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Subject:

Role of Dietary Supplements and Medicinal Plants in Supporting Respiratory Health: A Survey of Physicians and Pharmacists in Touggourt, Algeria

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Congratulations!

Graduation Dedication

O God, life finds no joy except in thanking You, no day is pleasant except in obeying You, no moments are sweet except in remembering You,

and the Hereafter is sweet only through Your forgiveness, and Paradise is sweet only through seeing You, O God, the Most High.

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Praise be to God, a good and blessed praise, as boundless as what was, what is, and what will be. Praise be to God, by whose grace good deeds are accomplished, and by whose favor wishes are fulfilled.

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Bouaraguia Rayane

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List of Abbreviations

NF-kappa B	Nuclear Factor kappa-light-chain-enhancer of activated B cells
PP-AR gamma	Peroxisome Proliferator-Activated Receptor gamma
Wnt	Wingless-related integration site
catenin- B	beta-catenin
ASM	Airway Smooth Muscle
PDE4D	Phosphodiesterase 4D
cAMP	Cyclic Adenosine Monophosphate
F-actin	Filamentous Actin
SAC	S-allyl-cysteine
AGE	Aged Garlic Extract
NK cells	Natural Killer cells
PRR	Pattern Recognition Receptors
NKG2D	Natural Killer Group 2, member D
IFN-gamma	Interferon-gamma
EGCG	Epigallocatechin gallate
ROS	Reactive Oxygen Species
ECG	Epicatechin-3-gallate
EC	Epicatechin
Keap1	Kelch-like ECH-associated protein 1
Nrf2 2	Nuclear factor erythroid 2-related factor 2
ARE	Antioxidant Response Elements
SOD	Superoxide Dismutase
BLM	Bleomycin
EGC	Epigallocatechin
NADPH Oxidase (NOX)	Nicotinamide adenine dinucleotide phosphate oxidase
TNF-α	Necrosis Factor-alpha

Abstract

This study aimed to highlight the role of dietary supplements, particularly herbal supplements, in supporting respiratory health and alleviating certain respiratory diseases, including bronchitis, chronic obstructive pulmonary disease (COPD), and COVID-19.

This study was conducted in the Province of Touggourt, Algeria, using a questionnaire distributed equally among physicians (including general practitioners and respiratory/chest disease specialists) and pharmacists, with 50% of respondents from each group. The aim was to collect data on their knowledge, attitudes, and practices regarding the use of dietary supplements in supporting respiratory health and preventing related diseases.

The findings revealed a generally positive perception of dietary supplements and medicinal plants as complementary therapeutic approaches. Among the medicinal plants cited by participants, thyme was identified as one of the most frequently recommended species due to its reported anti-inflammatory, antioxidant, and expectorant properties.

The results also indicated that healthcare professionals were aware of the potential risks associated with dietary supplements, particularly drug–supplement interactions and inappropriate use without medical supervision.

$These findings underscore the growing interest in integrating dietary supplements into respiratory healthcare while highlighting the importance of evidence-based practice. The study emphasizes the need to strengthen awareness programs and professional training for healthcare providers, as well as to encourage further clinical and experimental research to better understand the mechanisms of action, efficacy, and safety of dietary supplements used in respiratory health**.**

Keywords: Respiratory diseases; dietary supplements; medicinal plants; thyme (*Thymus vulgaris*); healthcare professionals; Touggourt.

Résumé

Cette étude vise à mettre en lumière le rôle des compléments alimentaires, notamment à base de plantes, dans le maintien d'une bonne santé respiratoire et le soulagement de certaines maladies respiratoires telles que la bronchite, la bronchopneumopathie chronique obstructive (BPCO) et la COVID-19.

Cette étude a été menée dans le Land de Touggourt (Algérie) à l'aide d'un questionnaire dont 50 % étaient destinés aux médecins (y compris les médecins généralistes et les spécialistes des maladies respiratoires et pulmonaires) et 50 % aux pharmaciens, dans le but de recueillir des données relatives à leurs connaissances, leurs attitudes et leurs pratiques en matière d'utilisation des compléments alimentaires dans le domaine du soutien de la santé respiratoire et de la prévention des maladies associées..

Les résultats ont montré une tendance positive à l'utilisation des compléments alimentaires et des plantes médicinales comme thérapies complémentaires, le thym étant l'une des plantes les plus fréquemment utilisées en raison de ses propriétés anti-inflammatoires et antioxydantes. Par ailleurs, les participants ont démontré une conscience des risques potentiels liés aux interactions médicamenteuses, soulignant la nécessité d'une utilisation judicieuse de ces produits sous la supervision de spécialistes.

Cette étude constitue une étape importante vers une meilleure compréhension des compléments alimentaires, ce qui requiert une sensibilisation accrue et une formation professionnelle renforcée, ainsi qu'un soutien aux études cliniques et de laboratoire afin de comprendre leurs mécanismes d'action et d'assurer leur efficacité et leur innocuité.

Mots clés : Maladies respiratoires, thym, compléments alimentaires, plantes médicinales, Touggourt

الملخص

تهدف هذه الدراسة إلى إبراز دور المكملات الغذائية، لا سيما المكملات ذات الأصل النباتي، في دعم صحة الجهاز التنفسي والمساهمة في التخفيف من بعض الأمراض التنفسية، مثل التهاب القصبات الهوائية، والانسداد الرئوي المزمن*(COPD)* ، وكوفيد-19.

أُجريت هذه الدراسة بولاية تقرت (الجزائر) بالاعتماد على استبيان وُجِّه *50%* منه إلى الأطباء (منهم العام والمختص في الأمراض التنفسية والصدرية) و*50%* إلى الصيادلة بهدف جمع البيانات المتعلقة بمعارفهم ومواقفهم وممارساتهم تجاه استخدام المكملات الغذائية في مجال دعم الصحة التنفسية والوقاية من الأمراض المرتبطة بها.

أظهرت النتائج وجود توجه إيجابي نحو استخدام المكملات الغذائية والأعشاب الطبية كعلاج تكميلي، حيث اعتُبر الزعتر من أكثر النباتات استخدامًا بفضل خصائصه المضادة للالتهاب والأكسدة، إضافة إلى دوره المحتمل في تحسين وظائف الجهاز التنفسي. كما أبدى المشاركون مستوى جيدًا من الوعي بالمخاطر المحتملة المرتبطة بالتداخلات الدوائية بين المكملات الغذائية والأدوية التقليدية، مما يؤكد أهمية الاستخدام الرشيد لهذه المنتجات تحت إشراف المختصين.

وتُعد هذه الدراسة مساهمةً في تعزيز الفهم العلمي لدور المكملات الغذائية في مجال الصحة التنفسية، كما تؤكد الحاجة إلى تكثيف برامج التوعية والتكوين المستمر لفائدة المهنيين الصحيين، إلى جانب تشجيع الدراسات السريرية والمخبرية الهادفة إلى توضيح آليات عمل هذه المنتجات وتقييم فعاليتها وسلامتها.

الكلمات المفتاحية: أمراض الجهاز التنفسي، المكملات الغذائية، النباتات الطبية، الزعتر، الانسداد الرئوي المزمن، كوفيد-19، تقرت.

Introduction

Introduction

The respiratory system is one of the most vital systems of the human body, ensuring the exchange of oxygen and carbon dioxide between the organism and the external environment. This physiological process is essential for cellular respiration and energy production, thereby maintaining the normal functioning of all organs and tissues. Beyond gas exchange, the respiratory system also contributes to regulating blood pH, protecting the body against airborne pathogens, and participating in various metabolic and immune processes.

In recent decades, respiratory diseases have emerged as a major public health challenge worldwide. Conditions such as asthma, bronchitis, chronic obstructive pulmonary disease (COPD), and respiratory infections affect millions of individuals and significantly reduce their quality of life. The recent COVID-19 pandemic further highlighted the vulnerability of the respiratory system and emphasized the need for effective preventive and supportive healthcare strategies (Pouptsis et al., 2025; Salehi et al., 2024).

Conventional pharmacological treatments remain the cornerstone of respiratory disease management. Bronchodilators, corticosteroids, mucolytics, and antibiotics are widely prescribed to alleviate symptoms and improve respiratory function. However, despite their therapeutic benefits, these medications may be associated with adverse effects that can limit patient compliance and long-term use. Bronchodilators, for example, may induce tremors, palpitations, nervousness, and muscle cramps due to their stimulatory effects on the sympathetic nervous system (Sriprasart et al., 2023).

Consequently, healthcare professionals have shown an increased interest in complementary approaches that may enhance respiratory health while minimizing undesirable side effects

Among these approaches, dietary supplements have gained considerable popularity in recent years. Dietary supplements encompass a wide range of products, including vitamins, minerals, probiotics, and plant-derived preparations. Herbal supplements, in particular, are increasingly used because of their richness in bioactive compounds possessing antioxidant, anti-inflammatory, antimicrobial, and immunomodulatory properties. These characteristics suggest that they may contribute to strengthening the body's natural defenses and supporting respiratory function, especially in individuals suffering from chronic respiratory disorders (Mulijono et al., 2024).

Despite their widespread use and perceived safety, dietary supplements are not entirely free from risks. Many consumers use these products without professional guidance, often assuming that natural products are inherently harmless. However, inappropriate use may result in adverse

reactions, excessive intake of certain compounds, or interactions with prescribed medications. Such interactions can alter the effectiveness of medical treatments.

In this context, understanding the attitudes, practices, and knowledge of physicians and pharmacists regarding dietary supplements becomes increasingly important. Assessing the extent of their use, as well as the level of awareness regarding their benefits and risks, could provide valuable insights for public health authorities. This information can contribute to developing educational strategies aimed at promoting the safe and effective use of dietary supplements in respiratory health management.

Accordingly, this study aims to investigate physicians' and pharmacists' attitudes toward and knowledge of dietary supplements, assess their perceived role in supporting respiratory health and alleviating its diseases, and evaluate the level of awareness regarding potential drug-supplement interactions. Furthermore, this study seeks to highlight the importance of informed decision-making when using these products as complementary therapeutic tools.

This dissertation is divided into two main parts. The first part consists of a bibliographic review presented in two chapters. The first chapter provides an overview of the respiratory system, including its structure, functions, and major diseases, whereas the second chapter focuses on dietary supplements, their classification, composition, therapeutic potential, and associated risks. The second part is dedicated to the practical study and comprises two chapters. The third chapter describes the materials and methods used in conducting the survey, while the fourth chapter presents, analyzes, and discusses the results obtained in light of the available scientific literature.

Chapter one: Generalities of the respiratory system

I. Generalities of the respiratory system

I.1 . The concept of respiration

The term respiration refers to the sum of processes that lead to gas exchange between the atmosphere and the body's cells. These processes include:

- The entry and exit of air from the lungs, also known as ventilation.
- Gas exchange between the blood and the air in the lungs
- Transport of gases via the blood to the body's cells (Makhlouf, 2004)

I.2 . The respiratory system

It is a group of organs responsible for gas exchange, specifically the intake of oxygen and the release of carbon dioxide. The human respiratory system includes the nose, pharynx, larynx, trachea, bronchi, and lungs. Each of these organs has a specific function in the breathing process. The importance of the respiratory system lies in its ability to provide the sufficient amount of oxygen needed by all cells. This condition is known as hypoxia, and it will affect all body cells, particularly brain cells, leading to their death. (Makhlouf, 2004)

I.3 . Functions of the Respiratory System

The respiratory system performs both respiratory and non-respiratory functions, including:

- Adapting the air to a suitable temperature for the body in hot and cold weather(Hussein Bahi, 2002)
- Filtering inhaled air of impurities using the hairs and mucous membranes of the nose.
- Retaining microbes using epithelial cells and mucous membranes of the nose and trachea.
- Eliminating foreign substances and impurities through sneezing and coughing, which are respiratory reflexes(Hussein Bahi, 2002)
- Delivering oxygen from the external environment to the lungs during inhalation and expelling carbon dioxide during exhalation.
- Producing sounds through the larynx(Hussein Bahi, 2002)
- Regulating body temperature(Hussein Bahi, 2002)
- Dissolving some small blood clots (Hussein Bahi, 2002)
- Producing certain hormones and saponins, which contribute to lung expansion (Hussein Bahi, 2002)

I .4. Physiology and Anatomy of the Respiratory System

The respiratory system, functionally, can be separated in two zones; conducting zones (nose to bronchioles) form a path for conduction of the inhaled gases and respiratory zone (alveolar duct to alveoli) where the gas exchange takes place. Anatomically, respiratory tract is divided into upper (organ outside thorax - nose, pharynx and larynx) and lower respiratory tract (organ within thorax - trachea, bronchi, bronchioles, alveolar duct and alveoli).

I .4.1. Upper respiratory tract

- **NOSE**

Nose and nasal cavity are divided into two halves by the nasal septum. The lateral wall of the nose consists of three turbinates or conchae (superior, middle and inferior). The passage inferior to inferior turbinate is preferred passage for nasotracheal Intubation(Ahmed-Nusrath A, Tong JL, Smith JE. 2008.)

- **The mouth (oral cavity)**

Is the second entry point for oxygen-rich air. It is located in the upper part of the face, between the nasal cavity and the suprahyoid region. It is oval-shaped with long anterior and posterior axes.

Its lateral diameter is 50 to 65 mm, and its anterior and posterior diameter is 70 to 75 mm.

The mouth includes the following structures: the cheeks, lips, vestibule, hard palate, soft palate, uvula, salivary glands, and teeth (Benazzouz S, 2023)

- **The pharynx**

is a tube-like passage that connects the posterior nasal and oral cavities to the larynx and oesophagus. It is divided into nasopharynx, oropharynx and laryngopharynx. Increase in soft tissue within bony enclosure of pharynx or decrease in bony enclosure size would result in anatomical imbalance and cause limitation of space available for airway (Watanabe T, 2002).

There are three narrowest portions of pharynx; passage posterior to the soft palate (retro palatal space), passage posterior to the tongue (retroglossal space) and passage posterior to epiglottis (retroepiglotic space). (Chou HC, Wu TL 2001)

- **Larynx**

The larynx is an airway composed of a complex cartilaginous skeleton to which muscles and ligaments are attached. The laryngeal mucosa is formed by two types of lining: 14. A ciliated columnar epithelium, which at birth is present throughout the larynx except for the vocal cord, and a non-keratinizing squamous epithelium, which initially covers the superior surface and free edge of the vocal cord(*Babin E*, 2005)

I .4.2. The lower airways

- **The trachea**

Extends from the larynx to the level of the fifth thoracic vertebra, where it divides into the right and left main bronchi. It passes through the mediastinum anterior to the esophagus. It is composed of 16 to 20 cartilaginous rings, smooth muscle, and fibrocartilaginous tissue. The trachea is lined internally with a mucous membrane containing cilia (which propel dust upwards) and mucus glands that play a role in filtering out foreign bodies and impurities. *(Benlahouès D.* 2013)

- **The bronchi and bronchioles**

The main bronchi are fibrocartilaginous tubes lined with muscle and an epithelium that secretes bronchial mucus. The two main bronchi branch off from the trachea at the carina.

The left bronchus is almost horizontal, while the right is an extension of the trachea. These two bronchi supply the lungs with air. Each main bronchus divides within the lung parenchyma into lobar bronchi, then into segmental bronchi. The lobar bronchi ventilate the lung lobes, and the segmental bronchi each ventilate a lung segment. As the bronchi subdivide (Figure 4) and their diameter decrease, they contain less and less cartilage, ciliated cells, and mucus-secreting cells. (Oussada D, 2022)

Upon reaching the lungs, there are:

- ❖ Five lobar bronchi (3 bronchi for the 3 lung lobes of the right lung and 2 bronchi for the 2 lobes of the left lung);
- ❖ Segmental bronchi, which originate from the division of the lobar bronchi;
- ❖ Terminal bronchioles which end in tiny air-filled sacs: the pulmonary alveoli. Furthermore, the main role of the bronchial tree is to carry air from the trachea to the pulmonary alveoli during inspiration and to expel air from the pulmonary alveoli back into the trachea during expiration, thanks to their mucous membrane covered with cilia which expel all inhaled particles to the outside, such as dust, bacteria, etc…(Mimouni A, 2021)

- **The lungs**

Two organs with spongy, elastic tissue. They are pink in children and gradually turn gray as a person ages. The base of the lung rests on the diaphragm, which is convex towards the lungs and tapered towards the abdominal cavity. The right lung consists of three lobes and is slightly larger than the left lung, which consists of two lobes. Each lung is surrounded by a double-walled membrane. The inner wall lines the lung, while the outer wall lines the chest wall. This membrane is known as the pleura. Between the two walls of the pleura is a fluid that reduces friction between the lung walls and the chest walls. (Al-Aqqad Al-Aref, 2014, p. 46)

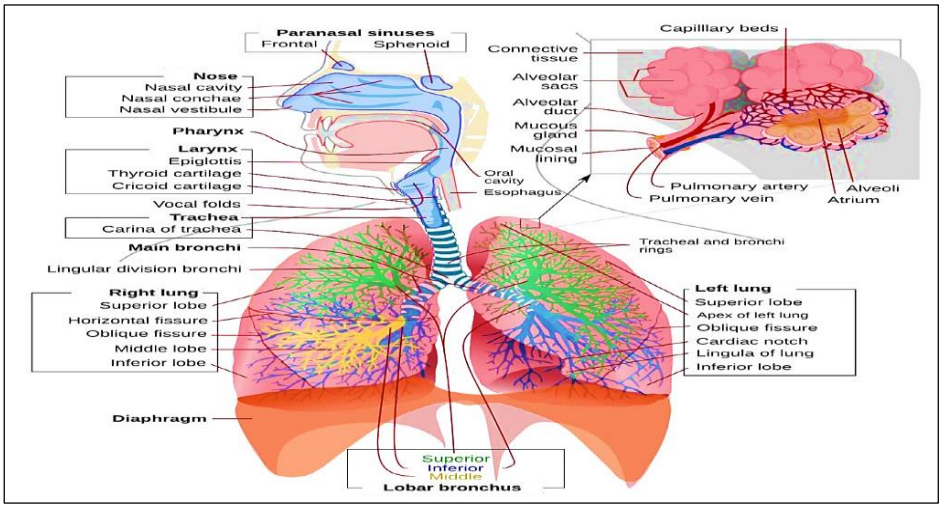


Figure (01): The human respiratory system(Nata et Launico, 2026)

I .5. The Mechanism of Respiration

The breathing process occurs as follows:

- The diaphragm muscle contracts, decreasing its curvature and widening the thoracic cavity vertically.
- The levator ribs contract, straightening the oblique ribs and pushing the sternum forward, thus widening the thoracic cavity from front to back and from side to side.
- As a result of the previous two steps, the volume of the thoracic cavity increases, and the lungs expand to fill the expanded thoracic cavity. This leads to an increase in the volume of air inside the lungs, reducing its pressure relative to the external air pressure. Air then rushes into the lungs through the nose and fills the alveoli, thus completing the process of inhalation.
- The diaphragm muscle relaxes, rising and returning to its original position. The ribs also fall downwards, and the sternum moves backwards, returning the thoracic cavity to its normal size.
- Thus, the lungs return to their original size, the volume of air within them decreases, and its pressure increases relative to the air outside. Air is then forced out of the alveoli, completing the process of respiration.(Al-Aqqad Al-Aref, 2014,.)

