Indu B, et al., J Dairy Res Tech 2023, 5: 026
DOI: 10.24966/DRT-9315/100026

HSOA Journal of Dairy Research and Technology

Review Article

Application of Essential Oils in the Dairy Industry: A Review

Indu B[1]*, Divya S[2] and Aiswarya V[3]

[1]*Assistant Professor, Department of Dairy Chemistry, Verghese Kurien College of Dairy and Food Technology, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur, Kerala, India*

[2]*Postgraduate Student, Department of Dairy Chemistry, Verghese Kurien College of Dairy and Food Technology, Kerala Veterinary and Animal Sciences University, Mannuthy, Thrissur, Kerala, India*

[3]*Post Graduate, Department of Dairy Chemistry, Verghese Kurien College of Dairy and Food Technology, Veterinary and Animal Sciences University, Mannuthy, Thrissur, Kerala, India*

Abstract

Various plants and spices can be found worldwide, and each one's usage varies depending on the local culture and traditions. Since they have been linked to potential antimicrobial activity against a variety of bacteria, essential oils are receiving interest from the academic and industrial worlds. Growing interest in essential oils and their use as dairy product preservatives as appropriate alternatives to synthetic preservatives has been observed in recent years. The interaction of essential oils with dairy products and their mode of action as preservatives for dairy products, however, have not been well examined. Essential oils have been identified as promising bio preservative, antioxidant, anti-microbial, and aroma-enhancing ingredients in dairy products.

Introduction

Essential Oils (EOs) are aromatic volatile liquids obtained from plant materials (from both vascular or nonvascular plants) including buds, flowers, fruits, seeds, leaves, twigs, bark, wood, roots and herbs [1].Essential oils have wide variety of applications. Many essential oils are used as scenting and flavouring agents, some are more or less powerful external or internal antiseptics, others possess an analgesic, heamolytic, antizymatic action etc. In food industry, essential oils are primarily used as natural preservatives as it prevents microbial spoilage. It is also used as flavouring agent in many food products. Antioxidant properties of essential oils are exploited to prevent the oxidative rancidity of fat rich products. For example, citrus essential oils can be used as a preservative, flavouring agent and also as an antioxidant [2].

During recent years, consumers are more aware of what they eat and seeks foods that are minimally processed and contains no chemicals. So manufacturers are also behind the natural additives that will give longer shelf life to the products. Essential oils are a good natural food additive to handle this situation. In addition to this essential oils can also gained interest against antimicrobial-resistant pathogens [3].

What are Essential Oils

The essential oil is the product obtained from a vegetable raw material, either by steam distillation or by mechanical processes from the epicarp of Citrus, or 'dry' distillation.

Inorganic solvents like water do not dissolve EOs; however, organic solvents do (ether, alcohol, fixed oils). With the exception of vetiver, sassafras, and cinnamon, they are volatile liquids with a distinct smell and a density below unity.

A plant can govern and regulate its surroundings (play an ecological function) by using essential oils, which can operate as chemical messages to deter predators, draw pollinating insects, prevent seed germination, and communicate with other plants.

The presence of essential oils can be found in various parts of aromatic plants, including their flowers (pink, orange, *lavender*, flower buds in the case of clove and bracts in the case of ylang-ylang), leaves (*mint*, *eucalyptus*, *bay leaf*, *thyme*, *sage*, *savoury*, *pine needles*), rhizomes (*sweet flag* and *ginger*), roots (*vetiver*), seeds (*coriander and carvi*), fruits (*anise*, *fennel*, and *citrus* epicarps), and wood and bark (in *sandalwood*, *cinnamon*, and *rosewood*) [4].

Biological Activities of Essential Oils

Antibacterial Activity: The majority of the time, phenolic chemicals like eugenol, thymol, and carvacrol found in essential oils are what give them their antibacterial properties [5]. These substances have the ability to disrupt the cytoplasmic membrane, the electron flow, the driving force of the proton, and the coagulation of cell contents [6].The primary characteristic of EOs is their hydrophobicity, which enables them to partition into the lipids of bacterial cell membranes, disrupting the bacterial structure and making it more permeable As a result, several biological molecules and various ions are released from the bacterial cell [7].

