



Research Article

The Untold Health Benefits of Herbal Black Salt (Kala Namak): A Scientific Overview

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Citation: Bali S, Khan A (2024) The Untold Health Benefits of Herbal Black Salt (Kala Namak): A Scientific Overview. Curr Res Cmpl Alt Med 8: 234. DOI: 10.29011/2577-2201.100234

Received Date: 3 March 2024; **Accepted Date:** 6 March 2024; **Published Date:** 8 March 2024

Abstract

Herbal Black Salt, also known as Kala Namak, is a traditional South Asian and Ayurvedic culinary and medicinal ingredient. Distinctive for its pungent aroma and varying color shades, ranging from dark violet to pink, it is manufactured using Himalayan or other natural rock salt through a special kiln-firing process incorporating Ayurvedic herbs. While Himalayan pink salt has been well-researched, studies on black salt are sparse. Notably, Kala Namak has a lower sodium content than common table salt and is rich in essential minerals such as iron, calcium, and magnesium. Furthermore, the incorporation of vital Ayurvedic ingredients like Amla (*Phyllanthus emblica*), Harad (*Terminalia chebula*), and Behera (*Terminalia bellerica*) endows it with numerous health benefits. Kala namak has gained recognition as a secret ingredient to give savory egg flavor to a vegan full-English breakfast. It can be sprinkled over grilled tomatoes and mushrooms, vegan sausages, baked beans, avocado toast, eggless salad, and cheese recipes for a delicious taste. This comprehensive overview provides information on the chemical and elemental composition of herbal black salt, the salient phytochemical features of its Ayurvedic components, and its possible health advantages, ranging from cardiovascular, renal, and oral health to antioxidative, anti-aging, and cognitive enhancements.

Keywords: Black salt; Kala namak; Herbal salt; Triphala; Fruit salad; Myrobalans

Introduction

Black salt, also known as *Kala Namak*, has gained attention for its remarkable nutritional profile and potential health advantages over commercially available table salts [1]. This man-made unique salt, with its characteristic sulphurous, pungent smell, is known by various names in South Asia. There is one variety of Himalayan rock salt that is also black in colour, but this naturally found black salt does not contain the herbal components of classical fabricated black salt. *Kala namak* primarily consists of sodium chloride, but its unique color and aroma come from the various trace components it contains. Notably, the salt's distinct smell can be attributed to its sulfur content, which is present in the

form of sodium sulfate (Na_2SO_4), sodium sulfide (Na_2S), sodium bisulfate (NaHSO_4), sodium bisulfite (NaHSO_3) and iron sulfide (FeS). The presence of Greigite, an Iron (II, III) sulfide mineral, gives the salt a range of colors: from brownish pink to dark violet in its crystal form, and from purple to pink when ground into a powder. Beyond its culinary uses, *kala namak* is also valued in Ayurveda for its medicinal properties [1,2].

The manufacturing process takes place in a kiln or furnace, where the raw Himalayan rock salt, combined with small amounts of the fruit pulp of Amla (*Phyllanthus emblica*), Harad (*Terminalia chebula*), and Behera (*Terminalia bellerica*) alongwith babul (*Acacia nilotica*) bark, is melted and roasted to produce black salt. The three myrobalans used are together known as Tri-phala (three fruits). After firing, the salt is cooled, stored, and aged before reaching the market. The final product, while appearing black in its

crystal form, is often ground into a fine powder that exhibits a pink hue [3,4]. Kala namak has been traditionally used in South Asian cuisines and Ayurvedic medicine. The current evidence suggests that due to the presence of Tri-phala, black salt could prove be a multi-faceted health enhancer, with potential benefits ranging from oro-dental and cardiovascular health to anti-aging effects.

Manufacturing process of Black Salt

The raw salt for making Kala Namak was originally obtained either from natural rock-salt mines located in the Himalayan belt of northern India or from salt quarried from the Sambhar and Didwana salt lakes in northern India. In the traditional method of making black salt , the chemistry principle utilized is the transformation of

relatively colorless rock salt to the dark commercial *Kala Namak* through a reductive process that converts some of the natural sodium sulphate in the raw salt to pungent hydrogen sulphide and sodium sulphide.

