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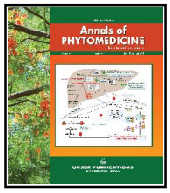

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Foods that heal: Traditional indigenous plants as bioresource for health security

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Abstract

The human population has become progressively reliant on a small number of plants for food and nutrition when actually there is an abundance of them. With growing populations and rapidly changing climates, there is a need to look for alternatives of plants that reduce expansion of land for agriculture, provide food security and preserve biodiversity. Humans have depended on nature for their existence since time immemorial. Throughout history, people have searched for 'The Tree of Life', a tree that would supposedly bring health and youthfulness to those who discovered it. The use of biological resources for healthcare has been nurtured by the indigenous people of every land. People of every culture have always tried and tested indigenous plants for thousands of years, identifying that almost all of nature is meant for food, clothing, shelter and wellbeing and adapting based on available resources. Plants that exert beneficial pharmacological effects on human body are called medicinal plants and they possess therapeutic properties mainly due to their natural ability to synthesize secondary metabolites like alkaloids, tannins, and flavonoids, *etc.*, which are the sources of important drugs such as atropine, codeine, digoxin, morphine, quinine and vincristine. The knowledge of medicinal plants and their use provide a vital combination of livestock and human healthcare in various parts of the world. This use of indigenous medicinal plants for healthcare has been developed over time in different cultures, based on the available natural resources in an area. Many of the traditional medicines are practiced in a non-formal way by the local people as well as through recognized systematic medicinal systems like Ayurveda in India. According to many of these systems, the medicinal plants not only provide health security, but also involve an array of practices and resources that relate to mind-body-nature balance and nutritional well-being of the individuals. The current article has the objective of highlighting some indigenous plants such as sago palm (*Metroxylon sagu*), grass pea (*Lathyrus sativus*), pearl millet (*Pennisetum glaucum*) and pulse crops that have the potential in solving the problems that are becoming increasingly real as time passes. Plants such as these have the potential to be utilized as modes of nutrition, sustainable use of traditional medicinal plants as well as the issues and challenges in global health security.

1. Introduction

Humans are majorly dependent on natural resources to satisfy their basic needs; namely, food, clothing and shelter. There are rising concerns over how long we will be able to enjoy these resources. These concerns are increasing our appreciation towards these essential reserves of nature; however, the clock is ticking. Natural resources are needed to support the growing population which is predicted to increase in the next 30 years by 2 billion people. Apart from the increase in population, the lives of older and frailer, younger (possibly lesser nourished) populations and populations suffering from increasing lifestyle disorders and other diseases, need to be secured. In addition to this, the economic discrepancy between the rich and the poor keeps growing which raises concern over the affordability of healthcare systems to the necessities (Mehrotra., 2021; Sangeeta *et al.,* 2023).

In principle, food and health security systems could help reduce the burden of adverse consequences related to health and curb the health risks related to food (Wahlqvist *et al.,* 2009). The concept of health security of developing countries being assisted by traditional medicine systems has been recognized by the World Health Organization (WHO) (Rao and Rajput, 2011). The biggest challenges faced by humankind in the year 2050 are going to be related to food where some people will experience starvation and undergo malnutrition, others will experience obesity as a result of excess calories. Formulation of healthier diets and increasing the production of food is the need of the hour (Rani *et al.,* 2023).

However, the solution to these problems does not lie in merely expanding the land for agriculture as the expense of such an activity will be borne by the surrounding ecosystem and the biodiversity which is already declining. Additionally, there is also a need for adaptation by society to environmental changes driven by climate change that can threaten the production of food and livelihood of the people (Ulian *et al.,* 2020). Food security can be directly affected by changing climates as it would result in reduction in availability of water, the weather getting warmer and arid soils. This in turn would raise food prices and decrease food availability. Therefore, understanding the technological and dietary potential of crops not commonly grown, as well as their tolerance to environmental stresses, is very valuable (Dias-Martins *et al.,* 2018).

The survival of a number of medicinal plants is threatened due to climate change, global warming, over harvesting and loss of habitat.

