

Application and Uses of Herbs in Milk and Milk Products

Meshram, B. D.^{1*}, Dixit Poonam², Wasnik, P. G.³, Shaikh Adil¹ and Rupesh Datir³

¹Department of Dairy Technology, College of Dairy Technology, Pusad, 445204, Maharashtra

²M.Tech Student, Department of Dairy Technology, College of Dairy Technology, Pusad, 445204, Maharashtra

³Department of Dairy Engineering, College of Dairy Technology, Pusad, 445204, Maharashtra

*Corresponding Author E-mail: bdmeshram@gmail.com

Received: 12.08.2016 | Revised: 23.09.2016 | Accepted: 28.09.2016

ABSTRACT

Herbs have multifarious role such as food flavorings, preservative and as medicinal ingredient. Various herbs are documented for their therapeutic properties viz., anti-oxidative, antihypertensive, anti-inflammatory, anti-diabetic, antimicrobial, etc. Some of the important herbs dealt in this review include Ashwagandha, Arjuna, Turmeric, Sage, Cinnamon, Cumin, Garlic, Fenugreek, Peppermint, Basil and Aloe vera. The examples of some spice and herbs containing antioxidants include basil, cinnamon, clove, dill, ginger, mint, oregano, rosemary, saffron, sage, thyme, etc., while herbs showing hypertensive properties include garlic, celery, tea, ajwain, ginger, lavender, basil, radish, sesame, etc. *Terminalia Arjuna* based sito sterol is considered as one of the best heart tonic for healthy cardiovascular system. Few herbs can help in extending the shelf life of dairy products (especially fermented dairy products) especially through their suppressing effect on fungi and bacteria. Hence, judicious use of herb application in dairy products may result in raising their nutritional and medicinal values and enable development of value-added dairy products. Fortification of herbs in dairy products could help in providing value-added, functional dairy foods at the same time boost the sale of important herbs.

Key words: Herbs, Functional food, Neutraceuticals, Fortification, Dairy foods.

INTRODUCTION

Since the ancient times, herbs have been used not just as food flavorings, but also as medicine and preservatives. There is a significant linkage between food habit and disease prevention; the effects of food on diseases such as diabetes, obesity, osteoporosis, hypertension and cardiovascular disease are documented in literature⁵¹. The

indigenous knowledge on medicinal plants is gaining worldwide recognition. India is the largest producer of medicinal herbs and is referred to as the 'Botanical Garden of the World'³⁵. With the emergence of fortified foods, there is a worldwide increase in health awareness and interest in adding herbs as prized food additive in dairy and food products¹.

Cite this article: Meshram, B.D., Poonam, D., Wasnik, P.G., Adil, S. and Datir, R., Application and Uses of Herbs in Milk and Milk Products, *Int. J. Pure App. Biosci.* 4(5): 226-235 (2016). doi: <http://dx.doi.org/10.18782/2320-7051.7470>

Due to the increased consumer awareness and interest to follow healthy nutrition and dietary strategy in achieving health benefits from foods beyond their basic nutrition, the market for value added functional foods has expanded manifold. World Health Organization survey indicated that about 70-80% of the world population rely on non-conventional medicine mainly population and 80% in developing countries depends directly on plants for their medical purposes⁴⁶. Herbs have found many uses in treating number of diseases and their herbal extracts can be used in pharmaceuticals, ayurvedic formulation, confectionery, nutritional foods, ready to-drink mixes, instant foods, seasonings, dairy products, seasoning blends, etc. Therefore, fortification of herbs in dairy products could provide value added, functional dairy product. The objective of collating literature on some important herbs will unravel the secracies, enabling us to know the causative factors for alleviating health issues otherwise plaguing certain individuals. Moreover, use of some specific herbs will help in shelf life extension of perishable dairy products.

2.0 Functional properties of herbs

Natural antioxidants, derived from plant sources are presumed to be safe as they occur in nature and are being used by human being from ancient time³². Antioxidants help in delaying the oxidation of molecules by inhibiting the initiation or propagation of oxidizing chain reactions by free radicals and may reduce oxidative damage to the human body^{23,36}. The antioxidant properties of herbs are due to presence of some vitamins, flavonoids, terpenoids, carotenoids and phytoestrogens. Some examples of spice and herbs containing antioxidants are: basil, cinnamon, clove, dill, ginger, mint, oregano, rosemary, saffron, sage, thyme, etc¹¹. There are arrays of naturally occurring medicinal herbs that have hypertensive/antihypertensive potential. These herbs may help in regulation of blood pressure by stimulating the physiological systems in humans. Some example of herbs showing hypertensive 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 rennin-angiotensin system, thereby lowering the blood pressure³³. The examples of few important herbs that have conferred medicinal or functional properties to dairy foods are dealt below.

