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Therapeutic and Nutritional Insights into Jaggery (*Gur*): A Unani Perspective with Biomedical Evidence

Abstract

Jaggery (*Gur*) is a traditional unrefined sweetener obtained from sugarcane juice or palm sap and has long been valued in Unani medicine for its nutritional and therapeutic uses. Unlike refined sugar, jaggery retains molasses, which provides essential minerals and bioactive compounds. Classical Unani texts describe jaggery as a digestive, blood-enriching, expectorant and restorative agent, with applications in conditions such as anaemia, respiratory disorders and general weakness. Recent scientific studies support several of these traditional claims by demonstrating its antioxidant, anti-inflammatory and haematinic properties, along with its potential to improve nutritional status. Its use in functional foods has further expanded its relevance in modern dietary practices. However, due to its glycaemic effect, careful consumption is advised, particularly in individuals with metabolic disorders. Overall, jaggery represents a valuable link between traditional knowledge and modern nutritional science and offers significant potential as a functional dietary component. Further clinical and pharmacological studies are needed to establish its therapeutic efficacy, safety and optimal use.

Keywords: Jaggery; Gur; Unani medicine; antioxidant; haematinic; glycaemic index; traditional medicine

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1. Introduction

Jaggery, locally known as Gur in India, is an unrefined natural sweetener prepared by concentrating sugarcane juice or palm sap without removing molasses (Kabiruddin, M., YNM). Unlike refined sugar, jaggery retains minerals, vitamins and phytochemicals that contribute to its nutritional and therapeutic value. In recent years, jaggery has increasingly been recognised as a functional food because of its physiological benefits beyond basic nutrition.

Classical Unani literature describes jaggery as hot in the second degree and moist in the first degree, possessing a sweet and slightly astringent taste. It is traditionally prescribed as a blood tonic (*Muqawwi-e-Dam*), stomachic (*Muqawwi-e-Meda*) and chest-soothing agent (*Musakkin-e-Sadar*), while being contraindicated in diabetes and in individuals with excessive hot temperament (Ghani, N., YNM; Nayaka et al., 2009). In Unani medicine, jaggery is also regarded as beneficial in conditions such as anaemia, cough, dyspnoea, constipation and general debility.

India remains the world's largest producer and consumer of jaggery, accounting for more than 70% of global production, with a substantial proportion of sugarcane processed into jaggery and khandsari products (Singh, Solomon and Kumar, 2013; Kumar and Singh, 2018). Traditionally available in solid or semi-liquid forms, jaggery is now also produced in granular and liquid forms to improve handling, storage and commercial utility. Technological advancements, including vacuum pan processing and the use of organic clarificants, have improved shelf life while preserving nutritional quality (Kumar and Singh, 2018; Rao, Das and Das, 2020).

Modern scientific investigations support many of the traditional claims associated with jaggery. Studies have demonstrated that jaggery contains iron, calcium, magnesium, potassium, phenolic compounds and flavonoids that contribute to antioxidant, anti-inflammatory and haematinic activities (Rao, Das and Das, 2020; Chavan et al., 2019; Sharma et al., 2021; Singh et al., 2020). Experimental studies have also suggested nephroprotective, hepatoprotective and antimicrobial effects, while recent clinical studies indicate its usefulness in improving iron status and supporting nutritional supplementation.

Despite increasing scientific interest, much of the available literature focuses mainly on processing techniques, storage and nutritional composition. Comparatively less attention has been paid to correlating traditional Unani concepts with current biomedical evidence. Therefore, the present review aims to integrate classical Unani knowledge with modern pharmacological and clinical findings to provide a comprehensive understanding of jaggery as both a functional food and a supportive therapeutic agent.

2. Methodology

This review was prepared through a structured search of classical Unani literature and contemporary biomedical databases to collect evidence regarding the nutritional and therapeutic significance of jaggery (Gur). Electronic databases including PubMed,

Scopus, Web of Science, Google Scholar and ScienceDirect were searched up to August 2025 using keywords such as “jaggery”, “Gur”, “Saccharum officinarum”, “Phoenix sylvestris”, “Unani medicine”, “phytochemistry”, “antioxidant”, “clinical trial” and “functional food”.

