Review Article

A Comprehensive Review on Emerging Importance and Economical Potential of Medicinal and Aromatic Plants (MAPs) in Current Scenario

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Abstract | The medicinal and aromatic plants (MAPs) are current hot topic in the industries for their products. MAPs used in various items like pharmaceutical industry, health care items, cosmetics, organic food items etc. MAPs are gaining global admire and most of the pharmaceutical companies filing patents on medicinal plants and their derivatives and about 40% newly approved drugs during last two decades are formulated from natural origin. Multitude of socio-economic factors influence economic values of medicinal plants both locally and at international level. The world trade in botanicals is US $ 32.702 billion and Asian botanical trade is for US $ 14.505 billion with 6.634 million tones and accounts for 44.35 per cent and 53.13 per cent of world trade in terms of value and volume, respectively. Following the leading role of China with 1.48% share in MAPs exports, India is second largest exporter of MAPS with 8.75% share in Asian trade of MAPs. Various biomass and leftover produced with these plants production, as the MAPs cultivation withstands a huge economic potential, but it has several limitations to adaptation as arable crops i.e. lower prices, non-availability of transit markets, underdeveloped cultivation technology, poor availability of cultivation resources and genetic materials and many more. Therefore, MAPs can be cultivated and adopted to various geographical landscapes if facilitated by governments especially in the rural areas of low-income Asian and African countries.

Received | November 19, 2020; **Accepted** | March 07, 2021; **Published** | May 04, 2021
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Citation | Riaz, U., S. Iqbal, M.I. Sohail, T. Samreen, M. Ashraf, F. Akmal, A. Siddiqui, I. Ahmad, M. Naveed, N.I. Khan and R.M. Akhter. 2021. A comprehensive review on emerging importance and economical potential of medicinal and aromatic plants (MAPs) in current scenario. *Pakistan Journal of Agricultural Research,* 34(2): 381-392.
DOI | https://dx.doi.org/10.17582/journal.pjar/2021/34.2.381.392
Keywords | Economic determinant, Human health, Medical and aesthetic potential, Sustainability, Trade potential

Introduction

Aromatic plants contain odorous volatile substances that exist in one or more sections as an essential oil, exudate gum, balsam, and oleoresin, including root, wood, bark, stem, foliage, flower, and fruit. Several complex chemical compounds are responsible for the distinctive fragrance. The term

essential oils are synonymous with fragrances or fragrances, as these oily fragrances reflect the essence or active elements of the plants. When you are exposed to air at normal temperatures, you are called volatile or ethereal oils. Critical oils are products with high concentration and low volume. Information on the chemistry and properties of essential oils of only about 500 species is currently known in some detail out of a total of about 1500 species of aromatic plants which serve as a source of raw materials for the perfumery. Of these, approximately 50 species use essential oils and aroma chemicals as a commercial source, although the number of those with daily and large-scale usage hardly exceeds two dozen.

Since then, the world of essential oils has expanded from the narrow area of description to a wide variety of applications in flavors, disinfectants, oral hygiene, cigarettes, pharmaceuticals and in virtually every sphere of human activity. Essential oils make up about 17% of the worldwide flavor and fragrance market. World production figures for essential oils range from 40,000 to 60,000 tons per annum. Spice oils demand is set at 2,000 tons per year (Joy *et al*., 2001). At the beginning of the twenty-first century, foreign market reports estimated the consumption of flavors and fragrances to be around US$ 8 billion (Bernáth, 2009).

Basic oils, or volatile oils, occur very commonly in the plant kingdom. Plants with essential oils were known, or even used in religious ceremonies, or for personal use, ornamentation, and flavoring foods long before history was documented. Hundreds of aromatic substances like cinnamon, ginger, and sandalwood were recorded around 2000 BC in the Vedic literature in India. Also, in dynastic Egypt, essential oil crops were widespread, and traces of the essential compounds could be detected in the funerary jars and cosmetic pots found in the tombs of the Pharaohs. The Greeks took the Egyptian knowledge, which Romans further developed, and applied it. Some six hundred plants and aromatics were detailed in the "De materia medica," written by Dioscorides. Hippocrates (460 BC) recommended the fumigation and fomenting of perfumes. At that time Romans distinguished three specific forms of perfumery: strong unguent "ladymata," scented "ladysmata" oils and perfumed "diapasmata" powders. From that ancient practice, the European application of essential oils has evolved, backed by experience from Persia, the Far East, and the New World (Bernáth, 2009). In Asian countries, plants are used for medicinal purpose since ancient times. In recent era cultivation of medicinal and aromatic plants became an emerging export industry in many Asian countries. India has one of the richest sources of many types of MAPs, however, since farmers are not aware of their potential and returns they have achieved little success in tapping the potential of these plants (Purohit and Vyas, 2004). China exports plants and raw drugs, therapeutics and other MAPs worth Rs 18,000 crores annually (Singh *et al*., 2007). In Nepal Himalaya, about 1800 MAPs are used for subsistence economy (Baral and Kurmi, 2006).

