



Value Addition of Traditional Indian Dairy Products Using Herbs and Spices- An Overview

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ABSTRACT

Natural antioxidants have positive effects on human well-being and various conditions of disease, such as cardiovascular diseases, neurodegenerative diseases, diabetes and cancer. They have been attributed to several of their biological activity to scavenge reactionary oxygen species (ROS) with oxidative stress. Herbs and spices are the rich source of natural antioxidants. They also contain many phytochemicals (tannins, flavonoids, alkaloids), essential oils, phenols, saponins, vitamins and micro and macro minerals. They play a great role in food system as flavourings, antioxidant, preservative and also possess medicinal property. Milk products are the most promising and fascinating foods due to their potential antioxidant activities. To extend the shelf life and nutrition value of dairy products specially fermented dairy products, few herbs are very helpful owing to their antifungal and antibacterial effect. Traditional Indian dairy products such as paneer, chhana, sandesh, dahi, lassi, ghee, butter and so on are the most commonly consumed food in Indian. It is well known that, milk and milk products are the most promising and compatible vehicle for delivering nutritional, functional health benefits of different herbs and spices. In this short review use of some of the important herbs and spices in traditional Indian dairy products has been dealt. Fortification of different herbs and spices in dairy products strengthens their nutritional and therapeutic values. It also enables the development of value-added dairy products.

KEYWORDS: Value addition, natural antioxidant, herbs, spices, dairy product

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1. INTRODUCTION

Rapid urbanisation and industrialisation in developing countries such as India have led to drastic lifestyle change leading to life style related conditions on the social and economic fronts. Because of the appearance of numerous life style related health conditions, the study of functional foods complemented by functional constituents or substances is increasingly concerned. Other than their nutritional value, functional foods provide a health advantage. Functional foods contain bioactive compounds that provide the health and well-being benefits of functional foods (Martirosyan and Singharaj, 2016). Herbs are widely used for centuries as food and medicine. It has reported a broad range of active plant compounds such as flavonoids, terpenoids, ligans, sulphides, polyphenols, carotenoids, coumarin, saponins, plant sterols, curcumins and phtalides (Basak et al., 2010, Guldiken et al., 2018). Herbs and spices have also been used as food additives all over the world, not only to improve the organoleptic properties of food, but also to increase shelf life by reducing or eliminating foodborne pathogens (El-Sayed and Youssef, 2019, Ahmad et al., 2021, Miran et al., 2021, Gokhale et al., 2021). Apart from taste enhancement, herbs and spices are also recognized for their preservative effect and possess antioxidant, anti-inflammatory, antitumorigenic, anticarcinogenic properties. (Muzolf and Stuper, 2021, Zayapor et al., 2021, Ali et al., 2021, Zeb, 2021, Pateiro et al., 2021, Pinto et al., 2021, Bhattacharya et al., 2022). Recently, research interests have centred on many herbs which may be useful adjacent in reducing risks of cardiovascular (CVD) and cancer diseases that have hypolipidemic, antiplatelet, anti-tumour or immune stimulation properties (Hussain et al., 2015, Prasad et al., 2017, Shishodia et al., 2003). India is known as the “World’s Botanical Garden” and the “Land of Spices” because it is the world’s largest producer of traditional medicinal herbs (Paswan et al., 2021). Today, industry is very much interested to use these herbal bio-actives for the variety of ways that the medicinal benefits of herbs could be transmitted as carriers through certain foods. Milk and milk products are one of the most significant sources and can be used as carriers for such foods (Sawale et al., 2013). India is the world’s largest milk producer. Therefore, every year a significant amount of milk is used for the manufacture of different kinds of Indian dairy products. Converting liquid milk into standard milking products retains milk solids not only for a longer period of time but adds value of milk as well. Indian conventional milk products have enormous demand and well-developed domestic markets. The perishable nature of milk and milk products makes the shelf life, very short. To improve the shelf life of milk and milk products, natural preservatives are used. As a result, the addition of herbs and spices to food and dairy products

appears to be a good alternative to chemical preservatives for improving dairy product functionality and extending shelf life (Wojdylo et al., 2007, Khoobchandani et al., 2010, Gonçalves et al., 2013, Pinto et al., 2021). The inclusion of herbal bio-actives in traditional Indian milk products not only allows the industry to meet the growing demands of customers for such foods but also helps to compete with increasingly functional food markets around the world (Paswan et al., 2021). Research to trigger and/or enhance the functionality of many conventional dairy products has been conducted. Therefore, Changes to the process are required to reduce the unintended effects of the bioavailability of functional components in plants and research must be based on the influence of processing conditions. Natural antioxidants often have lower side effects than synthetic antioxidants for the human body. Therefore, the objective of this review is to present the recent scenario of using herbs in different dairy products. Moreover, infusion of herbs in dairy products will improve the shelf life. The examples of some important herbs that are used in traditional Indian dairy products as a source of antioxidant and have medicinal and functional properties are delt below.

