1	1

CMC: Carboxymethylcellulose, SSG: Sodium Starch Glycolate, QA: *Qurs Alkali*

Formulation and assessment of different batches of *Qurs Alkali* effervescent tablet for final selection of the batch

The five selected batches were evaluated to finalize one single batch for the final physicochemical evaluation. The parameters, that suggested the final batch for effervescent tablets are the hardness of the tablet [Table 5], friability of the tablet [Table 5], effervescent cessation time of the tablet [Table 5], CO_2 gas content [Table 5], and moisture content of the tablet [Table 5].

On the basis of the above-mentioned tests, the batch that was nearer to standard parameters was batch 5 (B5), and later B5 was then evaluated for physicochemical standards.

Physicochemical observations of *Qurs Alkali* effervescent tablets (batch B5)

The appearance of QAET was found to be uniform, with an orange color. It possessed an aromatic, pungent, and lemon-like odor, while its taste was found to be sour.

The quality evaluation of QAET tablets was carried out through various physicochemical parameters. The mean percentage of tablet hardness was found to be 2.13 ± 0.066, whereas the mean percentage of tablet friability was observed to be 0.50 ± 0.035. The mean effervescent cessation time was recorded as 1.13 ± 0.17 s, and the mean percentage of CO_2 gas content was determined to be 10.39 ± 0.1126. In addition, the mean percentage of moisture content was found to be 13.85 ± 0.4709, and the mean percentage of weight variation was observed as 1.04965 ± 0.005. These findings collectively indicate the acceptable quality and consistency of the QAET tablets.

The total microbial analysis of the tablet specimen revealed that the total microbial count was found to be nil, indicating the absence of any bacterial colonies in the sample. Similarly, the total fungal count was also found to be nil, confirming that no fungal colonies were present in the tablet specimen.

Discussion

As we are encountering a resurgence of interest in the use of herbal products, herbal "renaissance" is happening globally.[19] Nowadays, people prefer herbal medicines which are popular for being safe, effective, and economical. Most of the common health issues and the natural methods of alternative treatment being shown to produce better results than Western medicines without any side effects is one of the important factors for popularizing the traditional system of medicine. USM is one of the most popular systems of medicine in effectively treating many of the common health issues.

This article reviewed the literature regarding QA and a needed change is required for its improved version. With many advantages, tablets also have a few disadvantages such as, (a) difficult to swallow in case of-children, unconscious patients and old patients and (b) Drugs with slow dissolution properties can lead to inadequate drug bio-availability in the body.[12,20] Hence, by keeping the disadvantages of tablets in mind, an approach was made to develop effervescent tablets from a Unani formulation "*Qurs Alkali*" which is an antacid. Effervescent tablets offer several notable advantages. They eliminate the need for swallowing, making them especially suitable for patients who have difficulty taking conventional tablets. These formulations provide better stability and enhance palatability, improving patient compliance. Effervescent tablets are also convenient to carry and offer improved therapeutic effects. Additionally, they cause less irritation

Table 4: Mean effervescent cessation time and angle of repose of different batches of *Qurs Alkali* effervescent granules

Batch number	Effervescent cessation time (s)	Angle of repose	Bulk density	Tapped density	Carr's index	Hausner's ratio
B1	59.70	41.0089	0.6122	0.7894	22.4489	1.2894
B2	60.10	40.2796	0.6250	0.7894	20.8333	1.2631
B3	54.51	40.3997	0.6382	0.7500	14.8936	1.1750
B4	60.20	40.7633	0.6250	0.7500	16.6666	1.2000
B5	53.55	40.3997	0.6250	0.7894	20.8333	1.2631
B6	50.19	40.8860	0.6122	0.7692	20.4081	1.2564
B7	52.30	40.1603	0.6250	0.7500	16.6666	1.2000
B8	53.10	40.2796	0.6382	0.7500	14.8936	1.1750
B9	60.25	39.9232	0.6122	0.7692	20.4081	1.2564
B10	60.10	40.5205	0.6122	0.7894	22.4489	1.2894