Turkey and Egypt are also a major exporter of aromatic and medicinal plants. Hong Kong, Japan, China, Korea, Pakistan and Singapore are leading exporter of MAPs from south Asia. Apart from these countries, Pakistan, Bangladesh, Afghanistan, Maldives had understood the importance of this industry and they are promoting the growth of these plants on commercial level.

Essential oils and chemical flavorings make up a wide number of industrial products. In many spheres of human life, these oils form essential ingredients of necessities. These are adjuncts to cosmetics, soaps, medicinal products, perfumery, confectionery, ice-creams, disinfectants from aerated waters, tobacco, agarbathis, and a host of related products. Natural substances are healthy and pleasant. The concern for nature and the passion for all simple and natural things have contributed to a green movement in the world of both natural and manufactured consumer goods. A future surprise awaits the industry, as on one hand the already dwindling world coal and petroleum resources and on the other hand, the concept of returning to nature is gaining international acceptance. This will revert the industry 's reliance on the petrochemicals to the natural perennial source. Thus, the essential oil and fragrance industry has a promising future due to a broad range of uses in man's daily life.

In today's market boom world, several folds have increased the position of essential oils. Besides the already established uses of essential oils, more and more areas are being opened which will support the industry (Joy *et al*., 2001). The production and use of essential oils are increasingly growing due to their multipurpose application: Essential oils are used in the perfumery, in the food industry, in the

domestic industry, in the condiment industry and the manufacture of sweets and beverages as well as medicinal and aromatherapy products of plant origin (Bernáth, 2009). In Japan and European countries, the use of essential oils is becoming common in therapeutics (Joy *et al*., 2001). Aromatherapy includes the use of plant-derived essential oils and aromatics to treat diseases. Many of the essential oils are stated to be better than antibiotics in several respects, due to their protection and broad activity range. Critical oil's synergistic behavior requires more investigation. Application of essential oils as an antifeedant, repellents, botanical insecticides, natural herbicides, and growth boosters in agriculture is still open to fascinating research fields. The synthesis of secondary metabolites in bioreactors using cell and tissue culture under controlled conditions provides exciting frontiers for future study (Joy *et al*., 2001).

Economic parameters

For the export purpose, various parameters were established for aromatic plants. For oil-producing plants a balanced ratio of monoterpene ketones which are responsible for better olfactory value (Panda, 2005).

Crop management: Aromatic plants demand intensive management. Different species require their distinct conditions of cultivation. In many medicinal and aromatic plants, plant characteristics differ widely with soil type and crop strategy, so care must be taken to achieve sufficient yields (Carrubba and Scalenghe, 2012) Cultivation may be conventional or may use conservation farming practices to retain organic matter in the soil and to conserve water, for instance with tillage-free farming. The World Health Organization advises making use of rotation to mitigate insect and plant disease problems (WHO, 2003).

Distillation: Different plant parts of aromatic plants are used for different purposes. Flower parts are used as a scent. Essential oil is present in its leaves, seeds, and flowers. The stem did not contain any oil. The age of leaves and flowers affects the quality and content of the oil. More ratio of leaves and flowers to stem produces more oil. Crop cultivation should be done at the full blossom stage to get more yield of herb and good quality of the oil. Steam distillation is done to get oil from plants. Fresh herbs material harvested at full blossom or shade dried herbs for 2-3 days is used for distillation. Green herbs should not be piled in heaps. It should be spread under shade thoroughly. Fresh herb distillation gives better quality oil (Panda, 2005).

