

## Effects of Medicinal Plants in Diagnostic Immunology

M. Fairoz Basha\*, K.V.L. Shrikanya Rao

Department of Biotechnology, Vikrama Simhapuri University, Kakatur, Nellore-524 324, Andra Pradesh

**Corresponding author:** M. Fairoz Basha

✉ saifairoz143@gmail.com

**Tel:** +918374448488

Department of Biotechnology, Vikrama Simhapuri University, Kakatur, Nellore- 524 324, Andra Pradesh

**Citation:** Basha MF, Shrikanya Rao KVL (2023) Effects of Medicinal Plants in Diagnostic Immunology. Int J Drug Dev Res J, Vol. 15 No. 3: 1002.

### Abstract

Despite advances in modern medicine, it has been stated that there is up to 70% of the developing in the great countries that still look to complementary and alternative medical systems, also known as traditional medicine. This makes us to think of the herbal plants and their origin. It is very important to understand the origin and the taxonomy of herbal plants to be able to build up associated conclusions and also build up a strong study later on. It is needless to mention that though herbal plants are difficult to keep in track with the complex components and their mechanism of action, it's important to know that the complex compounds of these herbal plants work in perfect harmony almost like an orchestra. Serological tests can be one step closer to understanding the whole mechanism and its action of the compounds understanding more about therapeutic effect of these herbal plants and even continuing with advancement in modern medicine. Without a doubt, herbal plants have very high importance due to the complex compounds that function in synergy. In this paper more, insight will be on the advantages and importance associated with the herbal plants while knowing more about the serological tests associated with it.

**Keywords:** Herb plants; Phytopharmaceuticals; Drugs; Health; Immunology

Received: 27-Feb-2023, Manuscript No. ijddr-23-13500; Editor assigned: 13-Mar-2023, Pre-QC No. ijddr-23-13500(PQ); Reviewed: 16-Mar-2023; QC No. ijddr-23-13500; Revised: 23-Mar-2023; Manuscript No. ijddr-23-13500(R); Published: 30-Mar-2023, DOI: 10.36648-0975-9344.23.15.3-1002

### Introduction

Herbal medicine is the use of herbs to cure people who are ill with infections or diseases. Its effects can range from being extremely potent to be so mild that it can be taken for an extended length of time. Herbal medicine comprises natural ingredients that can be used to treat illnesses and are known as phytopharmaceuticals. Many developments were achieved, and new methodologies were developed, leading to advancements in phytotherapy. Furthermore, the discipline of phytochemistry has grown significantly to find the proper role of herbal therapy in modern medicine (Weiss, 1988). Herbal remedies are still used for basic healthcare in many regions of the world. Whole traditional plants on based use different treatments are being introduced into the healthcare systems of other countries (RBG Kew, 2017) [1].

As a medical plant, it was recognized to have the positive benefits of herbal medicine, making it a center of research for many researchers all over the world. Herbal medicine offers various benefits, including a high economic value, the ability to help avoid illnesses, and the ability to fit into a family's budget, as opposed to

conventional medication. We could notice a variety of benefits for the plant, such as the synergism impact between its compounds and many more (Vishwakarma et al., 2013). Not to mention, Serological tests have many aspects that are very important for many reasons; it is used to identify the presence of pathogenic bacteria, and to understand the mechanism of action for some viruses. It can help us tackle how the components of the plant extract interact with different forms (Nehmé, 1991). Medicinal plants have been popular for historical and cultural reasons [2]. We can find that in the developing world large numbers of people depend on traditional medicine to get the health care required. Although modern medicine exists we can find that herbal medicine is still maintaining its historical and cultural popularity (Vishwakarma et al., 2013) we find that the value of the natural plants' comes from 1) the rate of implementation of novel natural compounds with a broad structural diversity, such as helping as templates for semi-synthetic and total synthetic modification, 2) whole ailments prevented by these compounds, continues 3) assign a value to which they are used in disease treatment. As a result, plant science has garnered too much dedication in recent

years (Nehmé, 1991). Although advantages and disadvantages herbal plants can be discussed according to several points, we can also mention other advantages such as its performance in the market, natural synergism, herbal shotgun approach, and isolated compounds versus herbal extracts. There are unfortunate limitations to herbal medicine such as lack of specific regulations, lack of effect, and lack of evidence. Each of the advantages and disadvantages will be discussed thoroughly [3].

It is important to mention Immunological diagnostic tools because it comprises all immunological phenomena and technologies that can be devised to help in the knowledge of specific clinical situations. The discovery and its range of ways for connecting antigens to agglutinable particles in recent years has expanded the use of agglutination over detection which with only those antigens that exist naturally on the surface of special particles (NETER, 1956) [4].

### Recent insight into medicinal plants and their classes

#### A brief definition of medicinal plants

Medicinal plants refer to a set of plants with a mixture of several ingredients that have therapeutic values. Humankind

tends to utilization these kinds of plants hopefully to be safer (Karunamoorthi et al., 2013). Medicinal plants have gained intention today especially in the developing countries which depend on their efficacy in health care and treatment of various diseases.

### Medicinal plants as alternative medicine

People tend to use medicinal plants for different reasons like their sanative pharmacological effects on the human body, have therapeutic properties. Besides, high costs of prescription drugs. (World health organization) WHO is clarify that 80% of people's depend on herbal medicine as main health care (Hossain; M., 2011) hence, we noticed the emerging term called alternative medicine and become more common in western culture. Traditional medicine is more common in japan, china, Pakistan, Thailand. Furthermore, we found herbal medicines trade contributes to an increasing economic state in some countries than mainstream pharmaceutical products such as Japan, Thailand (Hoareau & DaSilva, 1999) (Table 1) [5].

Medicinal plants defined as herbal medicine and refer to traditional medicine which is widespread in the world with it is the ability to treat disease. Medicinal plants contain ingredients and substances that have a therapeutic purpose and a significant

**Table 1.** This table depicts the extraction of new drugs from the medicinal plants with their utilization and function (Kumar et al., 1997).

Drug	Allicin	Cocaine	Magnolol	Nerifolin	Quinine
Plant	Allium sativum	Erythroxyllum coca	Magnolia bark	Thevetia	Chinchona sp
Use	Antifungal ameobiasis	Topical anesthetic	Peptic ulcer	Cardio tonic	Ameobic dycentry, Antimalarial

Drug	Vinblastine	Ajmalicine	Morphine	Pilocarpine	Reserpine
Plant	Catharanthus	Catharthus roseus	Papaver somniferum	Pilocarpus jaborandi	Ravolfia serpentina
Use	Anticancer	Anticancer hypotensive	Pain killer	Antiglaucoma	Tranquillizer

role in the synthesis of drugs (Hoareau & DaSilva, 1999). Recent research have proven the importance of medicinal plants specially used in Ayurveda (alternative medicine) reduced the toxic effects of radiation and chemotherapy in cancer in addition to, accelerating surgical wound healing which raises a significant question?! Do these plants have side effects if we use them frequently? Utilization of Ayurveda frequently without prescription maybe leads to toxic heavy metals. Besides, lack of information, drug standardization, and quality control. So, Awareness of using medicinal plants and knowing more about their causative and curative effects is very necessary in order to avoid any side effects that may happen. Eventually, knowing medicinal plants components and their role as curative for many various diseases increase the potential discovery of new drugs [6].

Medicinal plants can be classified based on their therapeutic values; the part used habitat, active constituent they contain, and botanical classification which is more popular. The classifications rely on their uses, some medicine herbs have tonic or remedy power, and others well said used as culinary herbs of their flavor. There are also aromatic and ornamental herbs used to produce perfume and decoration. The herbs divide into 5 categories aromatic, astringent, nutritive, bitter, and mucilaginous (Alamgir, 2017). Here, we are going to provide a model for the classification and identification of medicinal plants in certain species called Epimedium (Berberidaceae). This kind of classification depends on several characteristics such as morphological characteristics, microscopic characteristics, physical and chemical characteristics,

and ultimately molecular characteristics (Ren et al., 2018) as in (Figure 1) [7].