2. COMMON HERBS AND SPICES USED IN DAIRY PRODUCTS

There are arrays of naturally occurring medicinal herbs that have hypotensive/antihypertensive potential. These herbs may help in regulation of blood pressure by stimulating the physiological systems in humans. Some examples of herbs showing hypotensive properties are garlic, celery, tea, ajwain, ginger, lavender, murungai, basil, kudzu, radish, rauwolfia, sesame, etc. Angiotensin Converting Enzyme (ACE) inhibitors present in herbs may inhibit angiotensin-converting enzyme, a component of the blood pressure-regulating renin-angiotensin system, thereby lowering the blood pressure (Korhonen and Pihlanto, 2007). The examples of few important herbs that have conferred medicinal or functional properties to dairy foods are dealt in table 1 below.

3. MAJOR GROUP OF ANTIOXIDANTS

Natural antioxidants derived from plant sources are assumed to be safe because they occur naturally and have been used by humans since ancient times (Madsen and Bertelsen, 1995). The main functions of antioxidants are to delay the production of ROS and may reduce oxidative damage to the human body (Namiki, 1990, Ismail et al., 2004). Presence of vitamins, carotenoids, flavonoids, terpenoids, and phytoestrogens are the source of the antioxidant property of herbs and spices. Some examples of spice and herbs containing antioxidants are: basil, cinnamon, clove, ginger, thyme, etc (Carlsen et al., 2010, Panda et al., 2022).



Table 1: Common herbs and spices used in traditional dairy products

Name of the herbs and spices	Active component name
Ashwagandha (<i>Withania somnifera</i>)	Alkaloids, Steroidal lactones and Saponins
Tulsi (<i>Ocimum tenuiflorum</i>)	Oleanolic acid, Ursolic acid, Rosmarinic acid, Eugenol, Carvacrol, Linalool, and β -caryophyllene
Turmeric (<i>Curcuma longa</i>)	Curcumin
Coriander (<i>Coriandrum sativum</i>)	Coriendrol
Curry leaf (<i>Murraya koenigii</i>)	di- α -phellandrene, and caryophyllene,
Anola (<i>Phyllanthus emblica</i>)	Anthocyanin and phenol
Arjuna (<i>Terminalia arjuna</i>)	Tannins, Triterpenoid, Saponin, Flavonoids, Phenols, Phytosterols and alkaloids
Ginger (<i>Zingiber officinale</i>)	Gingerol
Clove (<i>Syzygium aromaticum</i>)	Eugenol
Cardamom (<i>Elettaria cardamomum</i>)	Cineole
Aloevera	Lignin, saponins, salicylic acids
Carrot (<i>Daucus carota</i> subsp. <i>Sativus</i>)	Carotene
Strawberry (<i>Fragaria×ananassa</i>)	Anthocyanins, flavonoids and polyphenols

3.1. Carotenoids

This group of antioxidants contains mainly beta carotene, lutein, zeaxanthin and lycopene. These compounds help in neutralizing free radicals, bolsters cellular antioxidant defences, maintains healthy vision and also prostate health. The source of beta carotene is carrot, spinach etc.; source of lutein, zeaxanthin is kale, collards, corn, eggs and citrus fruits and source of lycopene is tomatoes and processed tomato products.

3.2. Flavonoids

This group contains anthocyanidins, flavanols—catechins, epicatechins, procyanidins and flavanones compounds. These compounds help to boost cellular antioxidant activity, maintain brain function, heart health and neutralize free radicals etc. Source of anthocyanidins is berries, cherries and red grapes; source of flavanols—catechins, epicatechins, procyanidins are tea, cocoa, chocolate, apples and grapes and the source of flavanones is citrus fruits.

3.3. Isothiocyanates

This group comprises of sulforaphane compounds. This compound helps to enhance detoxification of undesirable compounds and boosts the cellular antioxidant defences system. It is widely found in cauliflower, broccoli, cabbage, horseradish etc.

3.4. Phenols

This group contains caffeic acid and ferulic acid which increases cellular antioxidant defences, maintain a healthy vision and heart health. The source of these components are apples, pears, citrus fruits, some vegetables etc.