I .6. Respiratory Diseases

Respiratory diseases are conditions affecting the airways, including the nasal passages, bronchi, and lungs. Respiratory diseases encompass acute respiratory infections as well as chronic respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), and lung cancer. The burden of respiratory conditions is exacerbated by multiple determinants

Other important factors include:

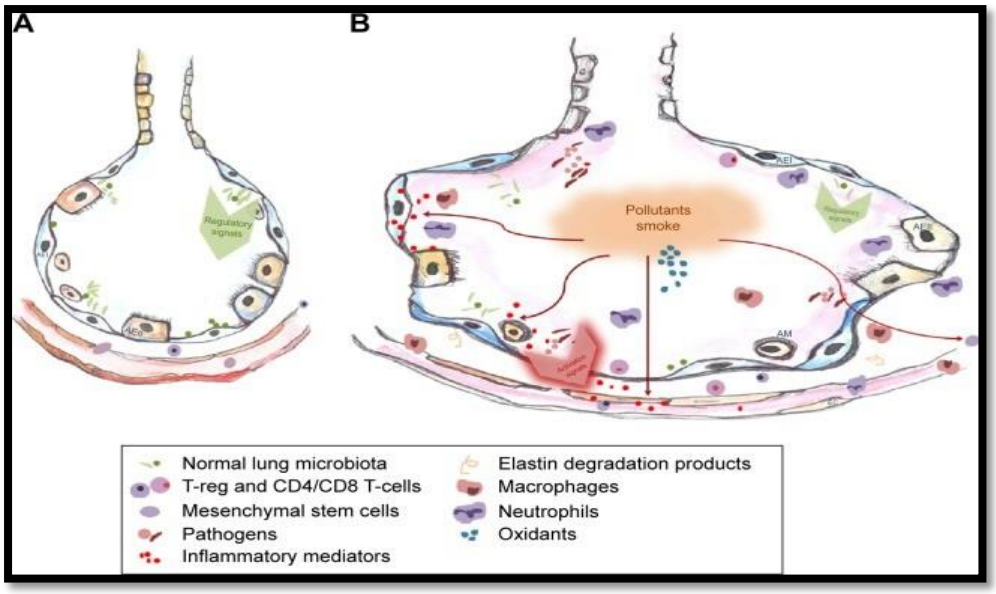
- High exposure to air pollution from both indoor and outdoor sources.
- Occupational health conditions, malnutrition, low birth weight, and multiple early lung infections(Hider O,2022)

❖ **The most common respiratory conditions**

I .6.1. Chronic Obstructive Pulmonary Disease (COPD)

- **<u>The Concept of Chronic Obstructive Pulmonary Disease</u>**

Chronic obstructive pulmonary disease is a disability affecting the lungs and involving irreversible lung damage. Therefore, the lungs cannot return to their previous capacity. COPD was formerly known by other names such as chronic obstructive airway disease or chronic obstructive lung disease, but these names are now obsolete and no longer used. (Daniel Lee, 2013)



Figure(02) : Mechanisms underlying COPD development(Hosseinzadeh et al., 2015)

- **<u>Causes of Chronic Obstructive Pulmonary Disease (COPD)</u>**

❖ Smoking

Smoking is a major cause of COPD. It is known to be the direct cause in more than 90% of COPD cases.

Tobacco smoke contains approximately 4,000 substances, 250 of which are classified as toxic, while 60 are known to cause various cancers, including cancers of the bladder, cervix, kidneys, larynx, lips, lungs, mouth, esophagus, pancreas, stomach, and throat. Tobacco smoke damages the lungs and causes inflammation and irritation of the airways. The tar in tobacco smoke damages and destroys the cilia, or tiny hairs, lining the airways.

❖ Chest Infections

COPD can also affect people who have previously suffered from chest infections, such as children. Chest infections can impair lung development. Furthermore, exposure to toxic agents like tobacco smoke increases the risk of developing COPD.

❖ Bronchiectasis and chronic asthma

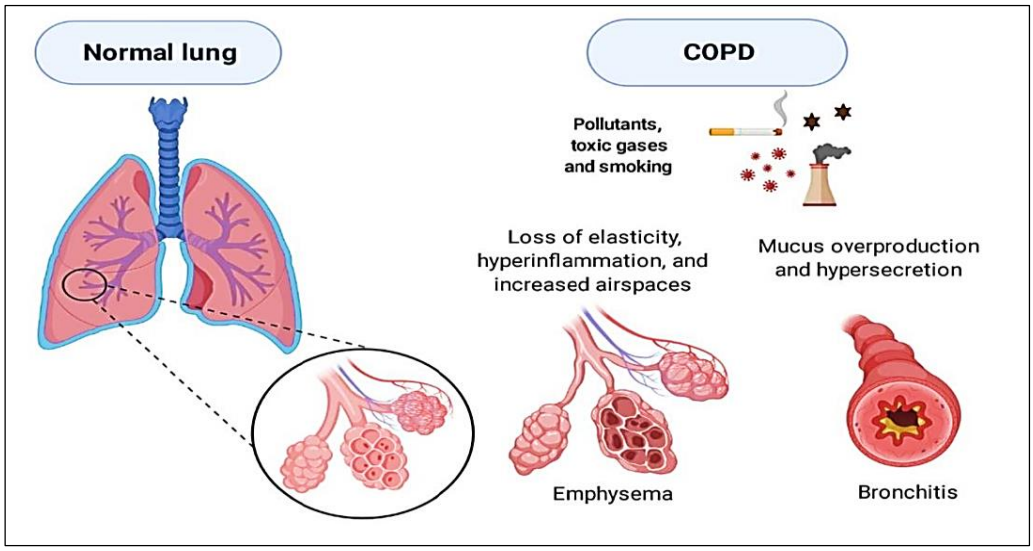
-Inhaling foreign objects like peanuts can clog the bronchial tubes.

- A weakened immune system that struggles to fight infections.

- Indigestion and acid reflux, where stomach acid enters the lungs.

- Dysfunctioning cilia, leading to ineffective expectoration.

- A genetic condition called cystic fibrosis, where thick, sticky mucus clogs the bronchial tubes, leading to persistent inflammation and recurrent chest infections(Daniel Lee, 2013)



Figure(03): Pathogens associated with chronic obstructive pulmonary disease (COPD)(Rodrigues et al., 2021)

- **Symptoms of COPD**

- Many people with COPD become accustomed to it without realizing they have it, especially in its early stages.

- You may find yourself getting tired easily when gardening or out of breath when walking uphill.

- People with COPD also cough up phlegm, especially in the morning.

-You may find that you constantly need to cough up phlegm (Daniel Lee, 2013,.)

-You may also find it difficult to clear phlegm from your lungs at times (Daniel Lee, 2013,.)

- The phlegm is usually clear. A change in color to green or brown, or an increase in its consistency, indicates an infection. Chest infections are common among people with COPD, especially in winter. In all cases, infections should be detected early and treated medically (Daniel Lee, 2013,.)

- **Diagnosis of Chronic Obstructive Pulmonary Disease (COPD)**

  - Pulmonary Function Testing: A complete lung function test measures the following:

1- The volume of air in the lungs during a full inhalation, known as total lung capacity (TLC).
2- The volume of air remaining in the lungs after a full exhalation, known as residual volume (RV)
3- How efficiently the lungs transfer oxygen from the air to the bloodstream, known as the carbon monoxide transport factor (TLCO) and the carbon monoxide transport coefficient (KCO).

❖ Chest X-ray:

A chest X-ray can also be helpful. It is usually performed in the hospital's radiology department. Practically speaking, there are no risks involved because the amount of radiation from a chest X-ray is very small, about 0.25% of the normal annual radiation we receive from exposure to cosmic rays and radioactive minerals in the earth. In chronic obstructive pulmonary disease (COPD), the lungs expand more than normal, and the resulting air-trapping pulmonary emphysema can be easily seen on a chest X-ray. Patients with COPD should also have a chest X-ray if they have a chest infection to check for pneumonia, a serious lung infection.

❖ Laboratory Tests:

- You may be asked to provide a sputum sample. Your doctor or pulmonologist will give you a container to collect samples, which can then be taken to your general practitioner's office or the hospital. This is done to determine if there is an infection in your lungs. A positive sputum culture will indicate an infection, and you will then need to take a course of antibiotics to treat it. If the result is negative, then you need to do this, as it means the infection is viral, not bacterial. Antibiotics only work against bacterial infections and are ineffective against viruses.

- Computed Tomography (CT) Scan: This scan is needed when more detailed examination is required. It is a painless scan that only requires you to lie on a couch that slides back and forth across a circle where the images are taken. CT scans can also be used to conduct a more thorough investigation if any abnormalities are detected in a chest X-ray. They can also be used to investigate suspected lung cancer. A CT scan should only be performed at the request of a pulmonologist to ensure that the number of scans is kept to a minimum, as the radiation dose is 80 times greater than that of a standard X-ray. (Daniel Lee, 2013)

- <u>COPD Treatment</u>

✓ If you are able to breathe without difficulty while performing your usual activities, continue your normal activities, exercise as directed by your doctor, and take your medications as prescribed.

✓ If you experience shortness of breath, wheezing, or coughing more than usual, use your nebulizer or inhaler as directed by your doctor, and practice pursing and relaxation techniques.

✓ If you have unexplained weight gain or loss along with swelling in your feet or ankles, increase your oxygen dosage only as directed by your doctor. Check your oxygen concentrator to ensure it is working properly. If you have a pulse oximeter, check your oxygen saturation. Increase your oxygen dosage only as directed by your doctor. Start taking corticosteroids only as directed by your doctor, and contact your doctor if you do not improve within 1-2 hours.

✓ If you experience frequent breathing problems, have increasing difficulty breathing at rest, or a sudden need to sleep with more pillows or in a chair, contact your doctor immediately. Call an ambulance if you cannot speak to a doctor or nurse right away, or go to the nearest emergency room. (Daniel Lee, 2013)

I .6.2. Bronchitis

- **The Concept of Bronchitis**

Bronchiitis can be defined as an inflammation of the lining of the bronchial tubes, which carry air to and from the lungs. Bronchitis is often characterized by the expulsion of thick mucus when coughing. In fact, bronchitis can be divided into acute and chronic. Acute bronchitis is usually caused by a cold or other respiratory infection and usually improves within a week to 10 days without any lasting effects, although the cough may persist for weeks. Chronic bronchitis, on the other hand, is a more serious condition that is usually caused by smoking and is characterized by persistent irritation or inflammation of the lining of the bronchial tubes. It is worth noting that chronic bronchitis is one of the medical conditions included in chronic obstructive pulmonary disease (COPD). (Raghib Al-Basra, 2010)

- **Factors that increase the risk of bronchitis**

A number of factors increase the risk of developing bronchitis, including:

- Smoking: Smokers, or those who live with smokers, are more prone to acute and chronic bronchitis(Raghib Al-Basra, 2010)
- Acid reflux: Frequent and severe heartburn can irritate the throat, making a person more susceptible to bronchitis (Raghib Al-Basra, 2010)
- Exposure to irritants at work: Exposure to lung irritants such as grains, textiles, or chemical fumes increases the risk of bronchitis(Raghib Al-Basra, 2010)
- Weakened immunity: Bronchitis may occur as a result of other illnesses, such as the common cold, or certain chronic conditions that weaken the patient's immune system. (Raghib Al-Basra, 2010)

- **Symptoms of bronchitis**

Symptoms of bronchitis include: A shallow, intermittent cough that produces clear, yellowish-gray, or green mucus (phlegm).-Headache.-Fatigue.-Sore throat.-Runny or blocked nose.-Slight fever.-Children.-Shortness of breath.-Body aches. (Raghib Al-Basra, 2010)

- **Treatment of Bronchitis**

- In fact, acute bronchitis often resolves without treatment. However, there is no complete cure for chronic bronchitis. It's worth noting that the symptoms of bronchitis can be managed using the following treatments:
- Antibiotics: Antibiotics are used in cases of bacterial infection but are not used for viral infections.
- Oxygen Therapy: This helps improve oxygen inhalation in cases of difficulty breathing.
- Bronchodilator: These help to clear mucus and open the airways.
- Cough medicines.

- Expectorants: These medications thin mucus, making it easier to cough up(Raghib Al-Basra, 2010)

I .6.3. COVID-19

- **The Concept of COVID-19**

Coronaviruses are a large family of viruses that can cause illness in animals and humans. Several coronaviruses are known to cause respiratory infections in humans, ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The newly discovered coronavirus causes the infectious disease COVID-19.

COVID-19 is an infectious disease caused by the newly discovered coronavirus. This virus and the disease it causes were unknown before the outbreak in Wuhan, China, in December 2019. (Al-Azhari, 2020.)

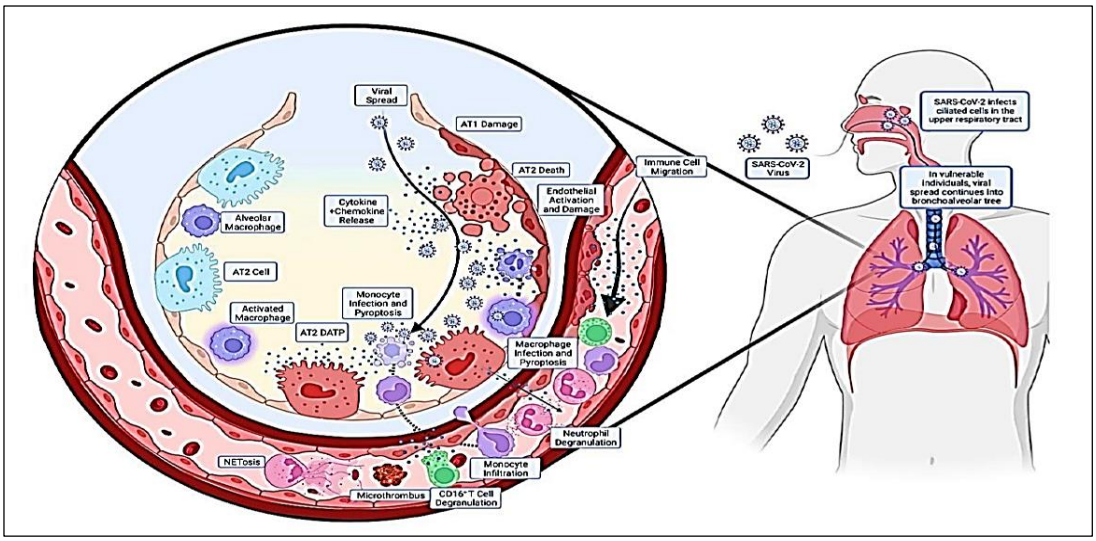
- **Symptoms of COVID-19**

The most common symptoms of COVID-19 are fever, fatigue, and a dry cough. Some patients may experience aches and pains, nasal congestion, a runny nose, a sore throat, or diarrhea. These symptoms are usually mild and begin gradually. Some people become infected but do not develop any symptoms and do not feel unwell. Most people (about 80%) recover from the disease without needing special treatment. Approximately one in six people who contract COVID-19 become seriously ill and experience difficulty breathing. Older people and those with underlying medical conditions such as high blood pressure, heart disease, or diabetes are more likely to develop serious illness. About 2% of people who have contracted the disease have died. People with fever, cough, and difficulty breathing should seek medical attention. (Al-Azhari, 2020)

- **How COVID-19 Spreads**

People can become infected with COVID-19 from other people who have the virus. The disease can spread from person to person through small droplets expelled from the nose or mouth when someone with COVID-19 coughs or sneezes. These droplets land on objects and surfaces around the infected person. Other people can then become infected by touching these objects or surfaces and then touching their eyes, nose, or mouth. People can also become infected by breathing in droplets expelled when an infected person coughs or exhales. Therefore, it is very important to stay more than 1 meter (3 feet) away from a sick person (WHO, 2020)

The WHO is evaluating ongoing research on the ways COVID-19 spreads and will continue to share the latest findings (WHO, 2020)



Figure(04): Pathophysiological Mechanisms of SARS-CoV-2-Induced Lung Injury and ARDS(Yu et al., 2024)

- **How COVID-19 is transmitted through the air**

Studies to date indicate that the virus that causes COVID-19 is primarily transmitted through contact with respiratory droplets, not through the air. (World Health Organization, 2020)

- **DIAGNOSIS AND IMAGING**

❖ **Molecular tests (RT-PCR)**

Samples are collected from the upper respiratory tract via nasopharyngeal and oropharyngeal swabs and from the lower respiratory tract via expectorated sputum and bronchoalveolar lavage (only for mechanically ventilated patients). After being stored at 4°C, the samples are sent to the laboratory where amplification of the viral genetic material is done through a reverse-transcription process.6 This involves the synthesis of a double-stranded DNA molecule from the existing viral RNA by either reversetranscription PCR (RT-PCR) or a real-time RT-PCR. Finally, the conserved portions of the SARS-CoV-2 genetic code are identified on the amplified genetic material.

The test is recommended to be repeated for verification in cases of a positive test and again to confirm viral clearance in COVID- 19 positive cases. The sensitivity of these tests is not very high, that is, approximately 53.3% of COVID-19-confirmed patients had positive oropharyngeal swabs, and about 71% of patients came out to be RT-PCR positive with sputum samples. The RT-PCR results usually show positivity after 2–8 days

❖ **Serology**

Till date, no effective antibody test has been developed. A centers for disease control and prevention (CDC) research on a test developed by the US Vaccine Research Centre at the National Institutes of Health is ongoing, which seems to have a specificity higher than 99% with a sensitivity of 96%.

❖ **Blood tests**

- A normal or decreased white blood cell count (and lymphopenia) can be observed in many cases, which is also considered to be indicative of a worse prognosis.
- Increased levels of lactate dehydrogenase, C reactive protein, creatine kinase (CK MB and CK MM), aspartate aminotransferase and alanine amino-transferase can be seen.
- Increased D-dimer levels and an elevated neutrophil-tolymphocyte ratio are seen in some patients.
- Coagulation abnormalities can be observed in severe cases, as indicated by increase in prothrombin time and international normalised ratio.

❖ **Chest X-ray**

Chest X-ray is usually inconclusive in the early stages of the disease and might not show any significant changes. As the infection progresses, bilateral multifocal alveolar opacities are observed, which may also be associated with pleural effusion

❖ **CT**

High-resolution CT (HRCT) is extremely sensitive and the method of choice for diagnosing COVID-19 pneumonia, even in initial stages of the illness. The most commonly seen features are multifocal bilateral ‘ground-glass’ areas associated with consolidation and a patchy peripheral distribution, with greater involvement of the lower lobes. A ‘reversed halo sign’ is also seen in some patients, which is identified as a focal area ofpatchy opacities surrounded by a peripheral ring with consolidation. Other findings include pleural effusion, cavitation, calcification, and lymphadenopathy.

- **Treatment**

The treatment is symptomatic, and oxygen therapy represents the major treatment intervention for patients with severe infection. Mechanical ventilation may be necessary in cases of respiratory failure refractory to oxygen therapy, whereas hemodynamic support is essential for managing septic shock (Cascella M, Rajnik M, Cuomo A, et al. 2020.)

Chapter Two: Nutritional supplements

II.1. Nutritional supplements

II.1 .1. Definition of nutritional supplements

Nutritional supplements (also known as dietary supplements) are products that are ingested in addition to the regular diet to provide additional health-promoting nutrients(Martens et al., 2021).

According to European Directive 2002/46/EC, food supplements are defined as foodstuffs intended to supplement a normal diet, constituting a concentrated source of nutrients (such as vitamins and minerals), nutritional substances (such as fatty acids, amino acids or fiber), or other bioactive compounds having a physiological effect(FAO, 2006 ; Karleskind et al., 2013)

II.1 .2. Forms of dietary supplements

Nutritional supplements are available in pharmacies and markets in various forms to suit everyone's needs, both in terms of speed of absorption and ease of use.

❖ **Solid forms**

- **Tablets:** These are the traditional form, characterized by their long shelf life and ability to contain large amounts of the active ingredient.
- **Capsules:** These are easy to swallow and dissolve quickly in the stomach, often made of gelatin or plant-based materials.
- **Softgel capsules:** These are specifically designed for oil supplements such as omega-3 or vitamin D

Figure (05): Food supplement in capsule form[3]

Figure (06): Food supplement in tablet form[3]

❖ **Easy-to-chew and swallow forms**

- **Gummy candies:** Recently, these have become very popular due to their delicious taste and are ideal for children or people who have difficulty swallowing tablets.
- **Chewable tablets:** These are partially absorbed in the mouth and have pleasant flavors.
- **Effervescent tablets:** These dissolve in water, ensuring a liquid dose of vitamins and rapid absorption.

Figure (07): food supplement in the form of a gummy candy[3]

❖ **Liquid and powder forms**

- **Powders:** such as protein or collagen supplements, allow you to control the dosage and mix with smoothies or food.
- **Liquids:** often come in bottles or drops, are absorbed faster.