Quality Evaluation, advertising, and labeling: Quality evaluation of aromatic plants includes its freshness, viability, and contents. In the case of oil production, the chemical composition of the oil is considered the most important parameter (Panda, 2005). Herbal and dietary supplement products have been criticized for not providing adequate criteria or empirical evidence to support their quality, protection, and presumed efficacy (Coghlan *et al*., 2012; Zhang *et al*., 2012). In 2013 report, one-third of the herbal products tested did not contain traces of the herbal products specified on the label, and other products were adulterated with non-listed fillers and possible allergens (Newmaster *et al*., 2013). Oil should be stored in aluminum containers or amber-coloured bottles. They should be well packed up to the brim and should be kept completely moisture-free. Storage causes various changes in the quality of aromatic plant products (Panda, 2005).

Role of medicinal and aromatic plants in the economy of the country

Several countries exporting MAPs like Turkey is exporting medicinal and aromatic plants to about 100 countries worldwide. North America, the European Union, Latin America, the Far East, and North Africa account for a substantial part of its international revenues. The list includes the United States, Germany, Vietnam, The Netherlands, Poland, Brazil, Canada, Italy, Belgium, Greece, France, and Japan. Big medicinal and spice thyme plants, bay leaf, cumin and anise, fennel seeds, juniper bark, hlep, fenugreek, rosemary, basil, sumac, sage, and lime are grown from Turkey. The data regarding 12 leading countries of import and export of medicinal and aromatic plant material from 1991–2003 showed in Table 1. The MAPs exports and imports of Turkey in 2018 showed in Table 2. The products which are most exported are oregano and laurel. A total of 80 thousand tons of medicinal and aromatic plants were exported in 2018, and revenue totaling USD 265 million (Table 2). The major imports into Turkey include tea, pepper, anise, oregano, cumin, ginger, and carob. Many of the imported goods, however, are handled within the framework of the inward processing regime and exported abroad again. Turkey 's cumulative

Table 1: *The 12 leading countries of import and export of medicinal and aromatic plant material, 1991–2003 (Lange 2006).*

Country of import	Volume [tonnes]	Value [1000US$]	Country of export	Volume [tonnes]	Value [1000 US$]
Hong Kong	59,950	263,484,200	China	150,600	266,038,500
USA	51,200	139,379,500	Hong Kong	55,000	201,021,200
Japan	46,450	131,031,500	India	40,400	61,665,500
Germany	44,750	104,457,200	Mexico	37,600	14,257,500
Rep. Korea	33,500	49,889,200	Germany	15,100	68,243,200
France	21,800	51,975,000	USA	13,050	104,572,000
China	15,550	41,602,800	Egypt	11,800	13,476,000
Italy	11,950	43,006,600	Bulgaria	10,300	14,355,500
Pakistan	10,650	9,813,800	Chile	9,850	26,352,000
Spain	9,850	27,648,300	Morocco	8,500	13,685,400
UK	7,950	29,551,000	Albania	8,050	11,693,300
Malaysia	7,050	38,685,400	Singapore	7,950	52,620,700
Total	320,550	930,524,400	Total	368,100	847,980,800

Figures based on commodity group pharmaceutical plants (SITC.3: 292.4=HS 1211). Source: UNCTAD COMTRADE database, United Nations. Statistics Division, New York.

medicinal and aromatic plants account for just over 38,000 tons of imports, although its monetary equivalent is just over $79 million. In terms of monetary value, the most crucial import element is green and black tea (Karik and Tunçtürk, 2019).