Table 5: Physicochemical parameters of *Qurs Alkali* effervescent tablet

Serial number	Tablet hardness	Tablet friability (%)	Effervescent cessation time	Co_2 gas content (%)	Moisture content (%)
1	2.2	0.44	1.10	10.59	14.54
2	2	0.56	1.16	10.20	12.95
3	2.2	0.52	1.13	10.39	14.06
Mean±SEM	2.13±0.066	0.50±0.035	1.13±0.17	10.39±0.1126	13.85±0.4709

SEM: Standard error of mean

and are generally better tolerated, while their rapid disintegration and absorption ensure quicker relief.[21] The formula of QA for the present study was taken from the NFUM (part V),[7] and the method of preparation was taken from Hamdard Pharmacopoeia.[22]

All ten batches of granules were subjected to physical evaluation in the laboratory of the Department of Ilmul Saidla, NIUM, Bengaluru, to finalize the optimal batch. The evaluation included (1) effervescence cessation time, (2) bulk density, (3) tapped density, (4) Carr's index, (5) Hausner's ratio, and (6) angle of repose. Various batches of effervescent tablets were prepared by optimizing the concentration of sodium bicarbonate, magnesium carbonate, *Acacia*, citric acid, tartaric acid, CMC, and SSG standard values. These batches were evaluated for different physicochemical properties.

Based on the parameters mentioned above, batch 5 was found to be the most suitable and met all the necessary criteria. Therefore, it was selected as the final batch and further evaluated for hardness, friability, effervescence cessation time, weight variation, CO_2 gas content, water content, and microbial analysis. Moreover, the physicochemical properties of QAET were evaluated, including organoleptic characteristics such as appearance, color, odor, and taste, as well as tablet hardness, friability, weight variation, effervescence cessation time, CO_2 content, water content, and moisture content. In the final phase, microbial and fungal counts of the effervescent tablets were assessed, and both total bacterial and total fungal counts were found to be nil. The present study aims to understand and develop a Unani antacid effervescent tablet of QA to enhance its usability, making it a more effective and reliable formulation.

Conclusion

The treasure of Unani medicine which is considered safe, effective, and economical can be exploited well and the benefit of Unani Pharmacopeial formulation QA can be achieved by modifying it into an effervescent tablet by the optimization of some appropriate excipients. The modified dosage form is more elegant, convenient, palatable, fast in relief, and easy to use which is a present day need. A clinical comparative study can be carried out in future to assess the efficacy of modified QAET in comparison with QA mentioned in Unani texts. This paper gathers all possible information targeting the key issue of developing a newer and better form of QA, thereby creating a more secure platform for the utilization of this formulation and adding a valuable contribution to mankind.

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Conflicts of interest

There are no conflicts of interest.

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Case Report

Successful Management of Erosive Gastritis with Unani Formulations: A Case Report

Abstract

Erosive gastritis is a common gastrointestinal disorder characterized by mucosal inflammation and surface erosions, often presenting with epigastric burning, nausea, and abdominal discomfort as symptoms. Although many patients respond well to conventional therapy, untreated or chronic erosive gastritis may lead to complications such as upper gastrointestinal bleeding, gastric ulcers, and an increased risk of gastric cancer. Therefore, alternative therapeutic approaches, including Unani medicine, are being increasingly explored for their potential efficacy and tolerability. This case report presents a 55-year-old female homemaker with an 8-year history of recurrent gastritis who presented with persistent epigastric burning, occasional nausea, and abdominal discomfort. Endoscopy revealed diffuse mucosal erythema and erosions, indicating erosive gastritis. Laboratory findings were unremarkable, except for mildly elevated liver enzymes. Treatment included a Unani regimen *Jawārish Anārayn, Ḥabb-i Ḥiltīt, Arq-i Kāsnī, Arq-i Bādiyān*, and *Sufūf-i Hāḍim* with dietary modifications per '*Ilāj bil Ghizā* principles. Over the course of 8 weeks, the patient's epigastric burning and dyspepsia were fully resolved without any reported adverse effects. During the 2-week post-treatment follow-up, the patient remained asymptomatic and required no additional medication. This case suggests that Unani formulations may be a safe and effective option for erosive gastritis when used with dietary and lifestyle changes. This regimen supports symptom relief and mucosal recovery. Additional studies are needed to confirm these results and investigate their mechanisms.