Figure (08): Food supplement in the form of ampoules[3]

Figure (09): Food supplement in the form of sachets[3]

II.1 .3. Types of nutritional supplements

a. Vitamins and minerals

- **Vitamins**

Vitamins are essential organic compounds that our bodies are unable to synthesize or produce in sufficient quantities(Verriere, 2022)

Vitamins are divided into two main types: water-soluble vitamins and fat-soluble vitamins.

❖ **Water-soluble vitamins:** These vitamins are not stored in the body and therefore need to be taken regularly.:

• Vitamin C: found in citrus fruits, strawberries, peppers, and broccoli.

• B vitamins: (B1, B2, B3, B6, B12) are found in liver and red meat, fish and seafood, eggs, legumes, whole grains, vegetables and fruits, nuts and seeds.

❖ **Fat-soluble vitamins:** These vitamins include:

• Vitamin A: Found in carrots, sweet potatoes, and spinach.

• Vitamin D: Found in fatty fish and egg yolks.

• Vitamin E: Found in nuts, seeds, and vegetable oils.

• Vitamin K: Found in dark leafy green vegetables, such as spinach and kale.

- **Minerals**

Minerals are inorganic elements essential for the body's health. They are divided into major minerals (needed in large quantities, such as calcium and magnesium) and trace minerals (needed in minute quantities, such as iron and zinc). They play a vital role in bone formation, energy production, oxygen transport, and nerve function, and are obtained from a balanced diet(Verriere, 2022)

b. Omega-3 fatty acids (type of unsaturated fatty acid)

Are essential fatty acids that the human body cannot produce, and therefore must be obtained from the diet. They are divided into three main types: alpha-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA)

Nutritional sources of PUFA are mainly nuts and fish, particularly small oily fish, like anchovy, sardine, or mackerel. ALA is found in vegetable sources, nuts, and seeds, while EPA and DHA are the main components of fish oil(Miyata & Arita, 2015)

Omega-3 has anti-inflammatory properties

c. Botanical Dietary Supplements

Botanical supplements, sometimes called herbal or plant-based supplements, are products made from plants, plant parts, or extracts(Sup et Scientifique, 2025)

Echinacea, green tea extract, garlic, and evening primrose oil are common examples of herbal supplements used for health purposes.

II.1 .4. Risks of misuse

- **Serious drug interactions**: Some supplements can counteract or amplify the effects of medications. For example, vitamin E or ginseng supplements may increase the risk of bleeding if taken with blood thinners (Cynober, 2022) (Verriere, 2022)
- **Toxicity and organ damage**: Excessive intake of fat-soluble vitamins (such as vitamins A and D) leads to their accumulation in the body instead of being eliminated, causing toxicity that can lead to liver damage(Cynober, 2022)
- **Gastrointestinal disorders**: High doses of certain elements, such as vitamin C and zinc, may cause nausea, cramps, and diarrhea(Cynober, 2022)

- **Nervous system damage**: Continuously taking excessive amounts of vitamin B6 in doses exceeding the recommended limit may lead to neurological disorders(Verriere, 2022)

II.2. Botanical Dietary Supplements

II.2 .1. Definition of Botanical Dietary Supplements

Plant-based dietary supplements are defined as concentrated sources of active phytochemicals designed to enhance physiological functions, where plants are provided in two main forms: traditional forms, which include the plant in its raw state or through classical extraction methods that preserve the "Totum" (the total mixture of components), most notably: powders resulting from drying and crushing plant parts, and extracts (dry and aqueous) aimed at concentrating active ingredients via natural solvents; or as isolated substances that are separated and purified to obtain a specific active compound at a precise concentration. Legally, any preparations with potent pharmacological properties intended exclusively for therapeutic purposes are strictly excluded to ensure a clear distinction from medicinal drugs (Sup & Scientifique, 2025)

Figure (10): Plant-based dietary supplements(Evexia, 2026)

II.2 .2. Sources of plant-based dietary supplements

This category of dietary supplements is characterized by a wide variety of sources, given the vast diversity of the plant cover used to extract their active compounds. Despite this widespread prevalence, Europe has never reached an agreement on a unified "positive list" for herbal dietary supplements. This is primarily attributed to fundamental cultural differences in how various populations perceive plants and their traditional methods of use. (Poznyakovsky et al., 2021)

Table (01): Some of the most commonly used and studied plant-based food supplements(Poznyakovsky et al., 2021)

Botanical	Scientific name	Popular use	Active components
Echinacea	Genus *Echinacea* (nine known species)	Immunostimulant	Chicoric acid, alkylamides
Garlic	*Allium sativum*	Antioxidant; antihypertension	Allicin, adenosine
Ginseng	*Panax ginseng*	Overall health; antistress	Ginsenosides
Green tea extract	*Camellia sinensis*	Antiproliferative; antioxidant	Catechins (ECGC, ECG)
Goldenseal	*Hydrastis canadensis*	Treatment of cold/respiratory infection; alleviate menstrual complications	Hydrastine, berberine

II.2 .3 The The main active substances in plant-based dietary supplements

The active substances found in dietary supplements may include phytochemicals, such as polyphenols (e.g., quercetin) or carotenoids. These compounds are valued for their antioxidant, anti-inflammatory, or metabolic-regulating properties(Lévy et al., 2013)

a. polyphenols

- **Chemical Structure and Classification**

Polyphenols are one of the largest classes of secondary metabolites, biosynthesized through the "shikimate" pathway. They are classified based on the number of aromatic rings and carbon atoms into:

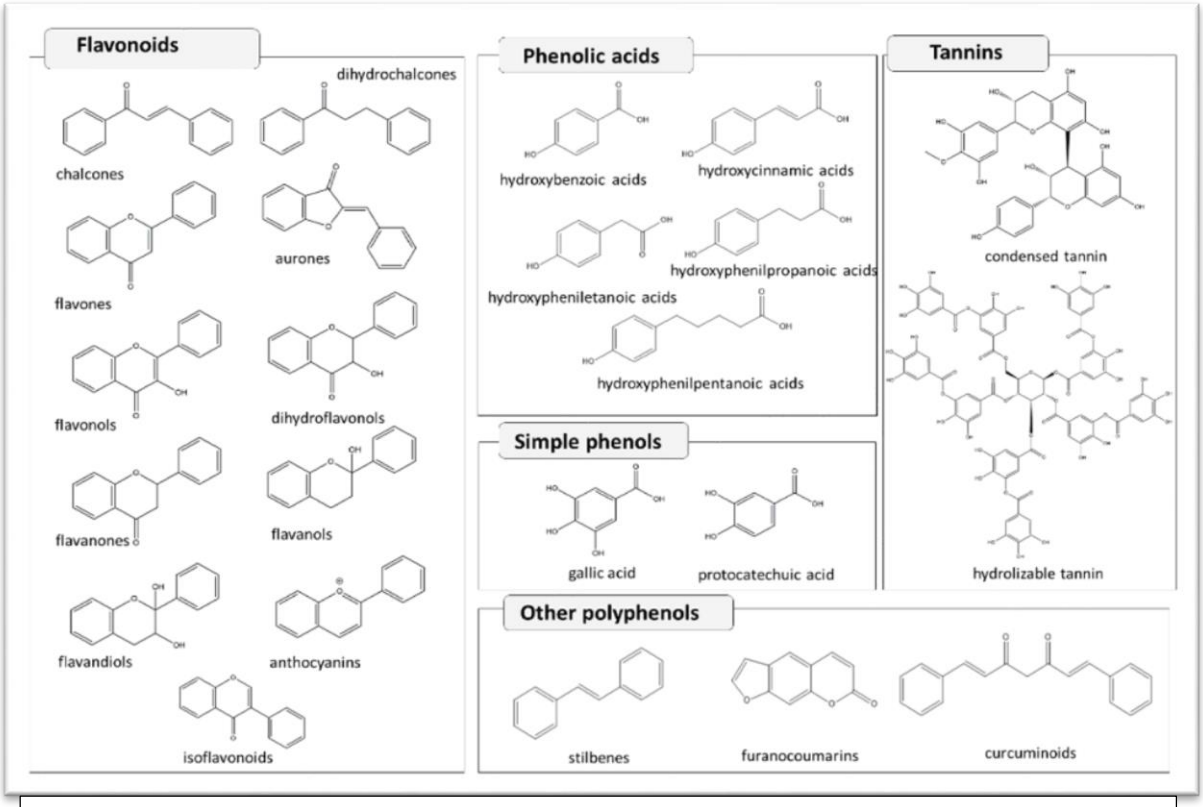


Figure (11): Examples of polyphenols, basic nucleus and classification.(Chiocchio et al., 2021)

- **Phenolic Acids:** Contain a carboxyl group and are divided into:
    - **Benzoic acid derivatives (C6-C1):** such as Gallic acid.
    - **Hydroxycinnamic acid derivatives (C6-C3):** such as Caffeic and Ferulic acids; these play a role in combating depression, diabetes, and high blood pressure.(Zaitone et al., 2019)
- **Flavonoids (C6-C3-C6):** Consist of two benzene rings linked by a three-carbon chain. This group includes flavones and anthocyanins, which act as antioxidant, anti-inflammatory, and anti-cancer agents, and improve microcirculation.(Bravo, 1998; Jang et al., 2020; Pengfei et al., 2009; Rosa et al., 2018; Tavsan & Kayali, 2019)
- **Tannins:** High molecular weight compounds, divided into:
    - **Condensed Tannins:** Stable flavonoid polymers.
    - **Hydrolysable Tannins:** Sugar esters with gallic acid, characterized by antimicrobial and astringent properties

b. Essential Oils

- **Definition of Essential Oils**

Essential oils are **volatile plant substances** that evaporate completely. They are extracted through physical processes, such as **distillation**. Chemically, they are characterized as a complex mixture of **terpenes** and various functional groups (including alcohols and phenols). They are **insoluble in water** but readily soluble in alcohol and fats.

- **Location (Secretory Structures)**

Essential oils are found within plant tissues in specialized "reservoirs" that vary according to the plant part:

- **Leaves and Stems:** (e.g., Mint and Basil).
- **Peels and Fruits:** (e.g., Citrus and Nutmeg).
- **Roots and Bark:** (e.g., Ginger and Cinnamon).
- **Storage Vessels:** They are concentrated within specific secretory cells, glands, or oil canals

II.3.The relationship between dietary supplements and respiratory health

II.3 .1. The role of vitamins and minerals

a. Vitamin D and its role in strengthening immunity

- **VITAMIN D AND DISEASES OF IMMUNITY**

Vitamin D acts as a potent immunomodulator, bridging innate and adaptive immunity, with deficiency strongly linked to increased risks of autoimmunity, such as multiple sclerosis (MS), rheumatoid arthritis (RA), and inflammatory bowel disease (IBD). It strengthens immune responses against infections while inhibiting pro-inflammatory cytokines that drive autoimmune disease progression. (Villamor E. 2006)

- **Key Connections Between Vitamin D and Immune Disease**

- **Immune Regulation:** Vitamin D receptors (VDR) are present in most immune cells (T and B cells, monocytes), allowing active vitamin D (1,25 $(OH)2D$) to modulate immune responses.
- Prevention and Severity Reduction: Studies indicate that maintaining adequate levels can reduce the risk of acute respiratory infections.
- **Autoimmune Diseases:** Deficiency is associated with increased incidence and severity of MS, RA, T1D, IBD, systemic lupus erythematosus (SLE), and psoriasis.
- **Infection Protection:** Vitamin D increases the phagocytic capacity of macrophages and induces antimicrobial peptides (like cathelicidin) to fight infections.
- **Anti-inflammatory Action:** Vitamin D helps inhibit the production of pro-inflammatory cytokines, reducing chronic inflammation.

- **Deficiency Effects:** Low vitamin D levels are linked to higher rates of relapse in autoimmune disease and reduced energy
- Respiratory Protection: It reinforces the integrity of respiratory epithelial cells and increases type I interferon signaling, which inhibits viral replication.
- **Optimal Levels:** Maintaining serum 25 $(OH)D$ levels of at least 30−60 ng/mL is recommended to support immune health, often requiring supplementation
- *Disclaimer: High doses of vitamin D to treat autoimmune diseases should only be taken under medical supervisio* (Yamshchikov AV, et al. 2009)

b. <u>The role of vitamin C in reducing Inflammatory</u>

Vitamin C (ascorbic acid) is a powerful antioxidant that reduces inflammation by neutralizing free radicals, downregulating pro-inflammatory markers, and modulating critical immune signaling pathways.

- Core Mechanisms of Action Vitamin C exerts its anti-inflammatory effects through several biological processes:

✓ **Neutralization of Free Radicals:** As an electron donor, it scavenges reactive oxygen species (ROS) and reactive nitrogen species (RNS), preventing oxidative damage to cells and tissues that typically triggers the inflammatory cascade.

✓ Gene and Pathway Modulation:

- **Inhibition of NF-κB**: It dampens the activation of Nuclear Factor-kappa B (NF-κB), a primary transcription factor responsible for the expression of pro-inflammatory genes.
- **Activation of Nrf2:** It promotes the Nrf2 pathway, which stimulates the body's internal antioxidant defense system to further protect against inflammatory stress.

✓ **Reduction of Pro-inflammatory Cytokines**: Vitamin C supplementation has been shown to decrease circulating levels of key inflammatory markers, including:

- C-reactive protein (CRP).
- Interleukin-6 (IL-6) and Tumor Necrosis Factor-alpha (TNF-α).
- Erythrocyte Sedimentation Rate (ESR). (Peluso I, Villano D, Roberts S, et al. 2014)

- Therapeutic Roles in Specific Conditions:

- **Metabolic and Chronic Diseases**: In obese patients with hypertension or diabetes, daily supplementation (e.g., 500 mg twice daily) significantly reduced hs-CRP and IL-6 levels over eight weeks.
- **Postoperative Recovery**: High-dose parenteral vitamin C (up to 15 g) has been used after surgeries like total knee replacement to manage acute-phase inflammation, reduce pain, and decrease the need for opioid analgesics.
- **Autoimmune Disorders:** It may act as an adjunct therapy in conditions like Rheumatoid Arthritis (RA) and Systemic Lupus Erythematosus (SLE) by reducing oxidative burden and modulating cytokine environments.
- **Intense Exercise:** Vitamin C can attenuate the inflammatory response and oxidative stress induced by exhaustive physical activity, such as ultramarathon running.

- Important Considerations:

- **Synergy with Other Nutrients**: Vitamin C works with other antioxidants, such as Vitamin E, to regenerate their active forms and create a more robust defense against lipid peroxidation.

- **Dosing Limits**: The body has a saturation point for vitamin C; excessive doses may not provide additional benefits and can cause gastrointestinal issues or kidney stones in some individuals.
- **Pro-oxidant Risk**: In the presence of free transition metals (like iron or copper), high doses of vitamin C can occasionally exhibit pro-oxidant effects, potentially exacerbating oxidative stress (Jouybar, R. 2012)

- Vitamin C and Infection

- **Immune System Support:** Vitamin C enhances the function of phagocytes (white blood cells that ingest harmful bacteria) and supports the maturation of T-lymphocytes.
- **Respiratory Infections & Pneumonia:** Regular supplementation may reduce the severity and duration of the common cold. Studies have found potential preventative and therapeutic benefits for pneumonia.
- **Sepsis Treatment:** High-dose IV Vitamin C has been used to treat severe infections like sepsis and COVID-19, with studies suggesting it may reduce ICU stay duration and mortality in some cases.
- **Antioxidant Role:** It neutralizes reactive oxygen species (free radicals) generated during infection-induced inflammation.
- **Deficiency Effects:** Lack of Vitamin C leads to weakened immunity and increased susceptibility to infections (De Gruttola,, T. 1997)

c. Zinc and its role in fighting infection

zinc is an essential trace mineral that acts as a gatekeeper of immune function, crucial for developing and activating immune cells like neutrophils, T-cells, and macrophages. It fights infection by enhancing antiviral response, inhibiting viral replication, and strengthening immune defenses against bacteria, reducing the duration and severity of colds, respiratory infections, and diarrhea.(Krężel A, 2016)

- **Key Immune Functions:** Zinc helps white blood cells fight infection and regulates the inflammatory response. It stimulates the production of T-cells and enhances the ability of neutrophils to kill microbes.

- **Fighting Viruses:** Zinc can inhibit viral RNA polymerase and reverse transcriptase in viruses like HIV and HCV, and it reduces the replication of SARS-CoV-2 (COVID-19) and rhinoviruses.

- **Infection Reduction:** Supplementation is effective in decreasing the duration and severity of diarrhea and lower respiratory tract infections (pneumonia).

- **Deficiency Effects:** Low zinc levels can cause immune system imbalances, increasing susceptibility to pathogens, especially in older adults or those with malnutrition.

- **Sources and Dosage:** Zinc is found in meat, seafood, dairy products, and nuts. Adults generally need 8–11 mg per day, but supplementation (e.g., zinc gluconate, sulfate) can be used to manage acute infections (Yamasaki S, 2007)

- **Zinc and Viral Infection**

Mechanisms: Zinc interferes with viral RNA polymerase, inhibits viral polyprotein cleavage, and can stabilize cell membranes to prevent virus entry.

- **Immune System Support:** Zinc supports both innate and adaptive immunity, enhancing the activity of antiviral proteins like interferon-alpha. (Hoppe-Seyler K, 2018)
- **Cold and Flu Treatment:** Sublingual zinc (75 mg to 100 mg daily) can reduce cold duration by approximately two days.
- **Respiratory Infections:** Evidence suggests zinc can reduce symptom severity and duration in acute respiratory infections and pneumonia.
- **Deficiency Risks:** Zinc deficiency is linked to higher vulnerability to infection, including increased morbidity for COVID-19.
- **Safety and Dosage:** High doses of zinc can cause gastrointestinal discomfort, nausea, and mouth irritation(Bozym RA, 2006)

II.3 .2. The Effect of Omega-3 on Inflammatory

Omega-3 fatty acids, particularly docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), are the main natural components of fish oil and are widely regarded as nutrients with anti-inflammatory properties. These acids have demonstrated potential protective effects against several inflammatory diseases, including asthma and allergies. Although the precise mechanisms underlying these effects are not yet fully understood, they are receiving increasing research attention due to their promising therapeutic potential(Miyata & Arita, 2015)

Numerous epidemiological studies have examined the impact of fish consumption or omega-3 fatty acid supplementation during different life stages, such as pregnancy, lactation, childhood, and adulthood, on the development of asthma and allergies. The results of most of these studies suggest a protective role for these acids, supporting the hypothesis of a causal link between low fish oil consumption in modern diets and the rising rates of asthma and other allergic diseases(Miyata & Arita, 2015)

Omega-3 fatty acids, particularly EPA and DHA, are used to produce a range of specialized, healing-promoting lipid mediators, such as resulfins, protectins, and marsinoids, through a series of enzymatic reactions. These compounds play a crucial role in reducing eosinophilic inflammation in the airways and promoting the body's own inflammatory response and healing processes(Miyata & Arita, 2015)

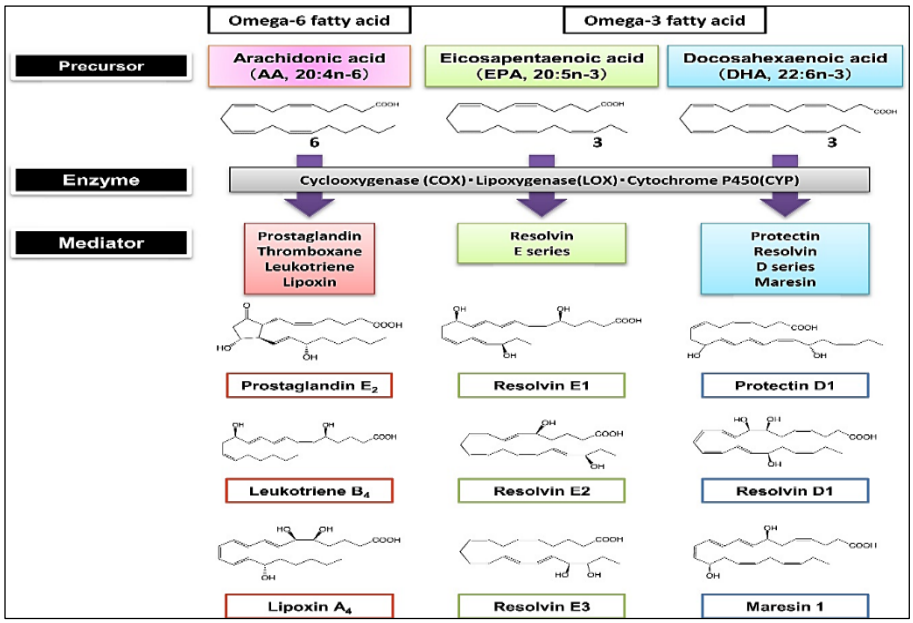


Figure (12): Metabolic pathways of omega-6 and omega-3 fatty acids and the formation of bio-mediators that regulate the inflammatory response(Miyata & Arita, 2015)

Studies show that omega-3 fatty acids have anti-inflammatory effects and contribute to reducing inflammation levels in the body through two mechanisms:

- **Reducing the Production of Inflammatory Substances**

Omega-3 fatty acids affect the production of chemicals that cause inflammation, such as prostaglandins and leukotrienes. Omega-3s reduce the production of these substances, which helps to reduce inflammation.