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Furthermore, livestock consume (by calorific value) about 36% of arable crops like sorghum, maize and wheat, necessitating one-third of the total arable farming area currently in use. This is a complicated situation because it is necessary to secure the long-term development of healthy and nutritious food while still preserving biodiversity in order to provide other products and ecological services that are both directly and indirectly important to human well-being (Ulian *et al.,* 2020). Cultivation is coming up as a financially viable choice for preserving the global resources of medicinal plants and their biodiversity (Rao and Rajput, 2011).

2. Traditional medicinal plants: Conventional uses

Herbal preparations that utilize plant constituents as active components are described as herbal medicines. These preparations usually use parts of plants like flowers, bark, fruits, leaves, roots, berries, seeds and sometimes even the entire plant (Verma *et al.,* 2022). The administration of these preparations is usually in the form of syrups where honey or syrup are used along with plant extract, boiled plant extracts or decoctions, alcoholic extracts or tinctures and infusions like herbal teas. For external application, essential oils, balms and cataplasms are used (Ramalingum and Mahomoodally, 2014). Before the arrival of aspirin which was derived from *Spiraea ulmaria*, in order to maintain energy or treat diseases, humans relied on crude ingredients of plants. Egyptian papyri show that *Spiraea ulmaria* was prescribed for swelling and fever whereas Hippocrates from Greece suggested it for fever and pain. Excavational studies suggest that the use of medicinal plants goes back to 8,000 years in China and 6,000 years in Iraq. Sumerians of southern Mesopotamia, who existed 5,000 years ago, maintained written accounts of use of herbal medicines and reported firmly-established medicinal uses for plants like thyme, caraway and laurel (Hussain *et al.,* 2023).

Traditional medicine is highly prevalent in developing countries where a significant proportion of the population is dependent on it for therapy (Karunamoorthi *et al.,* 2013). For instance, the ratio of traditional practitioners to the population is 1:500 and that of the medical doctors to the population is 1:40,000 in sub-Saharan Africa (Karunamoorthi *et al.,* 2013). The reason for this prevalence lies in its historical use and its connection to culture, even though western medicine coexists in these nations. The reliance on traditional systems of medicine systems will only rise in the coming times as it is culturally valid and likely to retain its affordability in comparison to the modern health-care system which has its own limitations along with being expensive (Karunamoorthi *et al.,* 2013). The factors that influence the patient to pick a traditional medicine system over modern medicine have been given in Figure 1.