Keywords: *Erosion, gastritis, Helicobacter pylori, Unani medicine, Warm-e-Meda*

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Introduction

Erosive gastritis is characterized by the erosion of the stomach lining, often occurring without significant microscopic inflammation. It is commonly identified through endoscopic findings and is caused by various irritants or chemicals, including nonsteroidal anti-inflammatory drugs (NSAIDs), alcohol, stress-related mucosal damage, and *Helicobacter pylori* infection.[1,2] Patients may present with upper abdominal pain, nausea, vomiting, indigestion, and, in severe cases, black stools or hematemesis.[3] Diagnosis is primarily established via endoscopy, which reveals erosions, erythema, and mucosal changes, while histological examination and immunohistochemistry can provide further insights into molecular mechanisms and potential therapeutic targets.[4] Management focuses on treating the underlying cause and relieving symptoms using proton pump inhibitors, H_2-receptor antagonists, antacids, and avoidance of irritants.[3,5] In cases of significant bleeding, endoscopic interventions may be necessary, and emerging biomarkers are being explored to enhance treatment outcomes.[6] Although many patients respond well to therapy, untreated or chronic erosive gastritis may lead to complications such as upper gastrointestinal bleeding, gastric ulcers, and an increased risk of gastric cancer.[6,7]

Therefore, it is essential to investigate alternative therapeutic approaches for the management of erosive gastritis. The Unani system of medicine may address this need, as it offers a substantial range of therapeutics for gastrointestinal disorders. Unani physicians categorize gastritis under names such as *Warm-i Mi'da, Iltihāb-i Mi'da, Sozish-i Mi'da*, and *Hurqat-i Mi'da*. The disease process emphasizes inflammation (*Warm*) of the gastric mucosa that, if prolonged, results in erosion (*Saḥaj*) or even ulceration (*Qurūḥ-i Mi'da*).[8]

According to Unani medicine, *Warm-i Mi'da* occurs when the stomach's natural

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hot, moist temperament becomes excessively heated or altered due to diet, lifestyle, or emotional factors. Ulcer develops due to infiltration of *Khilṭ Hād* (irritant and corrosive humor) in the stomach.[9] This leads to weakness in the digestive faculty (*Quwwat-i Hazima*), excessive thirst (‘*Atash*), heartburn (*Hiddat-i Mi’da*), nausea and vomiting (*Qay’*), flatulence (*Nafkh*), and loss of appetite. The disease can manifest as *Warm-i Mi’da Ḥār* (hot inflammation), *Bārid* (cold), or *Muzmin* (chronic), depending on the causative factors and humor involved.[8]

Unani scholars emphasized that when *Ṣafrā’* (yellow bile) becomes dominant or abnormally produced in the liver and reaches the stomach, it causes intense irritation, leading to *Warm-i Mi’da Hār*. In contrast, chronic conditions may involve dominance of *Sawdā’* (black bile) or altered sanginous humor (*Dam Fāsid*), leading to long-standing mucosal inflammation. Furthermore, Unani scholars recognized that emotional factors, such as excessive grief (*Huzn*) or anger (*Ghaḍab*), disrupt internal balance and indirectly influence gastric function, an idea now supported by modern evidence of gut-brain axis dysfunction in functional dyspepsia and stress-induced gastritis.[8,10]

Unani medicine treats *Warm-i Mi’da* (gastritis) through a holistic approach, focusing on correcting temperament, eliminating harmful substances, strengthening the stomach, aiding digestion, and removing causative factors. Drug selection is based on properties like digestive support, gastric strength, heat reduction, bile removal, carminative, and demulcent effects.[10] This case demonstrates complete symptom resolution of erosive gastritis using only a Unani regimen with no adverse effects, supporting its potential for gastrointestinal disorders and highlighting the need for further research.