Antioxidant Activity: Essential oils contain phenolic chemicals and other secondary metabolites with conjugated double bonds that often exhibit considerable antioxidant effects [8]. The most significant antioxidant qualities are found in the essential oils extracted from nutmeg, thyme, cinnamon, mint, basil, clove, oregano, and parsley. The phenolic structure of these chemicals influences their activity. The redox characteristics of phenolic compounds make them

***Corresponding author:** Indu B, Assistant Professor, Department of Dairy Chemistry, Verghese Kurien College of Dairy and Food Technology, Kerala, Veterinary and Animal Sciences University, Mannuthy, Thrissur, Kerala, India. Tel: 9400503677; E-mail: indub@kvasu.ac.in/ indubthayyil@gmail.com

Citation: Indu B, Divya S, Aiswarya V (2023) Application of Essential Oils in the Dairy Industry: A Review. J Dairy Res Tech 5: 026.

Received: September 6, 2023; **Accepted:** October 10, 2023; **Published:** October 17, 2023

important for both the oxidation of peroxides and the neutralisation of free radicals [9-11]. Other substances found in essential oils such alcohols, ketones, aldehydes, ethers, and monoterpenes also contribute to the antioxidant activity of Eos [12].

Cancer Chemoprotective Activity: Cancer therapy potential is demonstrated by essential oils. According to Edris [13], natural anticancer substances found in essential oils are essential for both cancer prevention and treatment.

Application in Dairy Industry

Dairy products are more susceptible to contamination major sources of contamination are from the use of raw milk, the dairy environment, and in some cases also vegetable coagulants [14]. Additives like preservatives and antioxidants enhance the overall quality and safety and prolong the shelf-life of products. Even though artificial additives have number of advantages it is responsible for conditions such as allergic reactions, asthma, nausea, diarrhea or in some cases even carcinogenesis in consumers [15].

Use of Eos to Cheese Products

Cheese is one of the dairy products with the highest commercial value and the greatest global consumption. The dairy industry has long placed a high priority on extending the shelf lives of cheese products because the current short shelf lives of many types of cheese severely restrict their commercialization, particularly in the case of fresh goods. Natural additives, such essential oils and plant extracts, are frequently used in place of artificial ones. Due to these natural compounds' exceptional antibacterial and antioxidant activity, their application as substitute food additives has grown over the past year.

E. coli O157:H7 and *L. monocytogenes* are two known harmful bacteria that can spread through cheese. When compared to controls, the cheeses containing bunium persicum essential oil considerably reduced the growth of *L. monocytogenes* and *E. coli* O157:H7 during storage. The results of the sensory evaluation revealed that the BEO-added samples significantly outperformed the control samples in terms of colour, odour, flavour, texture, and general acceptability [16].

Individual extracts of cinnamon, garlic, lemongrass, cress, rosemary, sage, and oregano each prevented L. *monocytogenes* from proliferating in processed cheeses [17].

The antibacterial and antioxidant potencies of EO/extract ingredients may potentially be impacted by interactions with dietary components. Dairy products' phenolic chemicals in particular appear to interact with proteins, reducing their antibacterial effectiveness against food borne infections. Additionally, because they absorb the hydrophobic components of EOs, lipids can impact how evenly EOs is distributed throughout the food matrix. Contrarily, it appears that the activity of EOs and extracts in the food matrix is unaffected by the presence of carbohydrates [18].

Fungi development is a regular issue for the consumer, the retailer, and the cheese maker when the cheese is ripening or being stored. These fungus not only cause financial losses but also cheese deterioration and the majority of them create mycotoxins [19]. Additionally, certain plant-based substances have demonstrated promising outcomes in preventing the growth of pathogenic fungus [20].

The findings demonstrated the superiority of clove oil emulsion over thyme oil and peppermint oil emulsions in inhibiting the growth of all fungi, with clove oil emulsion inhibiting all fungi growth at a concentration of 0.5% and thyme oil emulsion inhibiting all fungi growth at a concentration of 1%, respectively [21] (Table 1).