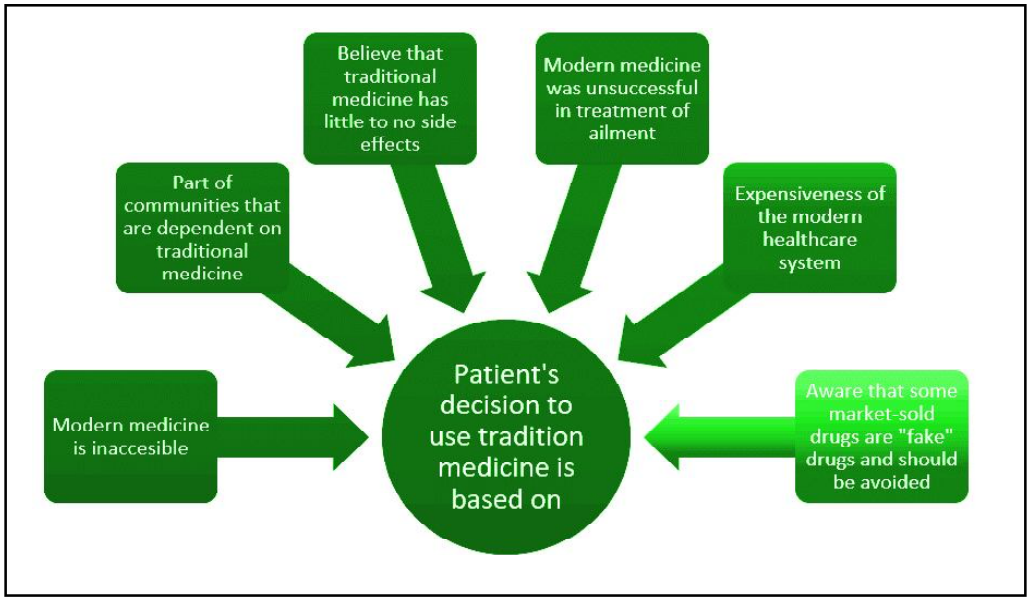

Figure 1: Factors influencing the decision of a patient to opt for traditional medicine for treatment.

All over the world, there is extensive and successful usage of medicinal plants. The continent with proper established documentation of medicinal plants is Asia. Consequently, the majority of internationally recognized medicinal plants originate in this area, especially in China and India. Herbal medicine is becoming increasingly popular in North America and Europe, particularly in the context of increasing lifestyle disorders and remedying the imbalances brought about because of it. Since ancient times, plants utilized in structured traditional medicine systems such as traditional Chinese medicine, Kampo, Unani and Ayurveda have prospered as medical systems. In addition to being well-established structured systems, these systems have multicomponent mixtures at the core of their medium of therapy (Karunamoorthi *et al.,* 2013).

In today's times, in comparison to chemical products which are harmful to both humans and nature, products made from natural sources represent safety. However, even though natural products have been treasured for their numerous qualities including aromatic, flavouring and medicinal, the demands of the contemporary times have been met by synthetic products. Thus, the current requirement is substituting the chemicals with compounds derived from plants (Karunamoorthi *et al.,* 2013).

2.1 History of plant-based food as therapy

In recent years, there has been a lot of discussion on established concepts in nutrition and the use of pharmaceuticals. The idea of having a diet providing nutrients in enough quantities to fulfil organic

needs of an individual also known as “adequate nutrition” is slowly being replaced by the term “optimal nutrition”. This term focuses on having a diet that prevents the possibility of infliction of disease, enhances general well-being and encourages good health. By performing intensive research on the various ways, food can provide protection to the human body, health specialists found that there is presence of substances known as phytochemicals in abundance in food. On the basis of this, there came about a concept of “functional food” which is also described by various terms like “medicinal food”, “vitafoods”, “medifoods” or “pharmafoods” (Varekar *et al.,* 2023). The parts of food plants that can provide therapeutic effects on consumption as described by a traditional, ethnomedical or biomedical system are called medicinal food plants. In addition to supplying the body with essential nutrients and satisfying hunger, medicinal food has the capability of providing good mental and physical health by reducing the occurrence of diseases related to nutrition. This is possible due to the presence of bioactive compounds in the plants. The intake and type; however, should be in the normal amounts, as expected in a diet.

The use of plants as health supplements dates back to 3300 BC with records on Egyptian hieroglyphics which described more than 700 such plants and herbs. The Ebers papyrus also describes many herbs that are used till this day such as *Aloe vera*. History has seen a strong link between pharmacology and food for the treatment of a variety of disorders and promotion of good health. “Let food be your medicine and medicine be your food”, has been expressed by Hippocrates in 500 BC. Spices, for instance, are many a times considered as enhancers of taste or flavours and in the olden times, spices were used in cooking as they had significant impact on the metabolism of an individual. *Curcuma longa*, more commonly known as turmeric, has been a part of Indian cooking since historic times. Turmeric shows the presence of a bioactive compound curcumin which is known to display many health-promoting properties such as anticarcinogenic, anti-inflammatory and antioxidant properties. Its mechanism of action includes its influence on the functioning of angiogenesis and cell-cell adhesion, modulation of the immune system, glutathione S-transferases and cyclooxygenases enzyme inhibition and inhibition of various cell signalling pathways. The allicin containing *Allium sativum* or garlic has displayed many positive effects on health such as enhanced circulation, lowering hypertension and improving levels of HDL while reducing LDL levels. It can be consumed both cooked and raw. The herb *Mentha piperita* or peppermint has been used for a long time for its properties helpful in solving any digestive troubles such as problem in evacuation of bowel can be resolved because it is a smooth muscle relaxant and some other troubles like abdominal distension and bloating. The herbs of the Lamiaceae family such as sage (*Salvia officinalis*) and thyme (*Thymus vulgaris*) were used to treat tonsillitis, laryngitis, bronchitis, cough, troubles related to spasmodic gastrointestinal tract and also used as an anthelmintic in Egypt during the ancient times. (Hussain *et al.,* 2023).

