Bibliometric study of chemical compounds based on medicinal plants anti-Alzheimer

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ABSTRACT
Alzheimer's disease is a chronic neurodegenerative condition that affects mainly memory and other cognitive functions. Interest in finding treatments effective for this disease has increased in recent years, leading to the investigation of the use of medicinal plants and isolated compounds as possible therapeutic treatments. This study aims to identify research on plants and isolated compounds that demonstrate efficacy in the treatment of markers of Alzheimer's pathology over the years. To achieve this goal, we performed a literature review using methods quantitative, which allows us to identify trends, authors, journals and research areas most relevant to the topic. We collect data and submit them to quantitative analyzes to get an overview of the state of the art in this particular field. The methodology employed included the use of bibliometric software for surveys quantitative surveys and the Rayyan platform for qualitative surveys. The quantitative analysis covered the leadership of the studies, the power analysis used in the articles and the identification of predominant themes. While in the qualitative analysis, we focused on the experimented plants that cause anti-Alzheimer's effects, with a focus on the isolated chemical compounds responsible by pharmacological action. As a result of the quantitative analysis, we found a growing interest in research on plants and Alzheimer's disease. Since the first publications at the beginning of the 2000s to the present day, there has been a steady increase in the number of studies, reflecting a significant progress has been made in understanding the possible benefits of plants in the treatment and in preventing this debilitating disease. Our findings highlight the continuing importance of research in this area, which may provide promising therapeutic alternatives to face the challenges posed by the disease of Alzheimer's. Through this bibliographic research, we hope to contribute to the advancement of scientific knowledge and for the development of more effective therapeutic approaches and accessible for this complex condition.

Keywords: Alzheimer's disease, isolated compound, medicinal plants, technology.

1 INTRODUCTION

Alzheimer's disease (AD) is a neurogenerative pathology discovered in 1906 by the German physician Alois Alzheimer. And as the number of elderly people in the world grows, there is a proportion of new cases of this pathology, due to physiological and immunological factors that decrease in old age. The main symptom of AD is memory loss, worsening of daily habits, difficulty in understanding, discouragement and mental confusion (Jamshidi-Kia et al., 2018).

For many years human beings have always been in contact with nature and have taken advantage of the environment to obtain tools, supplies and medicines. The ability to use plants as food and to treat diseases was conducted over several failures over time, and progressively man was able to use the flora for his activities. The use of medicinal plants is passed from generation and gradually the understanding of the effectiveness has been increased the reliability of the use of species around the world, due to the potential in the development of drugs favoring public health for the treatment of current and future neurological diseases (Breijyeh & Karaman, 2020).

Medicinal plants are a world wealth of importance in food and in the production of new medicines, only in Europe there are about 1300 species of wild plants for use in medicine and in the United Studies around 118 to 150 of the main existing and prescribed drugs are of natural bases and 80% of developing countries are dependent on herbal drugs. And 25% of developed countries the drugs prescribed are of wild plant origin, this growing consumption by herbal drugs from plants is expanding rapidly around the world in primary health (S.-L. Chen et al., 2016)

According to the Declaration of Alma Ata (1978), primary health care is care based on methodologies, technologies, practices that are reliable and accepted by society, disposed in the community at a cost that everyone can perpetuate from its use and the phases of its development. The declaration of Alma Ata also manifests the primordiality of the incorporation of medicinal plants and phytotherapy in the public health of countries, justifying that 80% of the world population uses plants or preparations from them in primary health (Akram & Nawaz, 2017)

Plant species are made up of healing properties due to the existence of chemical substances called secondary metabolites contained in parts of the plant that have as their purpose self-defense or sustainability in the environment. These metabolites are chemically classified within groups with biological activities flavonoids, alkaloids, anthraquinones, glycosides, tannins, saponins among others and may be present in several species, whether they are land plants, marine plants, lichens and / or fungi capable of assisting in the cure and / or treatment of neurological diseases including Alzheimer's (Panda & Jhanji, 2020)

One of the most important methods employed in the therapy for Alzheimer's disease is the management of normal levels of the enzyme acetylcholine in the synaptic cleft, but these drugs that provide this action have some side and adverse effects to those who consume, so the search for new more efficient drugs is of paramount importance, currently numerous active constituents of plants are explored and experimented in studies as possible drugs in the therapy of neurodegenerative diseases, Due to the availability, lower cost, low toxicological feats of herbal medicines in relation to synthetic drugs make them a better choice. (This approach called ethnopharmacological uses health system and pathologies and the inclusion of plants with their traditional knowledge, chemical and pharmacological studies in the discovery of new drugs based on the screening of plant extracts or isolated compounds (Tuzimski; Petruczynik, 2022) Pyou; Jhanji, 2020).

The pathology causes increased oxidative damage, neurofibrillary entanglements, decline of the enzyme acetylcholine among other serious problems in the brain that require medications to assist in the health of the person carrying the disease, although there are synthetic and semisynthetic drugs used for AD plants including here those with action on the CNS, especially those with direct or indirect action on the pathology, acting on the mechanism, or in the prevention of disease have importance in health (Panda & Jhanji, 2020).

The review presents studies of medicinal plants and their isolated compounds in the Scopus database effective for Alzheimer's in two methodological stages: qualitative and quantitative, focusing on the production of studies over the years and on the species studied. This study also aims to highlight the most commonly used families and isolated compounds of Anti-Alzheimer's interest.

