

## Comprehension on Aromatic and Medicinal Plants in Improving the Functionality of foods of Animal Origin

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### Abstract

The numeral of plants that have preservative and aromatic values to food is considerable during the last few decades. The change in consumption pattern of consumers that is “going green” is further augmenting. The advantage of these food additives is that they can be incorporated at any point of time with excellent antimicrobial, antioxidative and preservative action. The functional properties of these plants are exhibited by the presence and quantum of active substances. As animal source foods are having a rich nutritional dense matrix and are very much prone to oxidative deterioration and microbial spoilage, judicious use of certain plants (Medicinal and aromatic plants) and their extracts can be promising aspects of natural additive supplementation for modern consumers. Thus, this conception can benefit the expansion of diversity and functionality of bioactive compounds as natural preservatives in foods of animal origin sector.

**Keywords:** Medicinal and aromatic plants; Functional food; Animal food; Essential oil.

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## INTRODUCTION

Medicinal and Aromatic plants have been used to fortify foods throughout history as preservatives, flavor, and therapeutic agents. The herbs and spices are low cost commodities, they are nowadays appreciated as gold or jewels in many developing and developed countries.<sup>1</sup> The use of plant parts and extracts were used by ancient civilizations and have been used for Centuries in India and China. Today, these plants can be used to increase the acceptability of foodstuffs and improve their health thereby increasing the functionality of the product. Additionally, herbs and spices have been utilized as food additives all over the world,

not only to enhance the organoleptic properties of food<sup>2</sup> but also to increase the shelf life by decreasing or eliminating food-borne pathogens.<sup>3</sup> Several studies have recommended the use of dietary herbs<sup>4</sup> and spices for their beneficial effects on human health through their antimutagenic, anti-inflammatory, antioxidative, and immunomodulatory properties.<sup>5</sup> Nowadays, livestock products are a unique carrier that has been successfully used to deliver phytochemicals and other nutrients for health benefits in our nutrition food system.<sup>6</sup> Furthermore, the addition of herbs and spices or their extracts to different dairy and meat products make these products act a carrier for nutraceuticals.<sup>7</sup>

## MEDICINAL AND AROMATIC PLANTS (MAPS)

Medicinal and aromatic plants play an important role in the life of people. In Indian traditions, all the plants on this earth are considered medicinal [Jivak in Astanga Hriday (Sutra<sup>9-10</sup>)]. No exact definition of a Medicinal plant is possible however, medicinal plants could be defined in the simplest way as plants that are used in official and various traditional systems of medicines throughout the world. The foundation for the selection of these plants are depending upon the active ingredients that are capable of affecting the physiological processes of living organisms, including human beings. The definition of aromatic plants is even less precise. The plants have an aroma; being fragrant or sweet-smelling, implies the taste of aromatic herbs. These aromatic plants are exclusively used for medicinal purposes in aromatherapy and perfumery.

Spice plants are used as seasoning and flavoring agents having potent antioxidative and antimicrobial properties. These are capable of enhancing the sensory attributes by means of color and overall acceptability of food products. The complexity and overlapping uses of active ingredients found in these plants, make it practically impossible to establish them as medicinal or aromatic plants. Nutmeg, caraway, anise, dill, coriander, thyme, cinnamon, etc. are equally known as medicinal, spice, and essential oil crops. Therefore, these plants are frequently referred to as medicinal plants, disregarding their specific features of the presence of active ingredients. More recently, the term "Medicinal and Aromatic Plants" (MAPs) has been used in a slightly broader sense, distinguishing the fragrant (aromatic, ethereal) ingredients containing a group of medicinal plants.

## CLASSIFICATION OF MEDICINAL AND AROMATIC PLANTS (MAPS)

The MAP can be classified in different ways, but the subsequent form of classification is as follows:

### *Chemical Classification*

Based on the presence of active matter in the body of the plants.

