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Therapeutic Potential of Family Oleaceae in Ageing Associated Disorders

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Abstract

Ageing population across the globe is always facing health challenges that need a solution that is sustainable and cost-effective. A gradual decline in usage of the ancient wisdom of treating ailments with common plants has made the elderly population highly dependent on synthetic medicines, which bring along its pros and cons. Natural medicines obtained from plants can be the key to solve the health challenges afflicting the ageing population. Oleaceae family in the flowering plants is a treasure trove of medicinal plants having a large number of secondary metabolites of pharmaceutical importance. In this article, Oleaceae has been reviewed extensively and an overview of the medicinal properties of its various genera has been presented. The natural products obtained from these plants possess anti-hypertensive, anti-diabetic, anti-depressants, anti-oxidant, anti-tumour and neuroprotective properties. Oleaceae emerges as a promising family that can be effective in managing health issues of the elderly population. Therefore medicinal plants and their secondary metabolites of this family should be properly evaluated for the benefits of the old age population across the globe.

Introduction:

There is a growing trend where phytotherapy is being preferred over modern medicine to cure diseases and there are instances where it has emerged as a better alternative. As reported by Prince *et al.* (2015) approximately 23% of global burden of diseases is found in the elderly population that suffers from diseases such as cardiovascular diseases, neurological disorders, cancer, diabetes, musculoskeletal diseases, respiratory diseases and other degenerative diseases. Judicious utilization of the phytochemicals in a way that integrates the ancient wisdom pertaining to the immense therapeutic value of the medicinal plants with modern innovative and simple to implement methods is perhaps an ideal way to address these challenges.

Many species of family Oleaceae have been a part and parcel of traditional medicine in various parts of the world. Many of these species have been exploited for their high nutritive value and vital economic importance. Oleaceae family with its multitude of plants could be the treasure trove furnishing all that is required to combat the health issues of the ageing population. The review intends to take stock of the medicinal plants in family Oleaceae, to ascertain the utility of these plants in preventing and curing

health challenges undergone by the elderly people all across the globe.

Oleaceae- the Olive family:

Oleaceae is a major family of angiosperms that are distributed widely all across the world and is found in tropical, subtropical and temperate climates. The family is characterized by the predominant presence of trees, shrubs, and few woody climbers and comprises over 600 species belonging to 25 genera (Green, 2004). Oleaceae is broadly divided into five tribes namely Myxopyreae, Forsythieae, Fontanesieae, Jasmineae, and Oleae. Myxopyreae consists of three genera *Myxopyrum* Blume, *Dimetra* Kerr and *Nyctanthes* L.; Forsythieae consists of two genera *i.e.*, *Abeliophyllum* Nakai and *Forsythia* Vahl.; Fontanesieae is comprised of a single genus *Fontanesia* Labill and tribe Jasmineae consists of only two genera namely *Menodora* Humb & Bonpl and *Jasminum* L. The tribe Oleae is the largest tribe of the family and is further divided into four subtribes- Ligustrinae, Schreberinae, Fraxininae, and Oleinae. Subtribe Ligustrinae consists of two genera- *Syringa* L. and *Ligustrum* L., Subtribe Schreberinae also consists of two genera- *Comoranthus* Knobl. and *Schrebera* Roxb., while subtribe Fraxininae

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consists of the only genus *Fraxinus* L. The sub-tribe Oleinae consists of the remaining twelve genera namely- *Chionanthus* L., *Forestiera* Poir, *Haenianthus* Griseb, *Picconia* D.C., *Phillyrea* L., *Hesperelaea*, *Notelaea* Vent., *Olea* L., *Priogymnanthus* P.S. Green, *Noronhia*, *Nestegis* Raf. and *Osmanthus* Lour.