2 ETHNOPHARMACOLOGY AND ALZHEIMER'S DISEASE

The origins of ethnopharmacology go back to ancient times, when communities depended exclusively on nature to meet their health needs. Over the centuries, these cultures have accumulated a vast knowledge about the medicinal properties of the plants present in their ecosystems. This knowledge was transmitted orally from generation to generation, constituting a true treasure of traditional wisdom and with the advancement of modern science, there was a tendency to devalue this ancestral knowledge. Fortunately, ethnopharmacology has emerged as a discipline to rescue and elevate this knowledge, recognizing its potential in the development of new treatments and therapies (Pirintsos et al., 2022).

One of the main characteristics of ethnopharmacology is its multidisciplinary approach. This area of study combines elements of ethnobotany, ethnology, anthropology, botany, pharmacology and chemistry, among other disciplines. This holistic approach allows for a deeper understanding of traditional practices of medicinal plant use, incorporating cultural, social and scientific aspects (Reyes-Garcia, 2010).

This approach highlights the importance of biodiversity conservation. By investigating medicinal plants valued by local communities, ethnopharmacologists have succeeded in identifying and preserving key species in their natural habitats. This promotes sustainability and conservation of natural resources, ensuring the continued availability of medicinal plants for future generations (Rodrigues et al., 2022) .

One of the main objectives is the discovery of new therapeutics based on traditional knowledge. Many modern medicines have their origins in compounds found in plants used in ethnopharmacological practices. Research in this area can lead to the identification of new bioactive compounds, providing knowledge for the development of more effective treatments with fewer side effects (Turpin et al., 2022).

This approach has shown promise in the context of Alzheimer's disease, as many cultures possess ancestral knowledge about using plants to promote cognitive health and improve brain function. Understanding the ethnopharmacological practices related to Alzheimer's disease is critical to identifying plants with potential neuroprotective or cognitive-enhancing properties. Several cultures around the world have used medicinal plants as part of their traditional treatments for impaired memory and brain function problems (Gregory et al., 2021).

Through scientific research, it is possible to investigate the chemical properties of plants and identify bioactive compounds that can act in the brain, protecting nerve cells and accepting the neuroinflammatory processes associated with Alzheimer's disease. In addition, ethnopharmacology values the traditional knowledge and ancestral wisdom of indigenous communities. This information is valuable for the discovery of new therapies and may open avenues for the development of drugs for neurological diseases that are more effective and have fewer side effects (Grodzicki & Dziendzikowska, 2020).

A notable example is the Ginkgo biloba plant, widely used in traditional Chinese medicine and other Asian cultures. Ethnopharmacological and scientific studies have shown that Ginkgo biloba extract has antioxidant and anti-inflammatory properties, which can improve cognitive function and slow the progression of Alzheimer's disease (Tewari et al., 2018a).

Another plant that arouses interest in ethnopharmacology is turmeric (Curcuma longa), known for its anti-inflammatory and antioxidant action. Turmeric's main active compound, curcumin, has been the subject of research for the treatment and prevention of Alzheimer's disease due to its neuroprotective properties and its ability to inhibit the formation of beta-amyloid protein plaques in the brain, a hallmark of the disease (Mishra & Palanivelu, 2008; Sharifi-Rad et al., 2020).

Ethnopharmacology also contributes to the discovery of new therapeutic targets. Through the investigation of ethnopharmacological practices, it is possible to identify plants and substances that operate in different molecular pathways related to Alzheimer's disease, such as the regulation of beta-amyloid metabolism, the fight against oxidative stress and the modulation of brain inflammation (Tewari et al., 2018b).

Although ethnopharmacology has guarantees for Alzheimer's disease research, it is important to note that studies in this area are still ongoing. Scientific validation of these medicinal plants and natural substances as effective treatments requires rigorous investigation and further clinical studies (Akram & Nawaz, 2017)

In short, ethnopharmacology plays a key role in Alzheimer's disease research, exploring the traditional knowledge of different cultures and identifying medicinal plants with therapeutic potential. This multidisciplinary approach offers new perspectives and could lead to the development of innovative and more effective treatments for this neurodegenerative condition that affects millions of people around the world (Tyler & Tyler, 2023).

3 METHODOLOGIES

In order to analyze the production of scientific studies on plants and isolated compounds for Alzheimer's disease, we opted for bibliometric research by analysis of the Software-RStudio through the tool Bibliometrix and Scopus. (Aria & Cuccurullo, 2017).

Bibliometrics is an area that addresses quantitative research, analysis of several studies detailed as year of publication, countries, journals, most cited authors, funders among others, this series of evidence shows the importance of scientific production in various areas such as health, humanities, education, technologies among others. Through statistical data, bibliometrics makes it possible to evaluate and monitor the evolution of the field of study through the classification of citations and cooperation through keywords and themes. As a result, one can know about the area (GUIMARAES; MOREIRA; BEZERRA, 2021).