Production and trade of essential oils in Turkey

Turkey's global sales of essential oils for 2018 amounted to about $42 million. The principal products are rose oil, stearopten oil, and oregano oil (Table 3). Increased international sales of essential oils in Turkey in recent years seem to have contributed to a rise in the amount of essential oils in the plants. Especially in the thyme, laurel, mint, rosemary, cumin, myrtle, lemon leaf, anise, and aromatic herbs such as aphids are produced from essential oils in Antalya, Manisa, Mersin, Mugla and Hatay province. A major part of important oil exports is made to EU countries. As of 2018, France, Germany, Australia, the USA, Switzerland, England, Greece, Ireland, Bahrain, Canada, and Spain were the largest exporting nations. France's share of total exports is 53%. Nearly all of the rose oil produced in Turkey is exported. 2018 International trade amounts to about $14 million. Major exports were made to EU countries, USA, Switzerland, Bahrain, Kuwait, Japan, UAE, Australia, Azerbaijan, Turkmenistan, Iraq and the Republic of Northern Cyprus in Turkey. France's share of overall foreign exports of oil was 62%, Germany's share was 13%, the US share was 10%, and Switzerland had a 9% share. Table 3 includes essential oils that have been imported into Turkey. The main essential oils imported into Turkey include oregano, lime, lemon, other citrus oils, and peppermint oil. The total volume of essential oils imported in 2018 was 552 tons and roughly $26 million (Karik And Tunçtürk, 2019).

Economic parameters to understand the value of medicinal plants

In terms of the number of species, MAPs represent one of the major human consumption of the natural world. The value, utility and worth of these plants to livelihoods of the people is fathomless. It may be indicated in terms of their contribution to financial income, cultural identity, healthcare and livelihood security, however the direct contribution of these plants to a country's economy are estimated in many ways (Hamilton, 2004). In last few decades, the international trade for indigenous medicinal plants and plant-based drugs have increased manifolds (Hamilton, 2013). Multi-million portion of developing countries is based on international trade of medicinal plants (Mander and Le Breton, 2006). With paramount increase in popularity of herbal products, such trades are likely to expand markedly by the year 2050 (Lange and Mladenova, 1997).

The MAPs trade is major shareholder of GDP to agriculture in any agro-based country or geographical locations abundant in natural vegetations. It is prerequisite to explore the potentials of MAPs as arable crop into routine agriculture. There are various

indicators or set of parameters which can represent the true value, sustainable cultivation and trade of MAPs for farmer and national benefits. The main driver for the cultivation of medicinal plants could be in two components i.e. pull and push effects. The pull effects refer to the factor that attract farmers to cultivate MAPs, rather than traditional crops. These factors include attractive prices, fixed market channels, price assurance by agents and monopoly of the group of producers in cultivating these crops. Whereas, push effects are dominated by the uncertainty of net income generated from the traditional seasonal crops due to factor and product market imperfections. Well-established market channels prompt farmers to cultivate MAPs (Chandresh *et al*., 2014). Therefore, under the current climatic shifts, low productivity of traditional field crops has significantly pushed the farmers towards medicinal crops for profit maximization. The MAPs foster the economic windows for unshielded groups of farmers in peri urban and marginalized lands.

Table 2: *Medicinal and aromatic plants exports and imports of Turkey in 2018 (Anonymous, 2019).*

Product	Exports		Imports	
	Amount (kg)	Value (US $)	Amount (kg)	Value (US $)
Oregano	16,212,000	52,331,000	1,787,584	4,750,033
Laurel Leaf	13,253,940	36,716,616	989,611	1,523,208
Cumin	6,455,169	19,500,621	1,003,631	3,290,609
Anis seed	2,418,735	9,637,809	3,612,533	6,589,114
Sage	1,824,818	6,695,586	743,980	1,620,684
Sumac	2,108,382	4,491,056	461,260	113,673
Licorice	1,069,961	3,102,837	1,102,153	1,985,376
Spice Mix	300,476	2,006,843	3,374	45,123
Mahaleb	123,283	1,242,394	19,903’	92,954
Spearmint	620,292	1,876,792	87,241	133,100
Rosemary	493,389	1,477,264	619,752	839,080
Black Cumin	404,691	983,074	3,678,628	7,312,482
Carob	2,421,351	18,433,777	2,462,071	4,166,059
Linden	116,741	1,521,480	25,151	54,442
Turmeric	45,704	201,441	979,376	1,096,073
Cinnamon	38,505	234,165	873,560	1,542,843
Coriander	142,351	187,920	522,207	275,604
Clove	5,555	99,894	279,113	482,837
Thyme	48,547	1,287,456	6,276	6,826
Saffron	4,602	89,848	91	20,187
Ginger	26,368	116,984	2,990,512	3,295,411
Curry	24,723	78,260	-	-
Fenugreek	168,004	298,736	340	1,322
Cardamom	3,368	54,872	204,675	871,164
Nutmeg	10,125	55,425	45,820	58,087
Poppy seed	25,286,661	73,736,971	45,950	125,069
Morphine	25,647	8,434,688	2	368
Tea	3,321,866	12,035,946	15,635,054	38,911,087
Other Spices	2,985,503	8,233,055	69,633	34,799
Total	79,960,757	265,162,810	38,249,481	79,237,614

