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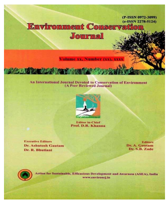

Application of natural preservatives and sweeteners in fruit products to reduce health risks - a review

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ABSTRACT

The costs of food deterioration in terms of both money and health are rising. Fungi, bacteria, yeast, insects, and rodent contamination of food supplies continue to be a major public health concern. Chemical preservatives are effective but can be potentially fatal to human health in certain cases. As potent food preservatives, essential oils made from plants are a great alternative to synthetic preservatives. They also possess a variety of anti-inflammatory, antibacterial, and antioxidant effects. The use of artificial sweeteners in food products, which raises safety questions and health issues while also having reduced nutritional value, is another problem in the food industry. Because natural sweeteners are linked to a healthy lifestyle and have superior nutritional qualities, consumers today prefer them. This article goes through the issues with artificial sweeteners and preservatives and goes into great length about the many different essential oils and natural sweeteners that are much safer and healthier alternatives.

Introduction

Preservatives are compounds, either natural or artificial, that are added to processed foods by preventing, delaying, or halting their fermentation, acidification, microbial contamination, and decomposition, which extend their shelf lives while maintaining their quality and safety. Today, chemical preservatives are more frequently used than natural preservatives. Some of them could have serious side effects, and a few of them are poisonous. Artificial preservatives such as nitrates, benzoates, sulfites, sorbates, parabens, formaldehyde, BHT (butylated hydroxytoluene), and BHA (butylated hydroxyanisole) have been associated with serious health hazards such as cancer, neurological damage, allergic responses, asthma, hyperactivity, and hypersensitivity, according to research. Many natural preservatives with antioxidant, antibacterial, and anti-enzymatic properties are obtained from plants, animals, microbes, and minerals. The extracts of neem, rosemary, basil, and clove are viable substitutes for their synthetic counterparts.

The contamination of food items with various microorganisms, including bacteria, fungi, viruses, parasites, etc., poses a significant challenge for the food industry. Through the production of various toxins during pre- and postharvest processing, these microbes degrade food products. As one of the most potent and thoroughly researched dietary pollutants of microbial origin, mycotoxins pose a serious health risk to people. Because synthetic chemicals are bioincompatible, nonbiodegradable,

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and unsustainable for the ecosystem, using them as food preservatives is currently a serious problem. Due to their ecofriendliness and largely accepted safety status, plant-based antimicrobials, particularly essential oils, have generated increasing interest as a potential replacement for synthetic preservatives (Maurya *et al.*, 2021).

Essential oils (EOs) are materials that have been intensely concentrated and are taken from the leaves, stems, flowers, seeds, roots, fruit rinds, resins, or bark of fragrant and medicinal plants (Hanif *et al.*, 2019). Due to their capacity to inhibit the growth of food-borne pathogens and preserve food products, these bioactive chemicals are appropriate for use in active packaging. Essential oils are currently used in active food packaging in the form of films and coatings that are applied to many food groups, including fruits, vegetables, fish, meat, milk, and dairy products, as well as bread and baked goods (Sharma *et al.*, 2021).

Due to consumers' increased attention to their health over the past ten years, the demand for zero-calorie and naturally produced sweeteners has increased significantly. Alternative sweeteners have been used to enhance food flavor, reduce blood sugar levels and draw consumers for a long time. They were initially adopted because of the high sugar-to-food ratio, which favored obesity in the general population and led to its widespread occurrence in infants and children. Saccharine, a low-calorie artificial sweetener, was thus made accessible in the 1980s. Since this sweetener was so well liked, others soon followed, the most common of which were cyclamates, aspartame, and acesulfame K. Over the years, there have been several disputes and debates surrounding sweeteners, including claims of liver and bladder toxicity, carcinogenicity, fetal deformities, and other risks (Saraiva *et al.,* 2020).

Natural sweeteners are produced by nature without added chemicals or fancy machinery (Neacsu and Madar, 2014). Neera (coconut), honey, mollases and stevia can be used as alternative sources of natural sweeteners because they do not increase blood sugar levels.