Classical Unani references including Makhzan-ul-Mufradat and Khazain-ul-Advia were consulted to identify traditional descriptions, temperament, actions and therapeutic indications. Experimental studies, clinical trials, observational studies, review articles and classical texts related to jaggery were included, whereas duplicate and unrelated studies were excluded.

The collected data were narratively synthesised and organised into thematic sections with particular emphasis on correlating traditional Unani concepts with contemporary biomedical findings.

3. Morphology

Jaggery ranges in colour from golden yellow to dark brown and may appear in solid, semi-solid or powdered forms. It is commonly moulded into blocks, balls or granules, with texture varying from soft to brittle depending on the raw material and method of processing (Kabiruddin, M., YNM; Ghani, N., YNM).

Macroscopically, jaggery possesses an irregular appearance with a granular crystalline texture, rough surface and mildly sweet aroma. Microscopically, it contains sucrose crystals interspersed with molasses residues, proteins, phenolic compounds and colloidal materials. Mineral deposits of iron, calcium, magnesium and potassium contribute to its nutritional value (Nayaka et al., 2009; Singh, Solomon and Kumar, 2013).

Jaggery is highly soluble in water and forms a golden-brown solution. Due to its hygroscopic nature, granulated jaggery may become sticky or cakey during storage. Adulterated jaggery may be recognised by unusually glossy surfaces, off-odours or unnaturally bright colours (Kabiruddin, M., YNM; Kumar and Singh, 2018).

Nutritionally, jaggery provides approximately 383 kcal per 100 g in addition to minerals and antioxidant compounds.

3.1 Vernacular Names

Illustrated in Table 1 (Kabiruddin, M., YNM)

Table 1. Vernacular names

Language	Name
Arabic	Faneez
Persian	Qand Siyah
Urdu	Gudh
English	Jaggery
Hindi	Gudh
Bengali	Gudh
Sindhi	Gudh
Gujarati	Gola
Kannada	Bella
Tamil	Vellam
Malayalam	Sarkkara

3.2 Unani Description

Illustrated in Table 2 (Ghani, N., YNM; Kabiruddin, M., YNM; Nayaka et al., 2009).

Table 2. Unani description

Aspect	Description	
Unani Name	*Gur*	
Source	Saccharum officinarum, Phoenix sylvestris	
Mizaj (Temperament)	Hot in 2nd degree, Moist in 1st degree	
Maza (Taste)	Sweet and slightly astringent	
Boo (Odor)	Mild sweet fragrance	
Muzir (Harmful for)	Diabetics; individuals with excess hot temperament	
Musleh (Corrective)	Filfil Siyah (Black pepper), Zanjabeel (Ginger)	
Badal (Substitute)	Turanjabeen	
Mukhrij (Expels)	Balgham (Phlegm) and excess Sauda (Black bile)	
Miqdare Khorak (Dosage)	4–6 Tola (≈ 40–60 g)	
Nafa-e-Khas (Special Benefit)		Muqawwi-Meda, Musakkin-e-Sadar

3.3 Actions (*Afal*)

Illustrated in Table 2 (Ghani, N., YNM; Kabiruddin, M., YNM)

Table 3. Actions (*Afal*)

Unani Term	English Equivalent
Dāfiʿ Taffun	Antiseptic
Hāzim	Digestive
Mulayyin Ṭabʿ	Mild laxative
Musakhkhin-e-Badan	Body warmer
Mukhrij-e-Balgham	Expectorant
Muḥallil-e-Auram	Anti-inflammatory
Musakhkhin-e-Raḥim	Uterine stimulant
Mustahī	Aphrodisiac
Muqawwi-e-Aʿẓā	Tonic
Mudirr-e-Ḥaiż	Emmenagogue
Muʿallid-e-Manī	Promotes semen production

3.4 Indications (*Istemal*)

Illustrated in Table 2 (Ghani, N., YNM; Kabiruddin, M., YNM).

Table 4. Indications (*Istemal*)

Unani Term	English Equivalent
Muḥāfiẓ-e-Advia	Preservative in formulations
Qabz	Constipation
Qillate Dam	Anaemia
Suʾ-ul-Qinya	Respiratory disorders
Iḥtibās-e-Ḥaiż	Amenorrhoea
Suʾāl	Cough
Ḍīqun-Nafs	Dyspnoea
Żuʿfe Istiḥā	Loss of appetite
Qillate Manī	Oligospermia
Qillate Ḥaiż	Scanty menstruation
Aurām	Inflammations
Kharish	Pruritus
Ghalba-e-Ṣafrā	Bilious disorders

Unani Term	English Equivalent
Yarqān	Jaundice
Żuʿfe Bāḥ	Sexual debility

3.5 Important Formulations

Illustrated in Table 2 (Ghani, N., YNM; Kabiruddin, M., YNM).