2.1 Ashwagandha (*Withania somnifera*)

Ashwagandha is referred to as Indian ginseng or winter cherry. One of the most esteemed medicinal plant used in Indian Ayurveda since centuries. It hails from Solanceae family, grown in Africa, the Mediterranean, and India. Ashwagandha is considered to be a vitalizer, adaptagen, facilitating the ability to withstand stressors, and has antioxidant properties. Sitoindosides and acyl steryl glucosides in Ashwagandha are anti stress agents. Ashwagandha is characterized by the presence of steroidol lactones, alkaloids and flavonoids. Their root contains maximum amount of alkaloids- nicotine, withanine, etc. Roots of the plant shows hypertensive, bradycardiac, antitumor, respiratory stimulant activities and immuno-stimulating effect⁵⁰.

2.2 Turmeric (*Curcuma longa*)

Turmeric is widely used as a spice, preservative, coloring matter and has wide range of medicinal and pharmacological applications. It exhibits anti-inflammatory, anti-HIV, anti-bacterial, antioxidant, antiparasitic, antispasmodic and anti-carcinogenic activities. Niranjan and Prakash³⁸ reported that it is a potent scavenger of a variety of Reactive Oxygen Species (ROS) including superoxide anion, hydroxyl radical, peroxy nitrite, etc. A total of 720 compounds, including 102 diphenyl alkanoids, 19 phenyl propene derivatives, 529 terpenoids, 15 flavonoids, 7 steroids, 3 alkaloids and 44 compounds of other types isolated or identified from 32 species, have been phytochemically investigated in *Curcuma longa*. The biological activities of plant extracts mainly involve anti-inflammatory and antitumor activities.

2.3 Arjuna (*Terminalia arjuna*)

Terminalia arjuna is a deciduous and evergreen tree that belongs to Combretaceae family. It is found in abundance throughout Indo-sub-Himalayan tracts of Uttar Pradesh, South Bihar, Madhya Pradesh, Delhi and Deccan region near ponds and rivers. It is also found in forests of Sri Lanka, Myanmar and Mauritius. *Terminalia arjuna* shows potential antioxidant and free radical scavenging activity due to presence of more amounts of flavonoid and phenolic content⁴⁷. The plant is rich source of natural antioxidants and hence finds usage in both Ayurvedic and Yunani systems of medicine. It is reported to possess properties such as styptic, anthelmintic, alexiteric, tonic, and useful in fractures, heart diseases, urinary discharges, biliaryness, ulcers, asthma, tumors, anemia, excessive perspiration, etc. *Terminalia arjuna* based phytochemicals are considered as one of the best heart tonic useful for healthy cardiovascular system. The sitosterol present in this herb lowers the cholesterol in blood serum by inhibition of cholesterol absorption. The active components of *Terminalia arjuna* are tannins, triterpenoid saponin (arjunic acid, arjunolic acid, arjungenin, and arjun glycosides). Flavonoids (arjunone, arjunolone, luteolin), gallic acid, ellagic acid, Oligomeric Proantho Cyanidines (OPCs), phytosterols, calcium, magnesium, zinc and copper⁴¹.

2.4 Sage (*Salvia triloba*)

Sage is the dried leaf of a mint family. The leaves of Sage plant are well known for their anti-oxidative properties and anti inflammatory activities. The major antioxidant compounds in sage include carnosol, carnosic acid, rosmadial, rosmanol, epirosmanol and methyl carnosate. Essential oil from sage is known to possess well-known antioxidant properties⁵². The oil extract of sage has been found to possess antimicrobial activities against a wide range of bacteria, which are mainly due to the cineole component. It is used as a flavouring and antioxidant in cheeses, pickles, vegetables, processed foods and beverages³¹.

2.5 Cinnamon (*Cinnamomum verum*)

Cinnamon is an herb traditionally used by many ancient cultures. They are small evergreen tree belonging to the family Lauraceae, native to Sri Lanka and South India. In addition to being used as a spice and flavouring agent, cinnamon is added in certain food for mouth refreshing effects²⁴. Cinnamon has been implicated in reducing the risk of colon cancer, acts as a coagulant and prevents bleeding²¹. Cinnamon also increases the blood circulation in the uterus and advances tissue regeneration. The essential oils of cinnamon have antimicrobial, antifungal, antioxidant and antidiabetic²⁶. Cinnamon shows complete antibacterial effect against food borne pathogens such as *Salmonella typhi*, *Salmonella paratyphi A*, *E. Coli*., *S. aureus*, *Pseudomonas fluorescens* and *Bacillus licheniformis*³⁷. They exert inhibition against fungal strains too. The Minimum Inhibitory Concentration (MIC) values for cinnamon essential oil ranged from 1.25 to 5.0%²⁰.