3. Foods with therapeutic potential

Since the beginning of the practice of agriculture, over thousands of species of plants have been cultivated. However, the society today, hinges on around 200 of these species, thereby greatly narrowing the genetic diversity range of the crops. Almost half of the global calorie intake is supported by crops such as maize, rice and wheat, putting the security of our food supply at extreme risk. Intensification of agriculture resulted in a reduction in the diversity of diets as well as food culture. Additionally, traditional crops, which provided essential micronutrients like zinc, vitamin A and iron to poor communities, were lost. All things being said recently, there has been increasing awareness about sustainable development, sustenance of the locals, biodiversity and its impact on the security of food and nutrition. Due to this, there has been a wide promotion of researching more efficient means of production for mainstream crops and the advantages of using underutilized conventional crops (Ulian *et al.,* 2020; Negi *et al*., 2023).

There is immense potential in the underutilized traditional crops yet to be realised in terms of sustainable food production and food security. These crops can often adapt to the changing climatic conditions and are of great importance to the locals. Conditioning these crops to normal agriculture would be of help considering the challenge we are facing with respect to sustainable food production. Many times, these underutilized crops serve more than one purpose and are part of production of medicines, fibres and timbres. Some of these were major crops, but have since been supplanted by new commercial varieties, for instance, lesser in popularity pulses like lablab have been replaced by millets. A valuable amount of traditional information on these varieties of plants such as usage and cultivation are rapidly becoming extinct. Fungi and crops that contribute to food security like cereals and domesticated legumes can have varying chemical, antioxidant and nutritional content, and therefore access to these become important as they might have a direct impact on human health. This impact could be positive or negative, for instance, the impact on the microbiome of the human intestine (Ulian *et al.,* 2020; Negi *et al.*, 2023).

3.1 Sago palm

One of the characteristic underutilized traditional food crops known as sago palm (*Metroxylon sagu*) is widely found in regions of the Pacific and Asia and very little research has been performed on this plant. It can grow in areas such as peat swamps and wetlands where economically important food crops are hard to cultivate. It can produce high amounts of starch (150-300 kg of dry starch per plant) and is therefore an important plant with respect to food security as it can provide a staple food without competing for arable land. Noodles and breads can be made comfortably without change in taste or quality when sago starch is mixed in wheat flour (60%). Accordingly, the volume of edible starch which is present in the markets can be enhanced with addition of sago starch. However, the wetlands and swamps where sago palms are growing are being converted into lands for growth of commercial crops like rubber trees and oil palm, thereby resulting in a significant reduction of the sago palm population. The growth of such crops desperately requires recognition, policy formation and funds by national governments (Dixit *et al.,* 2016).

3.2 Grass pea

A plant called grass pea or *Lathyrus sativus* is of great significance economically in many of the developing countries like Ethiopia, Nepal, Pakistan, Bangladesh and India. One or two weeks prior to the harvest of rice, its seeds are usually scattered into standing crops of rice. This way, the remaining moisture following the rice harvest is exploited by the grass pea seeds. Due to its nutritional value, it is