1. **Plants that produce Essential Oil:** Nutmeg, Anise, caraway, Parsley, Mint, Cinnamon
2. **Plants containing bitter substances:** Mugwort, Vermouth, Gentian, Chamomile
3. **Plants containing glycosides:** Ouabain, Digitalis, Scilla, Nerium oleander
4. **Plants containing saponin:** Mojave yucca, Gypsophila, Saponaria, Hedera Helix, ginseng
5. **Plants containing alkaloids:** Lobelia inflata, Datura, Nicotiana, Atropa, Poppy
6. **Plants containing flavonoids:** lettuce, Silybum, Verbascum, Kale, Peaches
7. **Plants Containing Tannins:** Maples, Hamamelis, Quercus, Willows, Quebracho, Sumac

### *Classification by Type of Consumption and Use*

1. **Stimulating Plants, Soft Drinks, and Herbal Teas:** Tea, Coffee, Tobacco, cocoa, cannabis
2. **Spice Plants:** Allspice, Basil, Cumin, Black pepper, Mustard, Thyme, fennel, poppy, sesame, anise
3. **Medicinal Plants:** Digitalis, Atropa, aloe, tulsi, neem, ginger, mint, cinnamon, Ashwagandha plant, Allium sativum, Vitexnegundo, stinging nettle, Orange flowers, Chamomile flowers
4. **Perfume Plants:** Lavender, Rose, Oriental lilies, Daphne, Heliotrope, Angel's trumpet (Brugmansia), Lily of the valley, Korean spicebush, Jimson weed (Datura), Tuberose, Lilac
5. **Gum and Mucilage Plants:** Acacia, Astragalus, Plantago, gum ghatti, (Anogeissuslatifolia), neem gum (Azadirachta indica), gum karaya (Sterculiaurens; Cochlospermumgossypium), Joel or Jingan gum (Lanneacoromandelic), and Mesquite gum (Prosopisjuliflora)
6. **Resin Plants:** Sweetgum, Ferula, cedar, fir, juniper, pine, redwood, spruce, Yew, larch
7. **Tannin Plants:** Rhus, Oak, gallnuts, lacquer

- leaves, cotinus leaves, oaks, blackberries, pomegranates
8. **Dye Plants:** Rubia, Bixa, AlkanaTinctorium, woad, madder, Indigo, saffron
  9. **Insecticide Plants:** Neem, Allium sativum, Artemisia absinthium, Citrulluscolocynthis, Laurusnobilis, Menthapulegium, Myrtuscommunis, Nerium oleander, Ocimumbasilicum, Origanummajorana
  10. **Wax Plants:** Jojoba, Myrica, palm, soybean, candelilla, rice

### ACTIVE INGREDIENTS

MAPs contain complex chemical substances having different physiological (metabolic) activities. These are mentioned as active or biologically active substances (principle), implying their effect on the physiology of living organisms. The active ingredients of plants are frequently classified into four traditionally accepted groups alkaloids, glycosides, essential oils, and other miscellaneous active substances.<sup>8</sup> These categories are mainly based on physiological, practical, and investigative considerations.

- Alkaloids are a group of nitrogen containing substances of basic chemical reaction; they frequently form salts and have strong physiological effects on living organisms. The alkaloids are very variable in their composition.<sup>9</sup>
- Glycosides are compounds of various chemical structures and physiological effects, and divergent metabolic origin. Although generally not regarded as a uniform group of

compounds, their common feature is that one or more identical sugar molecules are bound to a non sugar type compound.<sup>10</sup>

- Essential oils term refers to a mixture of various compounds, mainly terpenes and terpene derivatives that evaporate at room temperature without residues. Frequently they have characteristics and a strong odor and taste (aroma). These essential oils are generally extracted (isolated) by the steam distillation process.
- Miscellaneous substances like aromatic acids, bitter substances carbohydrates, mucilaginous substances, plant pigments, rubber, sterols, tannins, and vitamins cannot be classified into the above groups; they are of diverse chemical composition and physiological effectiveness. In contrast to the above classification, the biogenetic system of natural substances is based on the main pathways of universal metabolism and connects special metabolic pathways.

### SECONDARY METABOLITES

All plants produce an extensive variety of organic compounds that do not have any functions during their growth and development phase. These extensive varieties of organic compounds are generally referred to as secondary metabolites, secondary products, or natural products of the plant. They are different from the primary metabolites (amino acids, saccharides, etc.) in many characteristics. Primary metabolites are present in all the plants whereas secondary metabolites are found only in certain plants.

