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Review Article

HERBS FORTIFIED FOOD - KEY OF POLYPHENOLS: A REVIEW

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Herbs are the plants or plant parts that are useful to man for flavor, for fragrance, for medicinal purposes. In different herbs, a wide variety of active phytochemicals including the flavonoids, terpenoids, lignans, sulfides, polyphenols, carotenoids, coumarins, saponins, plants sterols, curcumins and phthalides have been identified. These phytochemicals have been shown to have several medicinal benefits. There are several ways in which the medicinal benefits of herbs could be conveyed via certain foods as carriers. In general use herbs are any plants used for foods, flavouring, medicine, perfume. Herbs refer to the leafy green parts of a plant either fresh or dried. Herbs are a subset of botanical product made from botanicals that are used to maintain or improve health called HERBAL PRODUCT or botanical product.

Keywords: Herbs, Product, Polyphenols

INTRODUCTION

An herb can be any form of a plant or plant product, including leaves, stems, flowers, roots, and seeds. These plants can either be sold raw or as extracts, where the plant is macerated with water, alcohol, or other solvents to extract some of the chemicals. The resulting products contain dozens of chemicals, including fatty acids, sterols, alkaloids, flavonoids, glycosides, saponins, and others. Because any given herb contains multiple ingredients, some manufacturers attempt to create standardized herbal products by identifying a suspected active

ingredient and altering the manufacturing process to obtain a consistent amount of this chemical. The Dietary Supplement Health and Education Act (DSHEA) of 1994 classifies herbs as dietary supplements. This law defines supplements quite broadly as “anything that supplements the diet.” Supplements therefore include vitamins, minerals, herbs, amino acids, enzymes, organ tissues, metabolites, extracts, or concentrates. A major difference between a drug and a dietary supplement is that dietary supplements may not claim to “diagnose, cure, mitigate, treat, or prevent illness.” It is interesting to note that dietary

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supplement manufacturers are allowed to make certain “structure/function” claims, which are often vaguely worded claims of health benefits. For example, an *Echinacea* product (often used to treat or prevent the common cold) might claim to “support the body’s natural defenses”. Traditionally, herb extracts have been used as antispasmodic, diuretic, carminative, analgesic, antipyretic, and anti-inflammatory agent. Herbs can be used to treat skin disorders, conjunctivitis and blepharitis. It is also highly recommended for the treatment of diabetes, bronchitis, chronic coughs, kidney stones and has galactogenic properties. The essential oils from some herbs inhibit the food borne pathogens like *Staphylococcus aureus* most effectively. The essential oils consist of anethole, estragole and fenchone as the major constituents. Essential oils from oregano, coriander, bay, clove, cinnamon, black pepper have inhibitory characteristics against food poisoning *Salmonella* species. Essential oils of cinnamon and clove at 200-300 ppm check the growth of aflatoxin produced by *Aspergillus*. Antimicrobial compounds present in herbs can extend shelf life of unprocessed or processed foods by reducing microbial growth rate or their viability. Basil contains linalool and methyl chavicol, which show their antimicrobial activity against a wide range of gram positive, and gram negative bacteria. Smith *et al.* (1999) have ascertained a level of 0.25-1.0% for the inhibition of *C.jejuni*, *E.coli*, *S.enteridis*. Tannins and non-tannins polyphenols present in the extract of herbs have antiviral properties. A number of studies have reported a high correlation between antimicrobial efficacy and the level of phenolic components present in certain herb and spice preparations. Indeed, compounds such as eugenol, carvacrol and carnosic acid present in clove, oregano and rosemary respectively, have

been identified as being responsible for antimicrobial activity (Dorman and Deans, 2000; and Moreno *et al.*, 2006). Many herbs contain potent antioxidant compounds that provide significant protection against chronic diseases. These compounds may protect LDL cholesterol from oxidation, inhibit cyclooxygenase and lipoxygenase enzymes, inhibit lipid peroxidation, or have antiviral or antitumor activity.