The concentration of Essential Oils (EOs) added to cheese plays a key role in improving its sensory characteristics [22,23].

Cheese Type	Natural antimicrobial (Source and concentration)	Inhibitory activity (microrganisms, counts, and storage conditions)	Reference
Feta	Oregano (0.1mL 100g^{-1}) Thyme (0.1mL 100g^{-1})	Inhibition of *L. monocytogenes* and *E. coli* 0157: H7 population (10^{6}CFU g^{-1}) for 18 and 22 days, respectively, after storage under modified atmosphere packaging (50% de CO_2 e 50% de N_2) at 4°C.	GOVARIS et al. (2011)
Cheddar	Garlic (dipping 25g of cheese in 100mL of plant extract solution).	Inhibition of *L. monocytogenes* (2 log CFU mL^{-1}) after storage at 23°C for 9 days.	SHAN et al. (2011)
Kareich	Cayenne (3%) or Green Pepper (9%)	Inhibition of *S. aureus* (1x10^{6}CFU g^{-1}) to undetectable levels within 2 days of storage at 4°C±2°C.	WAHBA et al. (2010)
Domiati	Black cumin seed oil (0.1% e 0.2%)	Decreased in *Salmonela enteritides* and *Escherichia coli* counts from 3.95log CFU mL^{-1} to 2.6log CFU g^{-1} after storage at 4°C for 42 days.	HASSANIEN et al. (2014)
Sheep's cheese	Rosemary essential oil (215mg L^{-1})	Prevented the growth of *Clostridium* spp. counts 3log CFU g^{-1} ripened for 5 months at 12°C	MORO et al. (2015)
Coalho Cheese mimicking models	Thymus essential oils (2.5µL mL^{-1})	Reduced 1.3log CFU mL^{-1} counts (from initial count) of *L. monocytogenes* incubated at 10°C for 24 hours	CARVALHO et al. (2015)
Cheddar Based Media	Cinnamon (400µg mL^{-1}) garlic (625µg mL^{-1}), lemon grass (550µg mL^{-1}), cress (475µg mL^{-1}), rosemary (750µg mL^{-1}), sage (825µg mL^{-1}) and oregano extracts (950µg mL)	All extract concentrations individually inhibited the population of *L. monocytogenes* (4x10^{3}CFU mL^{-1}) incubated at 37°C for 24 hours	TAYEL et al. (2015)
Fior di Latte	Thyme and sage essential oil (1500mg kg^{-1})	Inhibition of *Pseudomonas* spp and coliforms stored at 10°C for 6 days	GAMMARIELLO et al. (2008)
Whey and Requesón whey	Safranal (35µg kg^{-1})	Inhibited over 15% *Penicillium verrucosum* growth (population of 10^{5}CFU mL^{-1} of spore).	LIBRÁN et al. (2014)

Table 1: Antimicrobial actitivity of aromatic plants and essentiaal oils added to cheeses

Source: Gouvea et al., [20]

Application of Eos to Fluid Milk: One of the greatest natural alternatives to additives or pasteurisation to stop food spoiling from bacteria in a variety of food matrices is Essential Oils (EOs) [24,25] claim that adding essential oils from the Thymus *capitatus* plant can prevent bacterial development in pasteurised milk, extending the shelf life of the product. This led to the conclusion that Thymus *capitatus* EO improved the effectiveness of pasteurisation in maintaining the quality of raw milk. Encapsulated EO's may be a fantastic choice for milk industries as a natural and efficient antibacterial and antioxidant agent in order to monitor and maintain the quality criteria. [26] looked at how EO, which is made up of terpenoid compounds, aldehydes, ketones, alkanes, esters, alcohols, and benzene compounds, affected the sensory characteristics of milk (2008). The sensory characteristics of milk were altered by the addition of this EO at a concentration of 1.0 l/L. The milk had a greater taste of mint, was sweeter, and had a higher concentration of EO (1.0 l/L). There is no question that the EO addition was responsible for the odd flavours. Consequently, the 0.1 to 1.0 l/L range represented the threshold concentration for the perception of the flavour associated with the addition of EO.