Case Report

A 55-year-old female homemaker presented with a persistent burning sensation in the epigastric region for the past 8 years. The discomfort was noted to worsen after meals and was occasionally accompanied by mild nausea and abdominal uneasiness. She denied any episodes of hematemesis, melena, loss of appetite, or unexplained weight loss. Her past medical history was unremarkable, with no known diagnosis of hypertension, diabetes mellitus, thyroid disorders, or other chronic illnesses. She reported no drug allergies and did not consume alcohol or tobacco. There was no significant family history of gastrointestinal diseases or malignancy.

On examination, the patient appeared well-nourished, alert, and comfortable. She was afebrile, and her vital signs were within normal limits. Abdominal examination revealed a soft, non-distended abdomen with localized tenderness over the epigastric region. There was no guarding, rigidity, or palpable organomegaly, and bowel sounds were normal.

Upper gastrointestinal endoscopy demonstrated erythematous changes and superficial erosions in the gastric mucosa, findings suggestive of erosive gastritis. There was no evidence of peptic ulcer disease (PUD), active bleeding, or malignant lesions. Based on the clinical presentation and endoscopic findings, a diagnosis of erosive gastritis was established.

Timeline

The sequence of study events is shown in Table 1.

Diagnostic assessment

The patient presented with post-prandial epigastric burning, nausea, and localized tenderness. The differential diagnoses considered included PUD, gastroesophageal reflux disease (GERD), functional dyspepsia, and gastric malignancy. PUD was excluded based on the endoscopy, while GERD was deemed unlikely due to the specific location of symptoms and the absence of classic signs. Functional dyspepsia was considered less probable since endoscopic mucosal changes pointed toward an organic cause. Gastric malignancy was ruled out as there were no masses or suspicious lesions on examination. Endoscopy ultimately revealed diffuse erythema and erosions in the gastric antrum and body, without the presence of ulcers or masses, leading to a diagnosis of erosive gastritis.

To further assess systemic involvement and exclude other potential etiologies, a panel of routine laboratory investigations was performed. The results are summarized in Table 2.

Therapeutic intervention

The patient was initiated on a Unani pharmacological regimen, continued for 8 weeks. Details of the prescribed formulations, their dosages, pharmacological actions, and roles in management are summarized in Table 3.

In addition to pharmacotherapy, the patient was counseled on dietary modifications based on Unani principles of *‘Ilāj bil Ghidhā* (dietotherapy). The patient was advised to avoid spicy, oily, and acidity-causing foods while preferring light, bland meals to minimize gastric irritation and promote mucosal healing.[11]

Follow-up and outcomes

The patient was monitored biweekly for a total of 8 weeks following the initiation of the Unani therapeutic regimen. In addition, a posttreatment follow-up was conducted 2 weeks after completion of the treatment.

Table 1: Timeline of events

Date	Event
June 23, 2025	Initial consultation: Patient presented with epigastric burning, mild nausea, and abdominal discomfort
August 18, 2025	Last follow-up visit: Patient reported symptomatic improvement with ongoing management
September 01, 2025	Posttreatment follow-up: The patient reported no recurrence of symptoms following the completion of treatment