Detrimental effects of artificial preservatives:

When nitrate-based food preservatives are consumed, the nitrates transform into nitrites, which can react with hemoglobin to produce methaemoglobin, which can cause unconsciousness and even death, especially in young children. When proteins and nitrites react in the stomach, nitrosamines are produced, which are compounds that can cause cancer. Researchers have discovered a direct link between dietary nitrate levels and the number of Alzheimer's, Parkinson's, and type 2 diabetes fatalities. Foods containing monosodium glutamate may result in headaches, sweating, skin redness, nausea, and weakness after consumption (MSG). These include sodium nitrate, nitrosamines, potassium nitrate and more.

Sulfite-based food preservatives have the potential to exacerbate asthma and trigger life-threatening allergic responses. Along with methyl-isothiazoline and methyl-chloro-isothiazolinone, dangerous paraben compounds are frequently used. These are strong irritants and allergens that have been linked to potential neurological impairment in rats. The use of these harmful substances by expectant women may have a negative impact on the fetus's brain development. They are all powerful irritants of the skin, eyes, and lungs, including formaldehyde, DMDM hydantoin, diazolidinyl urea, and imidazolidinyl urea. These kinds of poisons can harm sperm DNA when exposed to high doses. According to research, hundreds of children's foods and beverages include food additives that can lead to tantrums and other disruptive behaviors. These include sodium metabisulfite, sodium sulfite, sodium bisulfite, potassium sulfite, *etc.*

Different chemical preservatives, such as sulfur dioxide, sulfites, sodium nitrite, sodium benzoate, benzoates, sorbates, formaldehyde, imidazoles, pyrrolidines, and thiocyanates, have significantly decreased the microbiological contamination of food goods (Gutiérrez-del-Río *et al.*, 2018). These chemical preservatives have caused negative concern in consumers because of their long-term degradation cycles, environmental toxicology, insect revival, and potential for teratogenesis and human and animal cancer (Basak and Guha, 2018; Falleh *et al.*, 2020).

Secondary metabolites:

There are five main classes of secondary metabolites: terpenoids and steroids, fatty acid-derived substances and polyketides, alkaloids, nonribosomal polypeptides, and enzyme cofactors.

1. *Terpenoids and steroids*: Terpenoids and steroids represent a sizable class of chemicals produced synthetically from isopentenyl diphosphate. Over 35,000 terpenoid and steroid molecules have currently been discovered. Steroids are modified terpenoids that are biosynthesized from the triterpene lanosterol and have a common tetracyclic carbon skeleton, in contrast to terpenoids, which can have a broad variety of unrelated structures.
2. *Alkaloids:* There are approximately 12,000 known alkaloids, and all of them have basic amine groups in their basic structures, which are biosynthesized from amino acids.
3. *Fatty acid-derived substances and polyketides*: It is estimated that 10,000 different molecules can be biosynthesized from basic acyl precursors such propionyl CoA, acetyl-CoA, and methylmalonyl CoA.
4. *Nonribosomal polypeptides*: Without direct RNA transcription, these amino acid-derived molecules are biologically produced by a multifunctional enzyme complex.
5. *Enzyme cofactors*: Cofactors for enzymes are nonprotein, low-molecular enzyme components (Thirumurugan *et al*., 2018)

Essential oils: EOs are significant secondary metabolic products that have been derived from the leaves, bark, flowers, buds, seeds, roots, stems, and fruits of several fragrant plants. The name "essential oil" comes from the word "essence," which denotes the presence of flavor and scent. It has been established that EOs contain a number of structurally related phenyl propanoids, terpenoids, and low molecular weight lipophilic short-chain aliphatic hydrocarbons. By utilizing hydrocarbons and oxygenated molecules such aldehydes, ketones, esters, oxides, and alcohols, a variety of aromatic plants also actively engage in the creation of EOs (Baldim *et al*., 2019).