There hasn't been any research done yet on the interaction between probiotic soy milk and essential oils made from herbs. Therefore, [27] used *Lactobacillus plantarum* A7 combined with C. *cyminum* essential oil to study the effects of probiotic soymilk in streptozotocin-nicotinamide induced diabetic rats. They found that the probiotic soy milk group that contained C. *cyminum* essential oil had substantial reductions in Fasting Blood Glucose (FBS), total cholesterol, and low-density lipoprotein cholesterol, with an increase in high-density lipoprotein cholesterol, as compared to other groups. Thus, it was determined that the combination of probiotic soy milk and herbal EO ingestion may be significant in the management of diabetes.

Utilizing Eos with Yoghurt: Essential oils are employed to enhance the lactic acid products' nutritive content, organoleptic qualities, and

health benefits [28]. One of the most popular dairy products with better nutritional value, flavour, and health benefits is yoghurt. Concentrated yoghurt (labneh) was given a 600 µL\kg dose of three essential oils: wheat germ, eucalyptus, and cinnamon. These findings demonstrated that EOs cause a reduction in the numbers of bacteria, yeast, and mould. None of the Labneh samples made by adding the corresponding essential oils contained either Coliform or E. coli. Because even a small amount of an EO can influence the taste of a product, it is crucial to choose the right EO and account for its concentration. Compared to wheat germ oil used in this study, cinnamon and eucalyptus oils have better antiseptic, antibacterial, and antifungal properties because they contain various secondary metabolites, such as polyphenolic and monoterpene compounds that inhibit the growth of pathogenic microorganisms, particularly gram-positive ones [29].

The samples of yoghurt that had been treated with eucalyptus oil had the best organoleptic qualities. Increasing the EO concentration reduced the levels of syneresis. Increasing the concentration of EOs also improved the total phenolic content, antibacterial activity, and antioxidant activity. The highest levels of phenolic content and antioxidant activity were found in yoghurt that contained 0.9% eucalyptus oil. With an inhibitory zone of 20.63 mm, Eucalyptus oil at the same quantity demonstrated the greatest antibacterial activity against *S. typhimurium* before *E. coli* (the inhibition zone was 19.43 mm). On the other hand, yoghurt supplemented with myrrh oil had the maximum antibacterial effect against *L. monocytogene* by 0.9%, and the inhibition zone was 19.21 mm. The outcomes indicated that eucalyptus and myrrh oils could be used [30].

Application of Eos to Ice Cream Ice-Cream: The physiochemical, microbiological, and sensory qualities of ice creams made with the essential oils from lemon, mandarin, and orange peels were studied by Tomar et al., [31]. Limonene, -pinene, and -terpinene were found to have an antimicrobial effect with lemon peel. The most promising technique for encapsulating peppermint essential oil, according to their research, is ca-alginate. According to sensory analysis, adding peppermint oil to ice cream up to 0.3% (w/w) could be a good way to enhance the functional qualities of the herb without compromising the texture.

Eos Used in Cream: In the study conducted by [32], lycopene and essential oils from Echinophora platyloba (EEO) were used to extend the shelf life of pasteurised cream. Lycopene concentrations were 20 and 50 ppm whereas EEO concentrations were 0.10% and 0.50%. They were combined and added to pasteurised cream, which was then examined for microbiological traits, lipid stability, and sensory qualities while maintained at 4°C and 25°C for two weeks. The pasteurised cream with the combination of the aforementioned ingredients in higher quantities performed best in terms of microbiological characteristics, chemical analysis, and stability when combined to control in storage conditions, according to the results of microbial tests and chemical analysis. Analysis of sensory studies revealed that all of the employed therapies were broadly accepted. The researchers discovered that creams with lower concentrations of the EEO and lycopene combination had the best sensory qualities. The study's conclusion suggested that EEO and lycopene may be used together as a natural preservative in dairy products with high fat content like cream and butter.