Table 2: Laboratory and diagnostic investigation results

Investigation	Result	Reference Range	Interpretation
Total leukocyte count	7000/mm^3	4000–11,000/mm^3	Normal
Liver function tests (mg/dL)			
Bilirubin, total	0.50	0.20–1.20	Normal
Bilirubin, conjugated	0.20	0.0–0.3	Normal
Bilirubin, indirect	0.30	0.0–1.1	Normal
ALT/SGPT (U/L)	106	9–52	Elevated
AST/SGOT (U/L)	64	14–36	Elevated
Alkaline phosphatase (U/L)	83	38–126	Normal
Total protein (g/dL)	7.70	6.3–8.2	Normal
Albumin (g/dL)	4.00	3.5–5.0	Normal
Globulin (g/dL)	3.70	2.0–3.5	Slightly elevated
A/G ratio	1.08	0.9–2.0	Normal
Helicobacter pylori	Negative	Negative	Negative
Upper GI endoscopy	Erythema and erosions in gastric mucosa	-	Consistent with erosive gastritis
HIV 1 and 2	Nonreactive	-	Negative
HBsAg	Nonreactive	-	Negative
HCV	Nonreactive	-	Negative
Thyroid profile	-	-	-
T3 (ng/mL)	1.42	0.69–2.15	Normal
T4 (µg/dL)	8.22	5.20–12.70	Normal
TSH (µIU/mL)	3.82	0.3–4.5	Normal

SGPT: Serum glutamic-pyruvic transaminase, AST: Aspartate aminotransferase, HBsAg: Hepatitis B virus, ALT: Alanine aminotransferase, SGOT: Serum glutamic-oxaloacetic transaminase, HCV: Hepatitis C virus, GI=Gastrointestinal, TSH: Thyroid-stimulating hormone, HIV: Human immunodeficiency virus

Table 3: Unani therapeutic interventions prescribed to the patient

Formulation	Dose and timing	Action	Role in management
Jawārish Anārayn	5 g, twice daily after meals	*Muqawwī-i Mi'da, Musakkin-i Ḥarārat*	Strengthens the stomach, reduces gastric heat and irritation[11]
Ḥabb-i Ḥiltīt	1 tablet, twice daily with lukewarm water	*Mufattiḥ-i Sudad, Muhallil-i Riyāḥ, Mu'īn-i Ḥaḍm*	Relieves flatulence, stimulates digestion[11]
Arq-i Kāsnī	50 mL, twice daily before meals	*Musakkin, Muqawwī-i Jigar, Muḥallil*	Cooling, hepatoprotective, reduces inflammation, soothes gastric mucosa[11]
Arq-i Bādiyān	50 mL, twice daily before meals	*Musakkin-i Sū-i Ḥaḍm, Muḥarrik-i Mi'da, Muḥallil-i Riyāḥ*	Antacid effect, enhances gastric motility, relieves postprandial discomfort[11]
Sufūf-i Hāḍim	5 g, twice daily after meals	*Muqawwī-i Mi'da, Muhallil-i Riyāḥ*	Strengthens stomach, relieves flatulence[11]

At the initial follow-up, the patient reported substantial symptomatic improvement, with a marked reduction in postprandial epigastric burning and abdominal discomfort. Clinical reassessment corroborated these findings, as localized epigastric tenderness was notably diminished.

By the 8-week follow-up, the patient experienced complete resolution of dyspepsia and epigastric burning. On clinical examination, the abdomen was soft and non-tender, with no signs of gastric irritation. No additional investigations were deemed necessary, as both patient-reported outcomes and clinician-assessed findings indicated significant recovery.

Intervention adherence was assessed through direct questioning and a review of the patient's medication usage log. The patient reported full adherence to the prescribed Unani regimen and strict compliance with recommended dietary modifications based on *'Ilāj bil Ghidhā*.

The therapeutic interventions were well-tolerated throughout the treatment period. No adverse drug reactions, unanticipated effects, or complications were observed. On a posttreatment follow-up at 2 weeks, the patient remained symptom-free, without recurrence of dyspepsia or epigastric discomfort, and required no additional pharmacological intervention.

Discussion

This case report demonstrates the successful management of erosive gastritis using a Unani-based pharmacological regimen, which integrated traditional formulations with dietary modifications. The therapeutic approach was

designed to target the underlying pathophysiological mechanisms of erosive gastritis, i.e., mucosal inflammation, gastric hyperacidity, and impaired digestion while supporting mucosal healing and restoring gastrointestinal function.