## Importance and benefits of medicinal plants

### Medicinal plants between the past and future

People are still relying on herbal medicines as a primary healthcare so many places in this world. This is specifically true survey of several rural committees in Asia, South America and Africa. Where plants knowledge is to traditional and uses are readily available and inexpensive. Many of these traditional plant-based drugs are being introduced in to healthcare systems in other countries (Royal Botanic Gardens., 2017). Economic Value of Medicinal Plants According to (A. Sofowora., E. Ogunbodede., A. Onayade, 2013) more following details show the economic value and growth of medicinal plants:

- The annual universal trade in herbs exceeds USD 100 billion.
- Each year, China and India exchange medicinal herbs for 2 to 5 billion US dollars.
- German country trades medicinal plants worth over a billion dollars each year.
- The Rose Periwinkle, a Madagascar native, sells for \$100 million every year.
- Each year, China trades 7,000 types and 7, 00,000 tonnes of herbal plants for medicinal use

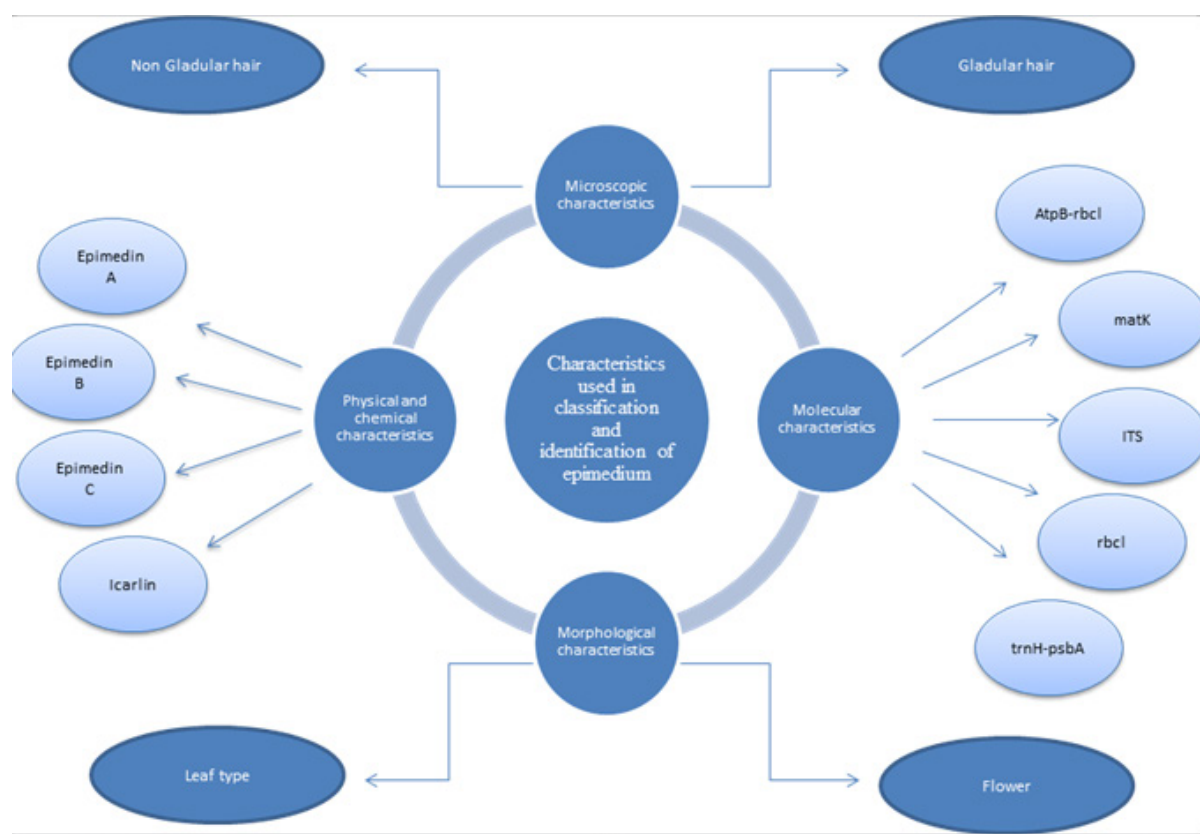


Figure 1 Identification important characters in epimedium.

- India had trading in 7,000 medicinal herbal plant species,
- Maximum Morocco country exports 58.7 tonnes of Medicinal plants every year
- Medicinal plant sales have increased doubled in China, tripled in India, and climbed by 25 percentage in Europe in the last five years (A. Sofowora, E. Ogunbodede and A. Onayade, 2013) [8].

### Herb plant for disease prevention

Previously, only focus on medicinal plant usage was on ailment treatment rather than disease prevention. However, a noteworthy report on scientific duty in the use of herb plants and their contents in it illness controlled and direct published in the literature. traditional Medicine was defined by a 'World Health Organization' (WHO) Expert Group as whole of knowledge, regardless of whether easily explainable or not explainable and in the diagnosis, treatment, and discord of physically, mentally, or socio imbalances, with simply relying on pragmatic observation, and wisdom passed sitting on through generations, whether verbally or nonverbally. (A. Sofowora, E. Ogunbodede and A. Onayade, 2013; WHO\_TRS\_622.Pdf, n.d.) [9].

### Health and medicinal plants

According to research and financial commitments, medicinal plants seem to have a great future as a health improver (Hoareau, L., & DaSilva, E. J. (1999). In most industrialized nations, the usage of Herbal medicine and elemental medicinal plants as a rule and foundation for sustaining healthy health is prevalent (UNESCO & Organization, 1996). Furthermore, industrialized societies' growth dependence on the usage of medicinal plants can be traced back extraction and growth for many drugs additionally chemotherapeutics from these plants, as well as historically utilized rural natural external remedies (to promote of Ethno botany and the Sustainable Use of Plant Resources in Africa: Regional Africa (Malawi, Mozambique, Tanzania, Uganda and Kenya) - (Mission). Project Findings and Recommendations; 1998, 1998), Furthermore, herbal remedies have grown in popularity in these communities for the treatment of minor diseases, as well as to offset the rising expenses to sustain personal health. Indeed, the increased demand publicly and commercially has become so high, there is a significant risk most herbal plants will become extinct or lose genetic diversity shortly. (A. Sofowora., E. Ogunbodede and A. Onayade., 2013) [10].

### Medicinal plants its strategies for disease prevention

Health advancement, disease cures or prevent, and abiding ailment management are progressive healthcare methods that emphasize prevention at various phases of the healthcare endlessness. Health advancement and disease prevention strategies strive to keep people healthy and prevent illnesses from arising. These strategies are known as primary preventative practices. There are three stages of prevention recognized. (ROBERTS, 1954):

(1) Its purpose - primary prevention - is for reducing the number of cases that have a disease or a condition.

(2) Its purpose -Secondary prevention- is to reduce the number of confirmed cases of a disease or an ailment in a given population (prevalence).

(3) Its purpose -Tertiary Prevention- is to limit the amount of impairment caused by an existing ailment. Primary and tertiary preventive activities are aimed at improving the health of people with chronic illnesses, slowing the worsening of its status, also avoiding problems [11].