HERBS GENERALLY USED IN FORTIFICATION OF HERBAL FOOD PRODUCTS

Aloe-Vera

The botanical name of Aloe Vera is *Aloe barbadensis*. It belongs to the family of Liliaceae. There are over 400 species of Aloe Vera plants in the Lily Family. The main compositions of Aloe Vera are anthraquinones, amino acids, sterols, hormones, vitamins, minerals, enzymes, saponins, lignin, sugars, proteins and water. Rowe *et al.* (1940) has reported the utilization of Aloe Vera in the treatment of X-ray burns. Benzoin tincture a compound present in the Aloe Vera which is utilized for healing human wounds, skin burns and constipation (Robbers *et al.*, 1996; and Syed, 1996). Aloe vera commonly known as Gheegwar/Ghritkumari belongs to family lilaceave. It is a desert plant having a very popular herbal remedy. Aloe is derived from Arabic word “alloeh” means “bitter”. Aloe vera leaf contains 95% of water, 75 nutrients, 200 active compounds, 20 minerals, 18 amino acids, 12 vitamins and 92 enzymes. It can be used as the source of vitamins like A, B1, B2, B6, B12, C, E, Folic acid, Niacin, etc. Owing to its succulent properties, it is a rich source of nutrients and essential minerals. Aloe plant is very much prevalent in hot and dry climates. It is among the oldest known medicinal

plants gifted by nature; hence often called miracle plant, known by many names. The aloe plant has long (up to 20 inches long and 5 inches wide), triangular, fleshy mucilaginous leaves that have soft spikes along the edges. The fresh parenchymal gel from the centre of the leaf is clear. There are more than 300 species of Aloe vera and of these only 4 or 5 are commonly used in medicines. The most widely used species of Aloe vera is *Barbadensis millar*. *Barbadensis miller* is not a cactus but is a cactus like plant with a rubber touch growing in the warmer tropical climates of the world. Numerous aloe species around the world are used for conditions ranging from dermatitis to cancer. Aloe gel's greatest use is as a skin salve and vulnerary for minor burns, abrasions, canker sores and other epithelial injuries. There is growing experimental evidence for its use as an antiviral, an ulcer remedy and an adjuvant cancer treatment due to its immune modulating effects. Due to its high nutritional value it can be incorporated as base food products like aloe juice, aloe squash, to get nutritional food to human health. Thus it is very popular among the world's population. Aloe juices and gels are available in the market to be used for various purposes. Aloe vera gel contains all the essential nutrition for a daily requirement. Therefore there are many companies that are involved in preparing Aloe vera juice and edible gels. Aloe vera leaf is processed by boiling, pasteurization and cold processing. The raw pulp of aloe vera contains approximately 98.5% water, while the mucilaginous or gel consists of about 99.5% water with a pH of 4.5 and only 0.5 to 1% solid material (Boudreau and Beland, 2006).

Moringa oleifera

Moringa Oleifera (*Drumstick tree*) is universally referred to as the miracle plant or the tree of life.

Other names for Moringa in English include: "Drumstick tree", from the appearance of the long, slender, triangular seed pods. "Horseradish tree", from the taste of the leaves, which can serve as a rough substitute for horseradish. "Ben oil tree", from the oil derived from the seeds. The *Moringa* plant derives this name based on its uses, particularly with regard to medicine and nutrition. It is a plant native to the sub-Himalayan tracts of India, Pakistan, Bangladesh and Afghanistan (Fahey, 2005). *M. Oleifera* is the most widely cultivated among the 13 species of the *Moringaceae* family and it is exceptionally nutritious with a variety of uses. Almost all the parts of this miracle tree have been found to be very useful. Leaves are used as forage, tree trunk for making gums, flower nectar in honey and powdered seeds for water purification Fuglie (1999). *M. Oleifera* leaf has been used as an alternative food source to combat malnutrition, especially among children and infants (Anwar et al., 2007). *M. Oleifera* leaves are reported to contain substantial amounts of vitamin A, C and E (Hekmat et al., 2015). The leaves of *M. Oleifera* have also been found to contain appreciable amounts of total phenols, proteins, calcium, potassium, magnesium, iron, manganese and copper (Hekmat et al., 2015). *M. Oleifera* leaves are also good sources of phytonutrients such as carotenoids, tocopherols and ascorbic acid (Saini et al., 2014). These nutrients are known to scavenge free radicals when combined with a balanced diet and may have immunosuppressive effects (DanMalam et al., 2001). Besides the leaves, the flowers and fruits of *M. Oleifera* have also been found to contain appreciable amounts of carotenoids (Saini et al., 2014e).