used for a variety of purposes such as fodder, feed as well as food. In addition to being a highly drought-resistant crop, it is also resistant to excess water and flood conditions. Grass pea also has the ability to grow on diverse soils ranging from heavy clays to poor soil. Therefore, grass pea shows great potential in terms of food security as well as for sustainable food production. A major drawback of this plant; however, is that it produces a neurotoxin β-N-oxalyl-L-α,β-diaminopropionic acid (ODAP) due to which consumption of this crop for extended periods leads to lathyrism, a neurological disorder which affects domestic animals and humans. A number of factors influence the accumulation of ODAP into *Lathyrus* such as abiotic stresses, nutrients and growth stage of the plant. This has resulted in very less research on this plant. Due to this lack of research, there is limited biotechnological investment and there is little understanding of the complex genome. Extensive plans allowing for detection of genotypes with lower ODAP content as well as combining increased yield with low ODAP content and efficient seed detoxification techniques are urgently needed (Xu *et al.,* 2017). Genomic tools that are breeder-friendly are becoming more widely available, therefore allowing breeding protocols to be more efficient. The use of next-generation sequencing has provided a way to tap into the wealth of genomic resources available for this underappreciated crop (Dixit *et al.,* 2016; Xu *et al.,* 2017).

3.3 Pulse crops

Other crops that would help to prevent possible protein malnutrition in the future are pulses. Pulse crops can be profitable as they are excellent sources of protein, resistant to change in climate and sustainable. A variety of pulses can account for 33% of dietary requirements as they comprise high levels of albumins and globulins. However, problems like presence of antinutritional factors, allergenicity or digestibility still need to be addressed if, they are to be workable alternative sources of proteins. Using pulses as a source of protein requires a significant amount of effort such as selection of the best species or implementation of optimised processing and production. Pulse proteins' mechanical flexibility, which allows them to produce soft gel particles comparable to whey proteins or fibril-like structures to imitate meat, is an added benefit. However, in order to gain consumer acceptance, it may be necessary to decrease or remove unwanted flavours. Studies have also found ways to significantly lessen the content of antinutritional factors by treatments with specific enzymes, modulation of the vegetative cycle, heat treatment or physical processes (Bessada *et al.,* 2019).

3.4 Cowpea

Cowpea or *Vigna unguiculata,* is high in protein and contains a wide range of nutrients. It also contains high levels of nutraceuticals like polyphenols, polyunsaturated fatty acids, antioxidants and dietary fibres. The widely consumed and grown cowpea is an essential legume for millions around the world in regards to health and nutrition. Cowpea is a staple food in the region of Latin America, Africa, southern Europe, Oceania and tropical, semi-arid and arid regions of Asia (Abebe and Alemayehu, 2022). Additional points of benefits are that cowpea is resistant to environmental stresses, stability in production and high relative productivity (Carneiro da Silva *et al.,* 2019). Through usage of suitable genotypes and enhancements in production systems, cowpea productivity and commercial feasibility can be increased in all major areas, reducing reliance on foreign inputs. Cowpea helps in improving the nitrogen and phosphate fertility of the soil, which will favour the succeeding cereal crops. Aside from nitrogen fixation, the crop's involvement in the system of crop rotation promotes the quantities of organic matter produced and increases carbon fixation. The accumulation of organic matter improves the fertility of the soil and physical attributes like production system sustainability, soil conservation and infiltration rate and nutrient retention. Certain studies were able to acquire high-yielding potential genotypes of cowpea with early maturity and plant morphology that was conducive to mechanised harvesting owing to the investments in research and broad genetic variation. These genotypes are more resistant to pests and pathogens, as well as unfavourable environmental conditions (such as dryness and temperature variation). Cowpeas have piqued the interest of large farmers in the last decade, having ceased to be a subsistence crop cultivated primarily by family farmers. Cowpea production increased at a faster rate than all other pulses in the first decade of the 21st century (Carneiro da Silva *et al.,* 2019).