The manufacturing process of black salt by the traditional method comprises a well-designed and systematic procedure, utilizing horizontal kilns built into the earth [4]. This age-old method involves several distinct operations (Figure 1). Kala Namak is prepared in this way in northern India and production is concentrated in the Hissar district of Haryana. The step-wise operation is given below:

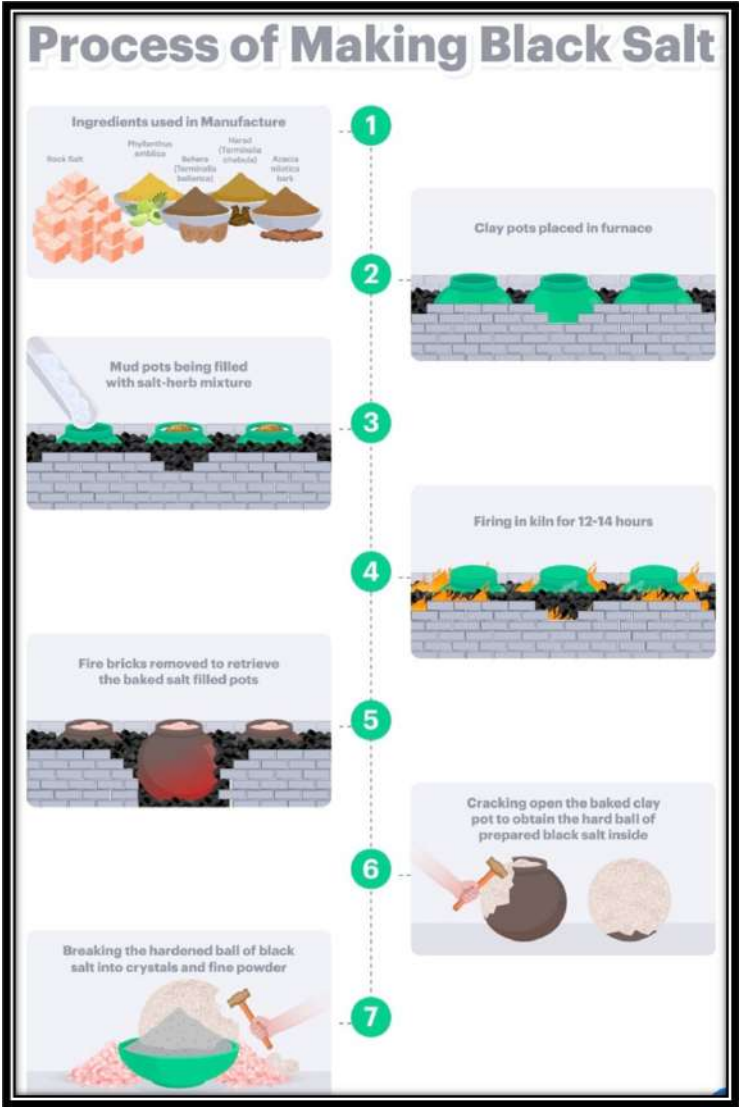


Figure 1: Steps in the process of manufacture of black (herbal) salt.