- **Boosting the Production of Anti-Inflammatory Substances**

Omega-3 fatty acids boost the production of anti-inflammatory substances, such as prostaglandin E3 and leukotriene B5. These substances help to reduce the inflammatory response and improve tissue health.

II.3 .3 .The effect of herbal supplements on respiratory health

a. Plants with anti-inflammatory effects and Bronchoconsction

❖ **Turmeric**

- **Presentation of Turmeric**

Turmeric is a rhizomatous herbaceous perennial plant (Curcuma longa) belonging to the ginger family (Priyadarsini, 2014)The medicinal properties of turmeric—the primary source of curcumin—have been known for thousands of years; however, the ability to determine the exact mechanisms of action and identify the bioactive components has only recently been investigated (Gupta et al., 2013)

Curcumin (1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione), also known as "diferuloylmethane," is the primary natural polyphenol found in the rhizomes of the turmeric plant (Curcuma longa) and other species of the Curcuma genus (Bharti, 2003)

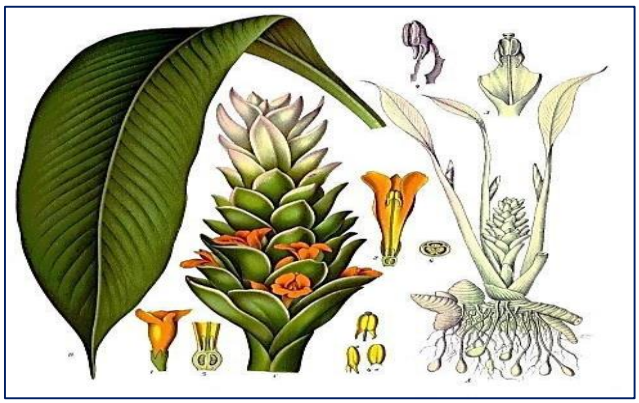


Figure (13) : Different parts of *Curcuma longa* L(Esatbeyoglu et al., 2012)

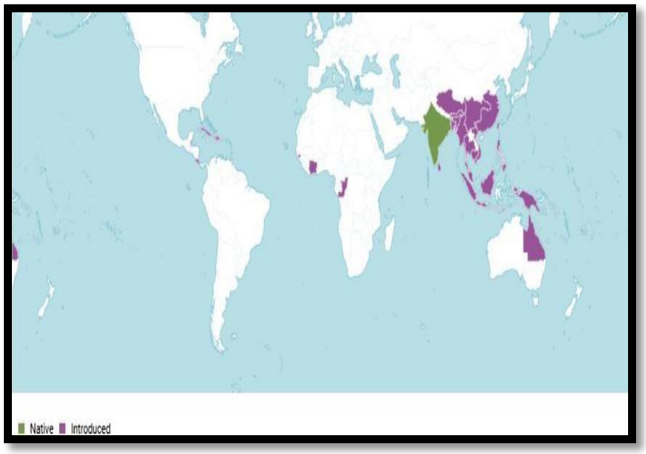


Figure (14): Global distribution of turmeric plants (Esatbeyoglu et al., 2012)

- **Botanical classification of turmeric**

Table (02) : Botanical classification of turmeric (Jansen et al., 2005)

Nom français	*Curcuma*
Autre nom utilisé	Safran cooli, safran des Indes
Règne	Plantae
Sous embranchement	Magnoliophyta
Classe	Liliopsida
Ordre	Zingiberales
Famille	Zingiberaceae
Genre	Curcuma
Espèces	Curcuma longa

- **Chemical Composition**

The analysis of *Curcuma longa* reveals a fascinating biochemical complexity, where the interaction between volatile and non-volatile fractions determines the plant's therapeutic profile. Here is a synthesis of the characteristics of these two major fractions derived from the rhizome(Robin et al., 2017)

- **The Non-Volatile Fraction: Curcuminoids**

This fraction represents the therapeutic and color signature of turmeric. It is dominated by a group of polyphenols called curcuminoids (approximately 3 to 5% of the dry matter). **(Pinson, 2012)**.

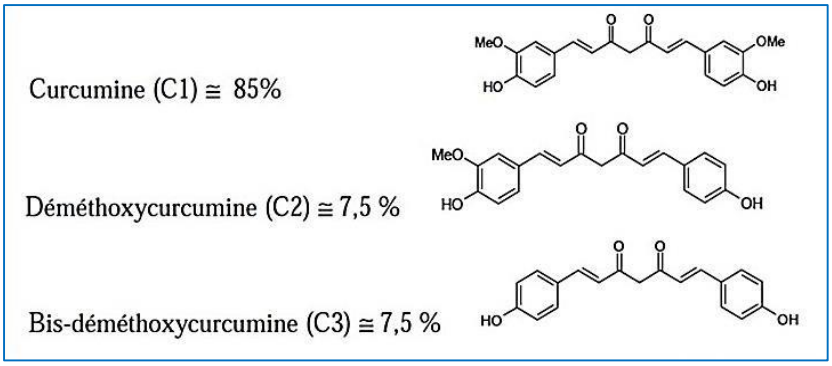
- **Curcumin (Curcumin I):** This is the major and most extensively studied compound. It is responsible for the bright yellow color and the majority of the anti-inflammatory and antioxidant properties.
- **Desmethoxycurcumin (Curcumin II) and Bisdesmethoxycurcumin (Curcumin III):** These structural analogs complete the plant's *totum* and work in synergy with curcumin.(Portes & Fernández-Kelly, 2008)
- **Other Constituents:** This fraction also includes carbohydrates (starch), proteins, and lipids, which form the matrix of the rhizome.(Vaquier, 2010)

- **The Volatile Fraction: Essential Oils**

Typically extracted via hydrodistillation, this fraction contains the aromatic compounds that provide turmeric with its characteristic odor.(Vaquier, 2010; Williams & Garnero, 1996)

Key Components: It is primarily composed of terpenes, including turmerones (alpha and beta-turmerone), curcumene, and zingiberene.

- **Properties:** Beyond their aroma, these molecules possess antimicrobial and antifungal effects. Recent research also suggests that turmerones may promote the regeneration of nerve cells.
- **Synergistic Role**: The volatile fraction can act in synergy with curcuminoids, sometimes facilitating their absorption.



Figure(15): Chemical structure of the main curcuminoids (Portes, 2008)

- **Mechanism of action**

- **Targeting Inflammatory Molecules and Proteins**

✓ **Inhibition of Inflammatory Proteins:** Curcumin works by preventing the activation of central proteins in the innate inflammatory response, such as NF-\kappa B and AP-1

✓ **Suppression of Cytokines:** It reduces the production of pro-inflammatory cytokines in both human and animal studies (Mollazadeh et al., 2019; Wang et al., 2025; Xi et al., 2025)

- ✓ **Modulation of Signaling Pathways:** It inhibits inflammation by modulating the PPAR gamma NF-kappa B signaling pathway; PPARs receptors play a role in regulating anti-inflammatory gene expression(Beigoli et al., 2025; Belvisi & Mitchell, 2009; Zhang et al., 2025)
- ✓ **Activation of the Wnt-beta-catenin Pathway**: It activates this pathway in dendritic cells and the lungs, which alleviates asthma symptoms and reduces the associated inflammatory response(Yang et al., 2017)

- **Improving the Functional Environment of the Lungs**

✓ **Enhancing Anti-inflammatory Factors**: It increases the production and enhances the effectiveness of Interleukin, an anti-inflammatory cytokine produced by both adaptive and innate immune cells (Eshaghi Ghalibaf et al., 2024; S. Wu & Xiao, 2016)

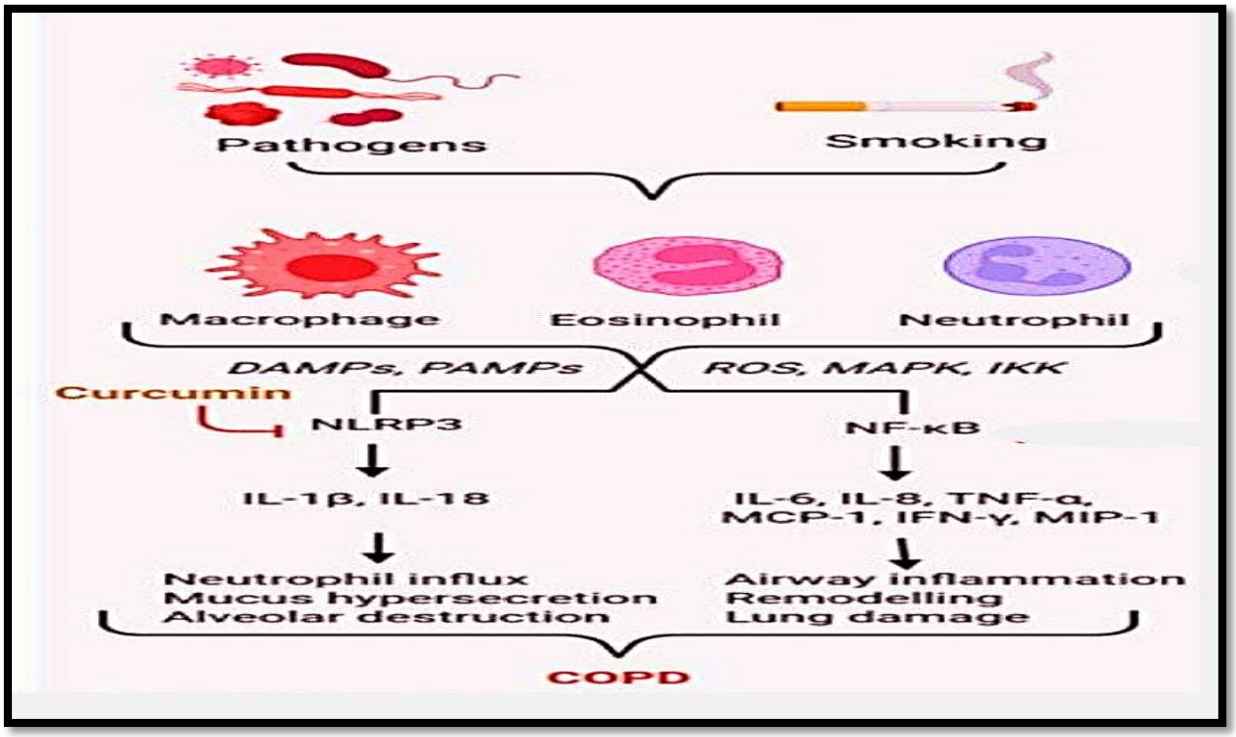


Figure (16): Cellular Inflammatory Mechanism of Chronic Obstructive Pulmonary Disease (COPD) and the Inhibitory Role of Curcumin(Mdkhana, 2023)

❖ **Ginger (*Zingiber officinale Roscoe*)**

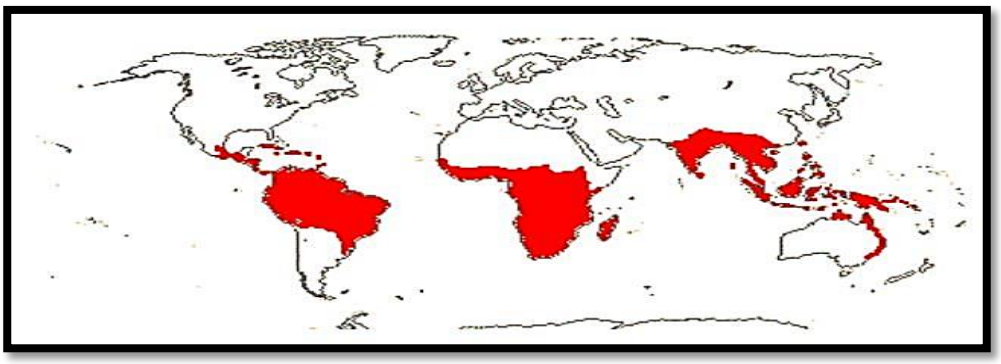
- **Presentation of Ginger**

Ginger (*Zingiber officinale Roscoe*)

Ginger is one of the most popular spices in the world. It belongs to the same botanical family as cardamom and turmeric (**Zingiberaceae**) (Bode et al., 2011; Iijima et al., 2003) Within this family, there are approximately **100 species** that are now rarely encountered in their wild state.

Regarding the ginger plant (*Zingiber officinale*) itself, it is a **perennial herbaceous plant** widely distributed throughout the tropical and subtropical regions of Asia, Africa, and the

Americas. The genus ***Alpinia*** is the most abundant within this family, comprising more than **300 species** (Saha et al., 2020)



Figure(17): Global distribution of the Zingiberaceae family (Butin, 2015)

- **Botanical classification of ginger**

Table (03): Botanical classification of ginger (Butin, 2015; Gigon, 2012)

French name	Gingembre commun
Scientific name	*Zingiber officinale (Roscoe)*
Kingdom	Plantae
Subkingdom	Trachéobionta
Phylum	Angiospermes (ou Magnoliophyta)
Sub -Phylum	Liliopsida (ou Monocotylédones)
Class	Zingibéridées
Sub -class	Zingibérales (ou Scitaminales)
Ordre	Zingibéracées
Family	Zingibéroïdées
Genus	*Zingiber*
Species	*Zingiber officinale Roscoe*

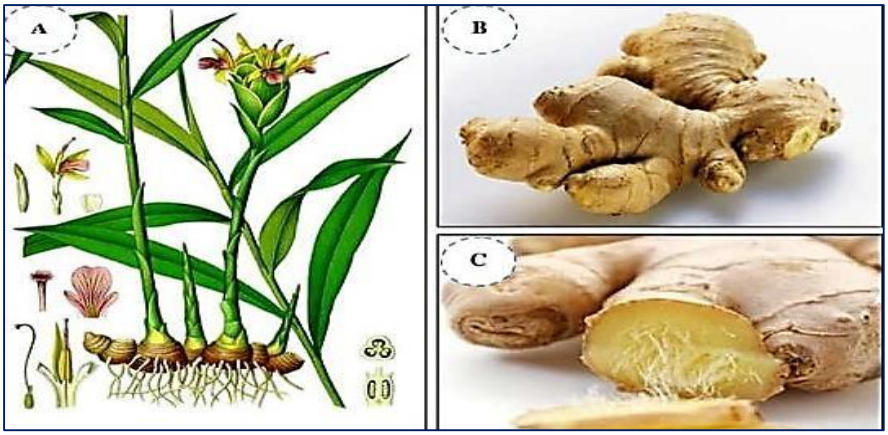


Figure (18): Zingiber officinale Roscoe. A: The whole plant; B and C: The rhizome (Pinson, 2012).

- **Chemical Composition of Ginger**

- **Basic Components and Nutrients**

The ginger rhizome is primarily composed of **starch (60%)**. It also contains proteins, fats (10%), essential oil, and a resin (Bruneton, 1999)Furthermore, it is a rich source of minerals such as iron, calcium, magnesium, manganese, sodium, and phosphorus. Regarding vitamins, ginger contains those of the **B family**, as well as **vitamin C**, which disappears once the ginger is dried **(Eymard, 2016)**.

- **Extracts and Oils**

Two primary substances are extracted from the ginger rhizome:

- ✓ **Oleoresin (6%):** It contains the chemical compounds responsible for the pungent flavor, such as **gingerol (15%)** (PR & Prakash, 2010)
- ✓ **Essential Oil (1-3%):** Its composition varies greatly according to geographical origin, containing odorous compounds such as (Zingiberene, Citral, Linalool). These extracts are intended for food flavoring, while only the essential oil is used in perfumery **(Katzer, 2008)**.

- **Biochemistry and Active Principle**

- ✓ **Gingerol (C_17 H_26 O_4):** This is the main active principle and a phenolic compound of the vanilloid family. It is responsible for the pungent taste in **fresh ginger**.
- ✓ **Shogaol:** Its concentration increases in **dried ginger** due to the conversion of gingerol. Shogaol, along with paradol and zingerone, is responsible for the sensation of heat (pseudo-heat) during consumption (Jolad et al., 2005)(Katzer, 2008).

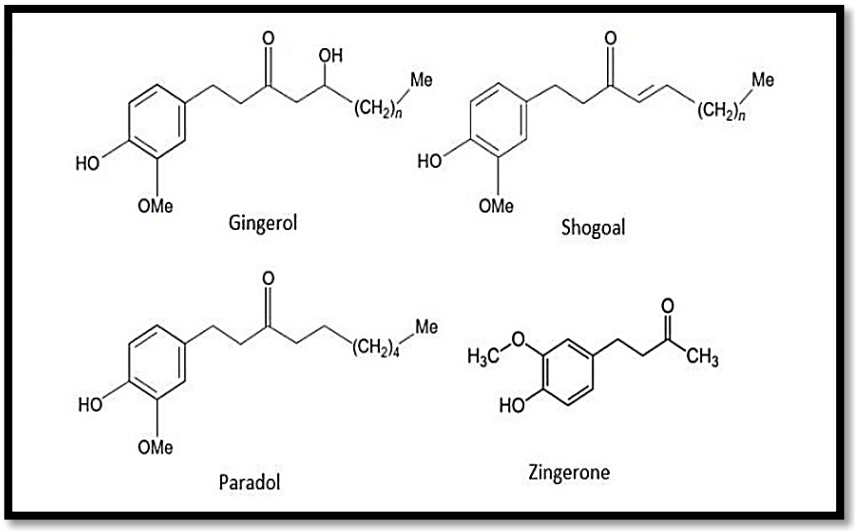


Figure (19): Structures of the main active constituents of ginger (Saida and Benhammadi, 2023)

- **Mechanism of action**

The academic mechanism of action for ginger constituents (**6-gingerol, 8-gingerol, and 6-shogaol**) in enhancing Airway Smooth Muscle (**ASM**) relaxation is summarized through two integrated biological pathways:

- **Inhibition of Phosphodiesterase 4D (PDE4D)**

The study, utilizing **fluorescence polarization** logic, demonstrated that ginger compounds act as inhibitors of the **PDE4D** enzyme.

- ✓ **Physiological Role of the Enzyme:** This enzyme normally breaks down cyclic adenosine monophosphate (**cAMP**), the chemical messenger responsible for signaling muscle relaxation and suppressing inflammation.
- ✓ **Effect of Ginger:** By inhibiting PDE4D, ginger compounds prevent the degradation of cAMP, leading to its intracellular accumulation. This accumulation synergistically amplifies the efficacy of **beta-agonists** and prolongs their relaxant effect on the airways.

- **Structural Modification of Contractile Proteins (Depolymerization of F-actin)**

The study examined the effect of **6-shogaol** on the cellular cytoskeletal structure responsible for the biomechanics of contraction.