The importance of disease control is to concentrate on techniques that reduce disease burden, recognised hazard situation, or find the disease spot in its earliest, manageable stages. Immunizations, (Ca)calcium and, Vitamin D Add to minimize on likelihood of blood pressure, osteoporosis and, cholesterol tests regular mode on health examinations, and screening find diseases such as breast, cervical, colorectal, and prostate cancer are examples of disease prevention practices. (Meuser et al., 2006; A. Sofowora, E. Ogunbodede and A. Onayade, 2013) [12].

### The curse of healthcare and its people and financial resources requirement

Every day, human die in developing popular countries around the world from various diseases that is avoidable or treatable owing to a lack of basic health care. It's only noticed developing these countries; malnutrition is frequently associated with the disease. Thus, those who eventually survive from the impact, rarely recover from this unfortunate event. The developing countries are not a cohesive group, but rather a collection of very different countries and regions at varying levels of development. Despite this, these developing countries share some characteristics, such as having scarce resources, lack of communications, long distances, decreased levels of education, and poverty. Those factors add up to keep these countries destitute perpetually. Despite this, their numbers continue to expand, particularly in rural regions. Socioeconomic aspects must be included in developing countries, specifically, in Africa when any disease prevention approach is conducted. Medicinal plants can play a role in disease control and cure strategies in Africa due to the abundance of plant biodiversity of African country is lower cost of plants using and its based medicines immediate as an alternative of manufactured synthetic drugs (Sofowora et al., 2013) [13].

### Disease prevention and medicinal plants

Strategies for Communicable Disease Prevention Supervision, stop fact finding, and immunization last three primary approaches to communicable disease prevention. Although it may seem that medicinal plants play a small role in these methods, some components derived from them and only used herbal remedy to boost the immune system. (Di Pierro, F., Rapacioli, G., Ferrara, T., & Togni, S. (2012); Ramakrishna et al., 2011)

People with NCDs use medicinal plants to improve their condition (Non-Communicable Diseases), and it can also be used to manage the biological hazard factors into NDCs, only in the beginning stages. (Jung et al., 2012; A. Sofowora., E. Ogunbodede and A. Onayade, 2013; Tan et al., 2010) [14].



## Ethnobotanical studies on medicinal plants treat disease naturally

Country of Bangladesh, the rate of consumption of the plants varied relatively. The leaves plants, such as *Spilanthes calva* and *Commelina paludosa*, were boiled, then combined with crushed peppers, and then eaten. The authors discovered that the addition of peppers had no medicinal value but was used to make the dish favorable (Rahmatullah et al., 2010; Sofowora, 1996) the juice of young *Centella asiatica* leaves or *Solena amplexicaulis* leaves was taken in its natural state. *Gymnopetalum cochinchinense* fruits were used to avoid ulcers, and *Solanum torvum* was used to prevent leucorrhoea, typhoid, and tonsillitis. *Saraca* bark and seeds were mashed and consumed raw as a treatment for irregular menstruation and menorrhagia. (A. Sofowora, E. Ogunbodede and A. Onayade, 2013)

Medicinal plants play for sure a critical role for prevention of disease and their advancements and their use have participated in disease prevention strategies. However, efforts must be made in the design and execution of these techniques to better classify, recognize, and place medicinal plants. These methods offer novel and intriguing perspectives on medicinal plants (Sofowora et al., 2013) [15].

## Uses and therapeutic effect on humans

The phytochemicals of medicinal plants are primarily responsible for their pharmacological effects. These phytochemicals are classified into two types: primary and secondary metabolites. Primary plant metabolites are engaged in essential life activities and are found in every living cell. Secondary plant metabolites, on the other hand, are the byproducts of secondary pathways. The secondary metabolites had an important role in modern medicine since these components were used in the manufacture of drug design (Hussein & ElAnssary, 2018) and are considered as an appropriate solution and effective for ailments like diabetes (Bahmani et al., 2014). Medicinal plants have many therapeutic effects that range widely from being an anti-inflammatory to being an anti-depressant and this is mainly due to the complex components that work in perfect synergy (Blahnik et al., 2001; Kumar et al., 2013) [16].

**Anti-inflammatory:** Inflammation, inflammation of joints, causing liver inflammation, lungs inflammation, inflammation of respiratory tract and ending inflammation (disease, redness, swelling, arthritis and hepatitis ect) is a common immune response to pathogens, chemical agents and physical traumas. For that, we know that there is type-I inflammations, acute inflammation: which is linked to up vascular permeability, and leukocytes emigration, infiltration of capillary. The other one type-II inflammation is a chronic inflammation which is linked to the invasion of mononuclear immune cells, macrophages, monocytes, and neutrophils, as well as fibroblast activation and proliferation (Kumar et al., 2013).

We can find an example of the treat with herbal plant extract for the treatment of inflammation such as the leaves of *R. officinalis*: which contains a range of bioactivities, additionally antioxidant (Richheimer et al., 1996), antitumor (Singletary et al.; 1996), antiinflammatory also anti-HIV (Aruoma et al.;1996).

Another example is *Achillea millefolium* L.: it's a perennial plant wide spread medicinal use and native to Europe that is well-known for its anti-inflammatory qualities in traditional medicine to treat pain and gastrointestinal disorder. Externally, Wounds, burns, edoema, and irritated skin have all been treated with the plant for a long time. According to research, two groups of secondary metabolites, which are isoprenoids and phenolics, have a significant role in antiinflammatory activities (Burk et al., 2010) [17].

**Populnea thespesia (Malvaceae):** In India south zone and Sri Lanka, the leaves and bark of *Thespesia populnea* are used to extract oil for the treatment of wounds and as an anti-inflammatory. *Thespesia populnea* ethanolic produce of bark to be used anti-inflammatory effects in both acute and chronic settings. According to phytochemical research, the ethanolic extract of bark includes 'alkaloids, carbohydrates, proteins, tannins, phenols, flavonoids, gums, mucilage, saponins, and terpenes'(Vasudevan et al., 2007).

**Antidepressant:** The World Health Organization estimates around 45 crores individuals seek from a mental or behavioral condition (Umadevi et al., 2011). Depression is anticipated to be the secondary cause of worldwide illness curse at 2020, finally cardio disease (Andersson Sundell et al., 2011). Plants like *Glycyrrhiza uralensis* (Zhao et al; 2008), *Lafoensia pacari* (Galdino et al; 2009), *Siphocampylus verticillatus* (Rodrigues et al., 2002), *Schinus molle* L (Machado et al., 2008), *Curcuma longa* (Z. F. Yu et al., 2002), and *Magnolia* bark and ginger rhizome (Yi et al., 2009) have antidepressant effect [18].

**Glycyrrhiza uralensis:** it was concluded after animal experimentation that the large amount of flavonoids derived from the natural plant had an antidepressantlike effect, and a research was designed to check effect of a particular flavonoid called liquiritin which was derived from the plant *Glycyrrhiza-uralensis*, special attitude of chronic multiple stress induced depression model rats, as well as possible association although its antidepressant-like effect and anti-oxidative activity by documenting the experimental animals' enzyme found at specific living cells of erythrocyte superoxide dismutase (SOD) activity and plasma malondialdehyde (MDA) (Umadevi et al., 2011).

**Lafoensia pacari:** A. St.-Hil. 'Lythraceae' that only used in country of Brazil traditional medicine to cure a variety of ailments including depression, Nonetheless, no research has been conducted on this putative influence on central-nervous-system (CNS) (Galdino et al; 2009).

**Siphocampylus verticillatus:** A hydro-alcoholic separation and produced from the aerial parts of *Siphocampylus verticillatus*, a Brazilian medicinal plant, was tested for antidepressant activity in two mice type of depression and against synaptosomal absorption of noradrenaline, serotonin, dopamine. However open field study, the extraction (dosage upto 100–1000 mg/kg, i.p.) notably reduced im-mobility durations on 'forced swimming test' (FST) and the 'tail suspension test' (TST) without affecting ambulation. It appears to have an effect on the dopaminergic, glutamatergic, adrenergic, and serotonergic systems. (Rodrigues et al., 2002) [19].