3.5 Pearl millet

Pearl millet, *Pennisetum glaucum*, is a crop popularly grown in regions of Asia and Africa. In other parts of the world like Brazil, this crop serves as a feed and cover crop rather than food for human consumption. It is well-known for producing nutritional cereal grains that can withstand drought as well as heat. These grains also have higher levels of amino acids compared to traditionally grown crops like rye and wheat, maize-like lipid levels, increased content of dietary fibre as compared to rice and are gluten-free. Furthermore, in comparison to corn, pearl millet is more affordable and resistant to aflatoxin contamination. Possessing a low glycaemic index, makes pearl millet a substitute food for weight management and lowers the risk of developing chronic illnesses like diabetes (Pei *et al.,* 2022). As a result, there should be greater emphasis on genetic improvement for launching novel cultivars with increased grain yields as well as evaluation of the benefits and potential use of pearl millet in the diet, since this cereal is important for food safety as well as a viable option for consumers looking for sustainable, nutritious and low-cost food items (Dias-Martins *et al.,* 2018). These constitute a few of the potential food crops among many others that are being currently researched.

4. Sustainable use of traditional medicinal plants

There is an increase in threat to extinction and erosion of medicinal plants in the wild and the general biodiversity in plants due to a rise in the pressure on forest ecosystems and unpredictable weather patterns. Urgent strategies that assist sustainable supplies catering to a rise in world demand in products derived from medicinal plants are required for the protection of these medicinal plants (Rao and Rajput, 2011). There has been a considerable amount of study on utilization of medicinal plants in a sustainable manner. These involve biodiversity management while maintaining its potential of satisfying the needs of the populations that come after us (Lindgren *et al.,* 2018; Chen *et al.,* 2016).

The practice of domestic cultivation is a widely accepted one, even though medicinal plant resources harvested from the wild are considered to be higher in efficacy. The production of medicinal plants encounters troubles such as erroneous identification of botanical origin, presence of active components in low amounts, contamination by pesticides and presence of toxic components. Through the

utilization of new techniques in cultivation, overcoming these troubles becomes easy. The advantages of controlled conditions of growth are the production stability is ensured and production of bioactive components is enhanced. By practicing cultivation techniques, there is recovery of the wild resources of medicinal plants as there will be a decrease in the harvest of these plants and the cost is also reduced to a more affordable level (Chen *et al.,* 2016).

There are arguments in support for and against the inclination towards cultivated or wild plants. This is mainly due to the outlook of communities who prefer wild plants as opposed to scientific facts and data. Wild plants differ in the secondary metabolites' concentration compared to cultivated plants. But these concentrations can be regulated under cultivation. Most companies merchandising in herbs are partial towards material from cultivated plants as their certification as organic or biodynamic is possible. International trade has been increasingly insisting on wild collections being certified. It is almost impossible to bring all species under cultivation immediately. Impetus should be given to cultivation at a smaller scale. This would mean an involvement of local communities also regulated harvests with regards to availability of populations thus encouraging natural proliferation (Rao and Rajput, 2011).

Certain medicinal plants are slow in growth and have a limited prevalence; therefore, overexploitation of their resources or over harvesting leads to exhaustion of resources and sometimes even extinction of species. This is why, it is important to develop plans for good harvesting practices and use medicinal plants in a sustainable manner. Collection of flowers or buds and leaves of medicinal plants is a far less damaging than harvesting an entire plant or roots. A favourable alternative to drugs that are produced from root or whole plants, is utilizing the leaves as treatment. The discovery that roots and leaf-stems of ginseng have equivalent pharmacological activities, for instance, makes the utilization of leaf-stems more advantageous in terms of sustainability (Chen *et al.,* 2016).

Non-scientific and unsustainable methods are used more often than not to source most of the biomass of medicinal plants from forests. CITES (Convention on international trade in endangered species of wild flora and fauna) guidelines are repeatedly ignored and exports and collections end up damaging local communities. Adverse effects of this are observed in the way of reduced livelihood opportunities for locals, decline in government revenue, biodiversity loss. This also goes against the essence of convention on biological diversity (CBD) objectives. The plethora of existing acts and laws fall short in curbing the menace. The administration of nations that undertake exports should employ viable strategies for the protection of the biodiversity of medicinal plants as well as the interest of the locals. They should further ensure that the collections abide with the guidelines put in place by guidelines of the conservation of medicinal plants, WHO/IUCN/WWF (world wide fund for nature), WHO guidelines for good agricultural and collection practices for medicinal plants, international standard for sustainable wild collection of medicinal plants (ISSC-MAP) (Wahlqvist *et al.,* 2009).