The use of *M. Oleifera* to improve the nutritional value of staple foods in many parts of

the world including Africa may not necessarily fall under fortification or enrichment. As previously defined, fortification which is sometimes used interchangeably with enrichment involves the addition of specific micronutrients to staple foods to improve the overall nutritional value of the targeted population. In this review, we will be using fortification to describe the improvement in the nutritional value of staple foods containing *M. Oleifera*.

Tulsi

Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs (Hammer *et al.*, 1999). The use of plants and plant products as medicines could be traced as far back as the beginning of human civilization. The earliest mention of medicinal use of plants in Hindu culture is found in "Rigveda", which is said to have been written between 4500-1600 B.C. and is supposed to be the oldest repository of human knowledge. It is Ayurveda, the foundation of medicinal science of Hindu culture, in its eight divisions deals with specific properties of drugs and various aspects of science of life and the art of healing (Rastogi and Mehrotra, 2002).

Medicinal plants are a source of great economic value all over the world. Nature has bestowed on us a very rich botanical wealth and a large number of diverse types of plants grow in different parts of the country. Nepal is rich in all the 3 levels of biodiversity, namely species diversity, genetic diversity and habitat diversity. In Nepal thousands of species are known to have medicinal value and the use of different parts of several medicinal plants to cure specific ailments has been in vogue since ancient times. Herbal

medicine is still the mainstay of about 75-80% of the whole population, and the major part of traditional therapy involves the use of plant extract and their active constituents (Akerle, 1993).

Tulsi, the "Queen of Herbs", is the most sacred herb of India. *Ocimum* belongs to the Lamiaceae family, which has close to 252 genera and 6700 species (Mabberley, 1997). There are three important varieties of Tulsi namely, Rama Tulsi (*Ocimum sanctum*), Krishna Tulsi (*Ocimum tenuiflorum*) and Vana Tulsi (*Ocimum gratissimum*).

The ability to utilize oxygen has provided humans with the benefit of metabolizing fats, proteins and carbohydrates for energy. Oxygen is a highly reactive atom that is capable of becoming part of potentially damaging molecules commonly called "free radicals." Free radicals are capable of attacking the healthy cells of the body, causing them to lose their structure and function. Cell damage caused by free radicals appears to be a major contributor to aging and to degenerative diseases of aging such as cancer, cardiovascular disease, cataracts and immune system decline and brain dysfunction (Sundquist *et al.*, 1992).

Fennel

Fennel (*Foeniculum vulgare* var. dulce) is an edible herb commonly used for savoury formulations, sauces, liqueurs, confectionary, etc. The herb has immense applications in therapeutic and culinary fields worldwide. Traditionally, fennel extracts have been used as antispasmodic, diuretic, carminative, analgesic, antipyretic, and anti-inflammatory agent. The herb can be used to treat skin disorders, conjunctivitis and blepharitis. It is also highly recommended for the treatment of diabetes, bronchitis, chronic coughs,

kidney stones and has galactogenic properties. The fennel essential oil consists of anethole, estragole and fenchone as the major constituents. Fennel is also rich in sugars, minerals, essential fatty acids, proteins and fibres. Essential oil and extracts of fennel seeds have strong anti-oxidant and antimicrobial activities. Oktay *et al.* suggested that it can be used against oxidative deterioration, and thus can be used as a food supplement or in pharmaceutical industry. Fennel seeds contain numerous flavonoid antioxidants like kaempferol and quercetin. These compounds function as powerful antioxidants protecting human body from cancer, infection, ageing and degenerative neurological diseases.