The primary formulation, *Jawārish Anārayn*, was prescribed owing to its well-documented *Muqawwī-i Mi'da* (stomach-tonic) and *Musakkin-i Ḥarārat* (heat-reducing) properties as described in classical Unani texts. It strengthens the gastric mucosa, regulates digestive functions, and alleviates excessive gastric heat and irritation, thereby contributing to a significant reduction in postprandial epigastric burning and discomfort. The main ingredients of *Jawārish Anārayn* are *Āb Anār Shīrīṇ* (*Punica granatum* L. sweet ripe fruit) and *Āb Anār Tursh* (*Punica granatum* L. sour unripe fruit juice).[11] Pharmacologically, *P. granatum* has demonstrated significant anti-inflammatory, antioxidant, and mucosal protection effects, which are crucial in managing gastritis. Pomegranate extracts suppress the activation of inflammatory pathways, including COX-2 and NF-kB, which are involved in the inflammatory response of gastritis.[12,13] The polyphenols in *P. granatum*, such as punicalagin and ellagic acid, exhibit strong antioxidant activity by scavenging free radicals and enhancing the levels of endogenous antioxidants.[12,14] The extracts increase the levels of protective agents like prostaglandin E2 (PGE2) and NO, which play a role in maintaining the mucosal barrier and promoting healing.[15,16] Moreover, in experimental models, pomegranate extracts have shown comparable efficacy to standard anti-ulcer medications like omeprazole.[17]

Ḥabb-i Ḥiltīt was included for its *Mufattiḥ-i Sudad* (de-obstruent), *Muhallil-i Riyāḥ* (carminative), and *Mu'īn-i Ḥaḍm* (digestive stimulant) actions. The main ingredient of *Ḥabb-i Ḥiltīt* is *Ḥiltīt* (*Ferula asafoetida* H. Karst. oleo-gum-resin). Gastric dysmotility and bloating are common in erosive gastritis, and this formulation might have facilitated the resolution of these symptoms by improving gastric motility and stimulating digestive secretions, leading to enhanced postprandial comfort.[11] Pharmacologically, an aqueous asafoetida suspension reduced ulceration induced by basal acid secretion and replenished gastric wall mucus in rats, consistent with an antisecretory/cytoprotective role.[18] Moreover, several studies observed reduced oxidative injury markers and suggested that free-radical scavenging contributes to mucosal protection.[18,19] In addition, increases in tissue PGE2 and vascular endothelial growth factor were reported with *Ferula* extracts, supporting enhanced mucosal defence and healing. In addition, inhibition of Nuclear Factor kappa B (NF-kB) p65 expression and reduction of inflammatory markers were observed in chronic ulcer models, indicating inflammation suppression as a healing mechanism.[19,20] In addition, pretreatment with asafetida reduced damage in indomethacin models, implying relevance to NSAID-associated erosive gastritis.[21]

Arq-i Kāsnī, a distilled preparation derived from *Cichorium intybus* L., exhibits potent anti-inflammatory and hepatoprotective effects, aligning with its classical descriptions as *Musakkin* (cooling) and *Muqawwī-i Jigar* (liver tonic).[11] Its ability to reduce gastric inflammation and soothe the mucosa was particularly relevant in this case, where endoscopic findings revealed erythema and erosions. By mitigating inflammatory responses, it likely facilitated mucosal recovery. Pharmacologically, *C. intybus* has demonstrated antisecretory activity, enhancement of mucosal defense, anti-inflammatory, and antioxidant actions. *C. intybus* root and leaf extracts have shown gastroprotective effects in experimental models of gastric ulcers in rats. This effect is attributed to its antisecretory activity and the enhancement of the gastric mucosa's defense barrier function.[22,23] The leaf extracts, both aqueous and ethanol, have been effective in reducing gastric juice volume, increasing pH, and decreasing acid output and ulcer index in indomethacin-induced gastric ulcers in rats.[23] The antioxidant properties of *C. intybus* play a significant role in its gastroprotective effects. By inhibiting lipid peroxidation, the plant helps protect the gastric mucosa from oxidative damage.[23] Additionally, its anti-inflammatory properties contribute to reducing inflammation in the gastric mucosa, which is beneficial in conditions like erosive gastritis.[24,25]