The focus of the administrations needs to be directed towards creating an inventory of the resources of medicinal plants and native traditional knowledge, thus aiding in cultivation as well as conservation of medicinal plants along with creation of wealth *via* this resource. Failures in regulated mechanisms deprive nations that are rich in biodiversity as well as the locals that strived to preserve it, their fair share in enterprise profits. There will be a continuous rise in harvesting natural population and depletion of species of medicinal plants unless necessary measures are initiated to remedy these concerns by cultivating these resources for a sustainable supply. Research towards medicinal plants requires strengthening in developing economies to deal with the rivalry from multinational companies. The export of crude dried drugs should be discouraged while the export of value-added commodities should be encouraged. With a worldwide emphasis on natural elements in consumer goods, there seems to be a bright future for the field of medicinal plants field (Rao and Rajput, 2011).

4.1 Health security: Challenges and issues

A crucial element of human security is health security. For the promotion of food security and minimisation of chemical and microbiological risks, for a number of populations, sanitation is provided and hygiene is ingrained. In a few places, occupational safety and controls for environmental contamination coexist. But, such protection is subject to the access to and existence of evidence-based, affordable and equitable management measures, diagnostic and preventive health.

Where there is an absence of health systems supporting populations, for a lot of people, fear of poverty because of catastrophic diseases or even slight injuries is real. There is a disparity with regards to the sector of global health where there are huge advances in success in some areas of the world while the others face a high scarcity. As reminded by the WHO, one third of the world's population in underdeveloped and transition nations still lack access to important advanced healthcare. Due to improper financing by government administrations, even though there is a rise in financing by private sectors, access to human resources and material for health care is limited.

Humanity in these regions is perennially plagued with the weight of communicable diseases such as tuberculosis, malaria, HIV, diarrheal diseases, pneumonia along with chronic diseases like ischemic heart diseases, diabetes, *etc.* High child and maternal mortality and re-emerging diseases (lifestyle, chronic, and infectious) are the usual constraints to positive impacts of factors such as social (urbanization and fast changes in demographics), institutional (increase in health costs and privatization, centralized and vertical programmes having little regard to the local conditions, poor utilization of community health care, brain drain of medical practitioners), and biophysical (related epidemics and environmental changes). Conversely, health challenges faced by developed economies are ageing population, low fertility, lifestyle related and chronic ailments, growing fiscal burdens due to an increase in health care expenditure (Flahault *et al.*, 2016; Negi *et al.*, 2023).

The urban-centred, advanced-technology-based, curative medicine has found a place across nations along with the global model for healthcare. In such systems, health planners have been confronted with many challenges of optimally combining promotive and preventive health with therapeutic medicine. Because of these continuing complex challenges, fundamentals of universal access basis contextual needs along with stress on primitive and preventive health *via* self-reliant, participatory, intersectoral alliance in various health plans remains an unaccomplished ideal. This reinforces the need of relying on independent models of healthcare distribution (Ulian *et al*., 2020).

It is very clichéd to comment that regions rich in biodiversity in the southern parts are the ones that suffer most from partisanship in accessibility, availability, and inexpensive healthcare. With an increase in alienation of populations from natural environments because of numerous factors, a collateral depletion of cultural set-ups including health resources and applications base occurs giving rise to a situation in which even though relevant knowledge persists, the practice is quite poor.

Such depletion of practices is more accentuated by education systems that fail to understand the importance of such inherent methods or practices, thus distancing youngsters from exploring these areas. The implication of this is that it is not often for the absence of potency that traditional knowledge is rejected but it is due to inadequate socio-political structures. There is a well thought out social implication of this traditional knowledge being an inexpensive, safe and accessible health option for guaranteeing health security to scores of rural families. Therefore, traditional knowledge medicines are important to support due to the failures of mainstream medicine in delivery primary healthcare.