For the synthesis of the first data, the date of collection on February 14, 2023 of the documents was chosen; choice of key terms by applying the Boolean operators TITLE-ABS-KEY (isolated AND compound AND alzheimer's AND plants); collection of bibliometric data in the Scopus database in which there was no exclusion of language or temporal design, having 530 records, then imported the documents in "BibTeX" format. Then, installed the RStudio Software - Applying the codes ("BIBLIOMETRIX", "LIBRARY (bibliometrix)", "BIBLIOSHINY ()"), in order to access the bibliometrix package and insert the documents in "BibTeX" format. To evaluate the quantitative analysis of research carried out over time, analysis of terminologies among authors and thematic evaluation among authors.

In the second step of data extraction applying the same key terms and filter in the Scopus database, articles from reviews, book chapters, short researches, conferences, books, editorials, letters and observations were excluded. There are 399 documents left for analysis that were inserted in the tool (Rayyan) - AI Powered Tool for Systematic Literature Reviews that enables the qualitative development of studies.

Of 399 documents 212 were included. And for the insertion of these 212 researches was read the abstracts and only the isolated active compounds with positive results in which the terms mentioned by the authors such as "first report", "potent inhibition", "more potent", "more active", "significantly", "strong inhibitor", "potently", "higher activity", "more effective activity", "more promising".

The 187 excluded articles had isolated substances with moderate and weak effect, studies that included seaweed, activity in neuropathological diseases that did not exclusively encompass Alzheimer's disease, inhibition by extract, did not mention the plant, studies of fungi, bacteria, review articles, no anti-Alzheimer's action or anti-Alzheimer's activity.

4 OUTCOME AND DISCUSSION

4.1 PRODUCTIVITY ANALYSIS

The first work produced regarding the keywords inserted in the Scopus database is authored by researchers Jin-Hui Kim, Sang-In Kim and Kyung-Sik Song, published in 2001. Under the title *Prolyl Endopeptidase inhibitors from green tea,* research conducted by methanolic extract of green tea leaves succeeded in isolating three compounds gallate from (-)-epigallocatechin, gallate from (-)-epicatechin and gallate from (+)-gallocatechin. From 2003 to 2006 had a continuous growth, the other years until the realization of this research it is possible to verify several oscillations. Relating to the measures taken worldwide of social isolation that have driven many researchers away from their face-to-face studies due to Covid-19, the year 2020 presented a satisfactory rate of documents with 62 publications compared to 2022 which obtained 69.

The most productive author according to Scopus' metric analysis is Choi, J. S. has 17 announced papers addressing studies of plants, Alzheimer's disease, cholinergic inhibition and neuroprotection. The first research conducted by the author entitled *Cholinesterase and BACE1 inhibitory diterpenoids from Aralia cordata* in the year 2009. The researcher has as first author 6 articles published in the *Archives of Pharmacal Research*; the others divided among other sources as co-author.

In analysis of publication of the documents by funding institution highlighted by Scopus China has (127 articles) and in second place South Korea (86 articles) until the date of this research, countries such as India, Japan, Spain, Saudi Arabia, Egypt, Pakistan, United States and Brazil do not appear as major producers by funding foundation, however by country / territory all other countries mentioned above, are the 10 largest producers of articles published on the plant over the years, where each one presents more than 20 indexed documents. Looking at the time frame from 2011 to 2017, the small difference between the two largest producers: China with 48 articles and South Korea presenting 40 plant research articles.

This number of studies involving plants and Alzheimer's disease may be related to the number of elderly people living in this country. China is the second most populous country in the world second only to India and according to China's seventh national census in 2020, there are 264,018,766 and 190,635,280 elderly people aged 60 and 65, if you buy with census conducted in 2010 the country's elderly population has aged rapidly and the number of incidences, mortality and problems related to aging gradually increases. The existence and incidence of the increase in Alzheimer's disease presents several problems in public health and in the urban and rural society of China, this recent census points out that there are 15.07 million elderly people with dementia and of this totality 9.83 million are with Alzheimer's. A study also showed that China spent US$ 167.74 billion on treatment for people with Alzheimer's in the year 2015 and points out that by the year 2050 the costs of this pathology may reach 1.8 trillion (R. Ren et al., 2022)

4.2 ANALYSIS OF VOCABULARIES

In the evaluation of the keywords used by all the researchers, inserted in the Bibliometrix tool, it was found 2758 sets of words where the term "Alzheimer's disease" was the most assiduous, with 404 appearances, in second place, word "plant extract", which repeats twice, as shown in Table 1. This denotes the importance of plant studies and a network of occurrence of this term during the passage of time as shown in Figure 3.

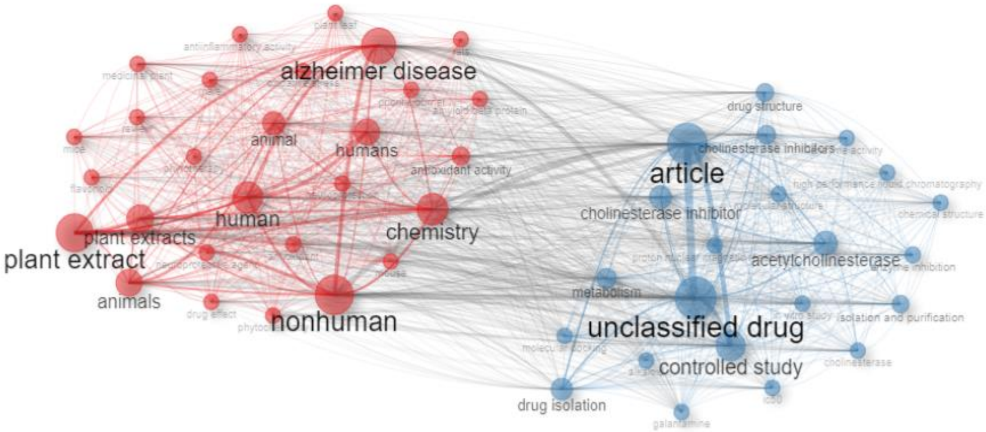
Table 1. Frequency, keywords and consistencies