2.6 Cumin (*Cuminum cyminum*)

Cumin is a small annual herbaceous plant that is a member of the aromatic plant family Umbelliferae. Cumin is cultivated in India, Morocco, Iran, Turkey, China and the America. The seeds of the plant are used to add flavor to spicy dishes. They are also used as an appetite stimulant and to ease stomach disorders²⁵. A powder suspension of the cumin inhibits mycelium growth, toxin production or aflatoxin production by *Aspergillus ochraceus*, *Candida versicolor* and *Candida flavus*. The antibacterial action has also been seen against a range of useful and pathogenic gram-positive and gram-negative bacterial strains²². Mainly cuminaldehyde, carvone, limonene and linalool and to a certain extent limnonene, eugenol, pinene, etc. contributes to the antimicrobial activity of cumin¹⁵. The fatty oil (mainly petroselic acid) present in cumin exerts antimicrobial effect too. Antifungal activity of cumin is recorded against food, human pathogens, including dermatophytes, vibrio spp., yeasts, aflatoxins and mycotoxin producers¹⁸.

2.7 Garlic (*Allium sativum*)

Garlic is used as important ingredient in some Indian spicy dishes. It is a rich source of phytochemicals and organosulfur compounds showing health benefits and anti-aging effects. It is used to spice food, cure colds, heal infections, and treat ailments like heart disease and cancer⁹. Allicin or diallyl thiosulphinic acid is the main constituent of garlic that has antimicrobial activity against both gram-positive and gram-negative bacteria. Allicin is enzymatically produced from its precursor aliiavia, the intermediate product of allylsulfenic acid¹⁶. Many studies have demonstrated efficacy of garlic extract in reducing the growth of many pathogens including *S. aureus*, *S. albus*, *S. typhi*, *E. Coli*, *L. Monocytogenes*, *A. niger*, *Pseudomonas aeruginosa* and *Proteus morganni*²⁷.

2.8 Fenugreek (*Trigonella foenum-graecum*)

Fenugreek is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. A novel amino acid from fenugreek seeds, 4-hydroxyleucine, increased glucose stimulated insulin release by isolated islet cells in both rats and humans. Oral administration of 2 and 8g/kg of plant extract produced dose dependent decrease in the blood glucose levels in diabetic rats. Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic rats. It also reduced hepatic and renal glucose-6 phosphatase and fructose-1, 6-biphosphatase activity. This plant also shows antioxidant activity. In India, the ground seeds are used in spice mixtures and as a condiment, and therefore constitute an important ingredient in Chutneys and spice blends. In Egypt, these seeds are either eaten raw after sprouting or are used to make a confection following roasting, grinding and cooking them with treacle and sesame seeds. In USA, fenugreek seed extract is used as principal flavoring ingredient in simulated maple syrup and other products⁵.

2.9 Peppermint (*Mentha piperita*)

Peppermint plant grows to about 2-3 feet tall. Dark green, fragrant leaves grow opposite white flowers. Peppermint is native to Europe and Asia, is naturalized to North America, and grows wild in moist, temperate areas. Some varieties are indigenous to South Africa, South America and Australia. The leaves and stems, which contain menthol (a volatile oil), are used medicinally and as flavoring in food⁸. Peppermint, a popular flavoring for tea is also used to soothe an upset stomach or to aid digestion. It has a calming and numbing effect, and is often used to treat headaches, skin irritation, nausea, diarrhea, menstrual cramps, flatulence, and anxiety associated with depression. Menthol and methyl salicylate, the main components in peppermint, have antispasmodic effects, with calming effects on the gastrointestinal tract. Several studies support the use of peppermint for indigestion and irritable bowel syndrome².

2.10 Basil (*Ocimum basilicum*)

Basil is commonly known as Tulsi. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum* showed significant reduction in blood sugar level in both normal and alloxan induced diabetic rats. Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi in diabetic rats. This plant also showed anti-asthmatic, anti-stress, antibacterial, anti-fungal, antiviral, antitumor, gastric anti-ulcer activity, antioxidant, anti-mutagenic and immunostimulant activities⁴³. Peppermint and Basil (*Ocimum basilicum*) are traditionally grown crops in Europe and Central Asia for the production of fresh herb, dry leaves or essential oils¹⁹. These plants portions find their applications as culinary herb or as minor adjuncts to salads and herbal tea and as aromatic agents in the food, pharmaceutical, functional food and nutraceuticals industries⁴.

2.11 Aloe vera (*Aloe barbadensis miller*)

Aloe vera has a long history of use as a topical and oral therapeutic. It is an acaulescent,

perennial plant, and belongs to Xanthorrhoeaceae family. Aloe vera is a native plant of the Mediterranean region but is found all over the world. The Aloe vera leaf can be divided into two main fractions: the green skin, which is rich in 1, 8-dihydroxyanthraquinone derivatives and their glycosides, and the colorless pulp that is richer in complex carbohydrates. Mucilaginous jelly like parenchyma is referred to as Aloe vera pulp or gel. This gel has a large content of water (95-99%), and contains proteins, lipids, amino acids, vitamins, enzymes, inorganic compounds, and small organic compounds in addition to carbohydrates. Acemannan (acetylated glucomannan), also known as carrysin, is the best known among the polysaccharides found in Aloe vera gel. Aloe vera is a source of essential micronutrients and active phyto-chemicals such as ascorbic acid, tocopherols and phenolic compounds which are able to reduce the free radicals that cause reactions of oxidation associated with CVD, carcinogenesis and aging. Many biological activities, including antimicrobial, laxative, protection against radiation, antioxidant, antiinflammatory, anti-tumour, anti-diabetic, antiallergic, as well as hypoglycaemic, gastroprotective, immunomodulatory and wound healing effects, have been attributed to this plant gel¹⁴.