Pudina

Mentha is a genus of plants in the family Lamiaceae (mint family). The species is not clearly distinct, with 13 to 18 variations estimated.

Mints are aromatic, almost exclusively perennial, rarely annual, herbs. They have wide-spreading underground and overground stolons and erect, square branched stems. The leaves are arranged in opposite pairs, from oblong to lanceolate, often downy, and with a serrated margin. Leaf colors range from dark green and gray-green to purple, blue, and sometimes pale yellow. The flowers are white to purple and produced in false whorls called verticillasters. The corolla is two-lipped with four subequal lobes, the upper lobe usually the largest. The fruit is a nutlet, containing one to four seeds.

Rosemary

Rosemary is an aromatic evergreen shrub that has leaves similar to hemlock needles. The leaves are used as a flavoring in foods such as stuffings and roast lamb, pork, chicken and turkey. It is native to the Mediterranean and Asia, but is

reasonably hardy in cool climates. It can withstand droughts, surviving a severe lack of water for lengthy periods. Forms range from upright to trailing; the upright forms can reach 1.5 m (5 ft) tall, rarely 2 m (6 ft 7 in). The leaves are evergreen, 2-4 cm (0.8-1.6 in) long and 2-5 mm broad, green above, and white below, with dense, short, woolly hair. The plant flowers in spring and summer in temperate climates, but the plants can be in constant bloom in warm climates; flowers are white, pink, purple or deep blue. Rosemary also has a tendency to flower outside its normal flowering season; it has been known to flower as late as early December, and as early as mid-February.

ANTIMICROBIAL COMPONENTS OF DIFFERENT SPICES AND HERBS

Ready to Serve (RTS) Beverages

The ready-to-serve beverages as per FSSAI specifications should contain at least 10% fruit content and not less than 10% TSS besides 0.3% acid maximum as citric acid. The levels of permitted preservatives include 70 ppm (maximum) for sulphur dioxide and 120 ppm (maximum) for benzoic acid. The total plate count and yeast and mold counts should not exceed, to 50.0 cfu/ml and 2.0 cfu/ml, respectively. The Coliform counts should be nil in 100 ml beverage samples.

Since these beverages are consumed as such without dilution, hence are termed as Ready-to-serve beverage. The majority of packaged fruit beverages belong to this category. Wide range of fruits including mango, citrus fruits, berries, litchi, guava, pineapple, grapes, etc., are preferred for RTS beverages.

Table 1: Different Herbs with their Antimicrobial Components: Different Herbs Fortified Food Products