In the same way, traditional health professionals in a community health situation are understood as bridging a gap in mainstream healthcare access. It is necessary to understand that in a lot of societies traditional medicine does play a vital complementary role parallel to the mainstream modern healthcare system and this fact needs to be better acknowledged and appreciated. This requires a multidimensional approach where numerous resources need convergence, including the ones in relation with local healthcare traditions (Karunamoorthi *et al.,* 2013).

As the last twenty years have shown us, there is an increased relevance in bringing biodiversity conservation objectives in line with the public health approach. At present, traditional knowledge health practices are being boosted either by states, which majorly focus on healthcare delivery; by organization of civil society whose focus is on health and conservation; or private sectors *via* marketing and production of supplements, healthcare services and medicines. Coordinated policy focus on various junctions providing health resources, various governance measures and practices remains insufficient. Even though, there exist several reports independently highlighting concerns related to the use of traditional medicines or biological resources (for instance, IUCN and WHO reports); studies comprehensively addressing issues related to sustainable use, conservation, and biological resources related equity; along with concerns related to impartial access to efficacious nutrition and healthcare, and biocultural resources and human resources required there under to accomplish development objectives at the governance of local level are very few. Most studies concentrate on health linkages and biodiversity of resources in relation to modern pharmaceuticals and only some focus from the perspective of community health (Unnikrishnan and Suneetha, 2013).

The idea of global health security supports the current regulations for global response and preparedness to the emergence of infectious diseases. The agenda of global health security which is a collaboration among governments had been launched in the year 2014, and it aimed at the safety of the interconnected world from threats of infectious diseases. The governments participating in the agenda of global health security focus on building up their nations' capacities for prevention, detection and response. In the public health related emergencies context, political and financial support has been received for the agenda from almost 50 countries and international organizations.

Respect towards human values and rights such as solidarity and equity should underlie every agenda of national security. These values are aligned with motives of a lot of people providing healthcare services in emergencies of public health. The agenda of health security should concentrate on building resilience to infectious disease outbreaks that may arise in the future, and necessitate a systematic long-term approach basis surveillance as well as strengthening of the national health systems. Shielding the populations from the threats of infectious disease requires that governments shoulder the responsibilities of serving the ones in need on priority, wherever they may live (Flahault *et al.,* 2016).

5. Conclusion

Populations around the world are increasingly accepting the traditional knowledge of medicines to satisfy their healthcare needs. Although ongoing public support is observed for retaining as well as encouraging the growth of traditional systems in both developed and developing nations, however, there is a disconnect in preference of the people and the efforts made by nations and institutions for integration. It is obvious that any healthcare model relying on a single system of medicine would struggle to meet potential demands in terms of healthcare in the foreseeable future. It is critical not to glamourize traditional medicinal systems but rather to critically consider issues of quality, efficacy and safety as well as rational usage and access through effective policy interventions and incorporate them into the conventional healthcare sector without jeopardising their key characteristics and diversity.

The contribution of neglected crops in regions where they were adopted are too numerous. These crops were able to survive for many years despite the ever-changing climate and provided for the necessitous rural populations. This is reason enough for the promotion of these crops as contributors in nutrition and food security. Allocation of resources, research and development initiatives, policy support and strong advocacy will be needed.

The question on how we can make the discovery of new plants more orderly is answered by the use of ethnobotanical data along with molecular tools such as DNA sequencing. Even though, the combination of 'omics' and metabolomics have demonstrated to be of great value, metabolite identification at a large scale still remains a challenge. That being said, with further development in this field, we can look forward to improved tools of discovery.

Future prospects

Advances in medicinal plant tissue culture has emerged as a powerful tool for the large-scale and highly efficient processing of valuable bioactive components, and advances in genetic engineering have made large-scale natural product biosynthesis feasible, thereby boosting conservation and sustainable use of medicinal plants. It is a strong belief that the idea of global health security should be broadened to include sustainability and solidarity. Thus, we can ensure the development of a long-term strategy as well as overcome the constraints relating to the current responses towards emergencies of global health.

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Conflicts of interest

The author declares no conflict of interest relevant to this article.

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