Secondary metabolites characterizing respective therapeutic importance:

Oleaceae is characterized by the presence of secondary metabolites called iridoids as the taxonomic markers (Jensen *et al.* 2002). The iridoids are a large family of bicyclic-monoterpenes that are known to have pharmacological activities of vital importance. In a study by Obied *et al.* (2008) it has been found that apart from the abundant presence of a secoiridoid oleuropein in olive drupes, there is a presence of neo-nuzhenide and 20-hydroxyoleuropein. As suggested by Damtoft *et al.* (1995) *Fontanesiaphillyreoides* representing the genus *Fontanesia* is marked with the presence of iridoids namely verbascoside, swertiamarin, loganic acid, secologanic acid and secologanoside. The genus *Fontanesia* has also exhibited the presence of secoiridoids (Damtoft *et al.* 1995).

The phytochemical analysis of *Jasminum sambac* conducted by Kalaiselvi & Kalaivani (2011) established the presence of alkaloids, terpenoids, phenols, flavonoids, phytosterols, glycosides, saponins and tannins. Pieroni *et al.* (2000) have established the anti-inflammatory activity of *Ligustrum vulgare* due to the presence of flavonones. Gulcin *et al.* (2007) have reported the presence of lignans in the root bark of *Chionanthus virginicus* in the form of phillyrin, pinoresinol- β -D-glucoside and pinoresinol di- β -D-glucoside which have been found effective as antioxidant agents. The presence of lignans has also been confirmed in *Forsythia intermedia* by Rahman *et al.* (1990). According to Piao *et al.* (2008), two more lignans apart from phillyrin were obtained from the fruits of *Forsythia suspensa*, possess high antioxidant activity.

Pharmacological uses of some genera in age-related disorders:

Genus *Olea*: it consists of about 40 species of which the most common one is *Olea europaea* L. It is commonly known as olive and is the representative plant of family Oleaceae. It is found in the Mediterranean, Africa, South-Western Asia, and the Himalayas. The pharmaceutical importance of olive leaf established that phenolic compounds such as oleuropein present in the olive leaves have a wide array of health advantages ranging from antioxidant, antihypertensive, hypoglycemic, hypocholesterolemic activity. Many of these activities tested in animals.

De Bock *et al.* (2013) have reported that there is significant absorption of oleuropein and hydroxytyrosol in the plasma when consumed as OLE (olive leaf extract) nutraceutical. Lafka *et al.* (2013) demonstrated that

ethanol extracts of OLE were found to have the highest antioxidant activity. It has been reported by Maragoni & Poli (2010) that the intake of phytosterols, sterols, and stanols in diet demonstrates hypocholesterolemic activity that can be effective in decreasing LDL cholesterol levels. Phytosterols present in extra virgin olive oil can be instrumental in reducing the LDL cholesterol level as well as fighting against oxidative stress, making EVOO an important ingredient of a healthy diet.

Genus *Jasminum*: it is a genus of about 200 species of shrubs and climbers having highly fragrant flowers, commonly called jasmine. These are most cultivated as ornamental plants. Most common species are *Jasminum officinale* and *Jasminum grandiflorum*. Popularly known as Chameli, *J. grandiflorum* is an evergreen shrub with a fragrant flower found in India, China, Japan, Persia, Afghanistan, Morocco, and Egypt. Various plant parts of *J. grandiflorum* exhibits high antioxidant activity. Chaturvedi *et al.* (2013) have illustrated the efficacy of a skin salve prepared from the methanolic extract of *J. grandiflorum* leaves in healing of wounds owing to its free radical scavenging property. Oleacein known to be an ACE (angiotensin-converting enzyme) inhibitor was extracted through fractionation of aerial parts of *J. grandiflorum* by Somanandhan *et al.* (1998), which can be effective against high blood pressure. *J. grandiflorum* flowers are found to be CNS depressant and jasminum oil has a capacity to cure various skin diseases. As per Ferreres *et al.* (2014), *J. grandiflorum* dried flower bud extracts were found to have the potent inhibitory activity of CNS related enzymes viz. AChe, BuChE and MAO-A besides possessing significant antioxidant activity, thus were very effective in the treatment of Alzheimer's disease (AD).