**Schinus molle L.:** (Anacardiaceae) is extensively used in different purposes with including the treatment on depression. The mice 'tail suspension test' (TST), a depression prediction pattern, were used to investigate the anti-depressant-like action to a hexanoic isolate from the leaves of *S. molle*. These data show that, at least in preclinical investigations, the extract of *S. molle* has certain pharmacological features with recognised antidepressants. (Machado et al., 2008).

**Curcuma longa:** Turmeric (*Curcuma longa*) best herbal medicine from India. Only liquid isolate and extracts to elicit a dose-dependent relationship of immovable trimming in the tail suspension test and the rapidly swimming test when administered orally to mice at dosages ranging upto 140 to 560 mg/kg for 14 days. (Z. F. Yu et al., 2002).

**Magnolia bark and ginger rhizome:** they are a medication combination more traditional Chinese medicine, prescribed for treating mental problems (TCM). However, the mechanism of similarity those unity on these two herbs on anti-depressant activities has not described (Yi et al., 2009) [20].

**Antioxidant:** Oxidation quickly degrades fats and oils. Unnatural antioxidants are extensively employed on lipidontaiuing meals to secure this oxidation of fats and oils. Consumers, in other hand, are becoming more concerned about whole safety of food additives. Large amount plant isolate and extracts only shown to exhibit variable degrees of antioxidant activity in lipids (Chipault et al; 1952). The antioxidant properties of methanol extracts of 180 Oriental herbs were investigated by measuring the peroxide values of linoleic acid after storage at 50. Of the herb extracts evaluated, 44 species showed significant antioxidant activity against linoleic acid oxidation. The anti-oxidative properties totally 44 special herb chose extracts were investigated further in a methyl linoleate system after thirty five days of storage. Eleven of the 44 species studied demonstrated very strong antioxidative properties. The antioxidant activity of the 11 species was investigated in relation to the description of extraction solvent (methanol, petroleum ether, ethyl acetate) (Kim et al., 1994) [21].

## Advantages and disadvantages of herbal plants

### Herbal shotgun approach and lack of effect

"Herbal shotgun approach" which is indirect to the "silver bullet method" appears to be one of the characteristics that make traditional medicine or herbal plants stand out. This nomination was used to distinguish the capability of phytomedicines to multitarget to the specific enzyme or receptor goal of a simulated medicine. We can see that as pharmaceutical students have studied over the years that single targeting is a better method of delivering medicine to the desired organ without troubles or complications and also to understand fully and correctly the mechanism of action -with exceptions for some medications-, but in the case of the herbal medicine we notice that it can target several organs and cells and perform several functions in synergy (Carmona & Pereira, 2013; Williamson, 2009) [22]. Interpreters trust that the simulated relations in the middle of element it is separate or an admixture of sauces as it pivotal slice in remedial effectiveness, but lately there have been clinical substantiation that the cure in the active factors is too low to ply any remedial

effect at all. As an illustration of the multitargeting effect and positive relations of herbal shops, is the pepper contains on alkaloid piperine, which is known as increase the bioavailability of a number of medicines similar as well vasicine (as know peganine). A downside that we can mention is the long time it takes to achieve the desired result after administration of the herbal plants. They are similar to antidepressant medication where continuous uptake for a period leads to its accumulation then eventually leading to its function (Williamson, 2009) [23].

### Synergism and lack of evidence

There are some speculations as for the reason herbal extract show a better effect than similar dosage of an separated compound, and whether more study is needed to determine if this entails synergy improved bioavailability, additional effects, or just the additive qualities of the ingredients (Williamson, 2009). Synergy is very difficult to prove and realize for in turn to suspected being present only in mixture. It's proven by mathematics but we see that it's difficult to prove due to "the immense time and money needed to test the individual components and compare the action with a same dose in the mixture" as Williamson et al mentioned in their paper [24]. As a result, the word "polyvalent action" is used without qualification to imply a better and cooperative type of impact, in an attempt to anticipate some of the complaints leveled. For that, the overall understanding of synergism is the aftereffect distinguished by the combination of substances that's higher than what would have been anticipated grounded on respective benefactions (Williamson, 2009). A variety of speculative possibilities have been suggested, still has only seen another materialize on clinical practice, which is often impossible to predict. Some may show only after a prolonged treatment of the combination, whilst others may appear with just substantial doses (Williamson, 2009) [25].

### Synergism between natural and synthetic compounds

Protection of microorganisms to numerous anti-biotic medications has prompted research into the synergism of antibiotics and plant-derived compounds. Many studies have demonstrated that phenolic chemicals, such as epigallocatechin gallate, which is separation from *Camellia sinensis* (Suresha et al., 1997; Takahashi et al., 1995), tellimagrandin I, isolated from *Rosa canina* (Shiota et al., 2000) have a high bioavailability. Furthermore, there have been option of enhance antibiotic activity when combined within plant extracts such as whole ethanolic extract of *Mangifera indica*. The specific relationships resulted in a four-fold decrease in tetracycline and erythromycin MIC (de Oliveira et al., 2011) [26].

### Unstable constituents and active constituents

The inclusion of intact plant ingredient, whereby contain antioxidants, may "protect" the actives from breakdown in some cases. Some instances are as follows: 'Valeriana spp., garlic (*Allium sativum*), ginger (*Zingiber officinalis*), and hops (*Humulus lupulus*) (Williamson, 2009). Even though some of the chemistry is understood, the active ingredients may still be unknown. Examples include Raspberryleaf, Chasteberry, *Rubus idaeus*, *Passiflora*, *Vitex agnus castus*, *Crataegus*, and others (Williamson, 2009) [27].

**Complexity of Drug Discovery:** The current drug discovery technology, “high throughput screening” (HTS), unstable adapted to extracts produced by natural origin. It is mostly owing to the high cost per sample, within the challenges restocking and increasing of isolating and identifying active chemicals, the shortage of reproducibility, and mediates from compounds in complex combinations (Schmidt et al., 2008) [28].

**Properties of Diagnostic Immunology:** Immunologic testing is important for making a quick diagnosis. Furthermore, antibody production and titers are higher in widespread illness, offering significant prognostic information. However, antibody testing is restricted since the presence of antibodies does not discriminate disease activity and the lack of antibodies does not rule out illness, particularly in individuals with early disease or those who are highly immunocompromised (Pfeiffer et al., 2015) [29].

**Elisa:** is a highly sensitive and selective analytical technique that is characterized by being rapid and high ability to detect bioactive chemicals (Kubo & Furutani, 2019).

**Trf assays:** has a strong long-lived fluorescence emission which can be then measured later on, Beneficial for high throughput screening, doesn't embrace washing steps. Though it's very attentive it takes a longer time to read a TR-FRET assay signal (Kubo & Furutani, 2019).

**Electrochemiluminescence Assay:** Sensors are a mix of electrochemistry and optical luminescence measurements. When a voltage is supplied to an electrode, the surface of the electrode is stimulated. As a consequence, an electron transfer occurs between molecules, and the ensuing emitted light is detected. ECL biosensors have been created to detect bacterial and chemical pollutants in food [30].

**Serological Tests (Antigen antibody Reaction) and their aspects :** Serological tests have piqued the interest of clinicians as its nonstandard or supplement to RT-PCR in the diagnosis of acute infection, while some may be low expensive and easier to carry out at the point of treatment. As a result, serological trial can be used as surveillance tools to better understand the epidemiology of specific illnesses and perhaps alert patients about their risk of future illness (Lisboa Bastos et al., 2020) (Table 2).