Herb/Spices	Part Used	Anti-Bacterial Component	Anti-Microbial Component	Benefits
AGRIMONY	Aerial.	A.pilosa	Flavonoids.	For sore throats.
ALFALFA	Leaves, stems, sprouts.	Saponins.	Xanthophylls.	Arthritis, reduce cholesterol.
ALOE VERA	Leaves.	Anthraquinoe	Salicylic acid	Treatment of minor burns, cut, sun burn.
AMLA	Fruits.	Polyphenols.	Superoxide dismutase.	Control blood sugar, treat constipation.
ANGELICA	Leaves, stems, seed, root	Polysaccharide	Essential oil.	Digestive problem, arthritis.
ASHWAGANDHA	Root, leaves, seed.	Sitoinosides.	Flavonoids.	Strengthens body, increase endurance.
ASTRAGALUS	Roots, rhizomes.	Polysaccharide	Essential oil.	Diuretic, lowering high blood pressure.
BEE BALM (MINT)	Leaves	Thymol.	Essential oil.	Source of essential oil.
BLUE BERRY	Leaves, fruits.	Phenol.	Flavonoids.	Protect capillaries from free radical damage.
BONESET (SAGE)	Leaves, flower.	Essential oil.	Polysaccharides.	Treat cold, flu, arthritis.
BORAGE (BEE PLANT)	Flower, seed oil.	Gamma linolenic acid.	Essential oil.	Anti-depressant, sedative.
BOSWELLIA	Resin.	Resin oil.	Essential oil.	Treat asthma, diabetes.
CHILI PEPPER	Fruit.	Capsaicin.	Capsaicin.	Reduce triglycerides level.
CHICORY	Whole herb.	Coumarins.	Flavonoids.	Cleaning blood loss of appetite and indignation.
CINNAMON	Bark.	Cinnamaldehyde	Essential oil.	Act as a anti-bacterial and anti-fungal.
ECHINACEA	Flower, roots, leaves.	Alkyl amides.	Flavonoids.	A good detoxifier.
GINKGO	Leaves and seeds.	Essential oil	Terpenoids.	Improve flow of blood to the brain and increase oxygen to the brain cells.
GOTUKOLA (BRAHMI)	Leaves, stems.	Madecassoside	Brahmi oil.	Treating varicose and memory loss.
HOLY BASIL	Leaves, stems.	Essential oil.	Linalool.	Improve memory and enhance cerebral circulation.
TURMERIC	Root.	Curcumin.	Turnerone.	Great natural liver detoxifier.

Blended Papaya-Aloe Vera RST: In Boghani *et al.* (2012) prepared a blended RTS beverages using 12% TSS, 0.3% acidity and 10% blended juices of blending ratio of 90% papaya juice + 10% Aloe vera juice. The storage studies revealed that blended papaya aloe vera gel could be

successfully stored for the period of 3 months without significant in chemical and organoleptic qualities.

Therapeutic Ready to Serve (RTS) made from Blend of Aloe Vera, Aonla and Ginger Juice: Blended therapeutic RTS beverages were

prepared using 15% of blended juice extracts of aloe vera, aonla fruit and ginger, 15% of Total Soluble Solid (TSS) and 0.3% of acidity by Sasi Kumar *et al.* (2013).

Aloe Chocolate Powder: Cocoa solids are a mixture of many substances remaining after cocoa butter is extracted from cacao beans. When sold as an end product, it may also be called cocoa powder or cocoa. In contrast, the fatty component of chocolate is cocoa butter. Cocoa butter is 50% to 57% of the weight of cocoa beans and gives chocolate its characteristic melting properties. Cocoa liquor or cocoa mass is a paste of roasted cocoa beans with cocoa butter and solids in their natural proportions. Chocolate requires the addition of extra cocoa butter to cocoa liquor, leading to an excess of cocoa solids and thus a relatively cheap supply of cocoa powder. Cocoa powder is rich in flavonoids, a type of phenolic acid. The amount of flavonoids depends on the amount of processing and manufacturing the cocoa powder undergoes, but cocoa powder can contain up to 10% of its weight in flavonoids.

Aloe vera chocolate powder was prepared by Jayabalan and Karthikeyan (2012). Maximum sensory analysis of colour, taste, aroma and texture in the aloe vera chocolate production is obtained from ingredients at the optimized process conditions. The optimum condition for taste is sugar 1000 g, skim milk powder 1019 g, cocoa powder 252.5 g and aloe vera juice 82.5 ml.

Bread

Bread is a staple in many parts of the world, whose quality is determined by several factors including loaf volume, the colour and texture of the crust and crumb. Its nutritional value is

dependent on the ingredient used in its formulation. Bread may be leavened by processes such as reliance on naturally occurring sourdough microbes, chemicals, industrially produced yeast, or high-pressure aeration. Some bread is cooked before it can leaven, including for traditional or religious reasons. Non-cereal ingredients such as fruits, nuts and fats may be included. Commercial bread commonly contains additives to improve flavor, texture, color, shelf life, and ease of manufacturing.