Application of Eos to other Dairy Products: According to Boroski *et al.,* [33], oregano extract and essential oils serve as powerful antioxidants for use in dairy beverages that are supplemented with linseed oil at a dosage of 2 g/100 g. Omega 3 fatty acid oxidation caused by light and heat was the main issue with dairy beverages, however a colour was also seen during storage. Linseed oil was used to address these issues, and as a result, the problem was much lessened. Therefore, it was determined that oxidation can be greatly decreased by adding a natural antioxidant to dairy beverages that are fortified with omega 3 fatty acids. In a study on the well-known Indian confection Burfi, which has a short shelf life, Badola et al., [34,35] succeeded in boosting both antibacterial and antioxidant activities by utilising herbal essential oil. For that purpose, 0.15-0.25 ppm of both the essential oil from Clove Buds (CLVB) and Curry Leaves (CRYF) was used. The findings demonstrated that as the amount of EO from herbs in Burfi increased, antibacterial and antioxidant activity also increased at the same time, lowering sensory characteristics. The characteristics of the physicochemical system did not alter much. When the relationship between burfi samples and quality criteria was calculated, 81.5% was reported. Therefore, the ideal concentration on khoa basis was discovered to be CRYF (0.10 ppm) and CLVB in order to maximise the stability of burfi during storage while taking into account its sensory characteristics (0.20 ppm).

Essential Oil Legal Considerations

The bioactive components of essential oils have been authorised by the European Commission for use as commercial flavouring agents. Before registering natural agents, the European Union (EU) conducts toxicological and microbiological testing to verify their safety profiles [36]. The Everything Added to Food in the United States (EAFUS) list is then updated with the tastes that have been registered. Generally Recognized or As Safe (GRAS) food additives are also included on this list, which has been recognised by the Food and Drug Administration. There are a few exceptions, such as estragole, which is on the EAFUS list but is restricted on the EU list because of its genotoxic and carcinogenic properties.

Conclusion

Essential oils are secondary metabolites found in plants that provide them the ability to defend themselves against pests like bacteria, fungi, insects, and herbivorous animals. It has been discovered that essential oils are beneficial against pathogenic and food deterioration agents.

Numerous studies have documented the positive effects of combining essential oils with dairy products; nevertheless, further in-depth research is required to fully understand the potential synergistic and antagonistic interactions between the constituents of essential oils and dairy products. If essential oils are used in dairy products in larger concentrations, then maintaining the flavour could be a challenge. Additional research on toxicity and safety is also required.

References

1. Mustafa NEM (2015) Citrus essential oils: current and prospective uses in the food industry. *Recent Patents on Food,* Nutrition & Agriculture 7: 115-127.

2. Bošković M, Baltić MŽ, Ivanović J, Đurić J, Lončina J, et al. (2013) Use of essential oils in order to prevent foodborne illnesses caused by pathogens in meat. Scientific journal Meat Technology 54: 18-24.

3. Patterson JE, McElmeel L, Wiederhold NP (2019) In Vitro Activity of Essential Oils against Gram-Positive and Gram-Negative Clinical Isolates, Including Carbapenem-Resistant *Enterobacteriaceae*. Open forum infectious diseases 6: 502.

4. Hanif MA, Nisar S, Khan GS, Mushtaq Z, Zubair M (2019) Essential oils. In Essential oil research: 3-17.

5. Dorman HD, Deans SG (2000) Antimicrobial agents from plants: antibacterial activity of plant volatile oils. Journal of applied microbiology 88: 308-316.

6. Pauli A (2001) Antimicrobial properties of essential oil constituents. Int J Aromather 11: 126-133.

7. Ultee A, Bennik MHJ, Moezelaar R (2002) The phenolic hydroxyl group of carvacrol is essential for action against the food-borne pathogen Bacillus cereus. Appl Environ Microbiol 68: 1561-1568.

8. Koh KJ, Pearce AL, Marshman G, Finlay-Jones JJ, Hart PH (2002) Tea tree oil reduces histamineinduced skin inflammation. British Journal of Dermatology 147:1212-1217.