Words	Occurrences
Alzheimer's disease	404
Plant Extract	325
Unclassified drugs	308
Articles	304
Non-Human	287
Acetilccolinesterase	266
Human	244
Quimíca	224
Control Study	202
Plant extract	194

Source: Adapted Bibliometrix (2023)

Figure 3 represents a set of ideas between authors and co-authors of related studies. The lines show a link between the keywords mentioned by the authors. On the red side, the featured keywords are "Alzheimer's disease," "plant extract," "human," "animal," "chemical," and "non-human," indicating a research collaboration over time among researchers in these areas. On the blue side, there are two featured terms, "articles" and "unclassified drug," which appear to be related to observational research studies and data collection. This figure can represent the interconnection of ideas and collaboration between researchers in different areas of study, as well as the collection of data through observational studies.

Figure 3. Co-occurrence Network

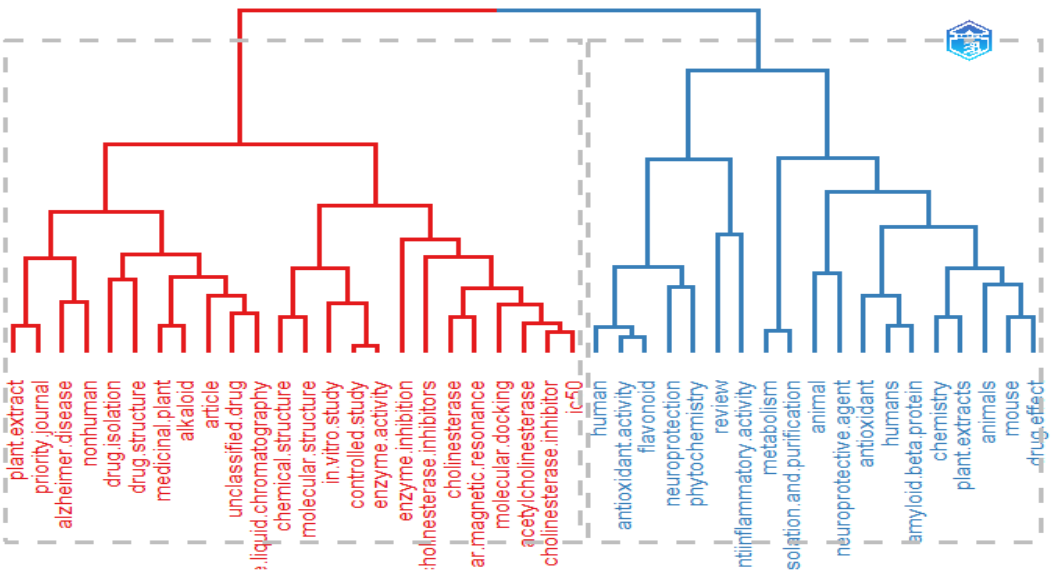


Source: Bibliometrix

4.3 EVALUATION BY THEME

In the analysis of the themes more in accordance with (Figure 4), it is possible to observe that the most recurrent themes in the research of plants and alzheimer are formed by 2 clusters in blue and red color.

Figure 4. Dendrogram



Source: Bibliometrix (2023)

Figure 4 shows two clusters, one in blue and the other in red, which represent the most recurrent themes in plant and Alzheimer's research. Through the analysis of the dendrogram, it is possible to observe the order and connections between these most frequent themes.

In total, 24 central themes with a high degree of development are identified, which are related to phytochemical studies of plants, isolation of chemical compounds and neurological inhibitory biological activities, both in humans and in non-humans.

The themes highlighted in blue are related to 19 central themes and represent studies in humans, isolation of compounds, antioxidant potential and control studies. In the dendrogram, it is possible to observe that the use of plants is related to all areas, from the tolerance and isolation of active substances to the performance of tests to verify the effects of drugs.

This analysis suggests a strong connection between plant phytochemical studies and Alzheimer's disease research, with a wide range of related topics and a comprehensive approach from administration to evaluation of the therapeutic effects of isolated compounds.