**Aspects of serological test:** Medicinal herbs include wide range of substances to be used to improve hazard and incurable infectious diseases by treating humans and protecting to animals also who are susceptible equivalent diseases (Al-Momani et al., 2007) [31].

**Antibacterial:** Spirituous extracts of 45 traditional Indian natural medicinal herbs were evaluated for antibacterial undertaking against drug-resistant bacteria and the pathogenic yeast ‘Candida albicans’. 40 plant extracts were tested for anti-bacterial activity

among the one or more test microorganisms, with various degrees of success. Anticandidal activity was demonstrated in 24 plant extracts. In all, 12 plants were discovered to exhibit broad-spectrum antibacterial activity (Lawsonia.inermis, Eucalyptus sp., Holarhenna.antidysentrica, Harpalus.indicus, Casuarina. equistifolia. Terminalia. belerica, Terminalia. chebula, Emblica. officinalis, Chlonorchis. sinensis, Syzgium. aromaticum and Punica. granatum) (Ahmad & Beg, 2001) [32].

The exposure of multi-drug resistance in human and animal pathogenic bacteria, as well as the unfavorable reaction of many anti-biotics, has sparked intense attract in the hunt for novel plantbased anti-microbial medicines. Alcoholic extracts above 45 long-established used Indian medicinal herbs were evaluated pro drug-resistant bacteria and a pathogenic yeast, Candida albicans, in this study (Ahmad & Beg, 2001) [33].

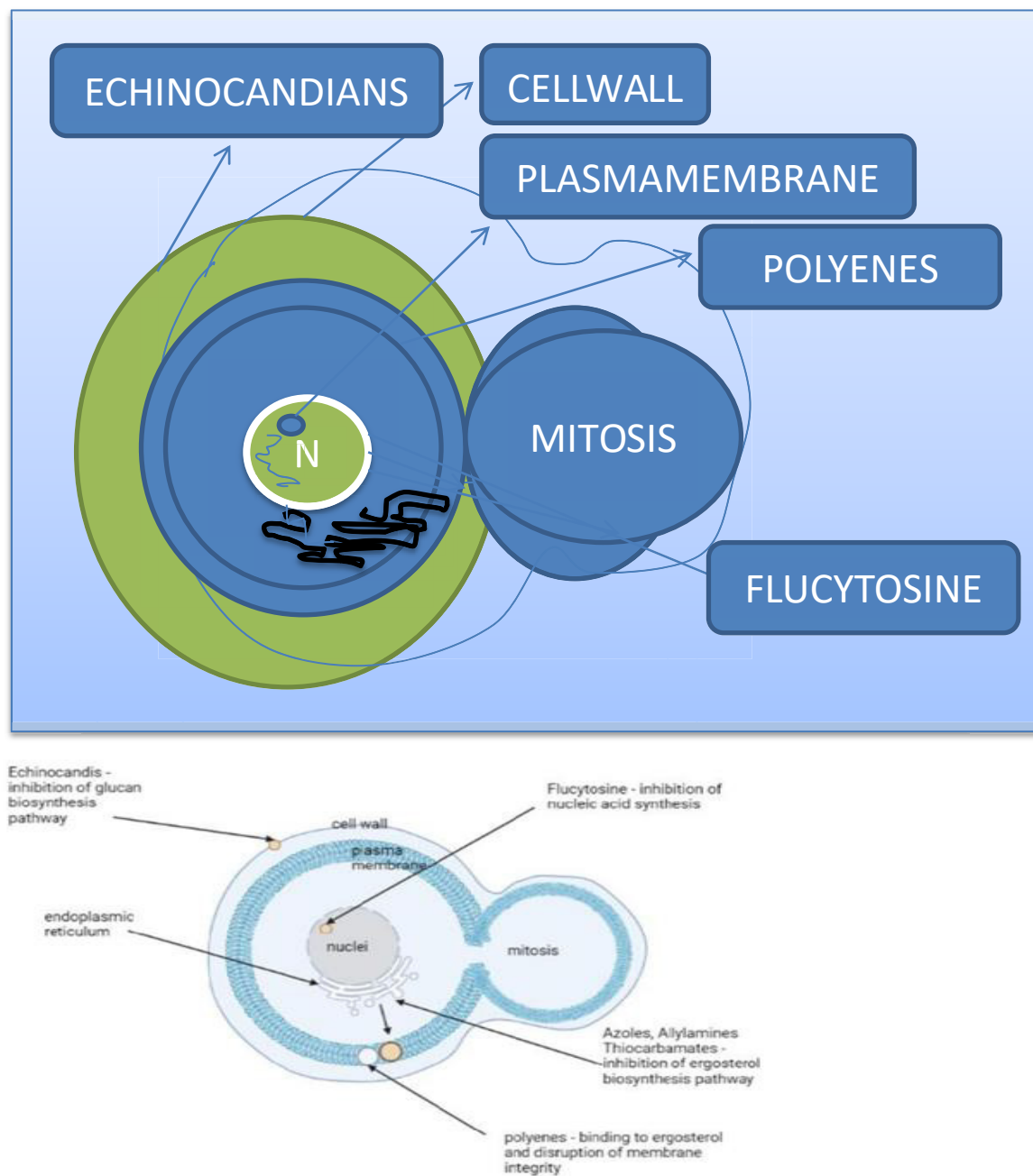
Serological tests were also conducted when researchers performed this test on Mycoplasma putrefaciens using plant extract from Jordanian herbal plants: (Artemisia herbaalba, Artemisia arborescens, Punica grantum, Allium sativum, Olea europea and Citrullus colocynthis). Moreover promote mycoplasma is only one of the smallest free-living microorganisms that lack rigid cell wall. This investigation found that all Mycoplasma species tested positive for ‘Artemisia herba-alba and Artemisia arborescens’. The particular medicinal plants are common in the Jordan desert within regularly utilised by Jordanians to cure a variety of ailments. As a result, these plants might be viewed as widely accessible alternatives to medications including fluoroquinolones, tetracyclines, macrolides, and chloramphenicols, which are presently utilized to treat mycoplasma infections (AlMomani et al., 2007) [34] (Figure 2).

**Antiviral:** Every year, between three and five million people becomes infected with a virus. While most antivirals have limited significant side effects and efficacy, herbal extracts should be used for therapeutic reasons as old times and are very well-known its antiviral properties and controlled reaction. As a result, organically derived drug therapy it could be potential treatment choice as also as viral infections. Alongside in this mind, several medical regimens and delivery systems were developed and have been used for natural product antiviral delivery, such as ‘micelles, nanoparticles, nanosuspensions, solid dispersions, microspheres and crystals, selfnanoemulsifying and self-microemulsifying drug delivery systems ‘(SNEDDS and SMEDDS). These diverse technologies administer medicinal phytochemicals in an efficient and trustworthy manner (Ben-Shabat et al., 2019) [35].

Various pharma plants the-individual phytocompounds interact with SARS-CoV2 proteins by both structural and nonstructural ways. Natural chemicals generate strong interactions with in active site of SARS-CoV2 protease, resulting in significant

Table 2. Resistance pattern of bacteria of different antibiotics (Palaniappan & Holly, 2010).

Bacteria	<i>S. Typhimurium</i> SG11	<i>E. Coli</i> N00666	<i>S. aureus</i> blaZ	<i>S. pyogenes</i> ermB	
	Minimum inhibitory concentration (ug/mg)	Amp	>512	>512	32
	Pen	>512	>512	128	S
	Tet	64	128	S	S
	Ery	1024	512	S	>512
	Bac	>512	>512	32	S
	Nov	256	64	S	S



**Figure 2** Mechanisms of action of traditional antifungal agents on cellular targets.

formation changes. These phytonutrient are capable of inhibiting both 'formational and non-formational proteins which is includes Spike protein, PLpro, and 3CLpro. Inhibition of virus replication or entry, blocking the angiotensin-converting enzyme 2 (ACE-2) receptor and "Transmembrane protease, serine 2 (TMPRSS2), regulation of inflammatory mediators, inhibition of endothelial activation, tolllike receptors (TLRs), and activation of the nuclear factor erythroid-derived 2-related factor 2 are all important anti-SARS-CoV-2 actions of medicinal plants and their metabolites' (Nrf2) [36].