- The inclusion of *M. Oleifera* flower, seed or leaf powder in bread dough prepared from wheat flour alone or in combination with other flours has been reported to improve nutritional the value of bread was studied by Ogunsina *et al.* (2010), Sengeev *et al.* (2013) and Chinma *et al.* (2014).
- In Chinma *et al.* (2014), studied that MOLP fortified bread reported approximately 17% and 88% increase in protein and crude fibre content respectively. The study by Chinma *et al.* (2014) on the use of MOLP in bread fortification combined germinated tigernut in the dough formulation. With this formulation, it will be very difficult to access the influence of MOLP separately from that of germinated tigernut.
- The improvement in nutrient composition of MOLP fortified bread was found to be accompanied by poor sensory properties including crust and crumb colour and reduction in loaf volume, weight and height compared to the unfortified bread studied by Sengeev *et al.* (2013). The MOLP fortified bread samples were reported to have herbal flavour.
- Studies by Karim *et al.* (2013) on MOLP fortified amala similarly reported poor rating for amala fortified with MOLP beyond 2.5%.

- In Lipi Das *et al.* (2013) fortified bread with fennel seed powder is likely to have higher consumer acceptability than white or other fortified bread. Crumb moisture increased and reached the maximum at 7.0% level of supplementation with gradual increase in crumb firmness. An attempt has been made to understand the role of fennel seed powder in the bread samples during storage. Antioxidant activity (i.e., total phenolic content, ferric reducing antioxidant power and 2, 2-diphenyl-1-picrylhydrazyl radical scavenging) showed an increase up to 7.0% level of supplementation. Bread with fennel seed content between 5.0 and 7.0% showed the highest acceptability among the fortified bread samples.

Biscuit

Biscuit is a term used for a diverse variety of baked, commonly flour-based food products. The term is applied to two distinct products in North America and the Commonwealth of Nations and Europe. The North American biscuit is typically a soft, leavened quick bread, and is covered in the article Biscuit (bread). According to Claughton and Pearce (1989), baked snacks such as cookies are widely consumed in many part of the world. They are used for feeding and nutrition improvement programmes especially among low-income groups (Claughton and Pearce, 1989). Thus, biscuits can be regarded as food vehicle for carrying desired nutrients to the target individuals.

- In Ogunsina *et al.* (2010) fortified biscuit/cookies by using seed. The protein content of cookies fortified with 10% and 20% MOSF increased by 45% and 90% respectively.
- In Alam *et al.* (2014) fortified biscuit/cookies by using *M. Oleifera* leaf. Wheat cookies

fortified with 10% MOSF resulted in higher increase (45%) in protein content than those reported for wheat cookies fortified with 10% MOLP by different authors.

- Ogunsina *et al.* (2010) reported that 20% level of *M. Oleifera* Seed Flour (MOSF) produced wheat cookies with surface cracking pattern and colour similar to the control. Beyond this concentration, both colour and surface cracking pattern were adversely affected. Further, the protein contents of the fortified cookies were reportedly higher than those of the unfortified control.
- Manaois *et al.* (2013), reported a higher increase (approx. 26%) in protein content of rice cookies fortified with freshly harvested 5% MOLP compared to dried MOLP at the same concentration which showed approximately 14% increase.

Cake

Cake is a form of sweet dessert that is typically baked. In its oldest forms, cakes were modifications of breads, but cakes now cover a wide range of preparations that can be simple or elaborate, and that share features with other desserts such as pastries, meringues, custards, and pies.

Typical cake ingredients are flour, sugar, eggs, butter or oil, a liquid, and leavening agents, such as baking soda and/or baking powder. Common additional ingredients and flavourings include dried, candied, or fresh fruit, nuts, cocoa, and extracts such as vanilla, with numerous substitutions for the primary ingredients. Cakes can also be filled with fruit preserves or dessert sauces (like pastry cream), iced with buttercream or other icings, and decorated with marzipan, piped borders, or candied fruit.