1. **Mud Pot Production:** Some producers purchase ready-to-use mud pots, but larger manufacturers often have their own units for crafting these pots. These pots typically measure 15-16 inches in height, with a mouth size of 4.5-5.5 inches, and diameters spanning 44-46 inches. Each pot can hold 35-40 kilograms of salt. Black soil is a preferred material for crafting these pots, owing to its optimal textural properties [4].
2. **Kiln Preparation:** The size and capacity of these horizontal kilns can vary. Smaller-scale producers might operate a kiln capable of accommodating 15 pots, while larger capacities can range from 18 up to 45 pots [4].
3. **Firing Materials:** Coal is the primary fuel used for firing, although some manufacturers use alternatives like cow dung or a combination of coal and molasses, known as Tikkli. Tikkli is more cost-effective, but it has a lesser thermal capacity than coal. The kiln is usually layered first with coal, followed by cow dung, and topped again with coal. The mud pots are then placed atop this layered setup to initiate the black salt production. The firing typically lasts for 12-14 hours to produce high-quality black salt [4].
4. White salt nuggets or rock salt are combined with the specific herbal ingredients that impart medicinal properties to the black salt. These ingredients include a trio of fruits known as Triphala - Amalaki (*Embllica officinalis*), Bibhitaki (*Terminalia bellirica*), and Haritaki (*Terminalia chebula*), and the bark of the Babul tree [4].
5. The heating process takes time, due to the high melting point of white salt, which is approximately 801°C. Once the kiln is fired up, the mud pots begin to heat, and are filled with the salt and herbal mixture. The temperature during the production rises to about 800-1000°C. A complete cycle takes 18-24 hours, followed by a cooling period overnight. Once cooled, the kiln pots are broken using hammer to retrieve the annealed chunky salt mass [4]. The salt crystals appear black and are usually ground into a fine purple powder before marketing.

Composition of Black Salt

Black salt contains a variety of trace elements and compounds, such as sodium sulfate, sodium bisulfate, sodium bisulfite, and iron sulfide, which together contribute to its unique characteristics. Iron sulfide is responsible for Kala Namak's dark violet color, while a range of sulfur compounds—most notably

hydrogen sulfide—impart a distinct savory aroma and mildly sour taste to the salt. The sodium content in Kala Namak ranges between 36.8% and 38.79%, making it comparable to regular table salt in that regard. Additionally, phytochemical screenings have revealed the presence of antioxidants like tannins, phenols, and alkaloids, suggesting that black salt may offer health benefits, particularly regarding oxidative stress and aging [2,3].

Herbs incorporated into Black Salt

A major ingredient blended into the black herbal salt is Triphala, a respected Ayurvedic mixture used for various health benefits. It is a combination of two words; 'Tri' meaning 'three' and 'Phal' meaning 'fruit', thus Triphala is a blend of three vital fruits native to the Indian subcontinent. Each of these fruits contributes unique therapeutic attributes, making Triphala a holistic remedy in Ayurveda [2,3]. Triphala includes the three myrobalans *Embllica officinalis*, *Terminalia bellirica*, and *Terminalia chebula*.

Amalaki or Indian gooseberry: Amalaki is a potent source of Vitamin C and antioxidants. It promotes immune function, revitalizes the skin, supports vision, and aids in overall rejuvenation. **Haritaki:** Often referred to as the "king of medicines" in Tibetan tradition, Haritaki is renowned for its purgative properties, promoting digestive health, and reinvigorating tissues. **Bibhitaki:** This myrobalan is known to be effective against diseases related to mucus and congestion. It acts as a natural astringent, detoxifying the body and aiding in the removal of excess water. In addition to these, **Babul bark** is another key Ayurvedic ingredient used in the production of black salt. Known for its medicinal attributes, Babul bark complements the other herbal components, and the combined presence of all four herbs in specific proportions elevates black salt from a mere seasoning to a wellness supplement rooted in Ayurvedic tradition [5]. The herbal constituents work synergistically and possess the potential to combat various health challenges, from digestive issues to skin problems [6]. Specific health benefits of each of the above herbs are described in the sections below.

HEALTH BENEFITS OF BLACK SALT

The addition of Triphala in formulating black salt not only enriches the salt's taste profile but also amplifies its health benefits, making it a valuable addition to various cuisines and therapeutic preparations (Figure 2).



Figure 2: Black salt incorporates phytochemicals from some very useful herbs, making it almost like an elixir. The beneficial effects of the herbal constituents are summarized in this figure.