**Table 1:** Three main groups of secondary metabolites

A - Terpenes	B - Phenolic Compounds	C - Nitrogen Compounds
Essential Oils	Phenylpropanoids	Alkaloids
Cardenolides Glycosides	Coumarins	Cyanogenetic glycosides
Saponins	Benzoic Acid Derivatives	Amines
Steroids	Lignin	Glucosinolates
Resins	Anthocyanins	Alkamides
Rubber	Flavonoids	Lecithins
Gibberellins	Tannins	Peptides (and polypeptides)
Cannabinoids	Volatile terpenoids	
Artemisinin	Hydroquinones	
Thapsigargin	Hydroxybenzoates	
	Hydroxycinnamates	

## PROCESSING

**Medicinal Plants:** Appropriate measures of primary processing are dependent on types of material (active compound). These processes should be carried out in conformity with national or regional quality standard norms. Drying Medicinal plants can be dried in several ways such as in the open air under shade, wire screened rooms, by direct sunlight, drying ovens or rooms, solar drier, indirect fire, microwave, infrared device, etc. depending upon material and requirement. Specific processing Some medicinal plants require specific processing such as peeling of roots or rhizomes, boiling in water, steaming, soaking, pickling, distillation, fumigation, roasting, natural fermentation, treatment with lime, and chopping.

**Aromatic Plants:** Hydro-distillation is done which are three basic types of essential oil hydro-distillation. In all these processes, condensation of the extracted volatiles oil in gaseous form is passed through a condenser which is cooled by running cool water.

Solvent extraction is used where total extractions are needed e.g. oleoresins extraction of ginger, cardamom, pepper, etc. and concentrates and absolutes of jasmine, rose, etc. After extractions, the solvents are removed.

## ESSENTIAL OILS

Certain aromatic plants contain odorous, volatile, hydrophobic, and highly concentrated compounds named essential oils (or volatile or ethereal oils). These are obtained from various parts of the plant such as flowers, buds, seeds, leaves, twigs, bark, wood, fruits, and roots.<sup>11</sup> The essential oils are complex mixtures of secondary metabolites consisting of low boiling point phenyl propenes and terpenes. The most significant families for the essential oils are Apiaceae or Umbelliferae, Asteraceae or Compositae, and Lamiaceae or Labiateae. Based on the type and concentration of active principle, essential oils exhibit cytotoxic effects on living cells, although non-genotoxic. The cytotoxic activity of essential oils is mostly due to the presence of phenols, aldehydes, and alcohols. Such cytotoxic activity is of great interest for applications against some human or animal pathogens and parasites, as well as for the preservation of agricultural and marine products. Moreover, essential oils can exhibit hypolipidemic, antioxidant, digestive stimulant, and antioxygenic activities and can also contribute to odor and ammonia control.

Aromatic plants and their essential oils are decent sources of natural antimicrobial and antioxidants, such as phenolic compounds, e.g., Anethole, eugenol, thymol, carvacrol, Terpinene, Methoprene etc.<sup>12</sup> The essential oil contains polyphenols in form of glycosides, although the bioactivity is governed by aglycon structures mainly to catechol in aglycons in the composition.<sup>13</sup>

## APPLICATION OF HERBS IN DAIRY PRODUCTS

Thoughtful application of numerous herbs in various forms i.e. powder, essential oils, etc. in certain dairy products has been successfully endeavored to have increased functionality. The account of each dairy product incorporated with herbs and spices has been deliberated herein.

Various significant results were obtained by incorporating these MAPs with the various dairy products. *Rajanikant*<sup>14</sup> reported that when *Arjuna* herb was incorporated with ghee (clarified butter fat) it helped in the prevention of Cardio Vascular Diseases. *Deshmukh et al.*<sup>15</sup> stated that the addition of Vidarikand (*Puerariatuberosa*), Shatavari (*Asparagus racemosus*) and Ashwagandha (*Withaniasomnifera*) increase the anti-oxidant property of ghee. Trials of *Panwar et al.*<sup>16</sup> concluded that incorporation of *Withaniasomnifera* imparts Aphrodisiac, Rejuvenative and life prolonging properties to ghee. Ghee is imparted with Immuno-stimulant, anti-hepatotoxic, anti-oxytocic, antioxidant, and anti-diarrheal attributes by adding *Asparagus racemosus*.<sup>17</sup> Sage (*Salvia officinalis*) and Rosemary (*Rosmarinusofficinalis*) increases the shelf life and anti-oxidant property of ghee.<sup>18</sup> Some MAPs like Cinnamon and licorice were added to Yogurt and Labneh (concentrated yogurt) to impart an inhibition effect.<sup>19</sup> *Chowdhury et al.*<sup>20</sup> stated that a mixture of Tulsi leaf (*Ocimum sanctum*), Pudina leaf (*Mentha Arvensis*) and coriander leaf (*Coriandrum sativum*) is added to yogurt to increase its  $\beta$ -D-galactosidase activity. A very popular Indian dairy product: Dahi (*Indian yogurt*) and lassi (a fermented drink) was incorporated with Aloe vera to impart immune-protective effects.<sup>21</sup> *Landge et al.*<sup>22</sup> reported that Ashwagandha powder was added to Shrikhand (sweetened and flavored) to increase its shelf life. *Kumar et al.*<sup>23</sup> showed that mint acts as flavor enhancer when added to yoghurt. Ice cream, an industrially important dairy product is made tastier (enhanced physiochemical properties) by adding ginger and basil (*variety Ocimum sanctum, O. Americanum, O. Basilicum and O. Gratissimum*).<sup>24</sup> Buch