Table 3: *Essential oil exports and imports of Turkey in 2018 (Anonymous, 2019; Karik and Tunçtürk, 2019).*

Product	Exports		Imports	
	Amount (kg)	Value (US $)	Amount (kg)	Value (US $)
Oregano oil	65,000	5,501,000	1,790	4,864,492
Spearmint oil	16,000	168,895	11,985	339,135
Rosemary oil	55	5,723	1,262	63,613
Lavandula oil	3,851	129,354	5,062	289,972
Rose oil	16,369	14,136,625	5,954	233,717
Lemon oil	3,121	131,230	380	1,996,689
Pepermint oil	1,212	44,566	243,607	3,189,027
Other citrus oil	4,822	113,459	64,406	2,239,109
Maceration	280,547	6,615,909	55,676	1,996,950
Hydrosol	364,240	1,921,192	31,833	2,268,460
Other essential oil	57,922	13,754,416	130,785	8,941,328
Total	813,139	42,522,369	552,740	26,422,492

Economic parameters of local market value

According to Williams *et al.* (2007), the market value of individual plant taxon depends on a multitude of factors and therefore it varies considerably.

- Generally, there is a disproportionate and inverse relationship between price per unit and the mass of the product vended. Sale values are subordinate for the sales of higher quantities of the product relative to the sales of lower quantities. For instance, plant part types such as bark and bulbs, given the larger quantity sold, have inferior values relative to other parts such as fruits, leaves and roots of the plants.
- The price of harvesting plant species fluctuates based on access of the harvester to the resources and the distance of trading markets from the harvesting sites.
- Prices also vary based on negotiations between sellers and buyers in local markets for purchasing indigenous products.
- Although, information on purchase/buying prices for medicinal plants and actual quantities being sold is sparse, because of incomplete records and often prohibited and outlawed nature of the trade. But, with the increase in demand, and thereby upsurge in value and quantity being sold, it may overexploit the resources hence, actual prices may vary.

Economic determinants of international market value

International market values and economic indicators of MAPs are based on a variety of factors. "Supply and demand" are the simplest equation that applies to every international trade (Agcaoili and Rosegrant, 2010) including both categories of "high value minor" crops such as MAPs. The contribution of these crops to a country's agricultural output is relatively low but has substantially amplified in the past decade due to growing demand of these plants in the healthcare sector globally (Khan *et al.*, 2011). The developed countries such as Europe and USA are devising medicinal systems that necessitate the use of herbal products and resources. Therefore, a marked increase in global demand of MAPs has seen in the recent years, and it has provided an ample opportunity to MAPs exporting countries to expand their economy share in this sector. The major consumers of the MAPs are USA, Europe and Japan, while nearly 30% of the global export is made up by Morocco and Egypt (Africa), India and China (Asia), Albania and Bulgaria (Europe) and Peru and Chile (South America) (Vasisht *et al.*, 2016). About 80% of World's MAPs supply is from local indigenous plants (Bernholz, 2004). Among major products to be traded from MAPs are (i) Phyto-pharmaceuticals (ii) Nutraceuticals and (iii) Cosmeceuticals.

In the recent years, the global demand of spices, herbs and MAPs has boosted up several folds, due to increasing interest of healthcare sector in the therapeutic properties of phytochemicals associated with indigenous medicinal plants. Present-day industrial utilization of these plants to produce herbals teas, extracts, decoctions, nutraceuticals, plant-based pharmaceuticals, and cosmeceuticals has been growing faster than the conventional medications and drugs. Thus, MAPs-based industrial sector has enormous potential for the economic growth of a country (Gunjan *et al.*, 2015). Several precursor molecules of the herbal drugs are directly or indirectly obtained from MAPs, for example, quinine is derived from *Cinchona officinalis* and digitoxin from *Digitalis purpurea* to treat malaria and cardiac problems, respectively. Likewise, many other phytochemicals and their derivatives such as paclitaxel, scopolamine, vincristine, pilocarpine, atropine and morphine are obtained from medicinal plants and share a significant portion in international global trade of related MAPs (Roosta *et al.*, 2017). The overall international market for the trade of herbal drugs was valued at approximately USD 23 billion in 2013, USD 24 billion in 2014 and USD 25 billion in

2015. This value has been estimated to increase with compound growth rate of approximately 7% annually, reaching USD 36 billion in 2020 (Lawson, 2013).