Protective and therapeutic effects of the Gasotransmitter Hydrogen Sulphide

Black salt contains small quantities of sodium sulfate (Na₂SO₄), sodium sulfide (Na₂S), sodium bisulfate (NaHSO₄), sodium bisulfite (NaHSO₃) and iron sulfide (FeS), all of which can yield hydrogen sulphide gas on being metabolized in the body. Hydrogen sulphide is now recognized as a gaso-transmitter. Gasotransmitters are small gaseous molecules that function as neurotransmitters. This family of neurotransmitters consists of three molecules, nitric oxide (NO), carbon monoxide (CO), and hydrogen sulphide (H₂S). Over the past few years, researchers have rapidly developed knowledge about the potential therapeutic role of hydrogen sulfide (H₂S) in various physiological processes including myocardial injury, vascular function, inflammatory responses, and blood pressure [7]. Consequently, H₂S has emerged as a promising candidate for **protection against cardiovascular disease**, since physiologic concentrations of H₂S can exert effects on mitochondrial function and promote myocardial cell survival [8,9].

Given the multi-factorial impact of H₂S on processes associated with cardiovascular pathophysiology, such as anti-inflammatory, anti-oxidative, and anti-apoptotic actions, some research studies have focused on the potential application of gasotransmitter-derived interventions in the treatment and prevention of cold-induced cardiovascular diseases [10,11]. Wei et al. conducted both *in vivo* and *in vitro* experiments to examine the cardioprotective effect of H₂S in a rat model. Hyperhomocysteinemia (HHcy) was induced to promote cardiomyocytic endoplasmic reticulum (ER) stress, which appears to be a common route for Hcy-induced cell damage and tissue injury [12]. Supplementation by exogenous H₂S was found to rescue cardiomyocytes from ER stress, reduce plasma total Hcy level, and **alleviate myocardial injury**. It was also discovered that H₂S supplementation could decrease the levels of cleaved caspase 12 and p-eIF2α in H9c2 cells. These results provide evidence for the protective function of H₂S as a novel gaseous signaling molecule in cardiovascular health. Thus, H₂S promises to play a central role in managing many chronic

disorders caused by conditions involving pathological endoplasmic reticulum (ER) stress.

Hydrogen sulfide also plays an important role in the functioning of the gastrointestinal (GI) tract. Since the intestinal lumen is a significant site for metabolism of sulfur amino acids in the body, high concentrations of hydrogen sulfide are present in the gastrointestinal (GI) tract. In individuals where there is inhibition of endogenous hydrogen sulfide production in the GI tract, inflammatory disorders may occur because of the disrupted mucosal integrity [13]. The anti-inflammatory properties of H₂S **aid in maintaining gut homeostasis** by improving mucosal defense and promoting mucosal repair. Furthermore, many reports affirm that H₂S is a potential neuromodulator as well as a **neuroprotectant**. Kimura et al. concluded that H₂S shields neurons against oxidative stress and bolsters glutathione levels [14]. In a cerebral ischemic study model, H₂S was found to prevent neuronal apoptosis by suppressing caspase-3 activation in murine neurons [15].

Beneficial Effects of Phyllanthus emblica in black salt

The existing scientific evidence strongly suggests that *P. emblica* (**Amla**), a key ingredient in black salt, is endowed with phytochemicals that provide beneficial effects to numerous body systems. These actions range from renal and cardiovascular protective effects to a potential role in managing COVID-19 symptoms. *P. emblica* is known as Amla in the vernacular. Amla's inclusion in black salt adds several health benefits to this traditional condiment. A study by Yokozawa et al. (2007) found that Amla extract attenuated age-related renal dysfunction in rats by reducing oxidative stress markers and suppressing inflammatory proteins such as iNOS and COX-2 [16]. Chen et al. (2009) further explored this, revealing that ingestion of Amla extract led to a significant decrease in oxidative stress markers in patients with uremia [17]. These findings suggest that Amla, as a component of black salt, could be a valuable adjunct in the prevention and management of **renal diseases**.