Genus *Osmanthus*: *Osmanthus fragrans* commonly known as sweet osmanthus, is an ornamental plant with a beautiful flower found abundantly in China, Japan, Asia (Omura *et al.* 2000). Lu *et al.* (2016) emphasized high antioxidant activity in *O. fragrans*. As reported by Casirola *et al.* (2006) preventing postprandial hyperglycemia with the help of alpha glycosidase inhibitors such as acarbose and voglibose is an efficacious measure to control diabetes that helps in lowering the postprandial glucose levels. A study led by Kang *et al.* (2012) confirms that alpha-glucosidase inhibitors present in the extract of *O. fragrans* can be effectively used to control diabetes. A study by Yang *et al.* (2017) confirmed that the bioactive molecules from the extract of *O. fragrans* flowers were potential inhibitors of alpha-amylase, alpha-glucosidase, advanced glycation end products (AGEs) and oxidative stress. Hozumi *et al.* (2017) carried out an investigation suggesting that *O. fragrans* oil considerably reduced the anxiety of patients undergoing colonoscopy when used for aromatherapy.

Genus *Fraxinus*: *Fraxinus rhyncophylla* commonly known as the ash tree is a deciduous tree grown for timber and its

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frequent use in Chinese Traditional Medicine (Hong *et al.*, 2012). The anti-depressant effects of *F.rhynchophylla* extract (FRE) were well exhibited by Kim *et al.* (2018) in a study on mice in which FRE acted efficiently against depression by ensuring normal levels of hormone secretion and neurotransmitters. Another study emphasizes the role of sesquillignans especially along with secoiridoids and coumarins present in *F.rhynchophylla* in reducing obesity by inhibiting pancreatic lipase. Shin *et al.* (2010) concluded that coumarins present in *F.rhynchophylla* possessed potent activity against adipocyte differentiation in 3T3-L1 cells and can be helpful in reducing obesity. According to a study by Hong *et al.* (2012), *F.rhynchophylla* extract demonstrated an impressive antioxidant and anti-inflammatory activity in LPS-induced macrophage RAW 264.7 cell. The study by Kim *et al.* (1999) indicated the presence of ferulaldehyde and scopoletin, potentially efficacious against nitric oxide synthase, along with a coumarin fraxidin.

Genus *Nyctanthes*: *Nyctanthes arbor-tristis* commonly known as Harsingar is a plant growing frequently in tropical and subtropical regions. Saxena *et al.* (2002) found that *N.arbor-tristis* leaf extract demonstrates significant CNS activities such as tranquilizing and hypnotic along with purgative activity. Bharshiv *et al.* (2016) investigated immune-modulatory properties of aqueous extract of *N.arbor-tristis* flowers (NAFE) and found significant humoral and cell-mediated immune stimulant activity which was mediated through splenocytes proliferation and increased the production of cytokines, especially the interleukins IL-2 and IL-6. Amarite *et al.* (2007) emphasized on the significant antioxidant activity of carotenoid found in *N.arbor-tristis*. A study by Nirmal *et al.* (2012) suggested significant analgesic and anti-inflammatory activity of b-sitosterol obtained from *N.arbor-tristis* leaves. Further strengthening the status of this plant as a powerful source of antioxidant is a comparative study accomplished by Patel & Gokhale (2016) that suggests that all aerial parts of *N.arbor-tristis* are potential source of antioxidants.

Genus *Abeliophyllum*: *Abeliophyllum distichum* Nakai commonly called white forsythia, only species in genus *Abeliophyllum* that is rare endemic plant for which considerable conservation measures are been taken (Kang *et al.* 2000). *A.distichum* has been found to have significant medicinal value. According to Park *et.al* (2014a), leaf extract of *A.distichum* exhibits anti-inflammatory activity. It has been concluded by Park *et al.* (2014-b) that methanol extract of flowers, leaves, and branches of *A.distichum* have potential anti-cancer activity and are effective against human colorectal cancer cells.