3.0 Application of Herbs and Herbal Nutraceuticals in Milk and Milk Products

3.1 Fat Rich Dairy Products

Herbs contain high amounts of phenolic compounds which possess antioxidant properties. The natural antioxidant properties of herbs have made their use in the formulation of functional foods specifically targeted for the people suffering from cardiovascular diseases¹. The antioxidant properties of herbs also led their use into fat rich dairy products for retarding auto-oxidation thereby prolonging the shelf-life. Moreover, it was found that the artificial antioxidants, like BHT (butylated hydroxy toluene) or BHA (butylated hydroxy anisole) are not safe for human consumption (suspected to have carcinogenic activity). On the other hand,

increasing sensitivity of consumers to synthetic ingredients as well as their increasing awareness about the effect of diet on their health contributed to the increasing trend to use natural additives like herbal extracts for the stabilization of fat rich dairy foods like ghee, butter oil, butter etc. Sage (*Salvia officinalis*) and Rosemary (*Rosmarinus officinalis*) extracts are the most widely used for this purpose. These extracts have antioxidant activity many times stronger than synthetic antioxidants like BHA or BHT¹².

Milk fat, particularly ghee has the characteristics to absorb all the medicinal properties of the herbs with which it is fortified, without losing its own attributes. About 60% medicated ghee preparations used for the treatment of various diseases were reported in Ayurvedic literature⁴⁶. Recently, Arjuna ghee was developed at NDRI, Karnal by incorporating functional attributes of Terminalia arjuna for providing beneficial effects against cardiovascular diseases and the product was more stable to oxidative deterioration as compared to control ghee³². Research evidence supporting the health benefits of herbal ghee preparations is scanty. In a clinical study on antiasthamine effects of vasa ghee. There was marked improvement in 92.59% cases within 21 days of study period. HPTLC studies have shown that vasicinone, an antiasthamine agent present in Adhatodavasica was responsible for antiasthamine effects of vasa ghee. The authors have also reported that vasa ghee consumption also had an additional benefit in reducing serum cholesterol level by 30.16%. Pharmaco clinical studies showed that Panchtikta ghee prepared with different methods was beneficial in reducing the cardiovascular diseases⁴⁶. A thorough study on the bioactive components of herbs and effect of different processing conditions on them during ghee preparation could lead us to diversify the usage in a well organised commercial way.

3.2 Dahi and Lassi

Aloe vera, an herb of the Liliaceae family has a long and illustrious history dating from

biblical times and given a high ranking as an all-purpose herbal plant. Scientific investigations on Aloe vera have gained more attention over the last several decades due to its reputable medicinal properties¹¹. Lassi, a ready-to-serve traditional fermented milk beverage has got wide popularity in India as well as in overseas markets. Sweet lassi with its characteristic sweet and slightly sour taste can be used as a food carrier for herbal bioactive like Aloe vera juice. A culture combination containing NCDC 60 and *Lactobacillus paracasei* ssp. *paracasei* at an inoculum rate of 1 percent was used for functional lassi preparation. Animal study of functional lassi revealed that it has better immune protective effects compared to control lassi.

3.3 Sandesh

Sandesh is a very popular heat-desiccated product of coagulated milk protein mass called chhana. About 80% of chhana produced in Kolkata (West Bengal, India) is converted into sandesh³⁴. Incorporation of herbs into these kinds of highly demanded dairy products will improve the health status of the consumers. Bandyopadhyay *et al.*³ incorporated herbs such as turmeric (*Curcuma longa L.*), coriander, curry leaf, spinach and aonla, separately as a paste, at the 10% level into Sandesh to induce the antioxidant properties into the product. The antioxidative levels of these herbs were compared with the synthetic antioxidants TBHQ and BHA: BHT (1:1) at 100 and 200 mg/kg levels. The authors have reported that the total antioxidative status of herbal sandesh was lower than samples with TBHQ but like those with 200mg/kg BHA: BHT (1:1). The authors have also reported that the use of coriander herb with its antimicrobial and antioxidant properties increased the shelf-life of herbal sandesh up to 8 days at (30±1 °C) and 30 days at (7±1 °C) when compared with the remaining samples.