4.4 MEDICINAL PLANTS INHIBITING THE ENZYMES ACETYLCHOLINESTASIS (ACHE) AND BUTYRYLCHOLINESTERASE (BUCHE)

One of the most widely used methods for detecting enzymatic inhibitory activity is the Ellman technique. This test is performed by means of photometry that has the ability to cause action of the enzyme through tissue extracts, homogenized fractions, isolated compounds among others. In this test the enzymatic activity is observed by the growth of the yellow color that is formed due to thiocholine, this occurs at the moment that thiocholine comes into contact with the reagent of 5,5'-dithiobis-(2-nitrobenzoic acid) or DTNB) the production of anions of yellowish color. This same enzymatic method written by Ellman et al, is also used with alteration by. That includes the thin-layer chromatography (CCD) technique. The studies by Thin Layer Chromatography are performed to trace plant extracts prepared in an amount of 10mg/mL added in a certain chromatographic plate in a thin layer of silica gel (Ellman et al., 1961) (Rhee et al., 2003) (Castro and Silva et al., 2020)

In addition to this enzymatic study several researchers use in *vivo method by the* tissue of the frontal cortex, in the cerebellum even in the area of memory, this method has the objective of observing improvements in memorization, inhibitory protection induced by oxidative stress among others (Farias et al., 2022)

Existing treatments for Alzheimer's disease use drugs to increase acetylcholine (ACh) levels, causing inhibition of acetylcholinesterase and butyrylcholinesterase that are in charge of hydrolyzing ACh into acetate and choline, act only in the progressive relief of Alzheimer's (Masondo et al., 2019)

In the brains of people diagnosed with Alzheimer's, the enzyme acetylcholinesterase is found in large proportion more than butyrylcholinesterase, this increase causes the rapid hydrolysis of acetylcholine prevented the action of the neurotransmitter (Marucci et al., 2021)

The importance of compounds presents in plants called secondary metabolites in addition to helping in the survival and protection of plants, has become fundamental for humans in the development of medicines. And these chemicals extracted from plants that have an affinity to act on the central nervous system (CNS) are of interest for the development of new pharmaceutical drugs as shown in (table 2) studies that obtained inhibitory activity of enzymes for Alzheimer's disease carried out over the years.

Tables 2. Medicinal plants with anticholinesterase and anti-butyrylcholinesteratic activity

Plants and Families	Anti-Alzheimer's Compounds	Author
Piper nigrum L. (Piperaceae)	Piperine (derivative)	(Jaipea et al., 2023)
Cassia timoriensis DC. (Fabaceae) Cassia grandis Lf (Fabaceae)	luteolin, cinnamic acid, 4-hydroxycinnamic acid	(Alhawarri et al., 2023)
Grewia tiliaefolia Vahl (Malvaceae)	propyl 3-hydroxy-10,13-dimethyl-6,7,8,9,10,11,12,13,14,15,16,17-dodecahydro-3H-cyclopenta [a]phenanthreno-17-carboxylato	(Rajput et al., 2023)
Fragaria ananassa Duchesne (Rosaceae)	4,22-cholestadien-3-one, stigmast-4-en-3-one	(Mahnashi & Alshehri, 2022)
Andrographis paniculata (Burm.f.) Wall. (Acanthaceae)	desoxy-Andrographolide (Derivative)	(Jatav et al., 2022)
Fritillaria taipaiensis P.Y.Li *(Liliaceae)*	taipainin (Derivative)	(A.-W. Wang et al., 2022)
Talguenea quinquenervia (Gillies & Hook.) I.M. Johnst., (Rhamnaceae)	Zizibberenalic acid, zizibberanalic acid, ceanotic acid, ceanotenic acid, ceanotannolic acid, 3-oxo-oceanic acid, 3-O-acetyl-oceanic acid	(Muñoz-Nuñez et al., 2022)
Notholirion thomsonianum (Royle) Stapf *(Liliaceae)*	2-(3,4-dimethoxifenyl) -3,7-dihidroxi-4H-cromen-4-one	(Mahnashi, Alshahrani, et al., 2022)
Plantago subulata L. (Plantaginaceae)	acteoside, isoacteoside, echinacoside, and arenarioside	(Özaslan et al., 2022)
Polygonum aviculare L. *(Polygonaceae)*	hydroxy succinimide	(Mahnashi, Alyami, et al., 2022)
Pongamia pinnata (L.) Pierre (Fabaceae)	pongapine, ovalichromene B, gamatin and pongaglabrone	(Nguyen et al., 2022)
Vincetoxicum funebre Boiss. & KotschyName (Apocynaceae)	daucosterol	(Abbas-Mohammadi et al., 2022a)
Conocarpus lancifolius Engl (Combretaceae)	lancifolamide	(Saadullah et al., 2022)
Berberis parkeriana CKSenvy. (Berberidaceae)	3-O-(p-Bromobenzoyl)jatrorrhizine	(R. Ali et al., 2022)
Caragana balchaschensis (Kasn. ex Kom.) Pojark. (Fabaceae)	quercetin (derivatives)	(Zhumanova et al., 2021)
Castanopsis cuspidata var. sieboldii (Makino) Nakai (Fabaceae)	4'-O-(α-L-rhamnopyranosyl) -3,3',4-tri-O-methylillagic acid and 3,3',4-tri-O-methylillagic acid	(Oh et al., 2021)