9. Burt S (2004) Essential oils: their antibacterial properties and potential applications in foods—a review. Int J Food Microbiol 94: 223-253.

10. Draughon FA (2004) Use of botanicals as biopreservatives in foods. Food Technology 58: 20-28.

11. Burt SA, Fledderman MJ, Haagsman HP, Knapen FV, Veldhuizen EJA (2007) Inhibition of Salmonella enterica serotype enteritidis on agar and raw chicken by carvacrol vapour. International Journal of Food Microbiology 119: 346-350.

12. Yilmaztekin M, Levic S, Kalusevic A, Cam M, Bugarski B, et al. (2019) Characterisation of peppermint (*Mentha piperita* L.) essential oil encapsulates. Journal of Microencapsulation 36: 109-119.

13. Edris AE (2007) Pharmaceutical and therapeutic potentials of essential oils and their individual volatile constituents: a review. Phytother Res 21:308-323.

14. Cardinali F, Osimani A, Taccari M, Milanović V, Garofalo C, et al. (2017) Impact of thistle rennet from Carlina acanthifolia All. subsp. acanthifolia on bacterial diversity and dynamics of a specialty Italian raw ewes' milk cheese. Int J Food Microbiol 255: 7-16.

15. Nikmaram N, Budaraju S, Barba FJ, Lorenzo JM, Cox RB, et al. (2018) Application of plant extracts to improve the shelf-life, nutritional and health related properties of ready to-eat meat products. Meat science 145**:** 245-255.

16. Ehsani A, Hashemi M, Hosseini Jazani N, Aliakbarlu J, Shokri S, et al. (2016) Effect of Echinophora platyloba DC. Essential oil and lycopene on the stability of pasteurized cream obtained from cow milk. Veterinary Research Forum **7**: 139-148.

17. Tayel AA, Hussein H, Sorour NM, El-Tras WF (2015) Foodborne pathogens prevention and sensory attributes enhancement in processed cheese via flavoring with plant extracts. J Food Sci 80: 2886-2891.

18. Khorshidian N, Yousefi M, Khanniri E, Mortazavian AM (2018) Potential application of Eos as antimicrobial preservatives in cheese. Innovative Food Science and Emerging Technologies 45: 62-72.

19. Hassanin AM, Soliman SA, Abdella SAS, Hamdy AS (2021) Antifungal Activity of Some Essential Oils Emulsions Against Fungi Contaminating Ras Cheese. Pakistan Journal of Biological Sciences 24*:* 1350-1358.

20. Gouvea FDS, Rosenthal A, Ferreira EHDR (2017) Plant extract and essential oils added as antimicrobials to cheeses: a review. Ciência Rural 47.

21. Belletti N, Kamdem SS, Tabanelli G, Lanciotti R, Gardini F (2010) Modeling of combined effects of citral, linalool and β-pinene used against Saccharomyces cerevisiae in citrus-based beverages subjected to a mild heat treatment. International Journal of Food Microbiology 136: 283-289.

22. Azizkhani M, Tooryan F (2016) Antimicrobial activities of probiotic yogurts flavored with peppermint, basil, and zataria against Escherichia coli and Listeria monocytogenes. Journal of food quality and hazards control 3: 79-86.

23. Gupta S, Khan S, Muzafar M, Kushwaha M, Yadav AK, et al. (2016) Encapsulation: entrapping essential oil/flavors/aromas in food. Encapsulations: 229-268.

24. Al-Rimawi F, Jazzar M, Alayoubi M, Elama C (2019) Effect of different essential oils on the shelf life of concentrated yogurt. Annual Research & Review in Biology 30: 1-9.

25. Aziz ZAA, Ahmad A, Setapar SHM, Karakucuk A, Azim MM, et al. (2018) Essential oils: extraction techniques, pharmaceutical and therapeutic potential-a review. Current drug metabolism 19: 1100-1110.

26. Farag RS, Ali MN, Taha SH (1990) Use of some essential oils as natural preservatives for butter. J the American Oil Chemists Society 67: 188-191.