Nutraceutical is the term applied to food products that are supplemented with vitamins, herbal ingredients, minerals, as part of several bioactive food products, dietary supplements and fortified beverages and food items. Global nutraceutical market has increased rapidly in past few decades. For instance, in USA alone 76% of adults are regular users of food supplements (Travis *et al*., 2019). Countries such as Malaysia, Thailand, Singapore and Philippines have seen an 8.4% annual overall compound growth rate in nutraceutical industry. About 40% of the population from Southeast Asia use nutraceuticals on regular basis (Tripathi *et al*., 2020). According to WHO 80% of African and Indian population are heavily dependent on indigenous herbal products and supplements for the treatment of common ailments. Therefore, there has been a constant upsurge in supply and demand of these herbal supplements (Bahorun *et al*., 2019).

Recently, natural ingredients based personal care items and cosmetics are excessively favorable trend in the global market. These cosmetic products possess the physiological active components that could cure skin problems and have desired antioxidant, smoothing, soothing and conditioning properties (Draelos, 2019). Therefore, with the invention of enhanced technologies in makeup, skin care and hair care products, this sector has strong economic impacts on a country's economy (Kim, 2016). For instance, Aloe Vera (*Aloe barbadensis*) is extensively used in cosmetic industry based on its natural sun-protection and soothing properties. Likewise, *Ginkgo biloba*, *Panax* spp, *Withania somnifera*, *Serenoa repens* are being used in replacement of synthetic vitamins for the treatment of skin and hair related problems. Similarly, many age-defying, hair growth stimulants and retardants, sun protecting lotions and creams, facial peels and masks and other products contain natural ingredients, therefore, the consumption, production and export of related medicinal plants have been increased manifolds (Dorni *et al*., 2017; Rao *et al*., 2017; More, 2019). Global market of cosmeceutical was USD 44 billion in 2017 and it is extrapolated to grow at a rate of 7% annually. Likewise, market share of USA was USD 2.8 billion in 2001 that increased by more than 7% annually through 2012. Therefore, it is an important indicator of economic value of herbal products with exponentially increasing global demand.

Indicators and parameters for sustainable cultivation and trade of MAPs

The production and consumption; and international import and export of MAPs can be regarded as important economic indicators. Although, it is challenging to estimate the exact figures on global demand of MAPs; however, trends can be extrapolated using already available data. There is an increasing human tendency to use MAPs for pharmacological reasons and recreational purposes due to natural drugs being cost-effective, safer, and easily accessible by majority of the population worldwide. Moreover, the current COVID-19 pandemic around the globe has further pushed the public to rely on herbs for their immunity and the trends are increasing since 2019. However, multiple factors viz., socio-economic, cultural, environmental, and geographical variables influence economic indicators of medicinal plants. There are several indicators which represent the sustainable and prospect cultivation and trade of MAPs. An overview has been presented in Figure 1.

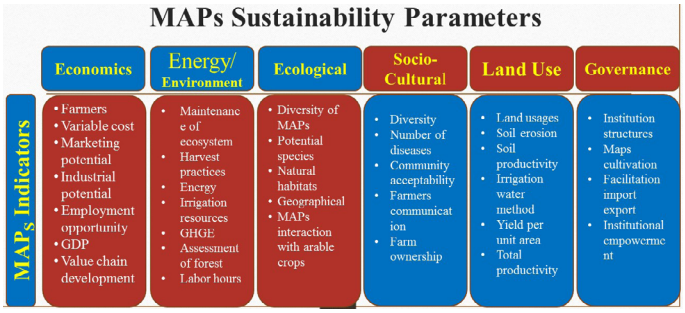

Figure 1: *MAP sustainability parameters.*

Multitude of socio-economic factors influences economic values of medicinal plants both locally and at international level. Surveys and researches conducted on local cultures in many regions have indicated that number of farm patches owned by locals, marital status of cultivators, annual income specially from growing staple crops and related utilization of the land are most influential factors on consumption and trade of medicinal plants (Khan and Rauf, 2014). However, there is a dire need to provide necessary facilities and better financial capitals to interested growers to upsurge trade into medicinal plants both at local and global level. It is also suggested to study profitable cultural aspects leading to enhance harvesting and maintenance of medicinal plants at local level. Domestication of in-demand medicinal plants by the cultivators can also positively influence

its trade. All these factors may contribute to the value of medicinal plants and hence can be observed via economic indicators (Niyaki *et al*., 2011).