Some of the important natural immune boosters that can help prevent and cure COVID-19 symptoms are 'Nigella sativa,

Allium sativum, Glycyrrhiza glabra, Zingiber officinalis, Ocimum sanctum, Withania somnifera, Tinospora cordifolia, and Scutellaria baicalensis. Furthermore, Kaempferol, Quercetin, Baicalin, Scutellarin, Glycyrrhizin, Curcumin, Apigenin, Ursolic acid, and Chloroquine are the best options for treating' SARS-CoV-2 infection symptoms (Malekmohammad & Rafieian-Kopaei, 2021) [37].

### Evolution and diagnostic tools

Innate and adaptive immune responses require more than 1600 genes (Zapico et al., 2000). These genes are very important for maintaining life in a difficult setting. The immune system



is somewhat not fully mature at native in addition to develop during a lifetime of exposure to many foreign challenges mention childhood, via young and mature adult hood (as well as pregnancy), to the deterioration of aged condition (Morens & Fauci, 2007) [38].

## The innate immune system

It serves in primary line of defense encounter invading microbes. Neutrophils, monocytes, dendritic cells, and macrophages are among the cells that make up the adaptive immune system. The effectiveness of total components of innate immunity is low in neonates compared to after life, since these cells develop and mature at distinct times throughout foetal life [39].

With the help of granulocyte-colony-stimulating factor, mature neutrophils develop towards the end of the first trimester and gradually grow in quantity before delivery. Their numbers soon recover to normal, but they have low bactericidal action, weak inflammatory responses, poor endothelial cell adhesion, and poor chemotaxis (Nussbaum et al., 2013). These deficiencies are particularly noticeable in preterm newborns, which also have lower serum IgG and complement levels [40]. As a result, newborns, especially preterm neonates, have reduced neutrophil functions. Increasing the child's susceptibility to bacterial illnesses (Filiat et al., 2011), Classical monocytes and macrophages are underdeveloped in preterm and newborn neonates. They have poor TLR4 expression and dysfunctional innate signaling pathways (Blahnik et al., 2001; D. Yu et al., 2009; Zlotoff et al., 2008), leading to diminished cytokine responses compared, with adults (Förster-Waldl et al., 2005). As a result, tissue healing is hampered, phagocytosis of potential pathogens is impeded, and bioactive molecule release is low. While the frequent of pulmonary macro-phages is lower in preterm and term newborns, they achieve adult levels in these cells within days after delivery (Blahnik et al., 2001) [41].

## The adaptive immune system

Thymus cell development takes place in thymus, therefore at its peak at born and in that early years of life before gradually diminishing. Developed single CD4+ and CD8+ positive T lymphocytes are identified in the thymus at week fifteen and in the periphery long before birth. Although, neonatal T cells vary from adult cells, showing that prone to foreign antigens is mostly limited to non-inherited maternal allo antigens throughout fetal development (D. Yu et al., 2009; Zlotoff et al., 2008) [42].

In Foreign antigen stimulation late fetal of T cells report in a Th2 immune response, which is aided by neonatal dendritic cells and epigenetic characteristics (Holt, 2004). Tolerogenic reactivity, diminished alloantigen identification, and inadequate react to foreign antigens define very early-life adjustable Tcell immunity (Hebel et al., 2014; Schwerd et al., 2017) [43].

Based on their developmental routes, B cells are divided into two groups. B1 cells produce very less affinity IgM with a little range of antigen specificities (which includes common bacterial polysaccharides), have small amount of somatic mutations, and are the first line defence (Bernard et al., 2011). 'B1 cells produce IL-10 and TGF- $\beta$ , which promote a Th2-like response, and B1 cells

make up 40% of B cells in the peripheral blood at birth' [44]. For a few months, this proportion remains high (Lydyard et al., 1992). 'Expected of the expression of terminal deoxynucleotidyl transferase, have increases diversity in V-D-J immunoglobulin gene segment attachments', conventional B cells (creating B2 cells) develop behalf multilineage CD34 common lymphoid progenitor in addition to produce a varied repertoire of immunoglobulin specificities. B cells are located in secondary lymphoid organs and bone marrow, where they widely play a role in the humoral response to adaptive immune-system [45].

Only result, the early human infant is vulnerable to a wide spectrum of viral diseases, and pathogenic bacteria, fungi, and parasites, even as their inborn and adaptive immune systems developed. Nonetheless, in developed countries, he or she stands a good chance of living. Before there was decent diet, cleanliness, and extensive immunization, newborns and young children had an extremely high death rate. In 1900, the infant mortality rate in the United Kingdom was 140 per 1000, but by 2000, it had dropped to 7 per 1000 (A decades of Change Trends in UK Statistics since 1900 - OpenGrey, n.d.) [46]. When compared to other age groups, babies and children had a higher reduction in mortality. The majority of this decline can be attributed to improved infection prevention and control. However, newborn mortality rates in many countries remain over 50 per 1000, demonstrating that a functional protective immune system was chosen under evolutionary pressure. Moreover, so-much pressure has selected a severe genetic polymorphism in the MHC, which is a key regulator of virtually over immune responses by presenting peptides to Thymus cells and Natural killer cells (Cutler & Meara, 2001) [47].

Although Agglutination on bacterial cells. These methods have a lead on this discovery of a number of novel diagnoses, also serology of people infected with entire-bacteria (NETER, 1956).

**Immunoassay of hormones:** A little standardised dosage of anti-serum is reacting within small standardised dosage of refine hormone antigen that has been rendered exquisitely apparent in some manner in these indirect procedures. A testing sample containing an un-identified amount of hormone is introduced, with it displaces a predictable and measurable quantity out of originally given observable hormone from the antibody through competitive inhibition (Berson, 1964) [48].

**Elisas:** The hunt for simple yet delicate ways for quantitative spotting about antigen and antibody in that didn't depend on particle cohesion or radio-labeled reagents resulted in the discovery of solid- phase enzyme- associated reagent assays in the 1970s (Engvall & Perlmann, 1971). In general, on fixed enzyme, once cleaned and free extra reagents, produces a colored complex that can be straightforwardly envision and quantitatively approximated by visual mass, chemic substances and conjugation of an enzyme bound to either antigen or antibody enables the detection of immune complex formation on a solid phase. The resultant assays, known as ELISAs, are inexpensive, adaptable, robust, and straightforward assays that employ a solid-phase support to separate bound and free moieties. Because of its combination of purity and sensitivity, ELISAs may utilize to examine huge numbers of small-volume test samples fit in most

basic laboratory settings. This technological advancement has had the greatest influence on epidemiology also diagnosis ID (Katti, 2001) [49].

**Fluorescent antibody methods:** Being Coons once made antibodies glow in the dusky, immunofluorescence applications have increased and extended. The notion, as presented, is simple, which is frequently necessary for its implementation. Fluorochromes substances that are release light of a given wavelength when struck by light of a different wavelength. The filter also absorbs incoming light while transmitting only the fluorescent light emitted to a viewer. For example, fluorescein iso-thiocyanate as it may be coupled with on antibody molecules in serum [50]. However antibodies will continue to operate as particulate antibodies while also glowing. Some fluorescent antibodies will stay linked with any molecules of their specific antigen that might be present in slide's surface if that antiserum is present in spread over a tissue slice or smear on a slide and washed away. When lighted with in exact wavelength also observed under a microscope with a exact filter, these antigen-antibody complexes will shine in a dark field at any position (for example, on a bacterium's cell wall or cell membrane) (O'Brien, 1965) [51].