A typical extraction method, hydrodistillation, is used to extract oils from plant materials (Silvestre *et al*., 2019). The bioactive components of EOs can produce a fragrance or flavor and are very volatile, producing a strong odor (Smith *et al*., 2005). Among the plant species from which EOs have been isolated are members of the families Asteraceae, Lamiaceae, Cyperaceae, Zingerberaceae, Piperaceae, Apiaceae, Myrtaceae, Solanaceae, Apocynaceae, and Lauraceae.

Essential oils have a limited solubility in water, which is denser than oils but has a high solubility in ether, alcohol, and fixed oils (Dhifi *et al*., 2016; Filly *et al*., 2016). At room temperature, essential oils are typically colorless, liquid and have a distinct aroma. Measurements of the refractive indices and the high optical activity of these volatile liquids can be used to identify them (Dhifi *et al*., 2016).

These aromatic plant extracts contain organic compounds such as carbon, hydrogen, and oxygen, as well as, in certain cases, sulfate and nitrogen derivatives. Essential oils have a modest level of activity in their atomic structure due to the attraction of functional groups by carbon and hydrogen atoms (Moghaddam and Mehdizadeh, 2017). These aromatic liquids are versatile and can take on a number of forms since they include many functional groups, including aldehydes, alcohols, ethers, ketones, acids, amines, sulfides, epoxides, and others (Baser, 2007).

Diverse sources of essential oils:

Based on their fragrance constituents, essential oils comprise a wide range of mixes that can be distinguished. Essential oils come in a variety of forms, such as those from *Azadirachta indica* (neem), *Lavandula angustifolia* (lavender), *Thymus vulgaris* (thyme), *Eucalyptus globulus* (eucalyptus), *Cinnamomum zeylanicum* (cinnamon), *Syzygium aromaticum* (clove), *Citrus limonum* (lemon), and *Melaleuca alterni* (Bhavaniramya *et al*., 2019). These volatile substances are responsible for regulating microbial development and food preservation. Neem essential oil, for instance, is a volatile combination that is produced from the tree's seed kernels. It smells strongly of sulfur and garlic (Bodiba and Szuman, 2018).

1. **Neem** EO: Neem essential oil considerably increased the antibacterial activity in poly(ethylene terephthalate) polyester fabric, according to a study by Ali *et al.* (2016). Neem has numerous secondary metabolites that can be discovered in different areas of the tree. Azadirachtin, azadirone, gedunin, meliacarpin, nimbin, salannin, and vilasinin groups, among others, were shown to be important pesticides and/or therapeutic principles. Neem crude extracts are shown to be more potent than pure

azadirachtin, indicating that the neem extract contains many additional chemicals with potentiating properties even at low concentrations (Hatti *et al.*, 2014).