- ✓ **F-actin Filaments:** These filaments constitute the structural scaffold required for smooth muscle contraction; they interact with myosin to generate the force that causes bronchoconstriction.
- ✓ **Biological Impact:** It was found that 6-shogaol effectively and rapidly induces the **depolymerization** (dissolution) of these filaments. Disruption of this protein scaffold causes the muscle to lose its mechanical ability to maintain a contracted state, resulting in direct airway relaxation.(Ahmed Abdelmawgood et al., 2024)

b. Immunomodulatory Plants

❖ Garlic

- **Presentation of Garlic**

Garlic (Allium sativum): A perennial plant of the amaryllis family (Amaryllidaceae), grown for its flavorful bulbs. It is native to Central Asia but grows wild in Italy and southern France, and is a classic ingredient in many global cuisines. The bulbs have a powerful onion-like aroma and a pungent taste, and they are not typically eaten raw.(PIATE & HARRISON, 2023)

- **Chemical Composition of Garlic**

The therapeutic and functional properties of garlic are attributed to a complex mixture of organosulfur compounds and micronutrients, which can be academically classified as follows:

- **Organosulfur Compounds**:
  - ✓ **Alliin (S-allyl-cysteine sulfoxide):** The primary non-volatile precursor and the most predominant flavor compound (Horníčková et al., 2010)
  - ✓ **Allicin:** A transient compound formed via the enzymatic thiosulfinate synthesis from alliin by the enzyme alliinase upon cell-wall disruption (Bloem et al., 2010)
  - ✓ **S-allyl-cysteine (SAC**): A stable, water-soluble bioactive compound found in garlic extracts, known for its high bioavailability (الله et al., 2023)
- **Secondary Metabolites and Phytonutrients:**

Phenolic Compounds and Flavonoids and Saponins and Sapogenins

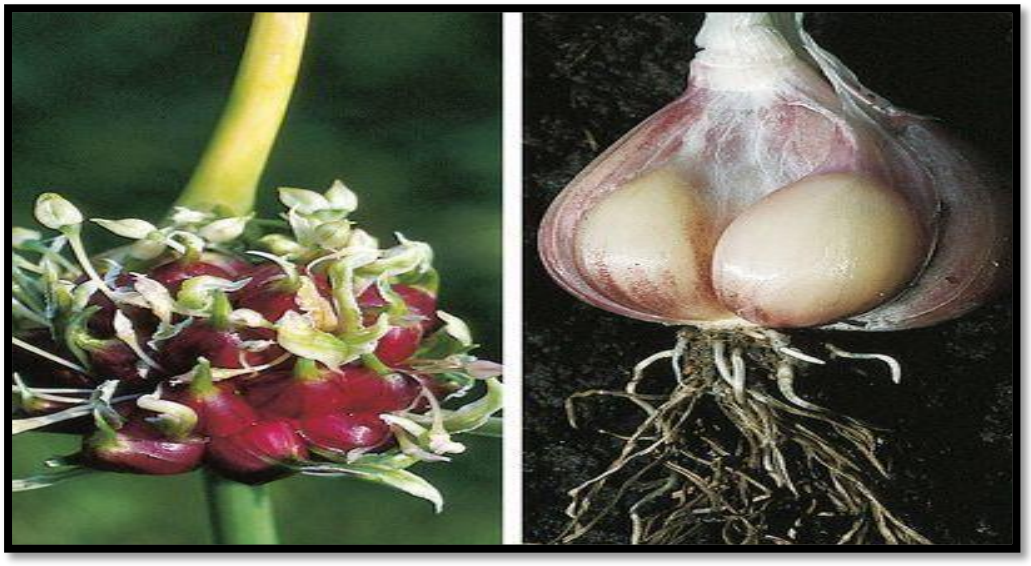


Figure (20) *: Allium sativum L.* (Takagi, 2020)

- **Botanical classification of Garlic**

Table (04): Botanical classification of Garlic (HADRI et al., 2023)

Kingdom	***Plantae***
Subkingdom	*Tracheobionta*
Phylum	*Spermatophytes*
Sub -Phylum	*Angiospermes*
Class	*Liliopsida*
Sub -class	*Liliidae*
Ordre	*Liliales (Asparagales)*
Family	*Alliaceae*
Genus	*Allium*
Species	*sativum L*

- **Mechanism of Aged Garlic Extract (AGE) on Immune Cells**

Aged Garlic Extract (**AGE**) acts as a bioactive stimulator that alters the behavior and readiness of key immune cells, specifically **NK cells** and **gamma\delta-T cells**, through the following mechanisms:

✓ **Enhancement of Proliferation**

AGE increases the ability of these cells to proliferate (multiply) more rapidly. In scientific research, improved *ex vivo* cell proliferation is considered a direct indicator that these cells possess a greater potential to fight pathogens within the body (*in vivo*) when an infection occurs. Both NK cells and gamma delta-T cells showed greater proliferation in culture after AGE supplementation (Bukowski & Percival, 2008; Percival et al., 2008)

✓ **"Priming" Mechanism**

Bioactive compounds in garlic, such as **SAC**, lectins, and fructooligosaccharides (Chandrashekar et al., 2011; Chandrashekar & Venkatesh, 2009), interact with Pattern Recognition Receptors (**PRR**) located on the surface of immune cells (Rowe et al., 2007)This interaction "trains" the cells and puts them on high alert, ensuring that their response is faster and stronger as

soon as an actual virus enters the body (Bukowski et al., 1999; Holderness et al., 2007; Kamath et al., 2003)

✓ **Developing the Defensive Arsenal (NKG2D)**

Garlic increases the expression of the **NKG2D** protein on the surface of Natural Killer (NK) cells. This protein is responsible for activating the cell, enabling it to efficiently kill virus-infected host cells. NKG2D plays an important role in the NK cell's cytotoxicity arsenal (Ishikawa et al., 2006)

- **Clinical Correlation: Balance Between Efficiency and Inflammation**

- **The Traditional Role of Cytokines**

Cytokines such as (**IFN-gamma**) are essential for stimulating cells to kill viruses; however, when levels are excessively high, they are primarily responsible for the severity of fatigue and distressing physical symptoms like fever and aches (Keech & Beardsworth, 2008; Turner, 1997)

- **The "Smart" Response**

Garlic users demonstrated a "smart" immune response where pre-primed cells eliminated viruses with high efficiency, leading to significantly lower inflammatory cytokine secretion (IFN-gamma) relative to baseline (D. Wu et al., 1994)This resulted in reduced illness severity, fewer symptom-days, and less loss of productivity (Josling, 2001)

c. Antioxidant Plants

❖ **Green tea**

- **Presentation of Green tea**

Green tea is derived from the leaves of the ***Camellia sinensis*** (L.) Kuntze plant, a **venerable** beverage with documented use dating back to approximately 3000 BC in ancient China (Ali Abaker Omer et al., 2025)Ancient Chinese medical texts initially recorded its health-promoting properties before it evolved into a widespread global commodity currently cultivated in over 30 countries China, India, Sri Lanka, Japan, Taiwan, and Kenya stand out as the primary producing nations for this plant, which is now consumed by over 3 billion people worldwide (Ali Abaker Omer et al., 2025; Chen & Lin, 2015)

- **Chemical Composition of Green tea**

Tea leaves contain a complex matrix of bioactive substances (BAS), including alkaloids, polysaccharides, vitamins, and minerals (Prasanth et al., 2019; Xing et al., 2019)However, the primary health efficacy of the plant is attributed to polyphenolic compounds, specifically the **catechins** found in high concentrations (Bag et al., 2022; Tang et al., 2019)This category comprises four major compounds: (**EGCG**), (**ECG**), (**EGC**), and (**EC**). Among these, **epigallocatechin-3-gallate (EGCG)** is the predominant constituent and is considered the principal agent responsible for most of the biological properties attributed to green tea leaves(Rojano-Ortega, 2021; Truong & Jeong, 2021; Yan et al., 2020)

Figure(21) : Green Tea flower(Shrivastava et al., 2018)

- **Botanical classification of Green tea**

Table (05): Botanical classification of Green tea(Rai et al., 2012)

Kingdom	**Plantae–Plants**
Subkingdom	Tracheobionta – Vascular plants
Super division	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Subclass	Dilleniide
Family	Theaceae – Tea family
Genus	Camellia L. – Camellia
Species	*Camellia sinensis* (L.) Kuntze – Tea

- **Antioxidant Mechanisms of Tea Catechins**

Catechins, specifically Epigallocatechin gallate (EGCG), are the primary drivers of the antioxidant activity in tea. Their biological potency is fundamentally determined by their molecular structure, particularly the number and positioning of hydroxyl groups (Rojano-Ortega, 2021; Truong & Jeong, 2021; Yan et al., 2020)

- **Functional Mechanisms**
  - ✓ **Direct Antioxidant Action**

The EGCG compound acts as a direct chemical line of defense through**:**

- **Metal Chelation:** It chelates free transition metals, such as iron and copper, which are known to amplify the formation of Reactive Oxygen Species (ROS) (Ferrali et al., 1997; Frei & Higdon, 2003)
- **Radical Scavenging:** It possesses a superior ability to donate hydrogen atoms or electrons to free radicals to convert them into stable molecules
- **Structural Superiority:** The presence of **ortho-dihydroxyl groups** on the B and D rings and a **galloyl moiety** at the 3rd position increases EGCG's capacity to scavenge free radicals (specifically superoxide anions and hydroxyl radicals) compared to other catechins (Higdon & Frei, 2003; Nanjo et al., 1999)
  - ✓ **Inhibition of Pro-oxidant Enzymes**

EGCG does not merely neutralize harmful molecules; it also inhibits the enzymes responsible for their production, such as:

- **Inhibition of NADPH Oxidase (NOX):** This enzyme is a major source of **ROS** in various cells, including lung and vascular endothelial cells (Buvelot et al., 2019; Sahoo et al., 2016)The text indicates that suppressing NOX (particularly NOX2 and NOX4) protects against diseases such as **pulmonary fibrosis** and **pulmonary arterial hypertension** (Carnesecchi et al., 2011; Sahoo et al., 2016)

❖ **Thymus**

- **Presentation of Thymus :**

Thymus vulgaris L. (thyme) and Thymbra spicata var. spicata (zahter) are aromatic herbs and members of the Lamiaceae family. These perennial shrubs are found in many parts of the world, especially in the Mediterranean region(Golmakani & Rezaei, 2008). Different varieties of Lamiaceae family plants have been found in various parts of Turkey(Sokmen et al., 2004; Uysal et al., 2015). Both thyme and zahter have a significant use in folk medicine, as local people prepare herbal teas from these herbs to relieve headaches, toothaches, colds, asthma, and rheumatism (Kizil et al., 2015; Lee et al., 2005)

Figure (22) : *Thymus vulgaris L*(Tousson et al., 2011)

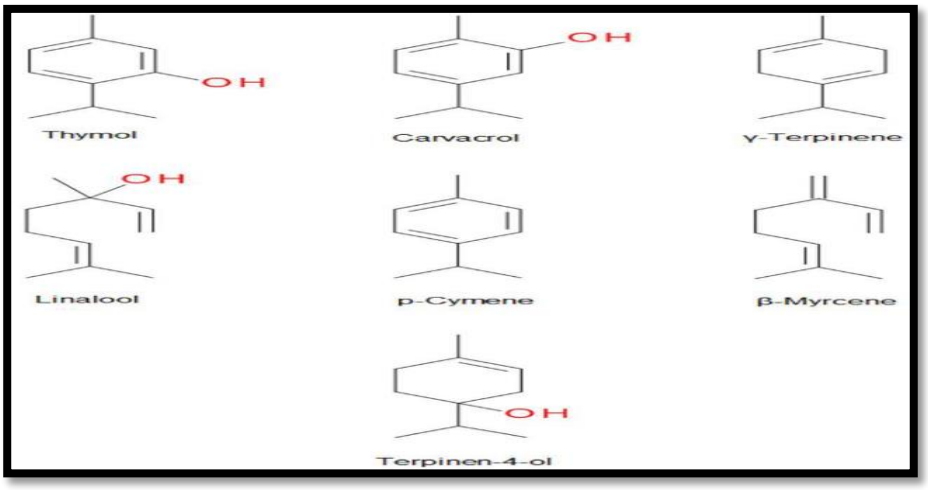
- **Botanical classification of *Thymus vulgaris L***

Table (06): Botanical classification of *Thymus vulgaris L*(Dauqan & Abdullah, 2017)

Kingdom	**Plantae**
Subkingdom	*Tracheobionta*
Phylum	*Magnoliophyta*
Sub -Phylum	*Magnoliophytina*
Class	*Magnoliopsida*
Sub -class	*Asteridae*
Ordre	*Lamiales*
Family	*Lamiaceae*
Genus	*Thymus*
Species	*vulgaris*

- **Chemical composition of thymus**

Chemical composition of thyme (*Thymus* spp.) is directly influenced by the climate and geographical location of the plant's habitat .(Dauqan & Abdullah, 2017)This influence leads to a phenomenon known as "chemical polymorphism" (*polymorphisme chimique*) within the common thyme species (*T. vulgaris*), which is responsible for the emergence of multiple chemotypes (*chémotypes*) that vary according to the primary constituent of the essential oil. In laboratory analysis, these chemical components are classified into two main categories: phenolic compounds, such as thymol and carvacrol, and non-phenolic compounds, such as geraniol. In parallel with these essential oils, thyme is rich in extracts highly concentrated with phenolic antioxidants and flavonoids (such as zeaxanthin, lutein, apigenin, naringenin, luteolin, and thymonin), supported by a dense profile of essential mineral elements (K, Fe, Ca, Mn, Mg and Se). Within this matrix, thymol plays the most pivotal and fundamental role in activating the potent antioxidant capacity of the plant (Hammoudi Halat et al., 2022).



Figure(23) : Chemical structures of the major compounds of thyme essential oil(Hosseinzadeh et al., 2015)

- **Antioxidant Mechanisms of thymus**

The capacity of thyme infusion to restore the activity of antioxidant enzymes (SOD and Catalase) is attributed to a precise biochemical mechanism linked to the pro-oxidant properties of its constituent polyphenols. Upon entering pulmonary cells, these compounds induce a mild and controlled state of oxidative stress, which acts as an alarm signal to trigger the nuclear factor erythroid 2-related factor 2 (Nrf2) pathway.(Rašković et al., 2015)

Under basal conditions, Nrf2 is sequestered and inhibited within the cytoplasm by the Keap1 protein. However, under the influence of the pro-oxidant properties of the thyme extract, Nrf2 dissociates from its repressor and translocates directly into the cell nucleus. There, it binds to the Antioxidant Response Elements (ARE) on the DNA strand, thereby stimulating the gene transcription and upregulation of cellular defense enzymes. As a consequence of activating this genetic pathway, the cell secretes massive amounts of superoxide dismutase (SOD) and catalase enzymes to compensate for the depletion induced by bleomycin (BLM), ultimately restoring the redox homeostasis and protecting the lung tissue from apoptosis(Hybertson et al., 2011)

Chapter Three: Materials and Methods

III. Materials and Methods

III.1. Geographical location

The Touggourt region possessed significant strategic importance due to its geographical location. It is part of the Wadi Righ region, which lies at the heart of the eastern Algerian oases and connects various regions. Consequently, its topography was an extension of the surface features of the eastern Algerian Sahara. So, what is the geographical and astronomical location of the Touggourt region?

Location: The Touggourt region is located in the south of the Wadi Righ region, extending astronomically between longitudes 7.52° and 5.3° East, and latitudes 34.15° and 032.6° North. Geographically, it is bordered to the north by the University region, to the south by Ouargla, to the east by the Grand Erg Oriental, and to the west by the M'zab Valley. The Touggourt region comprises13 towns and villages, stretching from north to south in the following order: Sidi Rached (now extinct), Sidi Slimane, El Harhira, M'Gour, El Ksour, Yemra, El M'Gharine, Zaouia El Abidia, Tebesbest, Beni Yessoud, Touggourt, En-Nezla, Massine, the town of Omar, and finally the town of Kouk, where the Touggourt region ends. This town also represents the southernmost point of the Wadi Righ region. Additionally, there is the municipality of Tayebat, located in the eastern part of the Touggourt region

The Eastern Low Desert extends astronomically between latitudes 35° and 20° North, and longitudes 8° and 4° East, with an elevation between 12 m and 15 m above sea level, although it drops to 35 m below sea level at Chott Melghigh in Algeria and Chott el Djerid 2 near the city of Gafsa in Tunisia.

The total area of Touggourt Province in Algeria is approximately 443.26 square kilometers.(Hiba Allah Bougrara,2021)

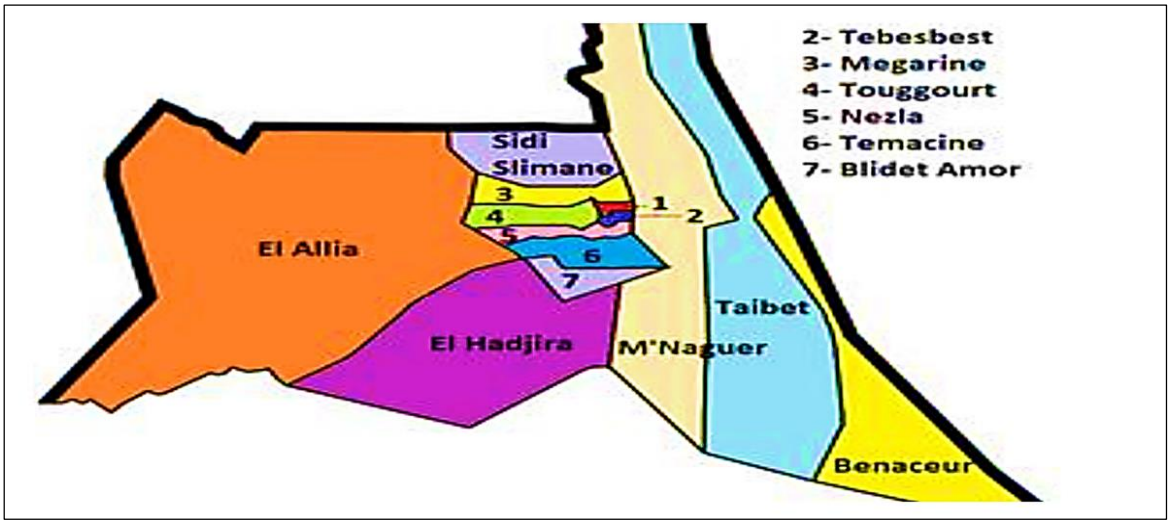


Figure (24): Geographical map of Touggourt Province

III .2. Study Period

The survey was conducted over two months, between April and May 2026, and included a number of pharmacists and physicians in the Wilaya of Touggourt. All participants were informed of the study's purpose.

III .3. Study Methodolog

The study adopted the descriptive-analytical approach as the most suitable for studying the phenomenon and analyzing data related to the use of dietary supplements and their effect on respiratory and chest diseases

III .4. Study Instrument

The questionnaire was used as the primary tool for collecting data from the sample. One hundred questionnaires were distributed to pharmacists and physicians throughout the Touggourt region

❖ ***Survey Topics***

The questionnaire is divided into nine sections (see appendices) to gather information related to the use of dietary supplements and herbal therapeutic products in the treatment of respiratory diseases (asthma, BPCO, chronic respiratory infections, etc.).

- **General Participant Information**

  Occupation, Years of Experience, Workplace, Specialization

- **Knowledge of Dietary Supplements**

  Level of scientific knowledge and awareness of research related to dietary supplements in respiratory diseases.

- **Clinical Use of Dietary Supplements**

Extent of their recommendation and use in conjunction with drug therapy and their effect on patients.

- **Efficacy and Safety of Dietary Supplements**

Evaluation of the effectiveness of supplements, risks of drug interactions, and safety of their use.

- **Supplements and Medicinal Plants (Herbal Medicine)**

Evaluation of the effectiveness of herbal products and the importance of research and regulation of them.

- **Use of Medicinal Plants in Respiratory Diseases**

  Extent of their recommendation, forms of use, and the most commonly used plants.

- **Source of Dietary Supplements**

Preference for local or imported supplements and evaluation of the quality and regulation of local products.

- **Mechanisms of Action of Dietary Supplements**

Their role in compensating for nutritional deficiencies, metabolic effects, reducing oxidative stress, supporting immunity, and anti-inflammatory effects.