Patil et al. (2019) reported **cardio-protective** effects of Amla in male albino rats, effectuated by mitigation of the oxidative stress induced by a high-fat diet [18]. Khanna et al. (2015) found that dietary supplementation with a standardized extract of Amla led to significant improvements in lipid profiles and reduced levels of high-sensitivity C-reactive protein (hs-CRP), a marker of inflammation, in overweight adults [19]. Moreover, *Phyllanthus emblica* has shown promise in treating **endothelial dysfunction** and **metabolic syndrome** (MetS). A randomized, double-blind, placebo-controlled study noted significant improvements in endothelial function, oxidative stress, inflammation, and lipid profile when human subjects were treated with aqueous extract of Amla [20]. These benefits could plausibly extend to black salt due

to its Amla content, making the former a potential candidate for daily dietary intervention to ameliorate MetS. Further, *Amalaki rasayana*, a preparation based on Amla, has been traditionally used in Ayurveda to promote well-being, especially in the elderly.

In a research study by Akhtar et al 2011, Amla proved effective in improving blood sugar and lipid levels [21]. Similarly, Amla's efficacy in treating **dyslipidemia** has been evaluated by Upadya and team [22]. Their study found that patients treated with Amla extract experienced significant reductions in total cholesterol, triglycerides, and LDL cholesterol. Notably, these improvements occurred without affecting CoQ10 levels, which is a drawback of statin medications. As Amla is a key ingredient in black salt, the latter could offer similar lipid-lowering benefits, and make black salt a beneficial addition to the diet of diabetic and hyperlipidemic individuals. Furthermore, in a study led by Karkon et al. (2018), Amla showed promising results in alleviating the symptoms of non-erosive reflux disease (NERD), a form of **gastro esophageal reflux disease** (GERD) [23]. Patients who consumed 500 mg of Amla twice daily for four weeks showed significant improvement in the frequency and severity of heartburn and regurgitation compared to a placebo group.

Interestingly, Varnasseri et al. (2022) conducted a randomized controlled trial that revealed promising results of Amla in the management of **Covid-19 symptoms**, including improvements in clinical symptoms like fever, cough, and shortness of breath [24]. In the case of **oral health**, a randomized, double-blind, controlled study found that chewing gum containing *Phyllanthus emblica* (PE) fruit extract led to significant improvements in oral hygiene [25]. Participants who consumed PE gum showed increased salivary flow rates and pH levels. They also had a significant reduction in harmful oral bacteria and volatile sulfur compounds, which contribute to **bad breath**. Another study found that a mouth rinse containing Amla was nearly as effective as chlorhexidine in reducing plaque and gingivitis in children [26]. Given that Amla is a component of black salt, these findings indicate the potential benefits of black salt gargles for oral health.

Besides, research conducted by Sarmah and associates demonstrated the **neuroprotective** effects of Amla in rats subjected to ischemic stroke [27]. The study found that aqueous extracts of Amla significantly improved neurological function and mitigated brain damage. The extract also helped normalize biochemical markers and boost mitochondrial activity. Amla is such a powerfully beneficial fruit that it is known as *Dhatrī-phal* in Sanskrit. *Dhatrī* is the term used for mother or wet nurse. Amla is also the base for the very popular jam like preparation called Chavanprash, which incorporates dozens of herbs and is a powerful rejuvenative and restorative [28].

Health benefits of Harad (*Terminalia chebula*) in Black Salt

Harad, or *Terminalia chebula*, is a key ingredient in black salt. Based on multiple research studies, *Terminalia chebula* appears to offer a wide range of health benefits, from supporting oral health to improving cardiovascular function and potentially aiding in mental health. Studies have reported that *Terminalia chebula* has strong antibacterial effects against oral pathogens like salivary *Streptococcus mutans*, the bacteria associated with dental caries. The efficacy of Harad in reducing bacterial count in the oral cavity was found to be comparable to chlorhexidine [29,30]. Also, several studies have demonstrated that *Triphala* (three myrobalans), a combination that includes *Terminalia chebula*, and chlorhexidine **reduced dental plaque and gingivitis** in equal measure when used as mouthwashes [31-33]. This suggests that black salt, with Harad as a component, could offer a natural, cost-effective alternative for oral hygiene and may offer benefits in managing dental health [34]. Another study showed that using *Terminalia chebula* mouth rinse led to a significant increase in salivary pH, making it more alkaline, which is beneficial for dental health [32]. *Triphala* has also demonstrated significant improvement in the human gut microbiome composition, which in turn can lead to manifold benefits to the gut-brain axis and gut-lung axis [35].