27. El-Sayed SM, Youssef AM (2019) Potential application of herbs and spices and their effects in functional dairy products. Heliyon 5.

28. Thabet HM, Nogaim QA, Qasha AS, Abdoalaziz O, Alnsheme N (2014) Evaluation of the effects of some plant derived essential oils on shelf life extension of Labneh. Merit Research Journal of Food Science and Technology 2: 8-14.

29. Fuad AR, Mohannad A, Claude E, Mohannad J, Avni Ç, et al. (2020) Use of cinnamon, wheat germ, and eucalyptus oils to improve quality and shelf life of concentrated yogurt (Labneh). Cogent Food & Agriculture 6:1.

30. Hamed AM, Awad AA, Abdel-Mobdy AE, Alzahrani A, Salamatullah AM (2021) Buffalo Yogurt Fortified with Eucalyptus (*Eucalyptus camaldulensis*) and Myrrh (*Commiphora Myrrha*) Essential Oils: New Insights into the Functional Properties and Extended Shelf Life. *Molecules* (Basel, Switzerland) 26:6853.

31. Tomar O, Akarca G (2019) Effects of ice-cream produced with lemon, Mandarin, and orange peel essential oils on some physicochemical, microbiological and sensorial properties. Kocatepe Veteriner Dergisi 12: 62-70.

32. Kostova I, Damyanova ST, Nastia V, Vastanie A, Ivanova M, et al. (2016) Use of essential oils in dairy products .Essential oil of basil (*Ocimum basilicum* L.). Indian J Applied Research 6: 211-213.

33. Boroski M, Giroux HJ, Sabik H, Petit HV, Visentainer JV, et al. (2012) Use of oregano extract and oregano essential oil as antioxidants in functional dairy beverage formulations. Lebensmittel-Wissenschaft und -Technologie- Food Science and Technology 47: 167-174.

34. Badola R, Panjagari NR, Singh RRB, Singh AK, Prasad WG (2018) Effect of clove bud and curry leaf essential oils on the anti-oxidative and anti-microbial activity of burfi, a milk-based confection. Journal of Food Science & Technology 55: 4802-4810.

35. Azizkhani M, Parsaeimehr M (2018) Probiotics survival, antioxidant activity and sensory properties of yogurt flavored with herbal essential oils. International Food Research Journal 25: 921-927.

36. Ozkan G, Simsek B, Kuleasan H (2007) Antioxidant activities of Satureja cilicica essential oil in butter and in-vitro. Journal of Food Engineering 79: 1391-1396.