3.4 Shrikhand

Shrikhand is a semi-soft, sweetish-sour, whole milk product prepared from lactic fermented curd³⁸. Shrikhand is prepared by admixing of sugar in required quantities with strained dahi

or concentrated dahi. Being a sweetish-sour and semi soft product it can easily harbour herbs/herbal extracts without undergoing significant quality changes. Landge *et al.*³⁰ successfully prepared shrikhand using Ashwagandha herb powder as an additive. The authors have found that addition of 0.5% Ashwagandha powder to shrikhand has improved the organoleptic quality and the product was remained acceptable upto 52 days at refrigeration temperature.

3.5 Ghee (clarified butterfat)

Herbs contain high amounts of phenolic compounds which possess potent antioxidant properties. The natural antioxidant properties of herbs have made their use in the formulation of functional foods specifically targeted for the people suffering from Cardio Vascular Diseases (CVDs). Presently, the herbal ghee being marketed in the global market is mostly sold as medicine (medicinal ghee). These products possess typical flavor, bitter or pungent taste and a dark color. Such therapeutic preparations are therefore not acceptable for regular consumption. At National Dairy Research Institute (NDRI), Karnal, India herbal ghee incorporating functional attributes of Arjuna herb has been developed for providing beneficial effects against CVD; such product had greater stability against oxidation as compared to conventional ghee. The consumer acceptability of such Arjuna ghee was very good⁴⁴. The antioxidant activities of vidarikand, shatavari (*Asparagus racemosus*) and ashwagandha (*Withania somnifera*) extracts, both as aqueous and ethanolic extracts, were evaluated as against synthetic antioxidant BHA. The active components of vidarikand are puerarin, daidzein, genistein and daidzin⁴⁰. The ethanolic extract showed more antioxidant activity than their aqueous counterpart, owing to greater phenolic content in the former extract. Hence, the ethanolic extract of the herb were more effective in preventing the development of peroxide value and conjugated diene in ghee compared to their aqueous extract. The antioxidant activity of the herbs decreased in the order:

vidarikand>ashwagandha>shatavari. The ethanolic extract of vidarikand had the maximum antioxidant activity among the herbs tested⁴². *Asparagus racemosus* (shatavari) are steroid glycosides, saponins, polyphenols, flavonoids, galactose and vitamins⁴⁸ and *Withania somnifera* are steroid lactones (withanolides), sitoindosides and steroid alkaloids. *Withania somnifera* is one of the major herbal components of geriatric tonics, this plant is also claimed to have potent aphrodisiac, rejuvenative and life prolonging properties Sharma⁴⁵. *Asparagus racemosus* is reported to have immunostimulant, anti-hepatotoxic and anti-oxytocic activities¹⁷ and antioxidant and anti-diarrheal activities in laboratory animals⁷. Rajnikant and Patil⁴⁴ developed herbal ghee using *T. arjuna* as herb focusing on the herb's anti-oxidative properties. Parmar *et al.*⁴¹ found that addition of ethanolic extract of *T. arjuna* bark at 7% by weight was highly effective in retarding the auto-oxidation of both cow and buffalo ghee during storage. Ethanolic extract of Arjuna herb showed significant ability to enhance the antioxidant potential of ghee; the efficacy was more pronounced in case of cow ghee compared to buffalo ghee. The shelf life (accelerated test) of the Arjuna herbal ghee at $80\pm1^{\circ}\text{C}$ was 8 days as compared to just 2 days for control ghee sample (devoid of herb). Sage (*Salvia officinalis*) and Rosemary (*Rosmarinus officinalis*) extracts have been the most widely used herbs for prolonging the shelf life of ghee and butter oil³⁹. These extracts have antioxidant activity many times stronger than that of synthetic antioxidants (i.e. BHA and BHT).

3.6 Yogurt and Labneh (concentrated yoghurt)

Herbal yoghurt was prepared using cinnamon and licorice, incorporating probiotic bacteria. The presence of herbs did not affect the probiotic population during storage and there were no significant differences in pH and total titratable acidity between herbal-yogurts and plain-yogurt during storage. Water extract of cinnamon-yogurt showed the highest inhibition effect on *Helicobacter pylori* growth

as compared to licorice-yogurt and control yoghurt⁶. Different types of herbal yogurts were prepared by mixing pretreated herbs with standardized milk using strains of *L. acidophilus* and *L. plantarum* (1:1 v/v) and incubated at 40 °C for 6 h; the herbs were namely tulsi leaf (*Ocimum sanctum*), pudina leaf (*Mentha arvensis*) and coriander leaf (*Coriandrum sativum*). They reported greater β-D-galactosidase enzymatic activity in herbal yoghurt compared to control yogurt (without any herbs). Among the herbal yogurts, tulsi yogurt showed the maximum β-Dgalactosidase activity¹³. Yoghurt containing cinnamon (6.0 % cinnamon extract dissolved in 1.0 ml milk) could be successfully stored under refrigeration for up to 28 days; the Lactobacillus species count in such yoghurt was 19.46×10^6 cfu/ml when fresh; the *Streptococcus thermophilus* count increased in yoghurt containing cinnamon up to 7 days, when stored under refrigeration⁶. Labneh is basically concentrated yoghurt quite popular in the Middle East. Labneh (23.0 % TS) containing 0.2 ppm each of thyme, marjoram and sage essential oils had extended shelf life (by 21 days over control) at 5 °C.