Furthermore, *Terminalia chebula* has also been shown to ameliorate endothelial dysfunction, a key cardiovascular risk factor, particularly among type 2 diabetic patients. Improvements in cardiovascular risk markers such as, increase in serum nitric oxide and reduction of high-sensitivity C-reactive protein values were observed. The presence of Harad in black salt could therefore provide cardiovascular benefits, especially for those having diabetes mellitus [36]. Additionally, a study using AyuFlex, a standardized aqueous extract of *Terminalia chebula*, showed significant improvements in joint mobility, comfort, and function in healthy, overweight individuals, without causing adverse effects [37]. This suggests that *Terminalia chebula* in black salt could be a valuable ingredient in improving joint health and well-being. Besides, a study found that *Terminalia chebula* had significant **cognitive benefits** for patients with chronic schizophrenia [38]. This research suggests that the antioxidant, anti-acetylcholinesterase, and anti-inflammatory properties of *Terminalia chebula* may offer potential natural treatment options for cognitive and behavioral symptoms related to psychiatric conditions like schizophrenia.

Health potential of *Terminalia bellerica* (TBE) in Black Salt

Terminalia bellerica (TBE), commonly known as Baheda, is another myrobalan present in black salt, which is endowed with various therapeutic properties. Several studies have elucidated the pharmacological benefits of TBE. A study by Pingali on

chronic kidney disease patients showed that TBE effectively reduced hyperuricemia. Besides decreasing serum uric acid, TBE also decreased creatinine levels and improved kidney function, comparable to the standard drug febuxostat [39]. Hence, as an ingredient in black salt, TBE might contribute to reducing uric acid levels and supporting kidney health. TBE has also been studied for its digestive and immunological benefits. In animal studies, it showed a preventive effect on *Salmonella Typhimurium* infection by improving the intestinal barrier and balancing gut flora [40]. This aligns well with traditional views on black salt as a beneficial ingredient for gut health.

A study by Kuriakose in 2017 demonstrated that TBE had significant protective effects against liver damage induced by chemicals like CCl₄. The workers found that TBE restored liver function and biochemical markers in animal models, comparable to standard hepato-protective medications like silymarin [41]. Other researchers have found that both TBE and its component ellagic acid protect against liver damage induced by Aceclofenac, a nonsteroidal anti-inflammatory drug [42]. Compounds like ellagitannins, found in the leaves of TBE, have displayed antioxidant and moderate hepatoprotective potentials. Also, in a recent study focusing on non-alcoholic fatty liver disease (NAFLD), *Terminalia bellerica* showed therapeutic effects by reducing harmful lipid levels and liver enzymes in mice [43]. This evidence demonstrates the ability of TBE to avert liver damage, signifying that the presence of TBE in black salt may offer an appreciable role as a hepato-protective health supplement [44].

Further, the formulation known as *Triphala churna*, which includes TBE, has been found to be effective in managing diabetic retinopathy and neuropathy in rats. This was the observation in two studies carried out by Suryavanshi et al. in 2021 and 2022, where *Triphala churna* reduced plasma glucose levels and delayed the progression of diabetic retinopathy and neuropathy [45,46]. Given that TBE is also an ingredient of black salt, this adds to the salt's potential benefits for managing diabetic complications. In addition, a comprehensive review by Gupta et al in 2020 emphasized the wide-ranging pharmacological benefits of TBE, including antioxidant, anti-inflammatory, and antimicrobial properties [47]. Also, an animal study on the *Terminalia bellerica* fruit (TBEA) extract revealed a significant reduction in the symptoms of Ulcerative Colitis, including a reduction in inflammatory markers like IL-6, IL-1 β and TNF- α , and also enhanced levels of antioxidants like glutathione and catalase [48]. In the case of oral conditions, TBE showed significant efficacy against bacterial growth of *Streptococcus mutans* in the mouth, a primary contributor to dental caries [49]. This suggests that black salt could potentially offer oral hygiene and dental care benefits. Besides, TBE helps in the management of metabolic syndrome issues such as obesity, insulin resistance, and hyperlipidemia.