Arq-i Bādiyān, prepared from *Foeniculum vulgare* Mill., served as a natural antacid and carminative, corresponding to its Unani attributes of *Musakkin-i Sū-i Ḥaḍm* (digestive soothing) and *Muḥarrik-i Mi'da* (stomach stimulant).[11] Pharmacologically, aqueous extracts of *F. vulgare* (fennel) have reduced ethanol-induced gastric damage significantly, with the highest protective effect observed at a dose of 300 mg/kg. This protective effect was attributed to the reduction in lipid peroxidation and enhancement of antioxidant activity, including increased levels of reduced glutathione, nitrite, nitrate, ascorbic acid, retinol, and β-carotene.[26] Moreover, fennel suspension administered orally showed dose-dependent ulcer protective effects against pyloric ligation, hypothermic restraint stress, indomethacin, and necrotizing agents like ethanol. The protective mechanism involves replenishing reduced nonprotein sulfhydryls (NP-SH) and modulating malondialdehyde (MDA) contents in the gastric tissue, which helps in reversing histopathological lesions characterized by mucosal hemorrhages and edema.[27] In addition, the essential oil of *F. vulgare* has shown anti-inflammatory effects by inhibiting the NF-kB pathway in acetic acid-induced colitis in rats, which suggests a potential mechanism for its protective effects in gastric inflammation.[28] In addition, compounds like (-)-Fenchone found in fennel essential oil have

demonstrated preventive antiulcer effects by reducing ulcerative injury and enhancing gastric healing through antioxidant and immunomodulatory properties.[29]

Sufūf-i Hāḍim was prescribed owing to its well-documented *Muqawwī-i Mi'da* (stomach-tonic) and *Muhallil-i Riyāḥ* (flatulence relieving) properties as described in classical Unani texts. Pharmacologically, the key ingredients of *Sufūf-i Hāḍim,* like *Piper nigrum* L., *Foeniculum vulgare* Mill., and *Carum carvi* L., demonstrated antioxidant, anti-inflammatory, and microbial modulation activity. *Piperine,* an active compound in black pepper, has shown anti-inflammatory effects in *H. pylori*-induced gastritis. It suppressed the infiltration of neutrophils and mononuclear cells in the gastric tissues of infected gerbils, indicating potential benefits in reducing gastric inflammation.[30] Caraway seed extracts have demonstrated antibacterial properties against *H. pylori*, a common cause of gastritis. This suggests a potential role in managing bacterial-induced gastric inflammation.[31]

The observed clinical improvement, with complete symptom resolution within 8 weeks and sustained remission at the 2-week follow-up, underscores the synergistic effect of these formulations. No adverse events or drug-related complications were reported, highlighting the tolerability and safety of this regimen. Importantly, patient adherence was optimized through simplified dosing schedules and active counseling on *'Ilāj bil Ghizā* (dietary regulation), which included avoidance of spicy, acidic, and heavy meals, alongside preference for light, easily digestible foods.

The unique aspect of this case lies in the complete symptomatic resolution with Unani treatment alone, without the use of conventional allopathic drugs. Furthermore, the absence of adverse effects and the patient's sustained recovery emphasize the safety and tolerability of these formulations.

From a clinical perspective, this case suggests that Unani regimens have the potential to be considered as adjuncts or alternatives in the management of erosive gastritis, especially for patients who are intolerant to or unwilling to use modern pharmacological agents. However, larger controlled clinical studies are needed to validate these findings and establish evidence-based guidelines.

Patient perspective

I have had stomach problems for 8 years and tried lots of treatments, but they only helped for a little while. Over the past 2 months, Unani medicine has made a big difference. I barely have any symptoms now, and it works better than anything else I tried.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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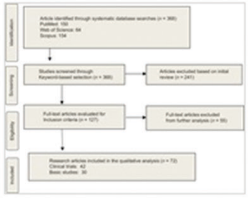

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