3.7 Yogurt spread

An herbal flavored spread based on yogurt was developed by Kumar *et al.*²⁹. Yogurt concentrate (60 % TS) was prepared by allowing the whey to drain from yoghurt. To this yoghurt concentrate, salt and coriander were added at the same rate of 2% by weight. For optimization of mint level, the mashed raw leaves were added at 2, 4 and 6% by weight of yoghurt concentrate. The yoghurt spread prepared with 2% mint had higher sensory scores than the ones prepared using higher (i.e. 4 and 6 % levels) rate of addition. The shelf life of the spread was 10 days when stored at 5 °C. Such mint flavored yoghurt spread is recommended for use in sandwiches, burgers, chapattis and other leavened bakery items.

3.8 Paneer (directly acidified cheese like product)

Turmeric was incorporated in paneer coagulum at the rate of 0.4% and 0.6% by weight of expected yield of product. The

REFERENCES

paneer samples containing 0.6% turmeric by weight remained acceptable up to 12 days as against 7 days for control paneer, when stored at 7 ± 1 $^{\circ}\text{C}$ ¹⁰. Turmeric powder when added to milk (0.6 % by weight of expected yield of paneer) prior to heat treatment in paneer making, helped in reducing the taste of raw turmeric in resultant product.

3.9 Ice cream

Different forms of ginger i.e., ginger juice @ 4%, ginger shreds @ 4%, sugar syrup treated ginger shreds @ 6% and ginger powder @1% were used to prepare 'ginger flavored herbal ice cream and compared against a control ice cream made using vanilla flavouring. Incorporation of ginger juice or ginger shreds (sugar syrup treated) at rate of 4% by weight of ice cream mix is recommended for obtaining acceptable quality 'ginger flavored ice cream'.⁶⁶ Trivedi *et al.*⁴⁹ recommended incorporating basil juice @ 6% and freeze dried basil powder @ 1% by weight of ice cream mix in the preparation of 'basil flavored herbal ice cream'. Basil variety *Ocimum sanctum* was preferred over *O. Americanum*, *O. Basilicum* and *O. Gratissimum*. Incorporation of basil juice led to decrease in fat, protein, carbohydrates, ash and acidity and an increase in pH; melting resistance of ice cream was reduced.

CONCLUSION

Since pre historical times, herbs have been used not just as food flavouring but also for its medicinal properties. The antimicrobial and antioxidant constituents present in herbs enables them to be used as effective preservatives. Incorporation of herbs in dairy product may result in improvement in the health and medical condition of human being. Herbal products with promising health benefit, should comply with the regulatory requirements with respect to safety, efficacy, quality testing and marketing authorization procedures. It should be devoid of any side effect. There is a need of systematic scientific studies and documentation.

- Ansari, M. M., Kumar, D. S., Fortification of food and beverages with phytonutrients. *Food Pub Health* 2(6): 241-253 (2012).
- Balakrishnan, A., Therapeutic uses of peppermint-A review. *J Pharm Sci & Res* 7(7): 474-476 (2015).
- Bandyopadhyay, M., Chakraborty, R., Raychaudhuri, U., Incorporation of herbs into sandesh, an Indian sweet dairy product, as a source of natural antioxidants. *Int J Dairy Technol* 60(3): 228233 (2007).
- Baratta, M. T., Dorman, H. J. D., Deans, S. G., Biondi, D. M., Ruberto, G., Chemical composition, antimicrobial and antioxidative activity of laurel, sage, rosemary, oregano and coriander essential oils. *J Essential Oil Res* 10(5): 618-627 (1998).
- Basu, K. T., Srichamroen, A., Health benefits of fenugreek. In: Watson, R. S., & Preedy, V. R., (Eds.), *Bioactive Foods in Promoting Health: Fruits and Vegetables*. (1st edn), Academic Press, USA. pp. 425-435 (2010).
- Behrad, S., Yusof, M. Y., Goh, K. L., Baba, A. S., Manipulation of probiotics fermentation of yogurt by cinnamon and licorice: effects on yogurt formation and inhibition of *Helicobacter pylori* growth in vitro. *Int Scholarly &Sci Res & Innovation* 3(12): 563-567 (2009).
- Bhatnagar, M., Sisodiya, S. S., Bhatnagar, R., Antiulcer and antioxidant activity of *Asparagus racemosus* Willd and *Withania somnifera* Dunal in rats. *Annals of the New York Acad. Sci* 1056: 261270 (2005).
- Blumenthal, M., Goldberg, A., Brinckmann, J., *Herbal medicine. Expanded Commission E Monographs*. Integrative Medicine Communications, USA, pp. 297-303 (2000).
- Borek, C., Antioxidant health effects of aged garlic extract. *J Nutr* 131(3): 1010S-1015S (2001).
- Shweta, B., Suneeta, P., Aparnathi, K. D., Evaluation of efficacy of turmeric as a

preservative in paneer. *J Food Sc. & Technol* 51(11): 3226-3234 (2014).