2. **Lavender** EO: Steam distillation is used to extract lavender essential oil from the *Lavandula angustifolia* plant. This type of oil contains a number of chemical components, such as B-ocimene, l-fenchone, viridiflorol, camphor, and linalyl acetate (Bhavaniramya *et al.*, 2019). Lavender essential oil was employed in starch-furcellaran-gelatin (S/F/G) films to assess their antioxidant, antibacterial, and physical properties in a study by Jamróz, Juszczak, and Kucharek (2018). The ability of packed foods to resist microbial growth and antioxidant damage was simultaneously dramatically enhanced.
3. **Eucalyptus** EO: In vitro and in a real food system, eucalyptus essential oil has the potential to be employed as an antibacterial agent against yeasts that cause food spoilage. The growth of yeast (*S. cerevisiae* SPA) in fresh fruit juices was successfully prevented by using eucalyptus essential oil in conjunction with thermal treatment. There is a possibility to use eucalyptus oil as an antibacterial agent in the preservation of beverages (Tyagi *et al.*, 2014).
4. **Tulsi** EO: The storage stability of the product was enhanced via the incorporation of 20% *O. sanctum* leaf extracts in the mango leather at refrigerated temperatures (Jabez *et al.*, 2015). Major metabolites in tulsi are eugenol, rosmerinic acid, apigenin and carnosic acid**.** Numerous qualities, including antimicrobial, antifungal, antibacterial, antiviral, antimalarial, anesthetic, antiprotozoal, and anthelmintic agents, are present in *O. sanctum*. Additionally, it contains antidiabetic, antifertility, anti-inflammatory, and antistress properties (Monga *et al.*, 2017).
5. **Lemon grass** EO: With some restrictions, *Cymbopogon citratus* essential oil has the potential to be a powerful component in food and chemical preservation. CCEO has properties that extend shelf life due to its physiochemical properties, low mammalian toxicity and quick breakdown in water and soil, which may make it possible to use CCEO or its isolatable fractions in food processing and preservation. Citral, myrcene, geraniol, neral, citronellal, and limonene are some of the secondary metabolites found in *C. citratus.* Lemongrass oil's antibacterial and antioxidant properties can prevent foodborne infections and spoilage organisms from growing and subsequently degrading the food product (Ekpenyong and Akpan, 2015).
6. **Tasmanian pepper EO:** The Tasmanian pepper leaf, which is an Australian plant that is a member of the Winteraceae family, is distinguished by its high concentration of sesquiterpene and monoterpene essential oils (Smyth *et al.*, 2012). The primary bioactive ingredient in Tasmanian pepper leaf essential oil, polygodial, is thought to have antibacterial and antifungal properties (Sultanbawa *et al.*, 2016).
7. **Lemon myrtle EO**: The Myrtaceae family plant known as lemon myrtle includes citral (82–91%) as its main bioactive ingredient, which has potent antibacterial properties. This essential oil has shown in vitro antimicrobial activity against many yeasts, including the most weakly acid-resistant strain, *Z. bailii* (Pengelly, 2003).
8. **Cinnamon EO**: Numerous antioxidants can be found in cinnamon bark (Dragland *et al.*, 2003). Researchers have discovered that the main components of cinnamon are eugenol and cinnamaldehyde, which exhibit antibacterial effects against bacteria, including *Salmonella enterica*, *E. coli*, and *Listeria monocytogenes,* and fungi, such as *Laetiporus sulphurous*, *Coriolus versicolor*, *Eurotium spp*., *Penicillium*, and *Aspergillus spp*. (Zhang *et al.*, 2018).
9. **Coriander EO**: *Coriandrum sativum L*., a member of the Umbelliferae/Apiaceae family, is a useful spice and medicinal plant. This plant's leaves and seeds are frequently used as seasoning, flavoring agents and preservatives in a variety of food preparations and for medicinal purposes. *C. sativum* essential oil and extracts can provide antifungal, antibacterial, and antioxidative actions due to distinct chemical components, such as linalool, camphor, and

cymene (Kačániová *et al.,* 2020). As a result, they can play a crucial role in preserving the shelf life of foods by preventing their deterioration (Pandey *et al*., 2022).

10. **Oregano EO**: Due to its antimicrobial, antidiabetic and antifungal qualities, oregano essential oil (OEO) is widely recognized. Thymol and carvacrol, which have been shown to have antibacterial, antioxidant, and distinctive odor-producing properties, are the two key components that are present. They can slow down the process of scavenging free radicals and lipid peroxidation in fatty diets (Leyva-López *et al*., 2017).

Due to their potential to stop the growth of food-borne viruses, yeast, mold, bacteria, and fungi and preserve food goods, essential oils are appropriate for use in active packaging and food processing and preservation. Essential oils are currently used in active food packaging in the form of films and coatings that are applied to many food groups, including fruits, vegetables, fish, meat, milk, and dairy products, as well as bread and baked goods. The final packaging material microstructure is influenced by the structural arrangement of the vital oil components. Food components, such as moisture, have a significant role in the migration of active compounds from biodegradable materials to food. This migration might speed up the emission of phenolic compounds from active food packaging materials. Essential oils increase the antioxidant activity of packaging materials by acting as oxygen scavengers and allowing the diffusion of active ingredients into coated food products. Essential oils boost the antibacterial properties of packing materials, protecting food from hazardous microbes because they are abundant in bioactive compounds (Sharma *et al*., 2021).