Spiranthes sinensis (Pers.) Ames (Orchidaceae)	quercetin, kaempferol, 3-(4-tolyloxy)-propanolic acid, ethyl ferulate	(Zou et al., 2021)
Mitragyna speciosa Korth. (Rubiaceae)	mitragynine	(Innok et al., 2021)
Vanda roxburghii R.Br. (Orchidaceae)	Gigantol, syringaldehyde	(Ahammed et al., 2021)
Grewia optiva J.R. Drumm. ex Burret (Malvaceae)	2,2'-(1,4-phenylene) bis (3-methylbutanoic acid)	(Ul Bari et al., 2021)
Lawsonia inermis var. spinosa (L.) Pers. (Lythraceae)	3-O-β-acetyloleanolic acid, oleanolic acid	(Balaei-Kahnamoei et al., 2021)
Astragalus membranaceus fish. ex Bunge (Fabaceae)	calycosin-7-O-β-d-glucoside, pratensein-7-O-β-d-glucoside, formononetin-7-O-β-d-glucoside, calycosin, genistein and formononetin	(S. Li et al., 2021)
Cremastra appendiculata (D. Don) Makino (Orchidaceae)	cremaphenanthrene	(L. Liu et al., 2021)
Amaryllis belladonna E. Mey. ex Steud. (Amaryllidaceae)	Acetylcarnosine	(Sibanyoni et al., 2020)
Rauvolfia vomitoria Wennberg (Apocynaceae)	vobasenal	(Zhan et al., 2020)
Acacia auriculiformis A. CUNN Ex. Benth *(Fabaceae)*	α-spinasterol	(Lawal et al., 2020)
Carissa carandas L. (Apocynaceae)	1-Heneicosanol; N-nonadecanol-1; cholesta-4,6-dien-3-ol, (3beta); di-n-octyl phthalate; 7,9-di-tert-butyl-1-oxaspiro (4,5) deca-6,9-diene-2,8-dione; 6-undecyl-5,6-di-hydro-2H-pyran-2-one e phenol, 2,4-di-t-butyl-6-nitro	(Kareti & Pharm, 2020)
Narcissus tazetta var. orientalis (L.) hört. (Amaryllidaceae)	11-Hydroxygalanthin and narcissidin	(Karakoyun et al., 2020)
Piper longum L. (Piperaceae)	piperine	(Khatami et al., 2020)
Hedyotis spread Spreng. (Rubiaceae)	6-O-E-pcoumaroyl scandoside methyl esterr, quercetin-3-O-[2″-O-(6‴-O-O-E-feruloyl) -β-d-glucopyranosyl] -β-d-glucopyranoside, E-6-O-feruloyl scandoside methyl ester, 6-O-methyldeacetylasperulosidic acid methyl ester, asperulosidic acid, deacetylasperulosidic acid methyl ester, scandoside methyl ester, 6-O-methylscandoside methyl ester.	(J. H. Park & Whang, 2020)
Hippeastrum reticulatum Herb (Amaryllidaceae)	N-chloromethylnarcissidinium, narciprimine, N-methyltyramine, 3β,11α-dihydroxy-1,2-dehydrocrinane	(Hoang et al., 2020)
Tinospora cordifolia (Willd.) Miers ex Hook.f. & Thomson (Menispermaceae)	Oxoglaucine, liriodenine, N-formylanonein	(Onoja et al., 2020)
Erythrina caffra White (Fabaceae)	Erythralin, erythrinin, cristanin A	(Nassief et al., 2020)
Zanthoxylum rigidum Humb. & Bonpl. ex Willd. (Rutaceae)	avicin	(Gonzalez et al., 2020)
Leucophyllum ambiguum Bonpl. (Scrophulariaceae)	furofuranone (derivatives)	(Rios et al., 2020)

Anarrhinum pubescens Loudon (Plantaginaceae)	iridoids (derivatives)	(Mahran et al., 2020)
Narcissus pseudonarcissus subsp. bicolor (L.) Baker (Amaryllidaceae)	carltonin	(Al Mamun et al., 2020)
Geophila repens (L.) I.M. Johnst (Rubiaceae)	pentylcurcumene	(Dash et al., 2019)
Andrographis paniculata (Burm.f.) Wall. (Acanthaceae)	3,4-di-di-o-caffeoylquinic acid, apigenin and 7-o-methylwogonin	(Bench et al., 2019)
Anthocleista vogelii Planch. (Gentianaceae)	swertisine	(Ajayi et al., 2019)
Dioscorea communis (L.) Caddick & Wilkin (Dioscoreaceae)	2,4,8-Trimethoxy-3,7-phenanthenediol	(Boudjada et al., 2019)
Zanthoxylum bungeanum Maxim. (Rutaceae)	3,4-Dihydroxyphenylethanol	(C.-H. Li et al., 2019)
Solenostemma argel (Delile) Hayne (Apocynaceae)	kaempferol	(Demmak et al., 2019)
Atalantia monophylla (L.) DC (Rutaceae)	lupalbigenin	(Posri et al., 2019)
Elsholtzia ciliata (Thunb.) Hyl. (Lamiaceae)	acacetin (derivatives)	(Nugroho et al., 2019)
Berberis vulgaris L. (Berberidaceae)	aromoline	(Hostalkova et al., 2019)
Artocarpus lakoocha Roxb. (Moracea)	2-Arylbenzofurans (derivatives)	(Namdaung et al., 2018)
Artabotrys spinosus Craib (Annonaceae)	O-Methylmoschatoline, artacinatine C	(Sichaem et al., 2018)
Narcissus poeticus L. (Amaryllidaceae)	narcipavine	(Šafratová et al., 2018)
Cassia obtusifolia L. (Fabaceae)	rubrofusarin 6-O-β-D-gentiobioside, nor-rubrofusarin 6-O-β-D-glycoside	(Shrestha et al., 2018)
Tephrosia purpurea (L.) Pers. (Fabaceae)	trans-tefrostacin	(Pitchai et al., 2018)
Delphinium denudatum Wall. (Ranunculaceae)	Norditerpenoid	(H. Ahmad et al., 2018)
Hieronymiella marginata (Pax) Hunz. (Amaryllidaceae)	sanguinine	(Ortiz et al., 2018)
Stachys japonica Miq. (Lamiaceae)	4'-O-methylisoscutellarein 7-O-(6'''-O-acetyl)-β-D-allopyranosyl (1→2)-β-D-glucopyranoside	(Nugroho et al., 2018)
Polygonum limbatum Meisn. (Polygonaceae) Dorstenia barteri Bureau (Moraceae)	(-) pinostrobin, 2',4'-dihydroxy-3',6'-dimethoxychalcone, 6-8-diprenyleriodictyol, isobavachalcone, 4-hydroxylonchocarpine e 6-prenylapigenin	(Dzoyem et al., 2017)
Leonurus japonicus Miq. (Lamiaceae)	caffeic acid, quercetin, p-coumaric acid, kaempferol and hydroxytyrosol.	(Nugroho et al., 2017)