- **Future Directions and Recommendations**

Integrating supplements into treatment protocols, training healthcare professionals, and promoting scientific research

According to the opinions of the specialists surveyed, the use of dietary supplements and herbal remedies for respiratory diseases was assessed as follows: (1- Strongly disagree, 2- Disagree, 3- Neutral, 4- Agree, 5- Strongly agree).

III .5. Ethnobotanical Data Processing

Using Quantitative Indicators in Ethnobotanical Studies, By compiling the results of indicator synthesis and analysis using Microsoft Office Excel 2007 and IBM SPSS 23

The following laws were adopted (Abu Alam, Raja Mahmoud. 2011)*:*

The law of arithmetic mean:

$\bar{x} = (x_1f_1 + x_2f_2 + \dots + x\square f\square) / (f_1 + f_2 + \dots + f\square) = (\sum^{k}_{(i=1)} x_if_i) / (\sum^{k}_{(i=1)} f_i)$

The law of standard deviation:

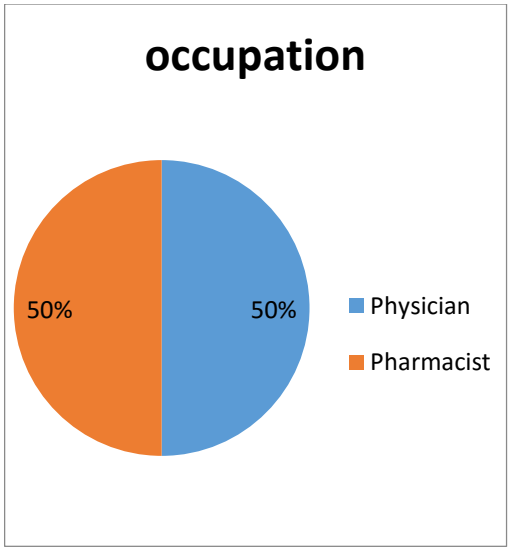
$\sigma = \sqrt{(\Sigma(x_i - \mu)^2 / N)}$

Chapter Four: Results and Discussion

IV. Results and Discussion

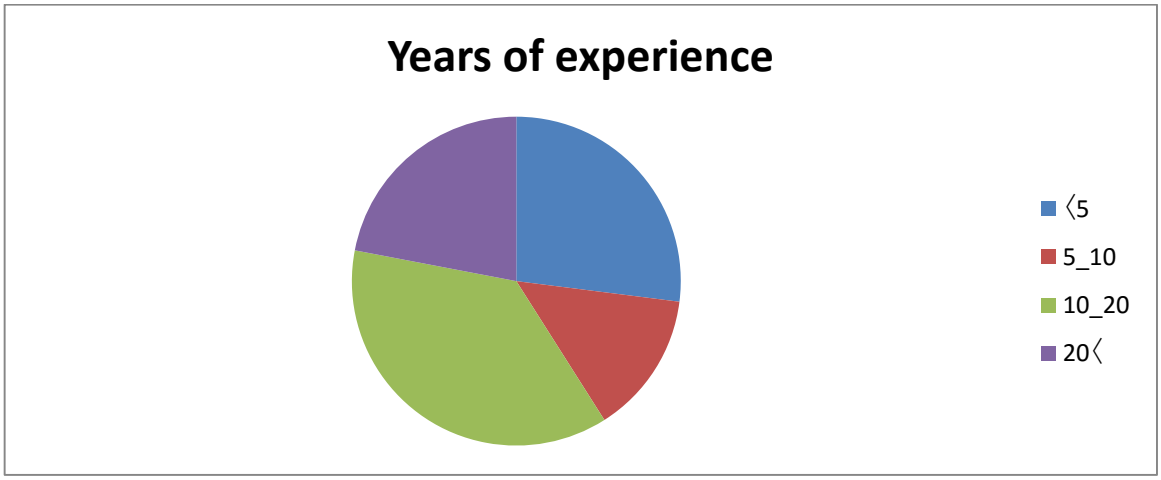
IV.1. Demographic Characteristics of the Sample

The results showed that the study sample consisted of 100 participants, equally divided between physicians and pharmacists (50% each), thus providing a balanced representation of healthcare professionals' opinions on the study topic. The largest percentage of participants had between 10 and 20 years of experience (37%), followed by those with less than 5 years (27%), reflecting a diversity in professional experience levels.



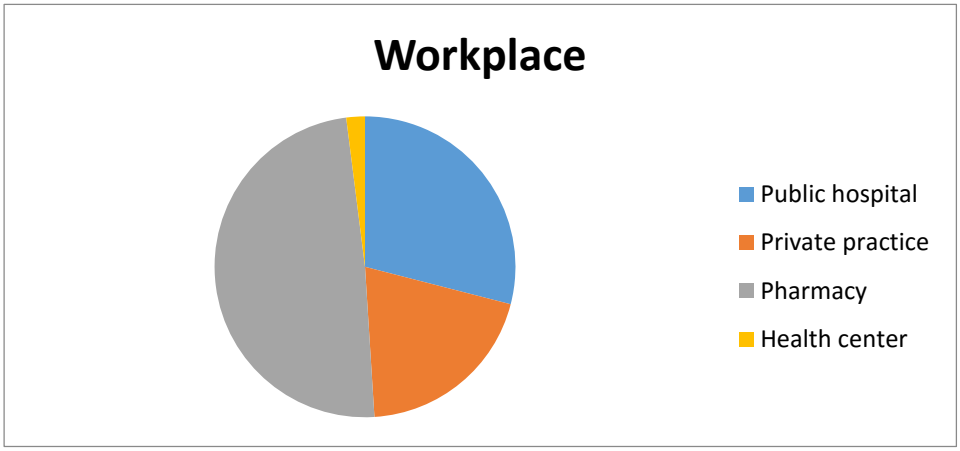
occupation			
		Frequency	Percentage
Valid	Physician	50	50,0
	Pharmacist	50	50,0
	Total	100	100,0

Years of experience			
		Frequency	Percentage
Valid	5□	27	27,0
	5-10	14	14,0
	10-20	37	37,0
	□20	22	22,0
	Total	100	100,0



Regarding workplace, the majority of participants worked in pharmacies (49%), followed by those working in public hospitals (29%), and then private clinics (20%), indicating that the results largely reflect the perspective of those working in the pharmacy sector

workplace			
		Frequency	Percentage
Valid	Public hospital	29	29,0
	Private practice	20	20,0
	Pharmacy	49	49,0
	Health center	2	2,0
	Total	100	100,0



IV.2. Analysis of the questionnaire's sections

IV.2.1. Knowledge of Dietary Supplements

The results showed average scores ranging from 2.90 to 3.04 for questions related to knowledge and scientific understanding of dietary supplements.

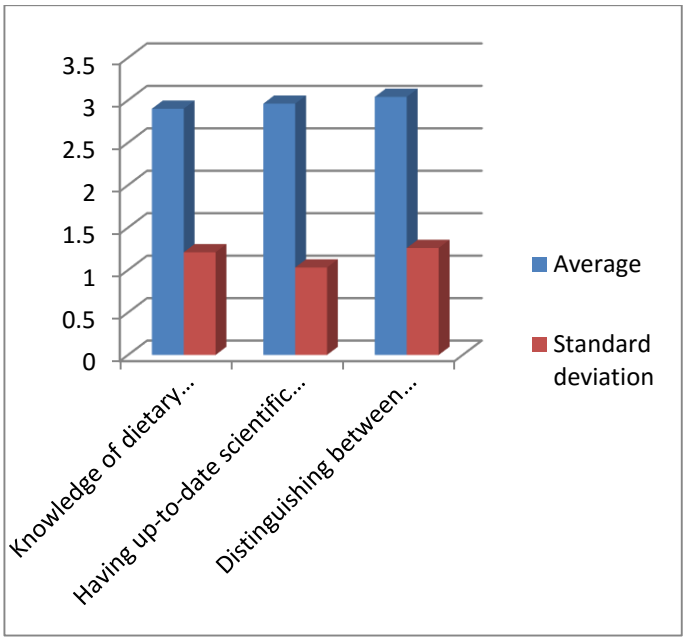
These results indicate that the participants' level of knowledge is moderate. A portion demonstrated acceptable knowledge of dietary supplements, while a significant percentage remained neutral or unconvinced of possessing sufficient knowledge or the ability to distinguish between scientifically proven and unproven supplements.

This moderate level of knowledge can be explained by several factors: First, dietary supplements are a rapidly evolving field, with new products and research findings constantly emerging, making it difficult for individuals to stay up-to-date. Second, the limited availability

of structured educational and training programs specifically focused on dietary supplements may restrict participants' opportunities to acquire comprehensive, evidence-based knowledge(Mepad, 2025).

	Average	Standard deviation
Knowledge of dietary supplements	2,9	1,21
Having up-to-date scientific publications on supplements	2,96	1,03
Distinguishing between effective and ineffective supplements	3,04	1,26

	Frequency	Percentage
Knowledge of dietary supplements	31	31
Having up-to-date scientific publications on supplements	26	26
Distinguishing between effective and ineffective supplements	30	30



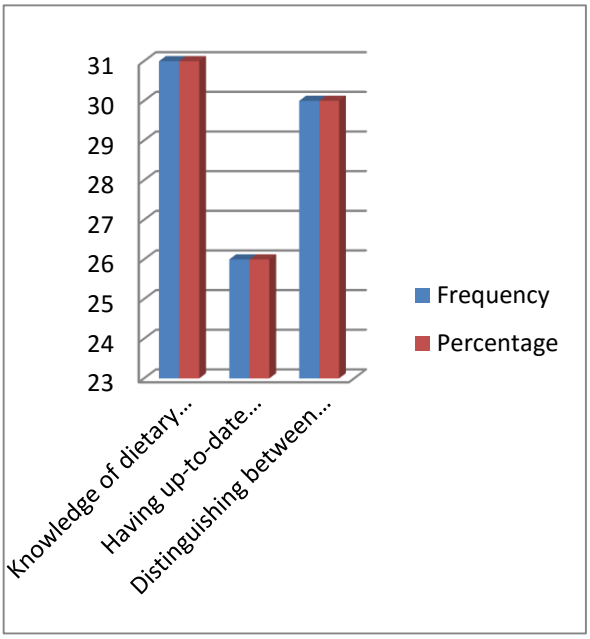


Figure (25): Knowledge of dietary supplements

IV.2.2. Clinical Use of Dietary Supplements

Questions related to recommending dietary supplements, their relationship to medication, and improving quality of life scored between 3.00 and 3.26.

In addition, a substantial proportion of participants believed that dietary supplements could contribute to improving the health status and quality of life of patients with respiratory diseases. This perception may be influenced by growing scientific evidence suggesting that certain vitamins, minerals, and antioxidants can play a supportive role in maintaining respiratory function, strengthening immune responses, and reducing the risk of nutritional deficiencies that may adversely affect patient outcomes.

However, the moderate nature of the scores also suggests that participants remain cautious regarding the clinical application of dietary supplements. Such caution may stem from concerns about the variability of scientific evidence, potential interactions between supplements and medications, differences in product quality, and the need for individualized patient assessment before recommending supplementation.

Overall, the findings suggest that participants recognize the potential benefits of dietary supplements as an adjunctive therapeutic option while maintaining the importance of conventional medical treatment and evidence-based clinical decision-making. This highlights the need for continued education on the efficacy, safety, and appropriate clinical use of dietary supplements, particularly in the management of respiratory diseases(Jolliffe et al., 2017).

	Average	Standard deviation
Recommending dietary supplements	3,3	1,07
Combining supplements and medications	3,23	1,1
The role of supplements in improving patients' lives	3	1,32

	Frequency	Percentage
Recommending dietary supplements	35	35
Combining supplements and medications	38	38
The role of supplements in improving patients' lives	32	32

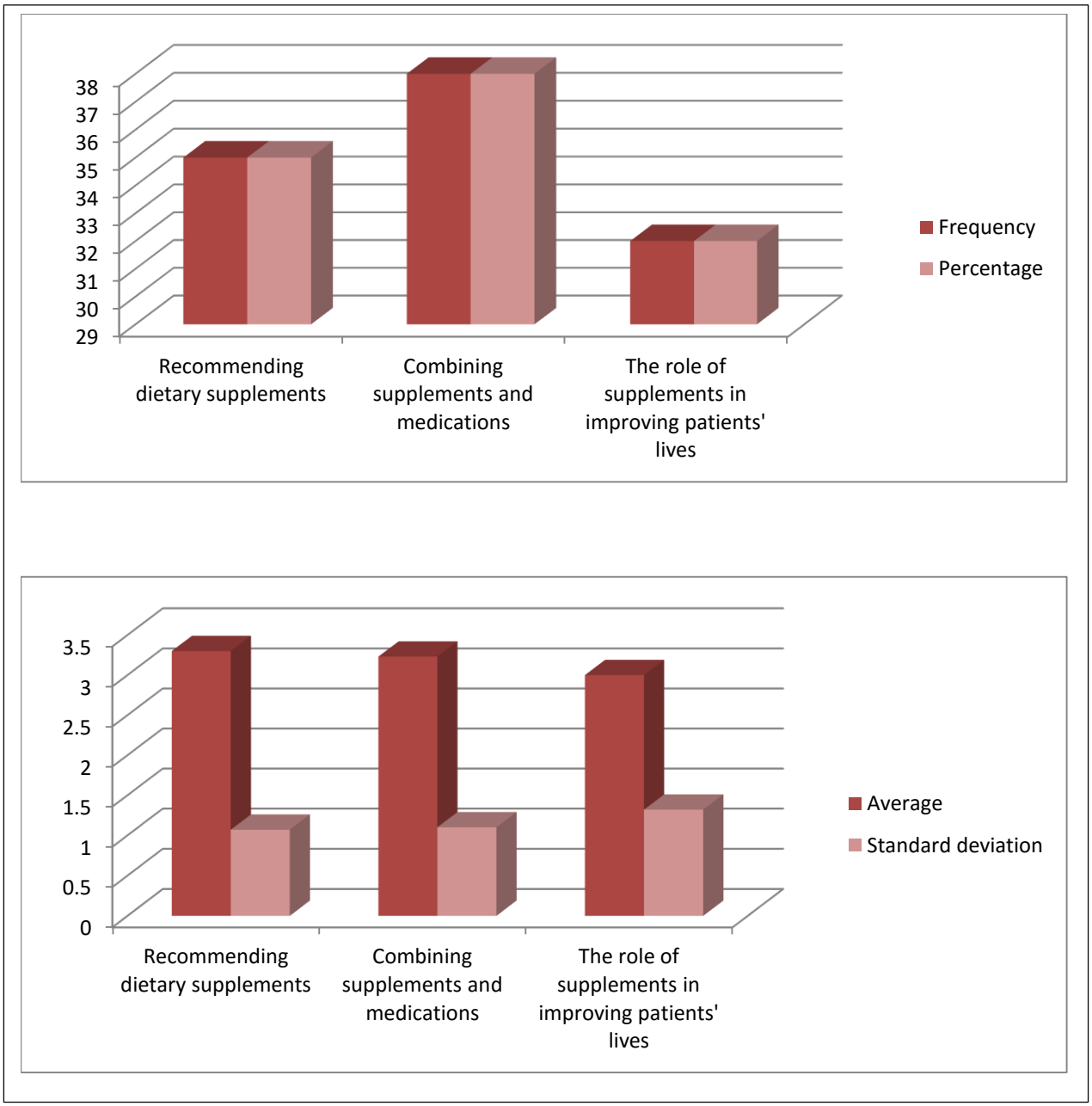


Figure (26): Clinical Use of Dietary Supplements

IV.2.3. Efficacy and Safety of Dietary Supplements

The results showed a significant increase in the averages for this axis, with the average efficacy score being 2.82, the average perceived drug interactions score being 3.45, and the average perceived safety score being 3.22 when used correctly.

These results indicate that participants are generally aware of the potential health benefits of dietary supplements while also recognizing the risks associated with their use. In particular, the

high average rating for drug interactions suggests a strong awareness that dietary supplements may interact with medications, potentially affecting treatment outcomes or increasing the risk of side effects. This reflects a professional and cautious approach to using these products.

Furthermore, the moderate to high safety rating indicates that participants consider dietary supplements relatively safe when used correctly and according to established recommendations. Meanwhile, the efficacy rating reflects a balanced perspective, with participants acknowledging the potential benefits while avoiding overconfidence in the therapeutic efficacy of dietary supplements.

These results reflect a level of professional awareness that supports the rational and evidence-based use of dietary supplements. Participants appear to understand the potential benefits and limitations of these products, emphasizing the importance of proper patient assessment, monitoring for potential drug interactions, and adherence to scientific evidence when recommending dietary supplements in clinical practice.

	Frequency	Percentage
Effectiveness of dietary supplements	14	14
Risk of drug interactions	29	29
Safe use of supplements	24	24

	Average	Standard deviation
Effectiveness of dietary supplements	2,82	1.21
Risk of drug interactions	3,45	1,31
Safe use of supplements	3,22	1,4

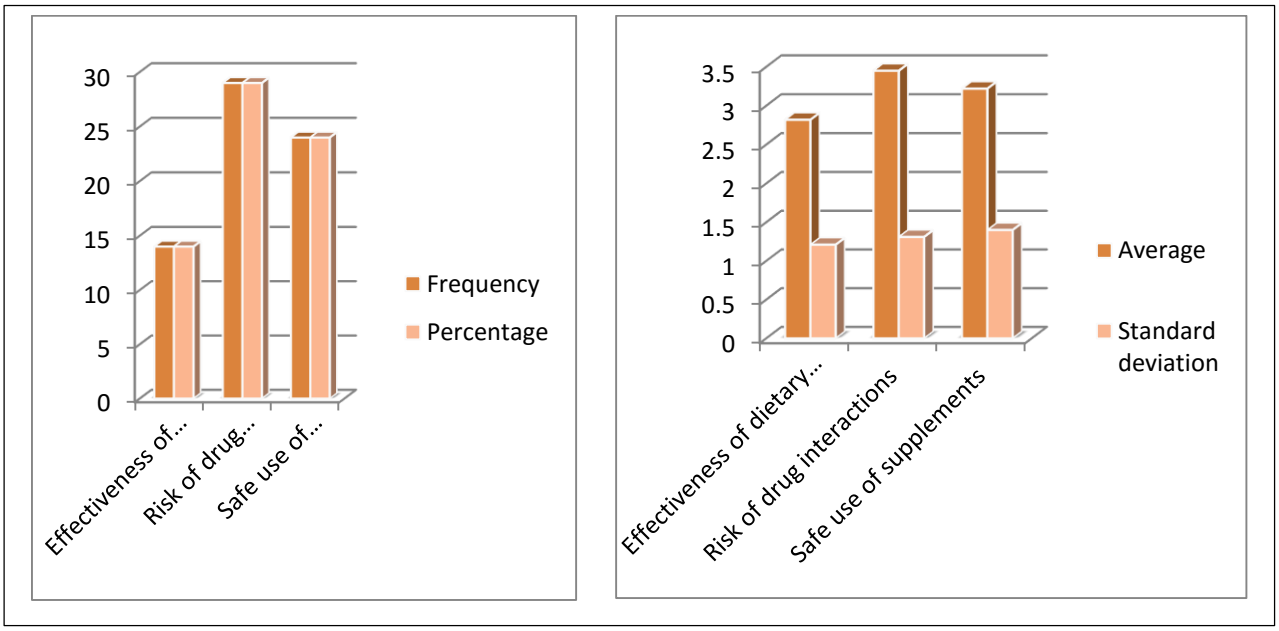


Figure (27): Efficacy and Safety of Dietary Supplements

IV.2.4. Herbal Supplements and Treatments

Statements regarding the need to promote scientific research on medicinal plants and monitor product quality scored very high (4.47 and 4.40).

These results reflect a clear consensus on the need for further scientific studies to evaluate the efficacy, safety, and mechanisms of action of medicinal plants and herbal supplements. Participants appear to recognize that evidence-based research is essential for validating therapeutic claims, determining appropriate dosages, and identifying potential side effects or interactions with conventional medications.

Furthermore, the high level of agreement regarding product quality control highlights participants' concerns about the variability in the composition, purity, and manufacturing standards of herbal products available on the market. This awareness underscores the importance of implementing robust regulatory frameworks and quality assurance procedures to ensure that marketed products meet established safety and efficacy standards.