Adverse effects of artificial Sugars:

Carbohydrates account for 40–80% of the total energy intake among macronutrients. Both free and nonfree sugars can be found in foods; nonfree sugars are naturally present within the cell structure, such as sugar in fruits and vegetables, starchy carbohydrates in grains, and lactose in dairy products. Free sugars are those that are present outside of the cell structure. In contrast, free sugars such as disaccharides and monosaccharides (such as glucose and fructose) are frequently added to food and do not occur naturally. On the other hand, consuming too much energy is linked to the buildup of body fat (Onaolapo *et al*., 2020). More precisely, an excessive intake of free sugars increases the chance of developing other harmful health disorders, such as diabetes and cardiovascular illnesses, and reduces micronutrient density (Hagger *et al*., 2017).

The biggest drawback of refined common sugar derived from sugarcane juice is that it lacks extra advantageous components (such as bioactive molecules) that could improve its nutritional value. Brown sugar, molasses, and noncentrifugal cane sugars are byproducts from the refinement of sugarcane juice. Many bioactive compounds, including phenolic acids and flavonoid glycosides, were found in these byproducts (Singh *et al*., 2015). Because phenols and flavonoids have significant dietary effects, additional scientists have since proposed switching to noncentrifugal sugars instead of refined sugars (Cervera-Chiner *et al*., 2021; Lee *et al*., 2018). For the same reason, people are becoming increasingly interested in natural sweetening alternatives.

Alternatives to artificial sugars:

Currently, natural sweeteners can take the place of both sucrose and artificial sweeteners. Consumers may find natural food products more enticing because they see them as healthier alternatives, according to current market trends. The existing pattern suggests that customers are open to experimenting with natural sucrose substitutes (Mora and Dando, 2021). For instance, consumers perceive beverages sweetened with stevia more favorably than they do SSBs in general (Olivo, 2019). Therefore, the use of natural sweeteners may present a novel and sizable financial potential for many businesses. Additionally, the beneficial impacts of natural sweeteners include improved metabolic health, reduced weight gain, and lowered blood sugar levels.

Other benefits include:

1. Honey and agave nectar have low glycemic indices, which may be beneficial for people on low glycemic index diets.
2. Low fructose levels, such as those in maple syrup.
3. It contains nutrients and health-promoting macromolecules (such vitamins, phytohormones, and minerals) (Valle *et al*., 2020).