**TRF assays:** TRF tests are run in 96-good, two site antigens found ELISA format. The labels are TRF-based lanthanide chelate labels with different fluorescence characteristics. An extremely lengthy fluorescence decay time and a very big Stokes' shift are two of these properties. Due to the lengthy decay time of fluorescence, the user can measure the fluorescence after the background has entirely gone [52]. Furthermore, within a protected micelle, on label, and lanthanide chelate, is on isolated from the antibody molecule and transformed with unique, extremely fluorescent chelate. Most importantly, these lanthanides chelate can be substituted for if few labels commonly used in ELISA-based method. However features taken together, contribute to the excellent sensitivity and low background in those TRF-based immunologic tests (Peruski et al., 2002) [53].

**IMS-ECL assays:** For many decades, IMS has been used to efficiently collect soluble and particulate antigens, separate, purify, and concentrate them with high-affinity antibodies (Haukanes and

Kvam, 1993; Lea et al., 1988; Ugelstad et al., 1993). Moreover, this technology's capability to collect and concentrate antigens from a various complicated biological matrix is a key characteristic. One of the main upper hands of IMS is the accelerated response kinetics due to the big pelagic area on the magnetic-beads as contrast to traditional ELISA also immunological reactions inside an explosive bead solution [54]. Beads can also be merging quickly or quietly to facilitate either fast seize in soluble antigens or gradual docking with particulate antigens. When the magnetic beads are placed in a magnetic field, they immediately separate antibody-seize materials from the nearby environment. These beads are composed of paramagnetic magnetite (FE<sub>3</sub>O<sub>4</sub>), which is magnetizable when an external field is present but not when it is not the beads come in a wide range of sizes; start with a few nanometers to many micrometers. In both typically spherical, although that form is determined by its production process and the end utilize requirements (Nguyen et al., 1999; Stenberg & Nygren, 1988) [55].

## Conclusion

The core of literature set of use of medicinal plants and the individual compounds in ailment forestallment has grown significantly. Traditional Medicine was depicted by a 'World Health Organization' (WHO) Excellent group also entire knowledge and practices utilized inside diagnosis, forestallment, and discarding of physico, internal, or social imbalances. Medicinal herbs have the eventuality to play crucial functions in disease prevention, and their promotion and operation are consistent with all existing disease preventative action. Still, combined efforts must be undertaken to ameliorate the classification, recognition, and placement of remedial plants within our understanding of the plant kingdom. In poor nation, a considerable part of portion of the population bank on traditional medicine to satisfy its health-care requirements. The benefits and downsides of herbal plants can be explored in a variety of ways. Herbal drug has unwelcome constraints similar as a lack of unequivocal restrictions, a lack of impact, and a lack of substantiation. And, as can be seen, serological tests are employed in a wide range of operations, from detecting the presence of a specific disease to determining how to treat pathogens.

## References

- Ahmad I, Beg AZ (2001) Antimicrobial and phytochemical studies on 45 Indian medicinal plants against multi-drug resistant human pathogens. *Journal of Ethno pharmacology* 74:113-123.
- Abu-Basha E, Janakat S, Nicholas RAJ, Ayling RD (2007) In vitro antimycoplasmal activity of six Jordanian medicinal plants against three *Mycoplasma* species. *Tropical Animal Health and Production* 39:515-519.
- Alamgir, ANM (2017) Therapeutic Use of Medicinal Plants and Their Extracts. In *Progress in Drug Research* 73).
- Sundell A, Gissler M, Petzold M, Waern M (2011) Antidepressant utilization patterns and mortality in Swedish men and women aged 20-34 years. *European Journal of Clinical Pharmacology* 67:169-178.
- Aruoma OI, Spencer JPE, Rossi R, Aeschbach R, Khan A et al (1996) An evaluation of the antioxidant and antiviral action of extracts of rosemary and provençal herbs. *Food and Chemical Toxicology* 34:449-456.
- Bahmani M, Golshahi H, Saki K, RafieianKopaei M, Delfan B et al (2014) Medicinal plants and secondary metabolites for diabetes mellitus control. *Asian Pacific Journal of Tropical Disease* 4:687-692.
- Ben-Shabat S, Yarmolinsky L, Porat D, Dahan A (2019) Antiviral effect of phytochemicals from medicinal plants: Applications and drug delivery strategies. *Drug Delivery and Translational Research* 10:354-367.
- Bernard A, Lepage V, Degos L, Lemerle J, Dausset J et al (2011) A human equivalent of mouse B-1 cells? *Journal of Experimental Medicine* 208:2566-2569.
- Berson SA, Yalow RS (1964) Lipopolysaccharide-Induced Tumor Necrosis Factor- $\alpha$  and IL-10 Production by Lung Macrophages from Preterm and Term Neonates. *Pediatric Research* 50:726-731.
- Burk DR, Cichacz ZA, Daskalova SM (2010) Aqueous extract of *Achillea millefolium* L. (Asteraceae) inflorescences suppresses lipopolysaccharide-induced inflammatory responses in RAW 264.7 murine macrophages. *Journal of Medicinal Plants Research* 4:225-234.
- Diniz M (2011). Modulation of drug resistance in *Staphylococcus aureus* by extract of mango (*Mangifera indica*) peel. *Revista Brasileira de Farmacognosia* 21:190-193.
- Engvall E, Perlmann P (1971) Enzyme-linked immunosorbent assay (ELISA) quantitative assay of immunoglobulin G. *Immunochemistry* 8:871-874.
- Filias A, Theodorou GL, Mouzopoulou S, Varvarigou AA, Mantagos S et al (2011) Phagocytic ability of neutrophils and monocytes in neonates. *BMC Pediatrics* 11:1-6.
- Förster-Waldl E, Sadeghi K, Tamandl D, Gerhold B, Hallwirth U et al (2005). Monocyte Toll-Like Receptor 4 Expressions and LPS-Induced Cytokine Production Increase during Gestational Aging. *Pediatric Research* 58:121-124.
- Galdino PM, Nascimento MVM, Sampaio BL, Ferreira RN, Paula JR et al (2009) Antidepressant-like effect of *Lafoensia pacari* A. St.-Hil. ethanolic extract and fractions in mice. *Journal of Ethno pharmacology* 124:581-585.
- Haukanes BI, Kvam C (1993) Application of Magnetic Beads in Bioassays. *Bio/Technology* 11:60-63.
- Hebel K, Weinert S, Kurokpa B, Knolle J, Kosak B et al (2014) T Cells of Infants Are Mature, but Hyporeactive Due to Limited Ca<sup>2+</sup> Influx. *The Journal of Immunology* 192:5160-5170.
- Hoareau L, DaSilva EJ (1999) Medicinal plants: A re-emerging health aid. In *Electronic Journal of Biotechnology* 2:56-70.
- Holt PG (2004) the role of genetic and environmental factors in the development of T cell mediated allergic disease in early life. *Paediatric Respiratory Reviews* 5:27-30.
- Jung CH, Ahn J, Jeon T, Kim TW, Ha TY et al (2012) *Syzygium aromaticum* ethanol extract reduces high-fat diet-induced obesity in mice through down regulation of adipogenic and lipogenic gene expression. *Experimental and Therapeutic Medicine* 4:409-414.
- Karunamoorthi K, Jegajeevanram K, Vijayalakshmi J, Mengistie E (2013) Traditional Medicinal Plants: A Source of Phototherapeutic Modality in Resource Constrained Health Care Settings. *Journal of Evidence-Based Complementary and Alternative Medicine* 18:67-74.
- Katti M K (2001) Are Enzyme-Linked Immunosorbent Assay and Immunoblot Assay Independent in Immunodiagnosis of Infectious Diseases? *Clinical Infectious Diseases* 32:1114-1124.
- Kim SY, Kim JH, Kim SK, Oh MJ, Jung MY et al (1994) Antioxidant activities of selected oriental herb extracts. *Journal of the American Oil Chemists' Society* 71:633-640.
- Kumar S, Bajwa BS, Kuldeep S, Kalia A (2013) Anti-Inflammatory Activity of Herbal Plants. *International Journal of Advances in Pharmacy. Biology and Chemistry* 2:272-281.
- Kumar S, Shukla YN, Lavania UC, Sharma A, Singh AK (1997) Medicinal and aromatic plants. *J Med Arom Pl Sc* 19:361-365.
- Lea T, Vartdal F, Nustad K, Funderud S, Berge A et al (1988) Monosized, magnetic polymer particles: Their use in separation of cells and subcellular components and in the study of lymphocyte functions in vitro. *Journal of Molecular Recognition* 1:9-18.
- Tavaziva G, Abidi SK, Campbell JR, Haraoui LP, Johnston JC et al (2020) Diagnostic accuracy of serological tests for covid-19: systematic review and meta-analysis. *BMJ* 370:25-36.
- Malekmohammad K, Rafieian-Kopaei M (2021) Mechanistic Aspects of Medicinal Plants and Secondary Metabolites against Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). *Current Pharmaceutical Design* 27:3996-4007.
- Meuser J, Bean T, Goldman J, Reeves S (2006) Family health teams: A new Canadian interprofessional initiative. *Journal of Interprofessional Care* 20:436-438.
- Morens DM, Fauci AS (2007) The 1918 Influenza Pandemic: Insights for the 21st Century. *The Journal of Infectious Diseases* 195:1018-1028.
- Nguyen VK, Leclerc N, Wolff CM, Kennel P, Fonteneau P et al (1999) Protection of Immunoreactivity of dry immobilized proteins on micro titration plates in ELISA: application for detection of autoantibodies in Myasthenia gravis. *Journal of Biotechnology* 72:115-125.
- Nussbaum C, Gloning A, Pruenster M, Frommhold D, Bierschenk S et al (2013) Neutrophil and endothelial adhesive function during human fetal ontogeny. *Journal of Leukocyte Biology* 93:175-184.
- O'Brien TF (1965) Diagnostic Uses of Immunology. *Medical Clinics of North America* 49:1757-1768.
- Palaniappan K, Holley RA (2010) Use of natural antimicrobials to increase antibiotic susceptibility of drug resistant bacteria. *International Journal of Food Microbiology* 140:164-168.
- Peruski AH, Johnson LH, Peruski LF (2002) Rapid and sensitive detection of biological warfare agents using time-resolved