A study identified gallic acid in TBE as the active component inhibiting fat absorption and improving metabolic parameters [50]. Therefore, TBE as a key ingredient in black salt may offer protection against manifestations of metabolic syndrome.

Culinary Uses

Black herbal salt or *Kala Namak* has a multiplicity of culinary uses. It can be used to enhance the flavor of Indian *chaat* dishes. *Chaat* is a term used for a diverse variety of spicy and tangy snacks, which includes roasted sweet potato, fried potato cutlets, crispy fried flour crackers (*papdi*) in yoghurt, and diced mixed fruit, to name a few. Black salt is also frequently added to South Asian dishes like *chutneys* (several types of finely ground and paste like sauces made from tamarind, coriander leaves, mint leaves, unripe mango and shredded coconut), fruit salads, and *raitas* (churned yogurt). *Raita* is a yogurt-based recipe, served as a side dish with Indian food. Kala namak adds a distinctive and unique taste to various variations of raita. It is added to raita dishes such as Pomegranate raita, cucumber raita, boondi raita, spinach raita, spring onion raita, bathua raita, soya bean curd raita, jaggery raita, onion tomato raita, dahi masala raita, aloo raita, Kashmiri raita, coriander raita, zucchini raita, beetroot raita, pumpkin raita and mixed fruit raita.

Kala Namak is becoming popular in Western countries as a key ingredient in vegan cooking due to its sulfuric taste and flavour, reminiscent of eggs [51]. The eggy aroma that enhances the flavor of egg-free dishes is attributable to the sulfur compounds (acidic bisulfates/bisulfites) present in kala namak that produce a chemical reaction when combined with other ingredients, giving a taste similar to eggs [52]. Kala namak is thus, a suitable condiment to create vegan alternatives to scrambled eggs, and for dishes such as tofu scrambles, vegan omelets, and eggless quiches. When added to dishes at the end of the cooking process, a subtle, sulfurous aroma is more noticeable.

Kala namak is also used to flavor several beverage recipes. A pinch of Kala Namak is added to enhance the taste of *Nimbu pani* (lemonade), pineapple masala drink, lemony lettuce drink, guava and pomegranate drink, pomegranate mojito, plum juice, guava smoothie and Amla juice. The rejuvenating and natural cooling effects of kala namak increase the drinks' hydrating benefits. *Jal Jeera* is a popular flavored drink in northern India that is prepared using various spices like cumin, dry mango powder, fennel seed powder, ginger, black pepper, mint leaves, and kala namak. This traditional appetizer is a perfect summer drink in scorching summers. Kala namak enhances the digestion-boosting and rehydrating effects of Jal Jeera [53]. Black Salt flavored Lemon Tea is a simple and refreshing drink. Sipping a warm cup can attenuate stress after a long day. Also, the high potassium content of kala namak can help relieve muscle cramps [54].

Kala namak is extensively used as a versatile and flavorful ingredient in different kinds of salads [55]. Beetroot salad, chickpea salad, cucumber salad, radish salad, beans salad, curd salad, watermelon salad, and apple salad are some of the tasty salads in which kala namak is included. Kala namak is also an ingredient in several pickles due to its strong aroma and umami taste that enhances the tanginess of pickles. It is added to lemon pickle, green chili pickle, mango pickle, raw papaya pickle, amla pickle, ginger pickle, radish pickle, and carrot pickle. Some other popular delicious dishes employing kala namak are strawberry *golguppa*, pomegranate chaat, sweet tomato sauce (*chutney*), stuffed dahi vada, kanji vadas, masala pav, vegetable sandwich, and paneer tikka.