4. MECHANISM OF ACTION OF ANTIOXIDANTS

An antioxidant is a material which at low concentrations, slows or prevents oxidation of a product. Antioxidant compounds interact with a few chemical processes: Hydrogen Atom Transmission (HAT), Single Electricity Transmission (SET), chelating metals in transition. Oxidation or loss of electrons can also lead to reactive free radicals that can cause oxidative stress or damage to cells. Before they can react and cause harm, antioxidants are in their nature capable of stabilizing free radicals just like a buffer does an acid to retain the natural pH. Because oxidation is a natural method of the body, in order to maintain a healthy state, balance with antioxidants is needed. It is assumed that the ingestion of antioxidants offers protection against oxidative harm and brings beneficial health benefits. The carotenoids such as lutein and zeaxanthin, are involved in antioxidant activities that have been shown to increase the density of macular pigments in the eye. It is observed that the antioxidants present in strawberries, chocolate, blue berries and teas have beneficial effects on cardiovascular health, Alzheimer's disease and even a reduction in the risk of some cancers.

5. APPLICATION OF HERBS AND SPICES INTO TRADITIONAL INDIAN DAIRY PRODUCTS

In recent days, herbal extracts and preparations are gaining importance than less toxic antioxidants and radio protectors. Herbs have been used throughout history as preservatives, flavourings and therapeutic agents to fortify foods. While herbs are low – cost commodities, they are



now priced for several decades as gold or jewels (El-Sayed and Youssef, 2019). Herbal intake has a significant health-promoting effect and reduces the incidence of different deadly diseases (Prasad et al., 2017, Shishodia et al., 2003). Dairy products are a special carrier that has been successfully used in our dietary food systems to carry phytochemicals and other nutrients for health benefits (El-Sayed and Youssef, 2019). In traditional Indian milk products, the use of diverse herbs and spices is discussed here.

5.1. Sandesh

Sandesh is a very common heat – desiccated commodity called chhana, a mass of coagulated milk protein. The inclusion separately as a paste of herbs such as turmeric (*Curcuma longa*), coriander (*Coriandrum sativum* L.), curry leaf (*Murraya koenigii* L.), spinach (*Spinacia oleracea*) and aonla (*Emblica officinalis*) improved its antioxidant properties at 10% level in Sandesh. The addition of herbal coriander resulted in increased shelf life of herbal Sandesh when stored at 30±1°C and 7±1°C respectively for up to 8 days and 30 days (Bandyopadhyay et al., 2007). The antioxidant levels of these herbs were compared at levels of 100 and 200 mg/kg with the synthetic antioxidants TBHQ and BHA:BHT (1:1). The author has confirmed that herbal sandesh's total antioxidant status was lower than TBHQ samples but comparable to those with 200 mg kg⁻¹ BHA:BHT (1:1). Sen and Rajorhia (1985) reported that the rate of chemical and microbiological degradation was significantly shown in the product samples stored in sanitized tin containers at 30°C and 7°C when cardamom powder was incorporated in sandesh at the rate of 0.05, 0.1 and 0.15% by weight of chhana.

5.2. Paneer

In 2014, Buch and co-workers added turmeric to the paneer at 0.0 (control), 0.2, 0.4, 0.6, 0.8 and 1.0% by weight of the predicted paneer yield to research the degree of paneer shelf life. The rate of addition of turmeric to milk was selected as 0.6% turmeric by weight of the predicted paneer yield based on changes in the sensory score of the paneer, which remains suitable for storage at 7±1°C for up to 12 days. According to Kaur et al. (2003) and Bajwa et al. (2005), incorporating coriander and mint at a 10% by weight level in paneer improved the overall acceptability score and product yield. Incorporation of 0.4% clove essential oil in chilled water during chilling of paneer was found suitable to decrease the rate of increase of free fatty acid (FFA) content in comparison to control paneer (Khatkar et al., 2017). Use of black pepper, cardamom and cinnamon in paneer preparation resulted extended shelf life (Eresam et al., 2015). 0.3% banana pseudostem juice used for dipping freshly prepared paneer for 2 h can significantly suppress proteolytic activity in paneer, acidity and FFA. Dipping fresh paneer

samples in garlic extract has also shown to be effective in suppressing the rise in tyrosine content during storage.

5.3. Khoa

Khoa has a limited shelf life of less than a week under ambient condition. Khoa is more prone to chemical and microbial spoilage irrespective of the storage conditions due to presence of high moisture content (Kumar et al., 2010). Prasad et al. (2017, 2018) studied on burfi, a sweet med prepared from Khoa and observed a significant increase in antioxidant activity in burfi fortified with herbal essential oils of turmeric, ginger and cardamom. Puri et al., 2018 observed incorporation of 0.09% (w/v of milk) heartwood extract during the preparation of khoa, increases the shelf life of peda (sweet med prepared from khoa) from 21–49 days at 4°C and from 14–35 days at 30°C. Addition of the essential oil of curry leaf and clove bud at 0.10 ppm and 0.20 ppm level on khoa, increases the storage stability of burfi without affecting the sensory quality of the product (Badola et al., 2018). Pandey and Poonia (2020) reported addition of 10% level of ber powder increases the antioxidant activity, total phenolic content as well as the sensory quality of Burfi.