	Frequency	Percentage
The efficacy of herbal supplements	34	34
Promoting scientific research	17	17
Improving quality control of herbal products	33	33

	Average	Standard deviation
The efficacy of herbal supplements	3,8	1
Promoting scientific research	4,5	0,82
Improving quality control of herbal products	4,4	0,81

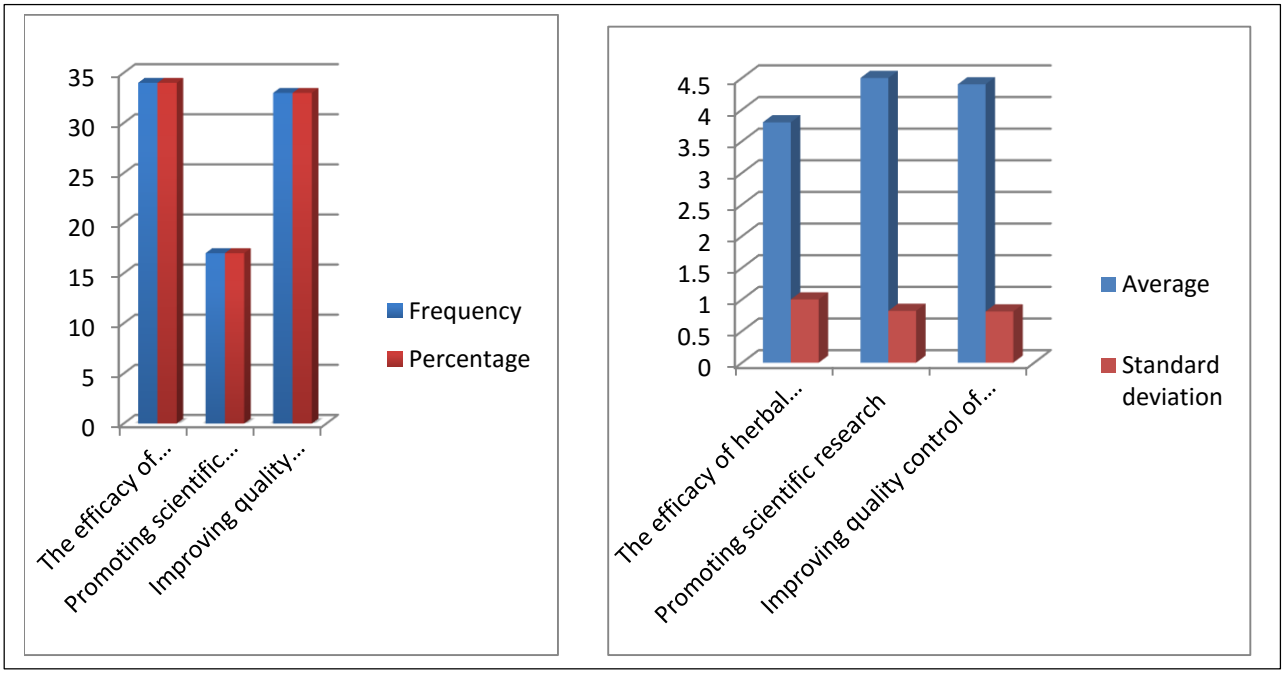


Figure (28): Herbal Supplements and Treatments

IV.2.5. Usage Patterns

The results of the herbal medicine recommendation showed that 84% of participants use these products "sometimes," while only 10% use them regularly. This indicates that herbal medicine is often used as a complementary treatment rather than a complete replacement for conventional drug therapy.

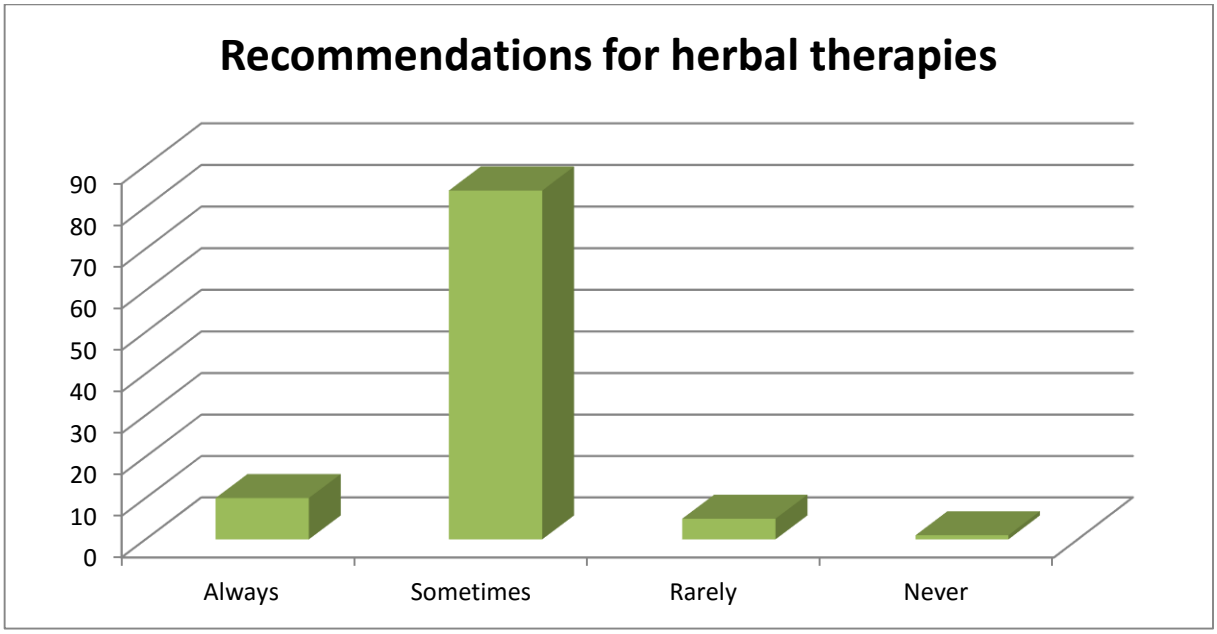


Figure (29): Phytotherapy recommendation

This suggests that participants generally view herbal medicines as a complementary or supportive treatment option, not as a complete replacement for conventional drug therapy. The prevalence of occasional use reflects a cautious approach, with healthcare professionals resorting to herbal products only when there is a perceived benefit, patient interest, or supporting evidence.

The relatively low percentage of users can also be explained by concerns regarding the strength of scientific evidence, the variability in product quality, potential side effects, and possible interactions between herbal products and prescription medications. These considerations are consistent with the professional commitment to evidence-based practice and patient safety(Welz et al., 2018).

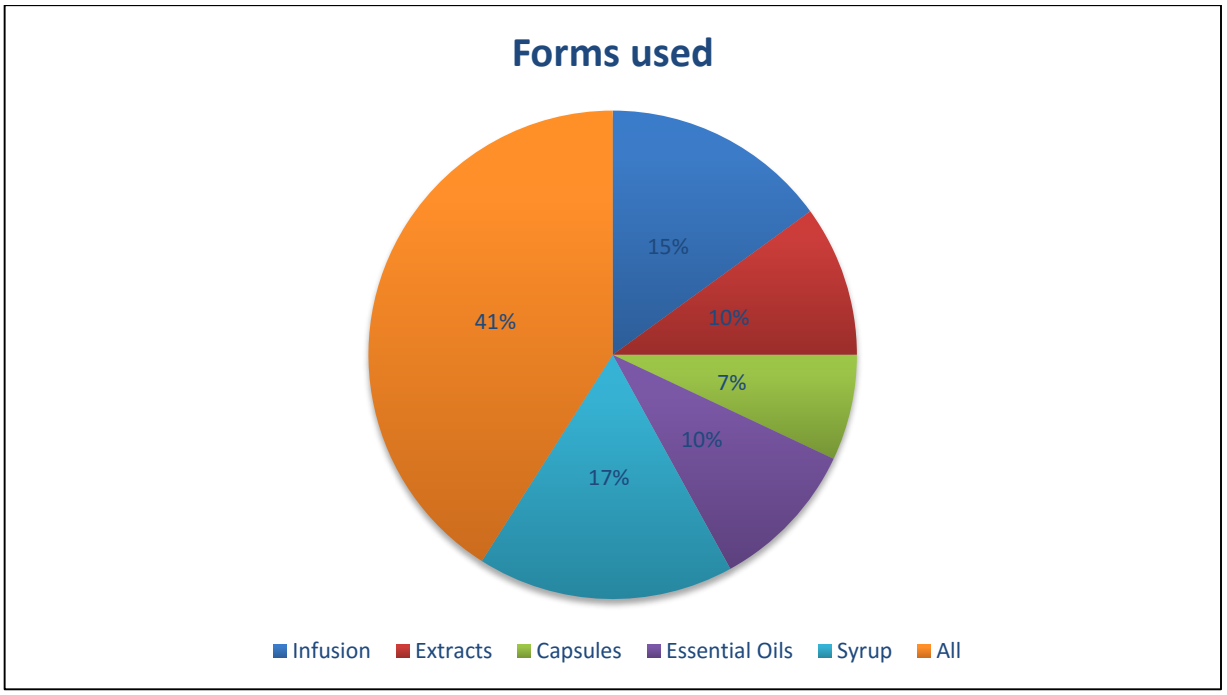


Figure (30): Commonly used forms

IV.2.6. Most Commonly Used Plants

The results showed that thyme (*Thyme*) was the most frequently used plant at 31%, an expected outcome attributed to its potent antioxidant properties. This is explained by its previously mentioned biochemical mechanism of action; in cases of asthma and bronchitis, the massive enzymes (SOD and catalase) induced via the activation of the Nrf2 pathway immediately neutralize the huge amounts of free radicals secreted by immune cells, thereby promptly reducing the swelling and inflammation of the bronchial mucosa، Other plants such as eucalyptus, ginger, and mint were also mentioned, but in smaller percentages.

This distinct preference for thyme underscores the participants' awareness of its active phenolic compounds, such as thymol, and their bronchodilatory properties. Furthermore, this choice reflects the alignment with local therapeutic culture and the accessibility of these herbs as primary options, substantiated by both empirical traditional knowledge and clinical research (Salehi et al., 2018)

	Frequency	Percentage
Thym	31	31
Eucalyptus	4	4
Ginger	2	2
Licorice	1	1
Mint	2	2
Chamomile	2	2
Other	9	9
All	49	49

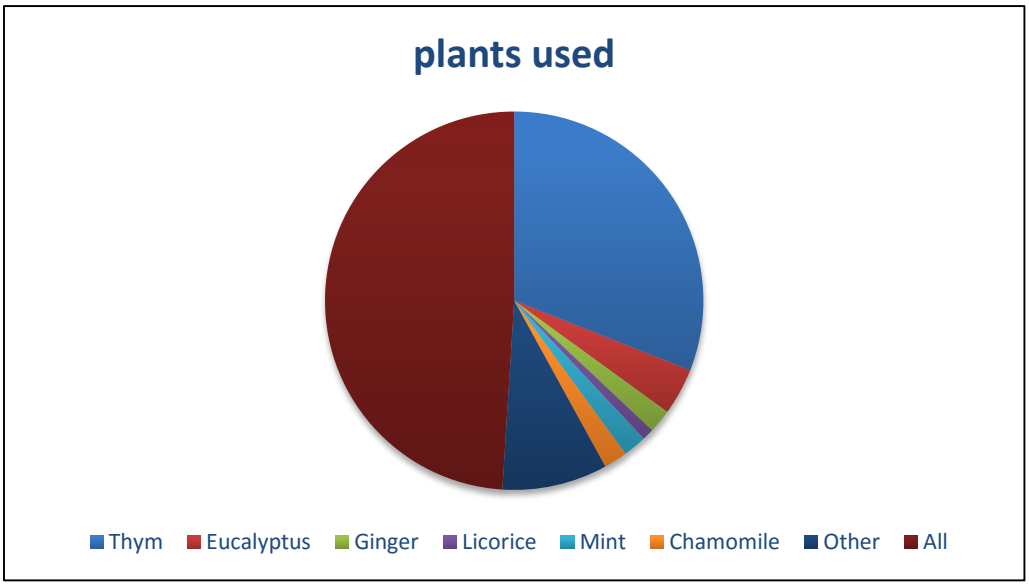


Figure (31): Most commonly used plants

IV.2.7. Source of Dietary Supplements

The results indicated a moderate inclination toward the efficacy of locally manufactured supplements when quality standards are met, given the immense diversity of raw materials such as the plant cover used. Conversely, opinions were divided regarding the preference for imported products or the adequacy of the regulatory frameworks governing local products.

This division reflects a trust deficit toward local regulatory oversight in comparison to the rigorous standards imposed on globally imported products. Consequently, this necessitates enhancing transparency within domestic supply chains to highlight the added value of national biodiversity as a competitive and safe component(Chester, 2025)

IV.2.8. Mechanisms of Action of Dietary Supplements

Questions related to the mechanisms of action of dietary supplements scored relatively high, ranging from 3.35 to 3.81.

These results indicate participants' awareness of the biological role of dietary supplements in:

• Compensating for nutritional deficiencies.

• Reducing oxidative stress.

• Enhancing immunity.

• Providing anti-inflammatory effects.

The highest arithmetic means were in favor of items related to enhancing the body's immune efficiency, with a mean of (**3.81**), followed by anti-inflammatory effects with a mean of (**3.54**). These statistical results align with what has been confirmed by previous studies regarding the mechanism of action of certain supplements—such as vitamins (C and D) and essential fatty acids. This is in addition to the role of turmeric and ginger extracts in alleviating bronchitis, and

the efficacy of garlic in supporting the immune resistance of the respiratory tract through cellular priming and pre-stimulation of immune cells against various pathogens.

These findings demonstrate that the participants' attitudes are grounded in a profound understanding of molecular and immunological biology, rather than mere superficial impressions. This advanced comprehension paves the way for developing integrative therapeutic protocols capable of targeting chronic inflammatory pathways with greater precision(Calder et al., 2020)

	Frequency	Percentage
Compensating for nutrient deficiencies	48	48
Impact on metabolic balance	33	33
Modulation of enzyme activity	37	37
Impact on gene expression	9	9
Reduction of oxidative stress	40	40
Anti-inflammatory effect	55	55
Strengthening immunity	58	58

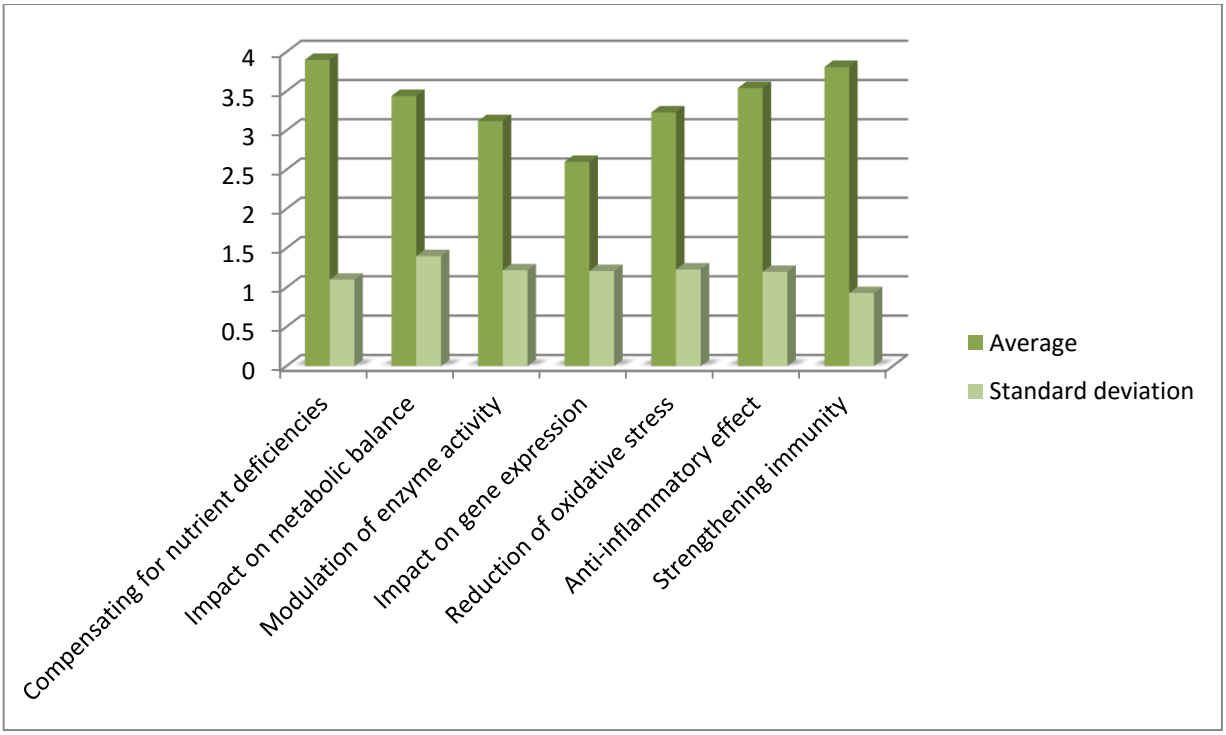


Figure (32): Mechanisms of Action of Dietary Supplements

IV.2.9. Future Trends and Recommendations

The results showed the highest averages in this area, reaching:

• Integrating supplements into treatment protocols: 3.49

• The need for training healthcare professionals: 4.13

• Strengthening scientific research: 4.21

These results confirm the strong conviction among participants regarding the importance of developing academic training and scientific research related to dietary supplements and herbal remedies

	Frequency	Percentage
Incorporating supplements into treatment	44	44
Healthcare training	36	36
Promoting scientific research	29	29

	Average	Standard deviation
Incorporating supplements into treatment	4,21	1,15
Healthcare training	4,13	1
Promoting scientific research	6,6	0,9

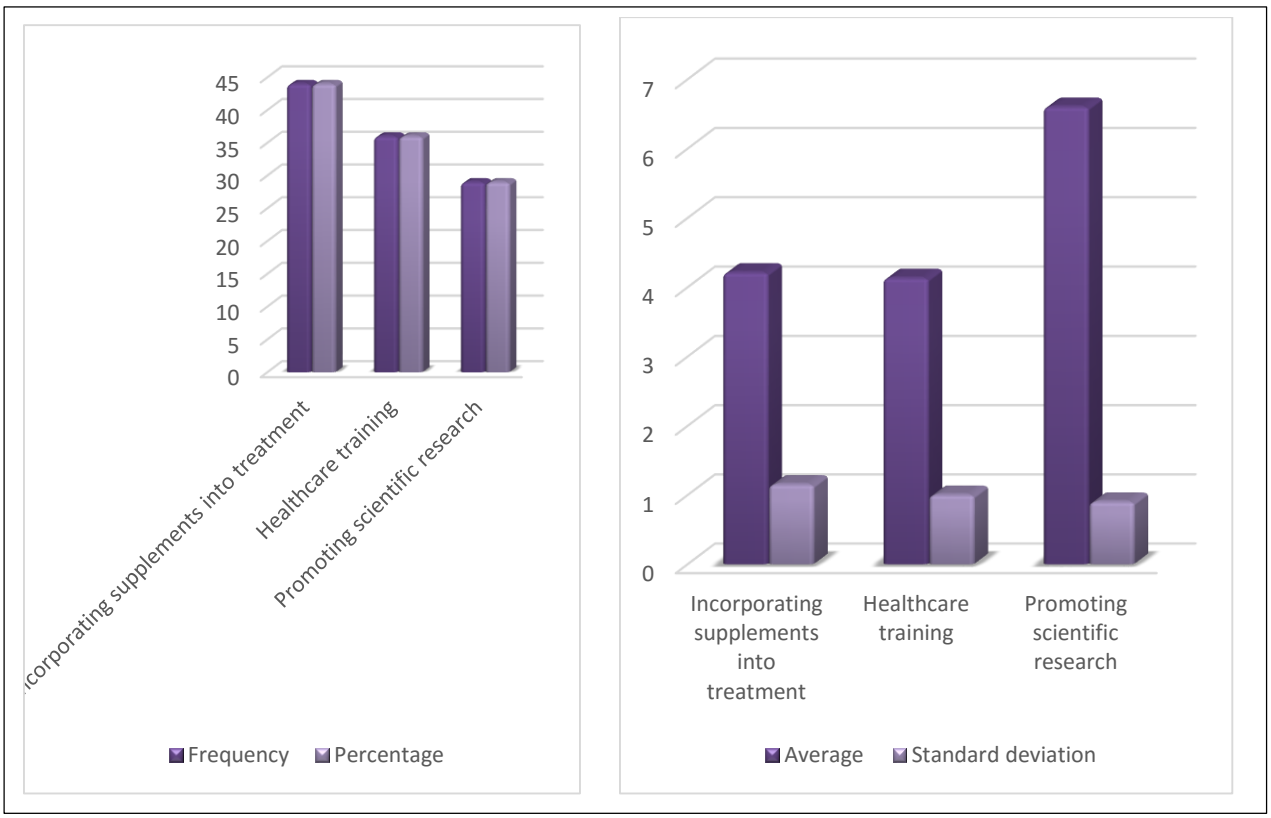


Figure (33): Future Trends and Recommendations

These high rates demonstrate that medical personnel aspire to transition from implicit acceptance to the academic institutionalization of supplements. The demand for specialized training programs reflects a genuine desire to regulate these practices and safeguard them with clear scientific and legislative frameworks that prioritize patient safety above all.