1. **Honey**: The most popular natural sweetener consumed worldwide is honey. Its usual chemical make-up includes minerals, vitamins, proteins, organic and amino acids, enzymes, and a number of bioactive chemicals. It also contains 60-85% carbs and 12-23% water, which contains compounds such as phenols and flavonoids (Machado *et al*., 2018). In contrast to other natural sweeteners, honey has antioxidant and antibacterial effects. It has been demonstrated that honey can delay or prevent food spoilage because of its oxidative effects.
2. **Molasses**: The term "molasses" is used to describe concentrated sugarcane or sugar beet juice. This sweetener is produced during the crystallization of sucrose, during which leftover syrups acquire crystallization inhibitors (Palmonari *et al*., 2020). The estimated components of molasses are 17–25% water, 30–40% sucrose, 4-9% glucose, and 5-12% fructose, vitamins and amino acids. Additionally, molasses has intriguing food processing qualities, such as the ability to hide undesirable flavors. Molasses has humectant and colligative qualities that lower water activity and increase the shelf life of baked goods (Mordenti *et al*., 2021).
3. **Maple syrup**: *Acer saccharum* Marsh, the most prevalent species of Canadian maple tree, is used to make maple syrup, a natural sweetener (Garcia *et al*., 2020). The antioxidant, antimutagenic, and antiproliferative characteristics of maple syrup in relation to human cancer are due to the presence of phenolic chemicals. Maple syrup is advantageous for type 2 diabetes professionals because it contains carbohydrate hydrolyzing enzymes such α-glucosidase, which has been found to have inhibitory activity against glucose absorption in the gut (Wan *et al*., 2012). Additionally, this sweetener's ethyl acetate-based extracts may be used to treat Alzheimer's disease. In addition, acetate-based extracts also exhibit anti-inflammatory effects.
4. **Coconut sugar**: Natural sweetener coconut sugar contains many carbs. Approximately 15% of the sugar from the inflorescence of coconut palm (*Cocos nucifera* L) is sucrose (Muriel *et al*., 2019). The sugar has a lower glycemic index (GI), ranging from 35 to 42, and a faster rate of digestion. A strong source of vitamins C, B1, B2, B3, and B6, the sugar has approximately 4 kcal per gram. Additionally, it exhibits a low glass transition temperature that is often linked to its fructose, glucose, and sucrose components (Srikaeo and Thongta, 2015 and Asghar *et al*., 2020). The sap from unopened spadices typically has a pH value of 7.0 to 7.3 and is strong in phenolic content and antioxidant activity (Asghar *et al*., 2020).
5. **Agave nectar**: Agave fructan is hydrolyzed to produce agave nectar, often known as agave syrup. The agave core stores nectar, which is its primary carbohydrate resource in the form of fructans (P'erez-Lopez and Simpson, 2020). Nearly 95% of the total soluble solids (TSS) in agave nectar are fructose concentrations, with 5% of glucose and sucrose. In comparison to other sweeteners (honey), syrup has a low glycemic index (17-27) due to the high fructose concentration and fewer calories. Because of this, agave nectar is used as an alternative to regular refined sugar and is suitable for obesity and the prevention of diseases such as diabetes. (Mejia *et al*., 2017 and Ozuna *et al*., 2020), against intestinal infections and the stimulation of the immune system (Catry *et al*., 2018). Additionally, agave syrup has prebiotic effects that encourage the growth of colonic bacteria, making it a good raw material for nutraceutical products.
6. **Date syrup**: The primary product from dates, one of the most common fruit trees (*Phoenix dactylifera* L.) in the Middle East, is date syrup. Date fruit has a high carbohydrate content (70–80% w/w), dietary fiber (8.7%), amino acids, proteins (1.8%), vitamins, salts, and minerals. Its primary physicochemical components are 16% moisture content and 79.5% total sugar, of which 94% is inverted sugar made up of glucose and fructose. The syrup has a high viscosity (17P at 20°C) and 4.1% coloring matter because of the complicated nonsugar molecular mixture. Additionally, the inverted sugar molecules affect the product's acidic elements (pH 3.8), which strengthens its ability to fend against germs (Ghnimi *et al*., 2017). Date syrup has high nutritional profiles, i.e., a

high content of unsaturated fatty acids (such as oleic, linoleic, palmitoleic, and linolenic acids) and a combination of 15 minerals, including potassium, iron, magnesium, and calcium. Additionally, the syrup contains fluorine and selenium, which provide effective tooth decay protection and immune system stimulation. According to Ibrahim *et al*. (2020), it includes at least six vitamins, including B1 thiamine, B2 riboflavin, nicotinic acid, A, and C.