11. Carlsen, M. H., Halvorsen, B. L., Holte, K., Bohn, S. K., Dragland, S., et al. The total antioxidant content of more than 3100 foods, beverages, spices, herbs and supplements used worldwide. *Nutr J* 9(1): 1-11 (2010).

12. Chan, K., Some aspects of toxic contaminants in herbal medicines. *Chemosphere* 52(9): 1361-1371 (2003).

13. Chowdhury, B. R., Chakraborty, R., Raychaudhuri, U., Study on beta-galactosidase enzymatic activity of herbal yogurt. *Int J Food Sci Nutr* 59(2): 116-122 (2008).

14. Cuvas-Limón, R. B., Julio, M. S., Carlos, C. E. J., Mario, C. H., Mussatto, S. I., & Ruth, B. C., Aloe vera and probiotics: a new alternative to symbiotic functional foods. *Annual Research & Review in Biology*, 9(2): 1 (2016).

15. Derakhshan, S., Sattari, M., Bigdeli, M., Effect of sub-inhibitory concentrations of cumin (Cuminumcyminum L) seed essential oil and alcoholic extract on the morphology, capsule expression and urease activity of *Klebsiellapneumoniae*. *Int J Antimicrob Agents* 32(5): 432436 (2008).

16. Ellmore, G. S., Feldberg, R. S., Allinlyase localization in bundle sheaths of the garlic clove (*Allium sativum*). *Am J Botany* 81(1): 8994 (1994).

17. Goyal, R. K., Singh, J., Lal, H., Asparagus racemosus-an update. *Indian J Med Res* 57(9): 408-414 (2003).

18. Hajlaoui, H., Mighri, H., Noumi, E., Snoussi, M., Trabelsi, N., et al. Chemical composition and biological activities of Tunisian Cuminumcyminum L. essential oil: A high effectiveness against *Vibrio* spp. strains. *Food Chem Toxicol* 48(8-9): 2186-2192 (2010).

19. Hay, R. K. M., Waterman, P. G., Volatile Oil Crops: Their Biology, Bio Chemistry and Production. *Longman Technical and Scientific*, UK, pp. 1-185 (1993).

20. Hoquea, M. M., Barib, M. L., Juneja, V. K., Kawamoto, S., Antimicrobial activity of cloves and cinnamon extracts against food borne pathogens and spoilage bacteria, and inactivation of *Listeria monocytogenes* in ground chicken meat with their essential oils. *Report Nat'l Food Res Inst* 72(1): 9-21 (2008).

21. Hossein, N., Zahra, Z., Abolfazl, M., Mahdi, S., Ali, K., Effect of Cinnamon zeylanicum essence and distillate on the clotting time. *J Medicinal Plants Res* 7(19): 1339-1343 (2013).

22. Iacobellis, N. S., Lo-Cantore, P., Capasso, F., Senatore, F., Antibacterial activity of Cuminumcyminum L. and Carumcarvi L. essential oils. *J Agric Food Chem* 53(1): 57-61 (2005).

23. Ismail, A., Marjan, Z. M., Foong, C. W., Total antioxidant activity and phenolic content in selected vegetables. *Food Chem* 87(4): 581-586 (2004).

24. Jakhetia, V., Patel, R., Khatri, P., Cinnamon: a pharmacological review. *J Adv Scientific Res* 1(2): 19-12 (2010).

25. Kaur, D., Sharma, R., An update on pharmacological properties of cumin. *Int J Res Pharmacy & Sci* 2(4): 14-27 (2012).

26. Kim, S. H., Hyun, S. H., Choung, S. Y., Anti-diabetic effect of cinnamon extract on blood glucose in db/db mice. *J Ethnopharm* 104(1-2): 119123 (2006).

27. Kumar, M., Berwal, J. S., Sensitivity of food pathogens to garlic (*Allium sativum*). *J Appl Microb* 84(2): 213-215 (1998).

28. Prevesh, K., Nirdesh, K., Tushar, O., A review on neutraceutical critical supplement for building a healthy world. *World J Pharmacy & Pharmaceutical Sci* 5(3): 579-594 (2016).

29. Kumar Santosh T., Arvindakshan, P., Sangeetha, A., Pagote, C. N., Rao Jayaraj, K., Development of mint flavored yoghurt spread. *Asian J Dairy & Food Res* 32(1): 19-24 (2013).