Rosmarinus officinalis (l). (Lamiaceae)	Nepitrin	(Karim et al., 2017)
Cornus officinalis Siebold & Zucc. (Cornaceae)	telimagrandin II, 1,2,3,6-tetra-O-galloyl-β-d-glucose	(Bhakta et al., 2017)
Morinda officinalis F.C. How (Rubiaceae)	anthraquinones, coumarin (derivatives)	(Y. K. Lee et al., 2017)
Pueraria lobata (Fabaceae)	Lupeol	(Koirala et al., 2017)
Kaempferia parviflora Wall. ex Baker (Zingiberaceae)	3,5,7,3′,4′-pentamethoxyflavone	(Seo et al., 2017)
Argemone platyceras Link & Otto (Papaveraceae)	(-)-munitagin	(Grid et al., 2017)
Rhodiola crenulata (Hook.f. & Thomson) H. Ohba (Crassulaceae)	(-)-Epicatechin gallate ((-)-ECG), rhodionin, herbacetin, rhodiosin	(F.-J. Li et al., 2017)
Carthamus tinctorius L.(Asteraceae)	carthatins	(Peng et al., 2017)
Juncus acutus L. (Juncaceae)	Juncunol	(M. J. Rodrigues et al., 2017)
Mutellina purpurea (Poir.) Reduron, Charpin & Pimenov (Apiaceae)	Pteryxin	(Orhan, Senol, et al., 2017)
Fritillaria walujewii Regel (Liliaceae)	tortifolin, Walujewine C, Sinpeinine A, Walujewine E, Walujewine A,	(Y.-M. Liu et al., 2017)
Crataegus oxyacantha Walter (Rosaceae)	β-Sitosterol-3-O-β-D-Glucopyranoside	(M. Ali et al., 2017)
Salsola grandis Freitag, Vural & Adigüzel (Amaranthaceae)	N-acetyltryptophan	(Orhan, Kucukboyaci, et al., 2017)
Valeriana officinalis var. latifolia Briq. (Caprifoliaceae)	volvalerenic acid K	(H.-W. Chen et al., 2016)
Mesua congestiflora (Clusiaceae)	α-mangostin, congestiflorone acetate	(Teh et al., 2016)
Pycnanthus angolensis (Welw.) Campaigned. (Myristicaceae)	pongaflavone, (2R,3R)-3-hydroxy-5-methoxy-2″,2″-dimethylpyrano [7,8:5″,6″]-flavanone	(Elufioye et al., 2016)
Xylia xylocarpa (Roxb.) W. Theob. (Fabaceae	(3b)-hopan-3-ol-28,22-olide , lupeol, betulin, 28-norlup-20(29)-ene-3β-hydroxy-17β-hydroperoxide, betulinic acid, oleanolic acid, 3β-formyloxy-l8α-oleanane-28,19β-lactone, 2,6-dimethoxy-p-benzoquinone	(Lam et al., 2016)
Cryptocarya infectoria Miq. (Lauraceae)	2-Methoxy-atherosperminine	(Wan Othman et al., 2016)
Hoppea fastigiata (Griseb.) C.B. Clarke in Hook.f. (Gentianaceae)	1,5,7-tri-hydroxy-3-methoxyxyanthione, 1,5-di-hydroxy-3,7-dimethoxyxyanthone, 1,3,5-tri-hydroxy-8-methoxyxyanthione	(Moon et al., 2015)
Ampelopsis brevipedunculata	santin, 7-O-α-rhamnoside Luteolin, 7-O-β-glucuronide Apigenin	(Rashed et al., 2015)