Table 5. Important Formulations

Formulation	Therapeutic Use
Ḥabb-e-Suda	Chronic cough
Majūn Muqawwi Meda	Stomachic tonic
Sharbat-e-Unnab with Gur	Sore throat and flu
Dawa-ul-Luk	General body tonic

3.6 Phytochemical Composition

Illustrated in Table 2 and Figure 1 (Ghani, N., YNM; Kabiruddin, M., YNM; Nayaka et al., 2009)

Table 6. Phytochemical Composition

Component	Constituents
Carbohydrates	Sucrose (65–85%), glucose, fructose
Minerals	Iron, calcium, magnesium, phosphorus, potassium, sodium
Vitamins	B-complex vitamins (B1, B2, B6)
Phenolic compounds	Flavonoids and tannins

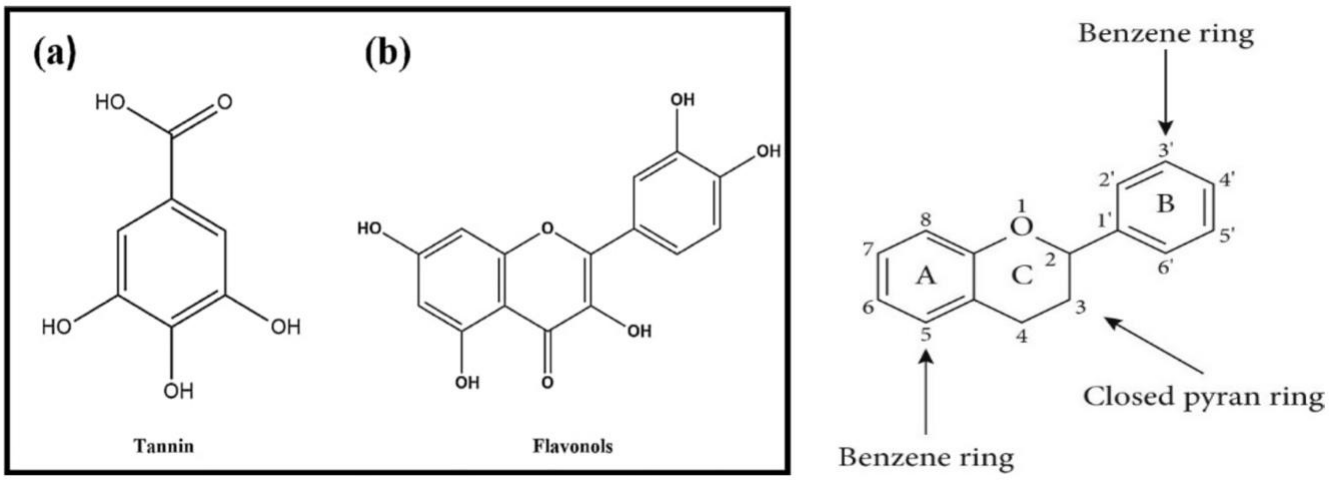

Figure 1. Tannin and Flavonoids

3.7 Nutritional Composition

Illustrated in Table 2 (Ghani, N., YNM; Kabiruddin, M., YNM; Nayaka et al., 2009).

Table 7. Nutritional Composition

Nutrient	Jaggery (per 100 g)	Refined Sugar (per 100 g)
Sucrose	65–85 g	99.5 g
Reducing sugars	9–15 g	Negligible
Minerals	0.6–1.0 g	0.05 g
Iron	10–13 mg	0.1 mg
Calcium	40–100 mg	5 mg
Vitamin C	Approximately 7 mg	Absent

4. Methods of Manufacturing

Forms of Jaggery

Solid Jaggery: Clarified sugarcane juice is boiled at 103–120°C and poured into moulds. Moisture content is generally below 3%.