- fluorescence assays. *Journal of Immunological Methods* 263:35-41.
- 36 Pfeiffer CD, Wong B, Wong B, Pfeiffer CD (2015) Diagnostic Immunology. *Diagnosis and Treatment of Fungal Infections* 45-64.
- 37 Rahmatullah M, Ferdausi D, Mollik MAH, Jahan R, Chowdhury MH et al (2010) A survey of medicinal plants used by Kavirajes of Chalna area, Khulna district, Bangladesh. *African Journal of Traditional, Complementary and Alternative Medicines* 7:91-97.
- 38 Ramakrishna Y, Goda H, Baliga MS, Munshi AK (2011) Decreasing cariogenic bacteria with a natural, alternative prevention therapy utilizing phytochemistry (plant extracts). *Journal of Clinical Pediatric Dentistry* 36:55-64.
- 39 Ren L, Guo M, Pang X (2018) Identification and classification of medicinal plants in Epimedium. *Chinese Herbal Medicines* 10249-254.
- 40 Richeimer SL, Bernart MW, King GA, Kent MC, Bailey DT (1996) Antioxidant activity of lipid-soluble phenolic diterpenes from rosemary. *Journal of the American Oil Chemists' Society* 73:507-514.
- 41 Rodrigues ALS, Da Silva GL, Mateussi AS, Fernandes ES, Miguel OG et al (2002) Involvement of monoaminergic system in the antidepressant-like effect of the hydro alcoholic extracts of *Siphocampylus verticillatus*. *Life Sciences* 70:1347-1358.
- 42 Schmidt B, Ribnicky DM, Poulev A, Logendra S, Cefalu WT et al (2008) A natural history of botanical therapeutics. *Metabolism* 57:3-9.
- 43 Schwerdt T, Twigg SRF, Aschenbrenner D, Manrique S, Miller KA et al (2017) A biallelic mutation in IL6ST encoding the GP130 co-receptor causes immunodeficiency and craniosynostosis. *Journal of Experimental Medicine* 214:2547-2562.
- 44 Shiota S, Shimizu M, Mizusima T, Ito H, Hatano T (2000) Restoration of effectiveness of  $\beta$ lactams on methicillin-resistant *Staphylococcus aureus* by tellimagrandin I from rose red. *FEMS Microbiology Letters* 185:135-138.
- 45 Singletary K, MacDonald C, Wallig M (1996) Inhibition by rosemary and carnosol of 7, 12-dimethylbenz[a]anthracene (DMBA) - induced rat mammary tumorigenesis and in vivo DMBA-DNA adduct formation. *Cancer Letters* 104:43-48.
- 46 Sofowora A (1996) Research on medicinal plants and traditional medicine in Africa. *Journal of Alternative and Complementary Medicine* 2:365-372.
- 47 Sofowora A, Ogunbodede E, Onayade A (2013) the role and place of medicinal plants in the strategies for disease prevention. *AJTCAM* 10:210-229.
- 48 Stenberg M, Nygren H (1988) Kinetics of antigen-antibody reactions at solid-liquid interfaces. *Journal of Immunological Methods* 113:3-15.
- 49 Suresha B, Sriram S, Dhanaraj SA, Elango K, Chinnaswamy K et al (1997) Anticandidal activity of *Santolina chamaecyparissus* volatile oil. *Journal of Ethno pharmacology* 55:151-159.
- 50 Takahashi O, Cai Z, Toda M, Hara Y, Shimamura T (1995) Appearance of antibacterial activity of oxacillin against methicillin resistant *Staphylococcus aureus* (MRSA) in the presence of catechin. *The Journal of the Japanese Association for Infectious Diseases* 69:1126-1134.
- 51 Tan AC, Konczak I, Sze DMY, Ramzan I (2010) towards the discovery of novel phytochemicals for disease prevention from native Australian plants: An ethnobotanical approach. *Asia Pacific Journal of Clinical Nutrition* 19:330-334.
- 52 Ugelstad J, Stenstad P, Kilaas L, Prestvik WS, Herje R et al (1993) Monodisperse Magnetic Polymer Particles. *Blood Purification* 11:349-369.
- 53 Umadevi P, Murugan S, Jennifer Suganthi S, Subakanmani S (2011) Evaluation of Antidepressant like Activity of *Cucurbita pepo* Seed Extracts in Rats. *International Journal of Current Pharmaceutical Research* 3:108-113.
- 54 Zhao Z, Wang W, Guo H, Zhou D (2008) Antidepressant-like effect of liquiritin from *Glycyrrhiza uralensis* in chronic variable stress induced depression model rats. *Behavioural Brain Research* 194:108-113.
- 55 Zlotoff DA, Schwarz BA, Bhandoola A (2008) the long road to the thymus: The generation, mobilization, and circulation of T cell progenitors in mouse and man. *Seminars in Immunopathology* 30:371-382.