Discussion

Black Herbal Salt, traditionally used in India to flavour various cuisines and therapeutic preparations, is enriched with several beneficial components. The most important constituent that enhances its health benefits is the addition of the three myrobalans, known as *Triphala*. The inclusion of the pulp of the three fruits (*triphal*) not only improves the taste profile of Black Salt, but also contributes to its numerous health advantages. One of the main ingredients in black salt is the myrobalan Amla, also known as *Phyllanthus emblica*. Current scientific evidence attributes numerous health benefits to Amla, which in turn could benefit those consuming black salt. Among these benefits are renal and cardiovascular protective effects, enhancement of skin complexion, improved oral health, averting senile changes in the eyes such as cataract, and a promising effect in managing Covid-19 symptoms [16,19]. Studies have found Amla extract to be effective in reducing oxidative stress markers in uremia patients and attenuating age-related renal dysfunction in rats. In terms of cardiovascular health, Amla has been reported to offer cardioprotective benefits by treating endothelial dysfunction and mitigating oxidative stress. Additional research has shown that Amla can potentially provide DNA protective and anti-aging benefits.

The next vital ingredient in black salt is the myrobalan Harad, or *Terminalia chebula*. Research has shown a wide range of health benefits associated with T. chebula, ranging from boosting oral health to improving cardiovascular function and even potential benefits in mental health. For instance, studies have shown that T. chebula has strong antibacterial effects against oral pathogens. Its presence in black salt offers cardiovascular benefits, especially for those having maturity-onset diabetes [36]. Additionally, research on *Terminalia chebula* suggests potential cognitive benefits for patients with chronic schizophrenia. Although more studies are needed to confirm the direct benefits of black salt, T. chebula's presence in the former indicates its broad health potential.

Terminalia bellerica (TBE) is another significant ingredient

in black salt, and is the third myrobalan. Behera offers an array of therapeutic properties that support the health benefits of black salt. Studies have indicated that TBE can manage hyperuricemia, offer digestive and immunological benefits, and even show protective effects against chemically induced liver damage [41]. Other research studies point towards the role of TBE in ameliorating diabetic complications, providing oral hygiene benefits, and potentially helping to manage some aspects of metabolic syndrome [47,50]. In Ayurveda, Behera is considered the most desirable and beneficial food item (*pathya*). The wide ranging systemic benefits of TBE suggest that black salt enriched with this ingredient is a potent health enhancer, spanning digestive health, liver functionality, and metabolic regulation. Black salt then, by incorporating into regular use, holds promising health benefits due to its rich ingredient profile, including *P. emblica*, *Terminalia chebula*, and *Terminalia bellerica*.

Conclusion

Black salt, deeply rooted in Ayurvedic tradition, has been popular in India down the ages for its health-enhancing properties. Its herbal components, primarily Triphala, consisting of *Emblica officinalis* (Amlaki), *Terminalia chebula* (Haritaki), and *Terminalia bellerica* (Bibhitaki), transform it from a simple seasoning to a potent wellness supplement. Through its ingredients, black salt furnishes a wide range of health benefits, ranging from aiding digestion, boosting immunity, improving oral hygiene, and supporting cardiovascular and renal health, to offering therapeutic relief in conditions such as hyperuricemia, non-erosive reflux disease, and even psychiatric conditions like schizophrenia. The inclusion of Amla, rich in Vitamin C and antioxidants, enhances its therapeutic potential in managing conditions like renal dysfunction, cardiovascular health, pulmonary betterment and Covid-19 symptoms. Further, Harad and Behera, other key constituents, offer diverse benefits such as supporting gut health, improving joint mobility, and exhibiting hepatoprotective properties. While preliminary findings, reported in both traditional knowledge and contemporary scientific research, offer a promising view of the vast health potential black salt holds, further comprehensive studies are essential to establish the full spectrum of its benefits. Nonetheless, black salt stands as a testament to the wisdom of ancient Ayurveda, reminding us of the profound ways in which our culinary choices can intersect with holistic well-being.

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