Economic factors such as property and production value of the land being used for the cultivation is also dependent on the fertility and capacity of the soil to grow such plants. Similarly, other ecological factors such as regularization of indigenous MAPs collection from wild, strategies regarding conservation of individual species and ecosystems are imperative to its economic output. Such knowledge will also clarify and thereby reducing the anthropogenic compression on natural resources for the cultivation of MAPs (Kuniyal *et al*., 2013). Therefore, these environmental factors also play significant role in determining of the value of MAPs. All these factors are interconnected for example, socio-economic well-being of agricultural communities, efficiency indicators and land use indicators. Whereas, efficiency indicator of MAPs values includes use of resources per acre or other units. It measures impact over time in relation to our capacity to fulfill productivity demands (Field to Market Report, 2012). Likewise, land use indicators demonstrate that how much area is dedicated to the production of in-demand medicinal plants (Van den Bergh and Grazi, 2014).

Role of medicinal and aromatic plants (MAPs) in GDP

The MAPs are not only fundamental to civilizations around the globe as basic preventive and curative health cares, but these has been also the cornerstone for sustainability of civilizations, source of incomes and trade. Though the medicinal plants belong to natural habitat but the better economic opportunities against the traditional field crops has led their cultivation under field conditions around the globe especially in Asia, Africa and Europe (Mohapatra *et al*., 2018). The distribution of medicinal plant species on earth is not equal, but also differs in geographical regions of the same generation. The tropical regions are the richest species in terms of species diversity. The total contribution to any national agriculture output of MAPs may be small, but their value per weight is among the highest among traded plants and adds significant growth to gross domestic products. An average annual income of 5000 USD per hectare can be obtained through mixed cropping of high-altitude medicinal herb. Even the high-altitude villages earn their 10-50% livelihood income from wild MAPs. it is estimated that current market of medicinal plants has a figure of more than 107 billion dollars annually (Karik and Tancturk, 2019). The global nutraceutical market is expected to reach US$278.96 billion by the end of 2021, with a growth rate of 7.3% per annum. Therefore, The World Bank expects the trade of medicinal plants to grow up to a trading value of five trillion USD by 2050 (Bucher *et al*., 2020). China is the world's biggest exporter of MAPs and Japan; USA and Germany are the leading importers (Bucher *et al*., 2020). But the global supply chain of MAPs is mainly regulated through developing countries of Asia, Africa and N. America (Karik and Tancturk, 2019).

The world trade in botanicals is US $ 32.702 billion and Asian botanical trade is for US $ 14.505 billion with 6.634 million tones and accounts for 44.35 per cent and 53.13 per cent of world trade in terms of value and volume, respectively (Karki, 2017). Following the leading role of China with 1.48% share in MAPs exports, India is second largest exporter of MAPS with 8.75% share in Asian trade of MAPs (Karki, 2017). In Bangladesh, about 12,000 tons of MAP materials worth US $ 4.5 million but Bangladesh also imports more than 5000 tons of material worth US$ 8 million. The domestic market of herbal medicines in Bangladesh is valued at US $ 60 million (Merry and Shahjahan 2013). Similarly, Nepal's trade in MAPs is more than USD 33 billion dollar annually (Pyakurel *et al*., 2019). In 2012, Pakistan exported MAPs worth over US $10.5 million (Sher *et al*., 2014). From only Asia and Africa, the Europe's import of MPAPs is about USD 1 billion (Zahra *et al*., 2020). Malaysian herbal industry produces a business of USD 315 million annually with steady growth rate of 20%. For example, Mander *et al*. (2007) estimated that South Africa produces an income about 5.6% of the National Health budget. Similarly, in China 40-63% of household income originates from the trade of medicinal plants (Boesi, 2014). Rasethe *et al*. (2019) presented that 90% of MAPs business in Malawi derives >50% of households' income. Similarly, over 61 000 kilograms of medicines valued US$344,882 provides business to Tanzania per year. The annual revenues produced in Morocco and Egypt for export of MAPs was US$55.9 and US$174, 227,384 million in 2015, respectively. About 951 tons of raw herbs worth of US$7.8 million was traded in Ghana's in 2010. Karik and Tancturk (2019) presented that in year 2018, about 300.000 tons of MAPs were produced in approximately and exported share generated