30. Landge, U. B., Pawar, B. K., Choudhari, D. M., Preparation of shrikhand using ashwagandha powder as additive. *J Dairying Foods & Home Sci* 30(2): 79-84 (2011).

31. Lu, Y. R., Foo, Y. L., Antioxidant activities of polyphenols from sage (*Salvia officinalis*). *Food Chem* **75**(2): 197-202 (2001).

32. Madsen, H. L., Bertelsen, G., Spices as antioxidants. *Trends Food Sci. Technol* **6**(8): 271-277 (1995).

33. Matsui, T., Matsumoto, K., Antihypertensive peptides from natural resources. In: Khan Math (Ed.), (1st edn), *Advances in Phytomedicine*. Elsevier Publisher, USA, pp. 273-299 (2006).

34. Mishra, L. C., Singh, R. R. B., Dagenais, S., Scientific basis for the therapeutic use of *Withaniasomnifera* (Ashwagandha): A Review. *Altern Med Rev* **5**(4): 334-346 (2000).

35. Modak, M., Dixit, P., Londhe, J., Ghaskadbi, S., Devasagayam, T. P., Indian herbs and herbal drugs used for the treatment of diabetes. *J Clin Biochem Nutr* **40**(3): 163-173 (2007).

36. Namiki, M., Antioxidant/antimutagens in food. *Crit Rev Food Sci Nutr* **29**(4): 273-300 (1990).

37. Naveed, R., Hussain, I., Tawab, A., Tariq, M., Rahman, M., et al. Antimicrobial activity of the bioactive components of essential oils from Pakistani spices against *Salmonella* and other multi-drug resistant bacteria. *BMC Complementary & Alternative Med* **13**: 265 (2013).

38. Niranjan, A., Prakash, D., Chemical constituents and biological activities of turmeric (*Curcuma longa* L.)-a review. *J Food Sci Technol* **45**(2): 109-116 (2008).

39. Ozcan, M., Antioxidant activity of rosemary, sage and sumac extracts and their combinations on stability of natural peanut oil. *J Med Food* **6**(3): 267-270 (2003).

40. Pandey, N., Chaurasia, J. K., Tiwari, O. P., Tripathi, Y. B., Antioxidant properties of different fractions of tubers from *Puerariatuberosa* Linn. *Food Chem* **105**(1): 219-222 (2007).

41. Parmar, P., Khamrui, K., Devaraja, H. C., Singh, R. R. B., The effects of alcoholic extract of Arjuna (*Terminaliaarjuna* Wight & Arn.) bark on stability of clarified butterfat. *J Med Plant Res* **7**(35): 2545-2550 (2013).

42. Pawar, N., Gandhi, K., Purohit, A., Arora, S., Singh, R. R. B., Effect of added herb extracts on oxidative stability of ghee (butter oil) during accelerated oxidation condition. *J Food Sci Technol* **51**(10): 2727-2733 (2014).

43. Prakash, P., Gupta, N., Therapeutic uses of *Ocimum sanctum* linn (tulsi) with a note on eugenol and its pharmacological actions: a short review. *Indian J Physiol. Pharmacol* **49**(2): 125-131 (2005).

44. Rajanikant, Patil, G. R., Development of process for herbal ghee. National Dairy Research Institute **10**(2): 1. <http://www.ndri.res.in/ndri/documents/pdf> (2005).

45. Sharma, P. V., Dravyaguna Vigyan, Chowkambha Sanskrit Sansthan. (2nd edn), Chaukhambha Bharti Academy, India, pp. 120123 (1998).

46. Shrestha, P. M., Dhillon, S. S., Medicinal plant diversity and use in the highlands of Dolakha district, Nepal. *J Ethnopharmacol* **86**(1): 8196 (2003).

47. Singh, C., Saini, N. K., Manda, H., Singhal, M., Sachdeva, K., Evaluation of antioxidant activity of *Terminalia arjuna* leaves extract. *Pharmacology online* **1**: 998-1006 (2011).

48. Thomsen, M., Shatavari - Asparagus racemosus. http://www.phytomedicine.com.au/files/article/satavar_i.pdf (2002).

49. Trivedi, V., Prajapati, J., Pinto, S., Darji, V., Use of basil (tulsi) as flavoring ingredient in the manufacture of ice cream. *Am Int J Contemp Res* **1**(3): 28-43 (2014).

50. Verma, K. C., Ashwagandha (*Withaniasomniferadunal*): wonder medicinal plant. *Agric Rev* **31**(4): 292-297 (2010).

51. WHO, Diet, nutrition and the prevention of chronic diseases Report of the joint WHO/FAO expert consultation (2002).

52. Zhang, W., Xiao, S., Samaraweera, H., Lee, E. J., Ahn, D. U., Improving functional value of meat products. *Meat Sci* **86**(1): 15-31 (2010).