IV.3. Discussion of Results

Our survey findings are consistent with several previous studies, which indicated the increasing use of dietary supplements and medicinal plants in managing respiratory diseases, particularly in Arab societies, where these products are readily available and inexpensive compared to some traditional treatments. Furthermore, the survey results revealed a positive attitude among physicians and pharmacists toward utilizing dietary supplements and herbal remedies as adjunctive therapeutic support. This is evidenced by the high levels of agreement with statements regarding their effectiveness and potential integration with conventional drug therapy, thereby enhancing consumer awareness of their efficacy and increasing the recommendation rate by healthcare professionals (Martineau, A. R., et al., 2017).

Moreover, the results showed that thyme is among the most commonly used medicinal plants in professional practice, offering the flexibility of being utilized in various forms. This aligns with the theoretical framework that confirmed its antioxidant properties and its role in alleviating asthma symptoms and respiratory congestion (Wagner, L., et al., 2015; Townsend, E. A., et al., 2013).

Participants also expressed a clear conviction in the importance of medicinal plants and dietary supplements in supporting the immune system and reducing inflammation. These findings are consistent with numerous studies demonstrating the supportive role of certain natural compounds in improving respiratory function (Venkatesan, N., et al., 2007; Ali, T., et al., 2021).

Conversely, the results revealed some participants' reservations regarding the safety of these products and their concerns about the potential for drug interactions, reflecting a professional awareness of the importance of the judicious and calculated use of dietary supplements and medicinal plants. This finding underscores the need for more rigorous clinical trials to more accurately assess the efficacy and safety of these products, as well as the importance of strengthening training and scientific awareness programs for healthcare professionals. This was also confirmed by Asher and colleagues, who found that many common medicinal plants (such as St. John's wort, ginger, garlic, and ginkgo) can seriously interact with vital medications like blood thinners (such as warfarin) or asthma medications. That study concluded that physician supervision is essential to ensure rational use and avoid the occurrence of bleeding or treatment failure (Asher, G. et al., 2017).

The study also demonstrated a strong consensus on the need to enhance scientific research and improve quality control for herbal products and dietary supplements. This reflects the participants' awareness of the importance of robust scientific evidence and strict quality standards before these products are widely adopted in therapeutic practice. This aspect was highlighted by the researcher "Newmaster" in his groundbreaking study, which conclusively demonstrated the presence of adulteration and contaminants in many herbal supplements on the market, emphasizing

the importance of making informed choices and relying only on regulated medical products (Newmaster, S. G. 2013).

In general, the study results confirm that dietary supplements and herbal remedies represent a promising complementary option in the field of respiratory diseases, and that their optimal benefit requires their integration within a structured scientific framework and under the supervision of specialized healthcare professionals (as stated by Hemilä and Chalker: Hemilä, H., & Chalker, E. 2013).

This approach ensures the achievement of the desired therapeutic benefit and significantly minimizes the risk of side effects and potential drug interactions. The results also reveal a positive attitude among physicians and pharmacists towards employing these products as part of integrative healthcare for patients with respiratory diseases.

conclusion

Respiratory diseases constitute a major public health challenge due to their high prevalence and their significant impact on patients' quality of life. In this context, dietary supplements, particularly those of plant origin, have attracted increasing attention because of their potential role in supporting respiratory health, strengthening immune defenses, and complementing conventional therapeutic approaches.

The bibliographic part of this study highlighted the importance of the respiratory system and provided an overview of major respiratory diseases, including bronchitis, chronic obstructive pulmonary disease (COPD), and COVID-19. It also emphasized the growing scientific interest in dietary supplements, especially vitamins, minerals, omega-3 fatty acids, and medicinal plants, owing to their antioxidant, anti-inflammatory, immunomodulatory, and respiratory-supportive properties.

The field survey conducted among 100 healthcare professionals, including doctors and pharmacists from the Wilaya of Touggourt, revealed a generally positive perception of dietary supplements as complementary approaches for promoting respiratory health. The results demonstrated that healthcare professionals recognize the potential benefits of these products in supporting respiratory function and improving patients' well-being when used appropriately alongside conventional medical treatments.

Among the medicinal plants reported by participants, thyme (*Thymus vulgaris*) emerged as the most frequently used species, accounting for 31% of the cited herbal supplements. This preference may be attributed to its well-documented anti-inflammatory, antioxidant, antimicrobial, and expectorant properties, which make it particularly relevant in the management of respiratory disorders.

Furthermore, the findings showed that participants were aware of the potential risks associated with dietary supplement use, particularly drug–supplement interactions and the consequences of inappropriate self-medication. This awareness highlights the importance of professional supervision and evidence-based recommendations to ensure the safe and effective use of these products.

Overall, the results of this study suggest that dietary supplements, especially herbal supplements, may represent valuable complementary tools for supporting respiratory health. However, their use

should remain rational, supervised, and based on scientific evidence, as they cannot replace conventional medical treatments.

In light of these findings, greater efforts should be directed toward strengthening awareness programs, improving the education and training of healthcare professionals, promoting collaboration between physicians and pharmacists, and encouraging further clinical and laboratory research. Such initiatives would contribute to a better understanding of the mechanisms of action, efficacy, and safety of dietary supplements, while supporting their responsible integration into respiratory healthcare practices.

Perspectives

- Conduct broader studies involving larger samples from different regions of Algeria.
- Assess patients' perceptions and practices regarding the use of dietary supplements for respiratory diseases.
- Investigate the clinical efficacy and safety of commonly used medicinal plants, particularly thyme, through controlled clinical trials.
- Promote continuing education programs for healthcare professionals on dietary supplements and potential drug–supplement interactions.
- Strengthen regulatory frameworks governing the production, quality control, and marketing of dietary supplements to ensure their safety and effectiveness.

Appendices

République démocratique populaire algérienne
Ministry of Higher Education and Scientific Research
University of Martyr Hamma Lakhdar El Oued

Questionnaire on the Use of Dietary and Phytotherapeutic Supplements Among Patients with Respiratory Diseases

As part of a scientific study aimed at evaluating the use of dietary supplements and phytotherapeutic (herbal) products in the management of respiratory diseases (asthma, COPD, chronic respiratory infections, etc.), we kindly ask you to complete this questionnaire accurately and objectively.

All information collected is strictly confidential and will be used solely for scientific research purposes**.**

Section 1: General Information

Variable	Options
Profession	☐ Doctor ☐ Pharmacist
Years of experience	☐ < 5 years ☐ 5–10 years ☐ 10–20 years ☐ > 20 years
Workplace	☐ Public hospital ☐ Private clinic / practice ☐ Pharmacy ☐ Health center
Specialty	.....

Likert Scale

score	Meaning
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

Section 2: Knowledge of Dietary Supplements - Statements

Statements	1	2	3	4	5
I have sufficient knowledge regarding dietary supplements in respiratory diseases.					
I follow recent scientific publications on these supplements.					
I can scientifically distinguish between effective and ineffective supplements					

Section 3: Clinical Use

Statements	1	2	3	4	5
I recommend dietary supplements to patients with respiratory diseases.					
I combine supplements with conventional medical treatment.					
Supplements improve the patients' quality of life					

Section 4: Efficacy and Safety

Statements	1	2	3	4	5
Supplements are effective in respiratory diseases.					
There is a risk of drug interactions.					
Supplements are safe if they are used correctly					

Section 5 : Compléments phytothérapeutiques

Statements	1	2	3	4	5
Plant-based (herbal) supplements are effective					
Herbal products/plants can be preferable in certain cases.					
It is necessary to strengthen research on medicinal plants.					
The quality of herbal products needs to be better controlled					

Section 6: Use of Medicinal Plants

Question	Options
Recommendation of phytotherapies	☐ Always ☐ Sometimes ☐ Rarely ☐ Never
Forms used	☐ Infusion ☐ Extracts ☐ Capsules ☐ Essential oils ☐ Syrup
Plants used	☐ Thyme ☐ Eucalyptus ☐ Ginger ☐ Licorice ☐ Mint ☐ Chamomile ☐ Others

Section 7: Origin of Supplements

Statements	1	2	3	4	5
I prefer imported supplements due to their quality					
Local supplements are effective under proper quality control.					
The regulation of local supplements is insufficient.					

Section 8: Mechanisms of Action of Dietary Supplements

Statements	1	2	3	4	5
Dietary supplements help compensate for deficiencies in essential nutrients.					
Dietary supplements influence metabolic balance.Certain dietary supplements modulate intracellular enzymatic activity.					
Dietary supplements can influence gene expression.					
Dietary supplements contribute to reducing oxidative stress.					
Certain dietary supplements have anti-inflammatory effects.					
Certains compléments alimentaires ont des effets anti-inflammatoires					
Dietary supplements contribute to strengthening the immune system					

Section 9: Guidelines and Recommendations

Statements	1	2	3	4	5
Supplements should be integrated into therapeutic protocols..					
Training/Education for healthcare professionals is necessary.					
Research on supplements must be strengthened					

Thank you for your participation in this scientific study.

Frequency table

occupation					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Physician	50	50.0	50.0	50.0
	Pharmacist	50	50.0	50.0	100.0
	Total	100	100.0	100.0	

Years of experience					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	5□	27	27.0	27.0	27.0
	Between 5 and 10	14	14.0	14.0	41.0
	Between 10 and 20	37	37.0	37.0	78.0
	Greater than 20	22	22.0	22.0	100.0
	Total	100	100.0	100.0	

Workplace					
		Frequency	Percentage	Percentage valide	Cumulative percentage
Valid	Public Hospital	29	29.0	29.0	29.0
	Private practice	20	20.0	20.0	49.0
	Pharmacy	49	49.0	49.0	98.0
	Health center	2	2.0	2.0	100.0
	Total	100	100.0	100.0	

Statistics								
		Q1	Q2	Q3	Q4	Q5	Q6	Q7
N	Valid	100	100	100	100	100	100	100
	Manquant	0	0	0	0	0	0	0
Average		2,9000	2,9600	3,0400	3,0000	3,2300	3,2600	2,8200
Standard deviation		1,21854	1,03397	1,26267	1,31809	1,09041	1,06950	1,20922

Statistics								
		Q8	Q9	Q10	Q11	Q12	Q13	Q14
N	Valide	100	100	100	100	100	100	100
	Manquant	0	0	0	0	0	0	0
Average		3,4500	3,2200	3,7900	3,3900	4,4700	4,4000	1,9700
Standard deviation		1,30558	1,36759	1,00800	1,25445	,82211	,81650	,43705

Statistics								
		Q15	Q16	Q17	Q18	Q19	Q20	Q21
N	Valide	100	100	100	100	100	100	100
	Manquant	0	0	0	0	0	0	0
Average		4,2700	5,2600	2,9700	3,3500	3,4100	3,8600	3,4400
Standard deviation		1,89553	3,19918	1,14992	1,05768	1,22347	1,09194	1,35079

Statistics								
		Q22	Q23	Q24	Q25	Q26	Q27	Q28
N	Valide	100	100	100	100	100	100	100
	Manquant	0	0	0	0	0	0	0
Average		3,1200	2.6000	3.2300	3.5400	3.8100	3.5900	4.1300
Standard deviation		1.22499	1.21439	1.22972	1.18424	92872	87727	1.00156

Statistics		
		Q29
N	Valid	100
	Missing	0
Average		4.2100
Standard deviation		1.14852

Frequency table

Q1					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	20	20.0	20.0	20.0
	I disagree	13	13.0	13.0	33.0
	Neutral	30	30.0	30.0	63.0
	All right	31	31.0	31.0	94.0
	I completely agree	6	6.0	6.0	100.0
	Total	100	100.0	100.0	

Q2					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	13	13.0	13.0	13.0
	I disagree	12	12.0	12.0	25.0
	Neutral	45	45.0	45.0	70.0
	All right	26	26.0	26.0	96.0
	I completely agree	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

Q3					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	18	18.0	18.0	18.0
	I disagree	12	12.0	12.0	30.0
	Neutral	29	29.0	29.0	59.0
	All right	30	30.0	30.0	89.0
	I completely agree	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

Q4					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	21	21.0	21.0	21.0
	I disagree	13	13.0	13.0	34.0
	Neutral	21	21.0	21.0	55.0
	All right	35	35.0	35.0	90.0
	I completely agree	10	10.0	10.0	100.0
	Total	100	100.0	100.0	

Q5					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	8	8.0	8.0	8.0
	I disagree	17	17.0	17.0	25.0
	Neutral	28	28.0	28.0	53.0
	All right	38	38.0	38.0	91.0
	I completely agree	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

Q6					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	2	2.0	2.0	2.0
	I disagree	28	28.0	28.0	30.0
	Neutral	25	25.0	25.0	55.0
	All right	32	32.0	32.0	87.0
	I completely agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

Q7					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	20	20.0	20.0	20.0
	I disagree	14	14.0	14.0	34.0
	Neutral	39	39.0	39.0	73.0
	All right	18	18.0	18.0	91.0
	I completely agree	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

Q8					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	13	13.0	13.0	13.0
	I disagree	8	8.0	8.0	21.0
	Neutral	25	25.0	25.0	46.0
	All right	29	29.0	29.0	75.0
	I completely agree	25	25.0	25.0	100.0
	Total	100	100.0	100.0	

Q9					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	16	16.0	16.0	16.0
	I disagree	14	14.0	14.0	30.0
	Neutral	24	24.0	24.0	54.0
	All right	24	24.0	24.0	78.0
	I completely agree	22	22.0	22.0	100.0
	Total	100	100.0	100.0	

Q10					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	3	3.0	3.0	3.0
	I disagree	5	5.0	5.0	8.0
	Neutral	30	30.0	30.0	38.0
	All right	34	34.0	34.0	72.0
	I completely agree	28	28.0	28.0	100.0
	Total	100	100.0	100.0	

Q11					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	13	13.0	13.0	13.0
	I disagree	10	10.0	10.0	23.0
	Neutral	19	19.0	19.0	42.0
	All right	41	41.0	41.0	83.0
	I completely agree	17	17.0	17.0	100.0
	Total	100	100.0	100.0	

Q12					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I disagree	2	2.0	2.0	2.0
	Neutral	15	15.0	15.0	17.0
	All right	17	17.0	17.0	34.0
	I completely agree	66	66.0	66.0	100.0
	Total	100	100.0	100.0	

Q13					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I disagree	5	5.0	5.0	5.0
	Neutral	6	6.0	6.0	11.0
	All right	33	33.0	33.0	44.0
	I completely agree	56	56.0	56.0	100.0
	Total	100	100.0	100.0	

Q14					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Always	10	10.0	10.0	10.0
	Sometimes	84	84.0	84.0	94.0
	Rarely	5	5.0	5.0	99.0
	Never	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

Q15					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Infusion	15	15.0	15.0	15.0
	Excerpts	10	10.0	10.0	25.0
	Capsules	7	7.0	7.0	32.0
	Essential oils	10	10.0	10.0	42.0
	Syrup	17	17.0	17.0	59.0
	all	41	41.0	41.0	100.0
	Total	100	100.0	100.0	

Q16					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Thyme	31	31.0	31.0	31.0
	Eucalyptus	4	4.0	4.0	35.0
	Ginger	2	2.0	2.0	37.0
	Licorice	1	1.0	1.0	38.0
	Mint	2	2.0	2.0	40.0
	Chamomile	2	2.0	2.0	42.0
	Others	9	9.0	9.0	51.0
	All	49	49.0	49.0	100.0
	Total	100	100.0	100.0	

Q17					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	11	11.0	11.0	11.0
	I disagree	24	24.0	24.0	35.0
	Neutral	32	32.0	32.0	67.0
	All right	23	23.0	23.0	90.0
	I completely agree	10	10.0	10.0	100.0
	Total	100	100.0	100.0	

Q18					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	7	7.0	7.0	7.0
	I disagree	10	10.0	10.0	17.0
	Neutral	37	37.0	37.0	54.0
	All right	33	33.0	33.0	87.0
	I completely agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

Q19					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	8	8.0	8.0	8.0
	I disagree	14	14.0	14.0	22.0
	Neutral	31	31.0	31.0	53.0
	All right	23	23.0	23.0	76.0
	I completely agree	24	24.0	24.0	100.0
	Total	100	100.0	100.0	

Q20					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	4	4.0	4.0	4.0
	I disagree	12	12.0	12.0	16.0
	Neutral	7	7.0	7.0	23.0
	All right	48	48.0	48.0	71.0
	I completely agree	29	29.0	29.0	100.0
	Total	100	100.0	100.0	

Q21					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	17	17.0	17.0	17.0
	I disagree	3	3.0	3.0	20.0
	Neutral	23	23.0	23.0	43.0
	All right	33	33.0	33.0	76.0
	I completely agree	24	24.0	24.0	100.0
	Total	100	100.0	100.0	

Q22					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	14	14.0	14.0	14.0
	I disagree	17	17.0	17.0	31.0
	Neutral	22	22.0	22.0	53.0
	All right	37	37.0	37.0	90.0
	I completely agree	10	10.0	10.0	100.0
	Total	100	100.0	100.0	

Q23					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	25	25.0	25.0	25.0
	I disagree	17	17.0	17.0	42.0
	Neutral	40	40.0	40.0	82.0
	All right	9	9.0	9.0	91.0
	I completely agree	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

Q24					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	13	13.0	13.0	13.0
	I disagree	15	15.0	15.0	28.0
	Neutral	20	20.0	20.0	48.0
	All right	40	40.0	40.0	88.0
	I completely agree	12	12.0	12.0	100.0
	Total	100	100.0	100.0	

Q25					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	11	11.0	11.0	11.0
	I disagree	9	9.0	9.0	20.0
	Neutral	10	10.0	10.0	30.0
	All right	55	55.0	55.0	85.0
	I completely agree	15	15.0	15.0	100.0
	Total	100	100.0	100.0	

Q26					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	4	4.0	4.0	4.0
	I disagree	5	5.0	5.0	9.0
	Neutral	15	15.0	15.0	24.0
	All right	58	58.0	58.0	82.0
	I completely agree	18	18.0	18.0	100.0
	Total	100	100.0	100.0	

Q27					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	2	2.0	2.0	2.0
	I disagree	7	7.0	7.0	9.0
	Neutral	34	34.0	34.0	43.0
	All right	44	44.0	44.0	87.0
	I completely agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

Q28					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	2	2.0	2.0	2.0
	I disagree	7	7.0	7.0	9.0
	Neutral	11	11.0	11.0	20.0
	All right	36	36.0	36.0	56.0
	I completely agree	44	44.0	44.0	100.0
	Total	100	100.0	100.0	

Q29					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	I completely disagree	5	5.0	5.0	5.0
	I disagree	8	8.0	8.0	13.0
	Neutral	3	3.0	3.0	16.0
	All right	29	29.0	29.0	45.0
	I completely agree	55	55.0	55.0	100.0
	Total	100	100.0	100.0	

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