5.4. Dahi

Herbal supplemented probiotic dahi prepared by Hussain et al. (2011) with the herb Aloe barbadensis Miller. The authors stated that the growth of the probiotic strain was assisted by Aloe vera supplementation (*Lactobacillus paracasei* L.). During the 12-day storage cycle, the probiotic viability was found greater than 7 log cfu ml⁻¹. Singh et al. (2013) prepared strawberry fortified stirred dahi (0.5 mg ml⁻¹) polyphenol extract. This fortification resulted in a sevenfold increase in polyphenol enriched stirred dahi's antioxidant activity. In terms of antioxidant activity and preservation of total phenolic content, no statistically significant difference ($p > 0.05$) was identified during 3 weeks of storage at refrigeration temperature (7–8°C).

5.5. Lassi

In India, as well as in overseas markets, lassi which is a ready-to-serve traditional fermented milk beverage has become widely popular. As a food carrier for herbal bio-actives such as Aloe vera juice etc., sweet lassi with its characteristics sweet and slightly sour taste can be used. By supplementing the herb Aloe vera and probiotics, functional lassi was grown. The inclusion of aloe vera juice in lassi at a rate of 15% increases the shelf life of lassi with satisfactorily good consistency for up to 23 days and also increases antioxidant activity, texture and aroma profile (Hussain et al., 2017, Moussa et al., 2020). Hussain et al. (2017) revealed that probiotic lassi supplemented with aloe vera decreases Shigella count and raises the amount of Hb, RBC and WBC haematological parameters in mice. Fortification of ginger, turmeric and carrot juice significantly increased the overall



phenolic content of herbal *lassi* compared to control *lassi* (Maji et al., 2016). The sensory scores of the three forms of herbal *lassi* i.e ginger, turmeric and carrot, at a level of 2%, 1% and 15% (v/v) respectively were ranked highest. It was also reported that turmeric fortified *lassi* showed the highest phenolic content compared to the ginger and carrot fortified *lassi* having shelf life 9 days at refrigeration temperature (Maji et al., 2018).

5.6. Shrikhand

As a semi-soft, sweetish- sour, whole milk product prepared from lactic fermented curd, shrikhand can easily harbour herbs/herbal extracts without major sensory quality changes. A study conducted by Landge et al. (2011) stated that the addition of 0.5% Ashwagandha powder to shrikhand improved organoleptic consistency and at refrigeration temperature, the product remained acceptable for up to 52 days. 0.2% ashwagandha powder in shrikhand and found excellent overall acceptability compared to control shrikhand. Addition of tulsi extract and turmeric powder at different proportion for the preparation of shrikhand was reported to increase the flavour, taste and overall acceptability. It also increases the chemical structure of shrikhand as compared to control (David, 2015, Ojha et al., 2018). Similarly, it was found that the addition of 4% ginger powder improves the overall acceptability of shrikhand, in addition to improving the product's medicinal benefit.

5.7. Ghee

The Indian name of clarifies butter fat is Ghee which is prepared by boiling off method. It is usually made from buffalo and cow milk individually or in combination. Around 30–35% of the milk produced in India is converted into ghee (Varkey, 2010). The herbal ghee sold in India is currently commonly sold as a medicine for the treatment of certain diseases and is thus known as 'medicinal ghee'. Parmar and Khamrui (2017) reported that ethanol extract of Arjuna bark improved ghee's shelf life compared to the control sample at 8°C in storage. Freshly prepared cow milk ghee with arjuna bark added also has excellent potential to act as a free radical scavenger. Parmar and Khamrui (2017) found that the ghee produced with 7% arjuna extract supplemented by creamery buffalo butter had maximum phytosterol content with sufficient sensory characteristics. Merai et al. (2003) added 0.6% Of the creamery butter ghee with Tulsi (*Ocimum sanctum*) leaf powder. They observed that the ghee obtained had comparable stability to the ghee containing 0.02% BHA for 8 days at high storage temperatures. They also consider that Tulsi leaves were the primary factor in prolonging ghee's oxidative stability. In addition, incorporation of a mixture of alcoholic and aqueous satavari herb extracts, Pawar et al. (2012) successfully improved the oxidative stability of ghee. Moreover, the antioxidant role of coriander extract

in ghee was evaluated by Patel et al. (2013). They observed that the coriander extract provided better oxidative stability for ghee throughout storage as compared to control samples.

6. CONCLUSION

Herbs and spices are natural ingredients that have long been used not only as food flavouring but also for their health benefits. Incorporation of herbs as a source of antioxidants in milk products has met acceptance for the delay of oxidation. Traditional dairy products are suitable carrier for herbs, to incorporate practical features that enhance customer health. Research is needed to meet technical challenges such as bioavailability and processing conditions in order to produce milk products enriched with herbs.

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