Liquid Jaggery: Boiling is stopped at an earlier stage (103–106°C), resulting in a product containing approximately 30–36% moisture.

Granular Jaggery: Crystallised syrup is granulated into particles smaller than 3 mm, dried and packaged to improve shelf life.

Organic Jaggery: Produced using herbal clarifying agents and methods compliant with organic standards (Ghani, N., YNM; Kabiruddin, M., YNM; Nayaka et al., 2009).

5. Pharmacological Properties

5.1 Nutrient Composition and Antioxidant Activity

Jaggery differs from refined sugar because it is processed without removing molasses, thereby retaining a broad range of nutrients and bioactive compounds. In addition to sucrose and reducing sugars, jaggery contains minerals such as iron, calcium, magnesium and phosphorus that contribute to blood formation and metabolic regulation (Chavan et al., 2019; Gupta et al., 2022).

A significant feature of jaggery is its content of phenolic compounds, flavonoids and tannins. These compounds help reduce oxidative stress by neutralising reactive oxygen species. Experimental studies using DPPH and ABTS assays have demonstrated that jaggery possesses stronger free radical scavenging activity than refined sugar (Sreeramulu et al., 2017; Sharma et al., 2016). Consequently, jaggery may protect lipids, proteins and DNA from oxidative injury. These findings support its traditional use in Unani medicine as a restorative and strengthening substance.

5.2 Anti-inflammatory and Cytoprotective Effects

Classical Unani texts describe jaggery as Muḥallil-e-Auram (anti-inflammatory) and Musakhkhin-e-Badan (body warming) (Ghani, N., YNM; Kabiruddin, M., YNM) on; Contemporary experimental studies provide support for these concepts. In vitro investigations have shown that jaggery extracts may reduce inflammatory me-

diators such as tumour necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6) (Sreeramulu et al., 2017; Sarkar, Christopher and Shetty, 2022).

Experimental evidence also indicates cytoprotective activity through protection of erythrocytes and connective tissue cells against oxidative stress. These effects are largely attributed to antioxidant constituents that preserve cellular integrity under stressful conditions.

5.3 Nephroprotective and Hepatoprotective Effects

Recent experimental research has highlighted the protective effects of jaggery on the kidneys and liver. Animal studies have shown that jaggery administration may reduce nephrotoxicity induced by toxic agents such as acetaminophen, reflected by improvements in serum urea and creatinine levels along with reduction in renal oxidative stress (Sharma et al., 2016).

Similarly, jaggery supplementation has shown hepatoprotective effects against chemically induced liver injury. Studies involving carbon tetrachloride-induced toxicity demonstrated reductions in elevated liver enzymes and restoration of normal hepatic architecture (Reddy et al., 2024). These effects may be associated with increased activity of antioxidant enzymes including catalase, glutathione and superoxide dismutase.

5.4 Haematinic Effects

One of the most widely recognised therapeutic benefits of jaggery is its role in improving blood health. Owing to its natural iron content, jaggery supports haemoglobin synthesis and may help manage iron deficiency states. Unlike refined sugar, jaggery provides iron along with other minerals and phytochemicals that may enhance nutritional value.

Clinical studies have shown that regular consumption of jaggery combined with raisins or sesame may improve haemoglobin levels and red blood cell indices (Khan et al., 2023; Reddy et al., 2024). A randomised controlled trial involving children demonstrated that sesame–jaggery supplementation significantly improved haemoglobin concentration and serum ferritin levels compared with standard treatment alone (Naimisha et al., 2025).

Furthermore, combining jaggery with vitamin C-rich foods such as amla and citrus fruits may enhance iron absorption (Hallberg and Hulthen, 2000; Hurrell and Egli, 2010). These findings support its traditional Unani indication in Qillate Dam (deficiency of blood).

5.5 Antimicrobial Activity

Palm-derived jaggery has demonstrated antimicrobial activity against various microorganisms. This activity is attributed to bioactive compounds such as polyphenols and related phytochemicals (Das et al., 2021). Such findings correspond with its traditional role as Muḥāfiẓ-e-Advia, where jaggery functions not only as a sweetening agent but also as a preservative in compound formulations.

5.6 Glycaemic and Metabolic Effects

Although jaggery is often regarded as healthier than refined sugar, it still contains high levels of carbohydrates and possesses a moderate-to-high glycaemic index. Studies have reported glycaemic index values ranging from approximately 65 to 84 (Sarkar, Christopher and Shetty, 2022; Perera et al., 2022).