7. **Stevia**: Due to its potential use as a sucrose substitute and wide range of applications as a natural sweetener in commercial food products, rebaudiana has attracted scientific and industrial interest (Bursa'c Kovacevic *et al*., 2018). Known for its great sweetness and possible use in pharmaceutical and therapeutic products, the perennial herb species *Stevia rebaudiana* is native to South America (Lemus-Mondaca *et al*., 2015). Stevia's sweetness is brought on by molecules called diterpene glycosides, notably stevioside and rebaudioside. Stevia's commercial significance in the food industry is increased by its potent sweetness, low calorie count, and cardiotonic, anticancer, and anti-inflammatory characteristics (Mathur *et al*., 2017).
8. **Monk fruit**: Ninety percent or less of the world's extract production comes from the *Siraita gosvernori* species, which is grown in the Chinese region of Guangxi. Monk fruit has historically been used as a natural sweetener and medication for the treatment of pharyngitis (Swiąder *et al*., 2019). It is currently offered commercially as table sweeteners and is typically offered in conjunction with *S. rebaudiana* and erythritol (Soejarto *et al*., 2019). Mogrosides, a class of terpene glycoside chemicals, are what give monk fruit its sweetness. Mogroside V, one of the five mogroside kinds in monk fruit, is the one with the highest concentrations and the highest sweetness intensity (256-378 times that of regular sugar) (Swiader *et al*., 2019). According to the antidiabetic and anticancer actions, mogrosides from *S. gosvernori* also have bioactive qualities (Liu *et al*., 2018). According to Liu (2018), mogroside V specifically causes apoptosis and cell cycle arrest in pancreatic tumor cells and is linked to free radical scavenging activities (Pandey and Chauhan, 2019). By boosting insulin secretion, decreasing lipid peroxidation, and lowering glucosidase activity, mogrosides also cause a hypoglycemic response (Gong *et al*., 2020).
9. **Yacon syrup**: Yacon (*Smallanthus sonchifolius*) is a perennial plant that is indigenous to South America's Andes. This plant's tubers can be used to make juice (or syrup) that can be used as a sugar replacement. Approximately 60% of their dry mass is made up of fructo-oligosaccharides (FOSs) and inulin (Kamp *et al*., 2019). Since human digestive enzymes cannot hydrolyze FOSs and they are not metabolized in the gastrointestinal tract, they are employed as low-calorie sweeteners (Yan *et al*., 2019). Chlorogenic acid, a phenolic and bioactive substance with therapeutic effects as well as antioxidant, antibacterial, anti-inflammatory, and hepatoprotective properties, was found in Yacon syrup. Importantly, the phenolic components in yacon syrup may aid in the prevention of chronic diseases, such as various cancers and cardiovascular diseases (Yan *et al*., 2019). Yacon syrup has also been advocated for diabetes patients as a different natural sweetener. Its extracts have shown inhibitory effects against the enzymes α-amylase and α-glucosidase, preventing the absorption of glucose and lowering postprandial hyperglycemia as a result (Russo *et al*., 2015).
10. **Palm sugar**: The sap of many palm species, including the sugar palm (*Arenga pinnata*), the nipa palm (*Nypa fruticans* Wurmb), and the palmyra palm (*Borassus flabellifer*), is used to make palm sugar, a common natural substitute in Asian nations (Lee *et al*., 2018). Palm sugar has been utilized in a variety of items, including drinks, desserts, and sweet soy sauce (Saputro *et al*., 2019). Lee *et al*. (2018) recently investigated the physicochemical characteristics and chemical content of palmyra palm granulated sugar. They showed a pH value of 6.90 and an overall Aw value between 0.30 and 0.48, which is ideal for long periods of storage. Although almost 91% sugar and approximately 5.6% reduced sugars made up the majority of the examined samples, several minerals (potassium, salt, and iron) were also

found. Additionally, considerable amounts of vitamins E, C, and D were discovered.

Future scope of research:

The future of research on natural preservatives and sweeteners has good potential, as they can improve the food chain, be used in the composition of processed food products, change packaging materials, and be used as coating materials, and natural sweeteners have many health benefits.

Conclusion

Chemicals used as artificial preservatives can be harmful to your health. The negative consequences of these substances in food, cosmetics, and drugs are becoming better known. Due to their nontoxic nature and several health advantages, natural preservatives are superior to their synthetic counterparts. Artificial preservatives to be replaced with better options such as essential oils. People should choose products with natural preservatives and carefully read food, cosmetic, and pharmaceutical labels to achieve and maintain good health. Another harmful additive in processed food is artificial sweeteners. This sugar lacks nutritional value, and an excessive intake of free sugars increases the chance of developing other harmful health disorders, such as diabetes and cardiovascular illnesses, and reduces micronutrient density and fat build-up in the body. Natural sweeteners such as honey, maple syrup, palm sugar, coconut sugar, and stevia also have favorable impacts on intake, including improving metabolic health, avoiding weight gain, and lowering blood sugar. Thus, it is time to start avoiding processed food products with artificial preservatives and artificial sweeteners to maintain a good healthy lifestyle.

Conflict of interest

The authors declare that they have no conflict of interest.

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