Genus *Chionanthus*: various plants of genus *Chionanthus* possess therapeutic importance in managing health issues of elderly people. *Chionanthus virginicus* commonly called fringe tree has therapeutic importance and is often used in homeopathic formulations. It has been inferred by Gulcin

et al. (2007) that extract of root bark of *C.virginicus* possesses anti-oxidant properties. Managing a youthful appearance goes a long way in ensuring the sociological and psychological well-being of the old people, therefore, providing a plant-based natural way to maintain and enhance skin health can prove beneficial for the old people. Lee & Cho (2018) have confirmed that the extract obtained from flowers of *C.virginicus* has potential alpha-glucosidase inhibitory activity besides having anti-inflammatory, anti-wrinkle, whitening properties thus can be utilized for managing health issues and cosmetic concerns of the aging population.

Table-1: Pharmacological Importance of some plants of Oleaceae family

Plant name (Botanical)		
Plant part used	Medicinal uses	References
<i>Myxopyrum serratum</i>		
Leaves	Anti - microbial	Gopalakrishnan <i>et al.</i> , 2012
Leaves	Anti-oxidant	Vijayan <i>et al.</i> , 2018
Stem & leaves	Anti-inflammatory	Rajalakshmi & Mohan, 2016
<i>Myxopyrum smilacifolium</i>		
Leaves	Anti-microbial	Sudharmini & Nair, 2008
<i>Phillyrea latifolia</i>		
Leaves	Anti-inflammatory	Diaz <i>et al.</i> , 2000
Leaves	Hepatoprotective	Janakat & Al-Merie, 2002
<i>Phillyrea angustifolia</i>		
Leaves & Fruits	Mouth Ulcers	Gonzalez <i>et al.</i> , 2010
<i>Schrebera swietenoides Roxb.</i>		
Leaves	Antibacterial	Chalo <i>et al.</i> , 2017
Root & Leaves	Appetizer, Diuretic Anthelmintic, anal & spleen troubles, Anaemia, Leprosy.	Tripathi <i>et al.</i> , 1996
Root	Antioxidant, anti-inflammatory, antipyretic	Manda <i>et al.</i> , 2009
Root	Leprosy	Padal <i>et al.</i> , 2010
Bark	Treats cough & mental depression	Khatoon & Irshad, 2016
Fruit	Antidiabetic	Bagali <i>et al.</i> , 2010
<i>Syringa pinnatifolia</i>		
Stem	Treats ischemia, heart diseases	Cao <i>et al.</i> , 2016
<i>Syringa pubescens</i>		
Flower & leaves	Anti-cancer	Yin <i>et al.</i> , 2008
<i>Syringa emodi</i> Wallich ex Royle.		
Flower & seeds	Treats fever	Bhat <i>et al.</i> , 2013

Genus *Forsythia*: it is commonly called the Golden Bell is represented by seven species of shrubs known for their ornamental value. *Forsythia* species are also known for their medicinal value encompassing various pharmacological properties such as anti-oxidant and anti-inflammatory that can be of value in managing pathological issues of the ageing population. As per Xia *et al.* (2011) phillyrin, the secondary metabolite predominantly found in the plant is

responsible for its significant anti-oxidant and anti-inflammatory activities besides some other pharmacological properties. It has been suggested by Valko *et al.* (2006) that oxidative stress is the root cause of diseases and disorders associated with ageing. The study by Lu *et al.* (2010) have confirmed that extract obtained from *F.suspensa* has immense antioxidant potential that was effective in acting against oxidative stress occurring due to diquat, a herbicide in rats. It has been reported by Li *et al.* (2014) the bioactive compounds present in *F.suspense* have significant anti-viral activity.

Genus Ligustrum: it is commonly called privet plant is another genus of plants that are also used widely in traditional Chinese medicine. A comparative study conducted by Wu *et al.* (2011) to compare the analgesic and anti-inflammatory activities of leaves extract amongst common *Ligustrum* species viz., *Ligustrum lucidum*, *L.sinensis* Lour and *L.pricei* inferred that *L.pricei* exhibiting highest analgesic and anti-inflammatory potential when tested in rodents.

Conclusion:

Family Oleaceae emerges as a family with significant medicinal value. Based on the review it is recommended that elaborate study of plants of family Oleaceae should be undertaken in order to exploit the medicinal importance and give a solution to the ageing population in preventing, managing and curing the diseases affecting them.

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