et al.<sup>25</sup> reported that turmeric is an effective way of extending the shelf life of panner (directly acidified cheese like product). Paste of turmeric (*Curcuma longa*), coriander (*Coriandrum sativum*), curry leaf (*Murrayakoenigii* L), spinach (*Spinaciaoleracea*) and aonla (*Emblicaofficinalis*) was added in Sandesh (*sweetmeat based on chhana*) to extend its shelf life and impart antioxidative property.<sup>26</sup> Samy<sup>27</sup> reported that cheese was attributed with antibacterial properties by the addition of clove essential oil.

#### **Usage of medicinal plants in meat and meat products**

The use of medicinal plants, which have an important antioxidative effect on meat and meat products, is increasing. The most studied medicinal plants for use in meat and meat products are thyme, thyme, rosemary, licorice, green tea, and Nelumbonucifera.<sup>28</sup> For instance, thyme was detected as effective in inhibiting oxidation, keeping the flavor and safety of meat. The sensory acceptability of muscle food is very important.<sup>29-31</sup> The effects of these plants on the quality of meat products vary depending on the usage dose and their original color and flavor.<sup>32</sup> The active edible film<sup>33</sup> with the incorporation of essential oil<sup>34</sup> in the film forming solution for preserving the quality attributes of meat food production is prospering.

Many researches have been done which proves that the functionality of meat and meat products has increased with the addition of various medicinal plants. Oregano, Thyme (5%) addition in Ground beef patties resulted in higher antioxidant activity than Thyme.<sup>35</sup> Jiang *et al.*<sup>36</sup> added Rosemary extract (0%, 0.02%, 0.05%, 0.1%) in precooked pork patties and found imparted anti-oxidative property (Licorice extract was more effective than rosemary extract). Oregano and sage leaves (0.2% w/w each) were added to cooked chicken and presented lower TBARS values than those of the control and BHT samples.<sup>37</sup> Rosemary extracts (250, 500, 750 mg/kg) added in porcine liver patties reduced lipid oxidation with no effect on color stability.<sup>38</sup> Marjoram, rosemary, and sage (0.4%) had antioxidant effects when used at the level of 0.04% of the sample (v/w) to minimize lipid oxidation and improve color with storage at 5°C for 41 and 48 days.<sup>39</sup> Beef patties blended with Myrtle extract (10%), Rosemary extract (10%), Nettle extract (10%) Lemon balm extracts (10%); showed antioxidant effects.<sup>40</sup> Chicken nuggets were incorporated with Anise, caraway, and nutmeg essential oil at refrigeration temperature for 15 days resulted in significant increase in shelf life with acceptable

sensory attributes.<sup>41</sup>

## **CONCLUSION**

Medicinal plants are conventionally used in folk medicine as natural healing remedies with potent therapeutic properties. The application of different kinds of medicinal plants as antioxidants has been studied in milk and meat products and these studies show promising results. These medicinal plants inhibited lipid oxidation and degradation of meat pigments thus stabilizing the color and helping to delay the rancid flavors in meat and meat products. These MAPs are found effective in increasing shelf life, increased antioxidative and microbiological property along with distinct essence. Further research is needed to determine their safe limits and toxicological effects in milk and meat products as the extraction or processing conditions may alter their properties.

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