Some studies suggest that jaggery may result in slower fat accumulation and improved antioxidant status compared with refined sugar diets. Phenolic compounds present in jaggery may contribute to better metabolic responses. Nevertheless, caution is required in individuals with diabetes and metabolic disorders because jaggery still significantly influences blood glucose levels.

5.7 Neuroprotective and Functional Food Potential

Recent studies have explored the incorporation of jaggery into functional food formulations, especially in combination with medicinal herbs such as Triphala and turmeric. Such preparations have demonstrated enhanced antioxidant activity and inhibition of enzymes associated with cognitive decline, suggesting possible neuroprotective potential (Mishra et al., 2023).

Jaggery is also increasingly utilised in nutraceutical and fortified food products including millet-based snacks, herbal laddus and probiotic formulations because of its mineral content, natural sweetness and compatibility with herbal ingredients (Sharma et al., 2022; Das et al., 2023; Chandel et al., 2022).

6. Clinical Evidence

6.1 Haematological Benefits

Several clinical studies have evaluated the effects of jaggery on haematological parameters. An interventional study among young adults demonstrated that regular intake of jaggery combined with raisins over eight weeks significantly improved haemoglobin levels and red blood cell indices (Khan et al., 2023).

Further evidence comes from a randomised controlled trial involving school-aged children in which sesame jaggery supplementation significantly improved haemoglobin concentration and serum ferritin levels compared with controls (Naimisha et al., 2025). These findings suggest that jaggery-based dietary interventions may represent a culturally acceptable approach for addressing iron deficiency anaemia.

6.2 Glycaemic Response

Comparative studies have evaluated the glycaemic response of jaggery in humans. Coconut jaggery has demonstrated a glycaemic index slightly lower than refined sugar; however, the difference is insufficient to classify it as a low-glycaemic food (Perera et al., 2022). Therefore, moderation remains essential, particularly among diabetic individuals.

6.3 Antioxidant Effects

Dietary intervention studies involving Triphala–jaggery formulations have reported reductions in lipid peroxidation markers and improvements in antioxidant status (Mishra et al., 2023). Although these studies are limited in scale and duration, they indicate potential benefits in enhancing antioxidant defence.

6.4 Respiratory Health

In Unani medicine, jaggery-containing formulations such as Sharbat-e-Unnab and Habb-e-Suda are traditionally used for cough, sore throat and expectoration. Observational reports suggest symptomatic improvement in mucus clearance and throat irritation, although robust controlled clinical trials remain lacking. (Ghani, N., YNM; Kabiruddin, M., YNM; Rafiq et al., 2023)

6.5 Functional Food Applications

Studies involving sesame–jaggery and amla-based formulations have demonstrated improved nutritional value and favourable consumer acceptance (Sharma et al., 2021; Sharma et al., 2022). Such findings indicate promising applications of jaggery in preventive nutrition and functional food development.

7. Safety and Contraindications

Jaggery is generally considered safe when consumed in moderate quantities as part of a balanced diet. However, because of its carbohydrate content and glycaemic impact, excessive consumption may adversely affect blood glucose regulation in diabetic and metabolically compromised individuals (Sarkar, Christopher and Shetty, 2022; Perera et al., 2022).

Classical Unani literature also advises caution in individuals with excessive hot temperament. Therefore, rational and moderate use is recommended.

8. Discussion

The present review demonstrates that jaggery occupies an important position at the intersection of traditional Unani medicine and contemporary nutritional science. Several traditional claims regarding jaggery correspond closely with findings from modern pharmacological and clinical investigations.

In classical Unani medicine, jaggery is regarded as a blood-enriching, digestive and restorative substance. Concepts such as Muqawwi-e-Dam and Muqawwi-e-Aʿẓā emphasise its role in strengthening vitality and supporting bodily functions. Contemporary clinical studies reporting improvements in haemoglobin levels and iron status provide scientific support for these traditional concepts (Khan et al., 2023; Naimisha et al., 2025).

The antioxidant properties of jaggery represent another significant area of convergence. Phenolic compounds and flavonoids present in jaggery help reduce oxidative stress and protect cellular structures from free radical injury (Sreeramulu et al., 2017). In Unani terms, this may be interpreted as preservation of internal balance and strengthening of innate defence mechanisms.