HERALD

Advances In Industrial Biotechnology | ISSN: 2639-5665

Advances In Microbiology Research | ISSN: 2689-694X

Archives Of Surgery And Surgical Education | ISSN: 2689-3126

Archives Of Urology

Archives Of Zoological Studies | ISSN: 2640-7779

Current Trends Medical And Biological Engineering

International Journal Of Case Reports And Therapeutic Studies | ISSN: 2689-310X

Journal Of Addiction & Addictive Disorders | ISSN: 2578-7276

Journal Of Agronomy & Agricultural Science | ISSN: 2689-8292

Journal Of AIDS Clinical Research & STDs | ISSN: 2572-7370

Journal Of Alcoholism Drug Abuse & Substance Dependence | ISSN: 2572-9594

Journal Of Allergy Disorders & Therapy | ISSN: 2470-749X

Journal Of Alternative Complementary & Integrative Medicine | ISSN: 2470-7562

Journal Of Alzheimers & Neurodegenerative Diseases | ISSN: 2572-9608

Journal Of Anesthesia & Clinical Care | ISSN: 2378-8879

Journal Of Angiology & Vascular Surgery | ISSN: 2572-7397

Journal Of Animal Research & Veterinary Science | ISSN: 2639-3751

Journal Of Aquaculture & Fisheries | ISSN: 2576-5523

Journal Of Atmospheric & Earth Sciences | ISSN: 2689-8780

Journal Of Biotech Research & Biochemistry

Journal Of Brain & Neuroscience Research

Journal Of Cancer Biology & Treatment | ISSN: 2470-7546

Journal Of Cardiology Study & Research | ISSN: 2640-768X

Journal Of Cell Biology & Cell Metabolism | ISSN: 2381-1943

Journal Of Clinical Dermatology & Therapy | ISSN: 2378-8771

Journal Of Clinical Immunology & Immunotherapy | ISSN: 2378-8844

Journal Of Clinical Studies & Medical Case Reports | ISSN: 2378-8801

Journal Of Community Medicine & Public Health Care | ISSN: 2381-1978

Journal Of Cytology & Tissue Biology | ISSN: 2378-9107

Journal Of Dairy Research & Technology | ISSN: 2688-9315

Journal Of Dentistry Oral Health & Cosmesis | ISSN: 2473-6783

Journal Of Diabetes & Metabolic Disorders | ISSN: 2381-201X

Journal Of Emergency Medicine Trauma & Surgical Care | ISSN: 2378-8798

Journal Of Environmental Science Current Research | ISSN: 2643-5020

Journal Of Food Science & Nutrition | ISSN: 2470-1076

Journal Of Forensic Legal & Investigative Sciences | ISSN: 2473-733X

Journal Of Gastroenterology & Hepatology Research | ISSN: 2574-2566

Journal Of Genetics & Genomic Sciences | ISSN: 2574-2485

Journal Of Gerontology & Geriatric Medicine | ISSN: 2381-8662

Journal Of Hematology Blood Transfusion & Disorders | ISSN: 2572-2999

Journal Of Hospice & Palliative Medical Care

Journal Of Human Endocrinology | ISSN: 2572-9640

Journal Of Infectious & Non Infectious Diseases | ISSN: 2381-8654

Journal Of Internal Medicine & Primary Healthcare | ISSN: 2574-2493

Journal Of Light & Laser Current Trends

Journal Of Medicine Study & Research | ISSN: 2639-5657

Journal Of Modern Chemical Sciences

Journal Of Nanotechnology Nanomedicine & Nanobiotechnology | ISSN: 2381-2044

Journal Of Neonatology & Clinical Pediatrics | ISSN: 2378-878X

Journal Of Nephrology & Renal Therapy | ISSN: 2473-7313

Journal Of Non Invasive Vascular Investigation | ISSN: 2572-7400

Journal Of Nuclear Medicine Radiology & Radiation Therapy | ISSN: 2572-7419

Journal Of Obesity & Weight Loss | ISSN: 2473-7372

Journal Of Ophthalmology & Clinical Research | ISSN: 2378-8887

Journal Of Orthopedic Research & Physiotherapy | ISSN: 2381-2052

Journal Of Otolaryngology Head & Neck Surgery | ISSN: 2573-010X

Journal Of Pathology Clinical & Medical Research

Journal Of Pharmacology Pharmaceutics & Pharmacovigilance | ISSN: 2639-5649

Journal Of Physical Medicine Rehabilitation & Disabilities | ISSN: 2381-8670

Journal Of Plant Science Current Research | ISSN: 2639-3743

Journal Of Practical & Professional Nursing | ISSN: 2639-5681

Journal Of Protein Research & Bioinformatics

Journal Of Psychiatry Depression & Anxiety | ISSN: 2573-0150

Journal Of Pulmonary Medicine & Respiratory Research | ISSN: 2573-0177

Journal Of Reproductive Medicine Gynaecology & Obstetrics | ISSN: 2574-2574

Journal Of Stem Cells Research Development & Therapy | ISSN: 2381-2060

Journal Of Surgery Current Trends & Innovations | ISSN: 2578-7284

Journal Of Toxicology Current Research | ISSN: 2639-3735

Journal Of Translational Science And Research

Journal Of Vaccines Research & Vaccination | ISSN: 2573-0193

Journal Of Virology & Antivirals

Sports Medicine And Injury Care Journal | ISSN: 2689-8829

Trends In Anatomy & Physiology | ISSN: 2640-7752