- Kolawole *et al.* (2013) reported the use of up to 20% MOLP in the fortification of wheat cake. The sensory property of the cake at MOLP level above 8% was reportedly rated low by the sensory panel.

Soup

Soup is a primarily liquid food, generally served warm or hot (but may be cool or cold), that is made by combining ingredients such as meat and vegetables with stock, juice, water, or another liquid. Hot soups are additionally characterized by boiling solid ingredients in liquids in a pot until the flavors are extracted, forming a broth.

Traditionally, soups are classified into two main groups: *clear soups* and *thick soups*. The established French classifications of clear soups are *bouillon* and *consommé*. Thick soups are classified depending upon the type of thickening agent used: *purées* are vegetable soups thickened with starch; *bisques* are made from puréed shellfish or vegetables thickened with cream; cream soups may be thickened with béchamel sauce; and *veloutés* are thickened with eggs, butter, and cream. Other ingredients commonly used to thicken soups and broths include egg, rice, lentils, flour, and grains; many popular soups also include carrots and potatoes.

- The use of leafy vegetables in soup and dishes has been a practice that transcends human history. A recent survey by Stevens *et al.* (2013) on the utilization of *M. Oleifera* plant reported that its leaves have found applications in preparing soup.
- Evidence of the use of *M. Oleifera* leaves, in making soup, exists in the literature (Babayaju *et al.*, 2014; and Chandramouli *et al.*, 2012).
- *M. Oleifera* was reportedly used in making soups alone or in combination with melon seed

and spinach by Babayaju *et al.* (2014). In this study, six soup blends were produced, in varying proportion; spinach and melon (60:40), *M. Oleifera* leaf and melon (60:40), *M. Oleifera* leaf, spinach and melon (30:30:40), spinach (100), *M. Oleifera* leaf and spinach (50:50) and *M. Oleifera* leaf (100). The control soup made from spinach and melon in ratio 60:40 was reported to have the highest acceptability. According to these authors, up to 30% of *M. Oleifera* leaf can be used in making traditional dishes with added species and melon, since this level of inclusion had ratings next to the control among the studied samples.

Tea

Tea is an aromatic beverage commonly prepared by pouring hot or boiling water over cured leaves of the *Camellia sinensis*, an evergreen shrub native to Asia. After water, it is the most widely consumed drink in the world. There are many different types of tea; some teas, like Darjeeling and Chinese greens, have a cooling, slightly bitter, and astringent flavour, while others have vastly different profiles that include sweet, nutty, floral or grassy notes. The phrase herbal tea usually refers to infusions of fruit or herbs made without the tea plant, such as steeps of rosehip, chamomile, or rooibos. These are also known as *tisanes* or *herbal infusions* to distinguish them from "tea" as it is commonly understood. Tea is second widely consumed beverage after water worldwide and because a combination factors are believed to play a role such as refreshing taste, attractive aroma and potential positive health effect (Sari and Velioglu, 2011). According to Quispe *et al.* (2012) increasing consumption of herbal teas is a worldwide trend because supplementation of human diet with herbal