Experimental studies demonstrating reduced inflammation and improved liver and kidney functions provide a possible explanation for its traditional use in conditions associated with weakness and chronic illness (Sharma et al., 2016; Khan et al., 2023; Reddy et al., 2024). However, it is important to recognize that much of this evidence comes from laboratory and animal studies. Although these findings are promising, they cannot be directly applied to clinical practice without further validation in human populations.

The role of jaggery in functional food development reflects an interesting overlap between traditional knowledge and modern innovation. In Unani practice, jaggery is often combined with other substances to enhance its therapeutic effects. This principle is being explored scientifically through the development of fortified foods, such as sesame–jaggery and amla-based preparations, which aim to improve both nutritional value and bioavailability (Sharma et al., 2021; Sharma et al., 2022; Das et al., 2023). The enhanced absorption of iron when combined with vitamin C–rich ingredients is a good example of how traditional combinations can be supported by modern nutritional science (Hallberg and Hulthen, 2000; Kotecha, 2011; Toteja et al., 2006).

Processing and storage conditions further influence jaggery quality and stability. Variations in moisture content and storage environment can affect the physicochemical properties and phenolic composition of jaggery, which may ultimately impact its therapeutic value (Rao et al., 2019; Singh et al., 2021).

From a public health perspective, jaggery-based dietary interventions offer a simple and culturally acceptable approach to address iron deficiency anaemia, particularly among children and women in developing regions (Kotecha, 2011; Toteja et al., 2006). Its accessibility and affordability make it a practical option for nutritional supplementation.

Despite these advantages, a cautious approach is required. Although less refined, jaggery is still a concentrated source of sugar and has a measurable impact on blood glucose levels (Sarkar, Christopher and Shetty, 2022; Perera et al., 2022; Elbagory et al., 2026). Therefore, its use should be moderated, particularly in individuals with diabetes or other metabolic disorders. This limitation is also acknowledged in Unani medicine, where its use is restricted in conditions related to an imbalance of temperament (Kabiruddin, M., YNM; Ghani, N., YNM).

Overall, the evidence suggests that jaggery should not be viewed merely as a sweetener but as a functional dietary component with potential therapeutic effects. However, the current body of research remains limited in scale and depth. Well-designed clinical studies are needed to better understand its long-term effects, optimal intake and role in disease management. A balanced approach that integrates traditional knowledge with scientific validation is essential for its appropriate use in modern healthcare (Sharma et al., 2022; Das et al., 2023; Chandel et al., 2022).

9. Conclusion

Jaggery represents more than a traditional sweetener; it reflects the integration of nutrition and therapy emphasised in Unani medicine. Its rich mineral content and bioactive constituents provide scientific support for several traditional therapeutic claims, particularly regarding antioxidant, restorative and haematinic effects.

Modern pharmacological and clinical studies support many traditional applications of jaggery, especially in relation to improving iron status, reducing oxidative stress and supporting nutritional supplementation. Furthermore, its increasing incorporation into functional foods highlights its potential role in preventive healthcare and public health nutrition.

Despite these advantages, jaggery should be consumed in moderation because of its glycaemic impact. Additional well-designed clinical studies are required to establish standardised therapeutic applications, safety profiles and long-term outcomes.

In conclusion, jaggery possesses significant potential as a functional dietary component that bridges traditional Unani knowledge and modern biomedical science.

10. Limitations

This review has several limitations that should be considered while interpreting the findings. First, the availability of large, well-designed clinical studies regarding jaggery remains limited. Much of the current evidence is derived from experimental studies or small-scale human interventions, thereby restricting generalisability.

Second, the nutritional and phytochemical composition of jaggery may vary according to source material, processing methods and storage conditions. Such variability limits standardisation and makes comparisons between studies difficult.

Third, several traditional claims described in Unani literature are based primarily on long-standing clinical experience rather than rigorous scientific validation. Although some of these claims are supported by modern evidence, numerous areas still require systematic investigation.

Finally, because this review follows a narrative approach, selective inclusion bias cannot be completely excluded. Future systematic reviews and meta-analyses may provide stronger evidence regarding the therapeutic potential of jaggery.

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