265 million US dollars of revenue for Turkey. A large quantity of residual biomass (solid, liquid, and gaseous) is produced every year from the agricultural sector throughout the world, which is supposed to be the most plentiful, economic and renewable resource on earth. There is a scope for dual utilization of residual biomass i.e. extraction of phytochemicals and further conversion into value added products. A brief list of aromatic plants with respect to their plant part usage and source of attain showed in Table 4.

Table 4: *Selective list of aromatic plants.*

Botanical Name	English Name	Part of plant used	Obtain From
Abies Webbiana	Indian Silver Fir	Leaves	Wild
Betula utilis	Himalaya silver birch	Bark /leaf	Wild
Borago officinalis	Borage	Herb	Cultivated
Calendula officinalis	Marigold	Flower	Cultivated
Ephedra gerardiana	Ephendra	Herb	Wild
Erigeron canadensis	Horse Weed	Herb	Cultivated
Fagopyrum esculentum	Buckwheat	Herb	Cultivated
Gnaphalium	Cotton weed	Herb	Wild
Hedera helix	Ivy	Leaves	Wild
Humulus lupulus	Common Hop	Ketkin	Cultivated
Inula racemosa	Elecampane	Root	Cultivated
Iris germanica	Orris	Root	Wild
Juglans regia	Walnut	Leaves	Cultivated
Juniperus communis	Common juniper	Seed	Wild
Melilotus officinalis	Yellow sweet clover	Herb	Cultivated
Mentha aquatica	Water mint	Herb	Wild
Nardostachys jatamansi	Spikenard	Root	Wild
Origanum vulgare	Oregano	Herb	Wild
Parmelia perlanta	Stone flower	Moss	Wild
Passiflora incarnata	Wild passion flower	Herb	Cultivated
Quercus robur	Common oak	Seed	Wild
Rosa canina	Dog rose	Flower	Wild
Salix alba	White willow	Bark	Wild
Taraxacum officinale	Dandelion	Herb	Cultivated
Urtica dioica	Nettle	Herb	Wild
Valeriana wallichii	Indian valerian	Root	Cultivated
Verbascum thapsus	Common mullein	Herb	Wild
Zanthoxylum acanthopodium	Toothache tree	Seed	Wild

Source: https://www.saussurea-costus.com/list-of-medicinal-and-aromatic-plants/ *accessed 12-05-2020.*

Conclusions and Recommendations

This review article depicted the economical values of medicinal and aromatic plants globally. As data showed there is a great potential in these areas with respect to export and GDP factors. Whereas, these plants are sensitive in nature and to some extant tricky in handling. They need special care in terms of production, growth, storage, and supply to the market. The MAPs cultivation withstands a huge economic potential, but it has several limitations to adaptation as arable crops i.e. lower prices, non-availability of transit markets, underdeveloped cultivation technology, poor availability of cultivation resources and genetic materials and many more. Therefore, MAPs can be cultivated and adopted to various geographical landscapes if facilitated by governments especially in the rural areas of low-income Asian and African countries.

Novelty Statement

The medicinal and aromatic plants hold potential to boost GDP and econo-my as reviewed by this article of various countries.

Author's Contribution

Umair Riaz: Idea executor and overall manage-ment of draft.
Shazia Iqbal: Statistical comparison.
Muhammad Irfan Sohail, Fatima Akmal, Ayesha Siddiqui, Ijaz Ahmad and Tayyaba Samreen: Data collection
Muhammad Ashraf: Conclusion summary
Muhammad Naveed and Naveed Iqbal Khan: Methodology preparation.
Rao Masood Akhter: References management.

Conflict of interest

The authors have declared no conflict of interest.

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