provides high antioxidant compounds that may have beneficial effects. Additionally, due to the advance development of technology and time constraint, people have started to seek for convenient herbal products. Herbal tea has been used for health care and diseases prevention for thousands of years in many countries (Zhao *et al.*, 2013) because according to Tschiggerl and Bucar (2012) herbal teas are convenience to take, easy to prepare, mild in action and in most cases with negligible side effects besides, cheap in price and rich in resource. *Cosmos caudatus*, commonly known as ulam raja by the Malay society, is getting attention by Malaysian herbal industries to be developed in tea form. It bear purple, pink or white ray florets, grows up to about 1-8 feet tall, hairless or sparsely hairy, leaves are finely dissected, 10-20 cm long and having 20-26 species worldwide (Rasdi *et al.*, 2010). *C. caudatus* is used traditionally to reduce body heat, improving blood circulation, as anti-ageing agent, strengthening bone marrow (because of high calcium content), to treat infection associated with pathogenic microorganisms and to promote fresh breath (Amna *et al.*, 2013). In addition, some of literature reported, *C. caudatus* is amongst herbs that have high antioxidant activity. According to Shui *et al.* (2005) the major antioxidants in *C. caudatus* could be due to a number of proanthocyanidins that exists as dimers through hexamers, quercetin glycosides, chlorogenic, neo-chlorogenic, crypto-chlorogenic acid and (+)-catechin. With the extremely high antioxidant capacity of about 2,400 mg L-ascorbic acid equivalent antioxidant activity (AEAC) per 100 g of fresh sample, *C. caudatus* is believed to reduce oxidative stress. It is well reported that the total amount of phenolic compounds may have a direct contribution in the defence against

oxidative stress and could be considered to be active metabolites involved in the antioxidant activity of herbs (Mediani *et al.*, 2012). However, a few literatures had found a declining trend of antioxidant activities with advancing maturity. Sreelatha and Padma (2009) demonstrated, this may due to old plants possesses inadequate antioxidant defence and/or owing overproduction of Reactive Oxygen Species (ROS), this equilibrium is hampered favouring the ROS upsurge that culminates in oxidative stress. Compared to young plant, Menichine *et al.* (2011).

CONCLUSION

M. Oleifera plant is indeed a miracle plant with enormous potentials yet to be fully explored in food application. The use of *M. Oleifera* leaf powder, *M. Oleifera* seed powder, *M. Oleifera* flower powder in various food applications such as in fortifying amala (stiff dough), ogi (*maizegruel*), bread, biscuits, yoghurt, cheese and in making soups was reviewed. Many of the studies summarized in this paper need further validation to substantiate their findings. For instance *M. Oleifera* leave powder was reported to reduce tendency for retrogradation in stiff dough prepared from plantain flour as shown by the low set back viscosity values. However, the study did not show retrogradation was actually affected when the stiff dough was prepared.

The study that Tulshi and Moringa leaves can be successfully incorporated in wheat flour biscuits up to a level of 1% to yield biscuits of enhanced nutritional quality with acceptable sensory attributes. Hence, development and utilization of such functional foods will not only improve the nutritional status of the population but also helps those suffering from degenerative diseases.

C. caudatus herbal tea prepared from young leaves exhibited significantly high in TPC, TFC, FRAP as well as DPPH inhibition as compared to mature and old leaves. It is supported by the Pearson's correlation coefficient which shows strong positive correlation between reducing power with TPC and TFC but negatively correlated between DPPH scavenging activity with TPC and TFC. Based on these findings, it is recommended to use young leaves for herbal tea preparation since it possessed high antioxidant activity which is beneficial for human health.

Fortification of wine with components having potential healthful properties renders the wine more beneficial to the consumer. The herbal extracts used in the fortification were found to complement the basic attributes of the wine when used in the specified amounts. Also regular, but limited administration of these fortified wines would help in receiving benefits of the herbal extracts, thus, minimizing the need for synthetic medicines for treating various disorders. The combinations gave a novel product with better qualities, increased acceptability and wider applications. Such fortifications need to be explored for developing products that could be included in the realm of Health-oriented products. Also the application of such fortified wines in the field of therapeutics is a conceivable approach.

Fennel seeds are a sweet spice used worldwide in various cuisines. Bread fortified with fennel seed powder showed high moisture content in the crumbs, rich antioxidant content and good consumer acceptability when up to 7.0% of fennel seed powder was added. Crumb firmness followed an increasing trend with the increase in the fennel seed powder content. It can thus be inferred that the optimum supplementation level of fennel seed powder

ranged between 5.0 and 7.0% per 100 g of wheat flour.

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