(Maxim.) Trautv. (Vitaceae)		
Artemisia maderaspatana L. (Asteraceae)	maderaspatana	(Jyotshna et al., 2015)
Angelica decursiva Franch. & Sav. (Apiaceae)	hydroxybenzoic acid	(Yousof Ali et al., 2015)
Piper bavinum C.DC. (Piperaceae)	Bavinol A	(Dung et al., 2015)
Garcinia hombroniana Pierre (Clusiaceae)	garcihombronan N	(Jamila et al., 2015)
Nelumbo nucifera Gaertn. (Nelumbonaceae)	liensinine	(Jung et al., 2010)
Evodia lepta Merr. (Rutaceae)	kokusaginin, melineurin	(Sichaem et al., 2015)
Achillea biebersteinii Hub. -Mor. (Asteraceae)	Quercetin-7-O-β-D-glucoside, patuletin-7-O-β-D-glucoside	(Sevindik et al., 2015)
Harpagophytum procumbens DC. ex Meisn. (Pedaliaceae)	verbascosides (derivatives)	(Bae et al., 2014)
Myristica fragrans Houtt. (Myristicaceae)	(7S)-8′-(4′-hydroxy-3′-methoxyphenyl)-7-hydroxypropyl]benzene-2,4-diol, (8R,8′S)-7′-(3′,4′-methylenedioxyphenyl)-8,8′-dimethyl-7-(3, 4-di-hydroxyphenyl)-butane, malabaricone C	(Cuong et al., 2014)
Ipomoea aquatica var. aquatica (Convolvulaceae)	quercetin, phenolic acid, chlorogenic acid, chlorogenic acid	(Sivaraman et al., 2014)
Maytenus imbricata Mart. ex Reissek (Celastraceae)	3-oxo-11α-hydroxylup-20(29)-ene, 3-oxo-29-hydroxyfriedelane, 3,7-dioxofriedelane	(V. G. Rodrigues et al., 2014)
Acanthopanax henryi Harms (Araliaceae)	5-caffeoylquinic acid	(X. D. Zhang et al., 2014)
Stemona sessilifolia (Friends.) Friends. (Stemonaceae)	stenin B	(Lai et al., 2013)
Amberboa ramosa (Roxb.) Jafri (Asteraceae)	Amberbin	(Ibrahim et al., 2013)
Murraya paniculata Kaneh. (Rutaceae)	eucrestifolin	(Rehman et al., 2013)
Boesenbergia rotunda (L.) Mansf. (Zingiberaceae)	Boesenbergine A	(Abdelwahab, 2013)
Holarrhena antidysenterica Wall. ex A.DC. (Apocynaceae)	conessine, conessimine, conarrimine, conarrimine and conimine	(Z. Yang et al., 2012)
Abuta grandifolia (Mart.) Sandwith (Menispermaceae)	R,S)-2 N-norberbamunin, (S-S)-O4″-methyl, Nb-nor-O6'-demethyl-(+)-curine, (S-S)-O4″-methyl, O6'-demethyl-(+)-curine	(Cometa et al., 2012)
Semecarpus anacardium Blume (Anacardiaceae)	1',2'-dihydroxy-3'-pentadec-8-enylbenzene (A) e 1',2'-dihydroxy-3'-pentadeca-8,11-dienylbenzene (B)	(Adhami et al., 2012)
Corydalis cava (L.) Schweigg. & Körte (Papaveraceae)	(+)-Canadalin, (+)-Canadin, (+/-)-corycavidin, (+)-bulbocapnin	(Chlebek et al., 2011)

Cyrtanthus contractus N.E.Br. (Amaryllidaceae)	narciprimine	(Nair et al., 2011)
Buxus sempervirens L. (Buxaceae)	(+)-buxabenzamidienin	(Orhan et al., 2011)
Morus lhou Koidz. (Moraceae)	5'-geranyl-4'-methoxy-5,7,2'-trihydroxyflavone	(J. Y. Kim et al., 2011)
Hippeastrum papilio (Ravenna) Van Scheepen (Amaryllidaceae)	11β-hydroxygalanthamine	(De Andrade et al., 2011)
Alpiniae officinarum (Zingiberaceae)	Galangin	(Guo et al., 2010)
Esenbeckia leiocarpa Engl. (Rutaceae)	leptomerin	(Cardoso-Lopes et al., 2010)
Ferulago campestris (Better) Grecescu (Apiaceae)	siol anisoate, epielmanticin	(Dall'Acqua et al., 2010)
Cleistocalyx operculatus (Roxb.) Merr. & L.M. Perry (Myrtaceae)	myricetin-3′-methylether 3-O-β-d-galactopyranoside, myricetin-3′,5′-dimethylether 3-O-β-d-galactopyranoside, quercetin, kaempferol and tamarixetin.	(Min et al., 2010)
Eschscholzia californica Cham. (Papaveraceae)	1-(3-hydroxy-4-methoxybenzyl)-2-methyl-6,7-methylenedioxy-1,2,3,4-tetra-hydroisoquinoline, reticulin	(Cahlíková et al., 2010)
Aralia cordata Thunb. (Araliaceae)	17-hydroxy-ent-kaur-15-en-19-oic acid, ent-pimar-15-en-8α,19-diol	(Jung et al., 2009)
Kaempferia parviflora Wall. ex Baker (Zingiberaceae)	5,7-Dimethoxyflavone	(Sawasdee et al., 2009)
Iris pseudopumila Tineo (Iridaceae)	Isoorientin, isovitexin	(Conforti et al., 2009)
Peganum nigellastrum Bunge (Nitrariaceae)	vasicinone, vasicine, harmine, deoxyasicinone, deoxivasicinone, deoxivasicine, harmaline, harmol, harman, nigelastrin I, nigelastrin II	(C.-H. Wang et al., 2009)
Magnolia officinalis Rehder & E.H.Wilson (Magnoliaceae)	4-O-methylhonokiol	(Y. K. Lee et al., 2009)
Ginger rhizomes (Zingiberaceae)	6-Gingerol	(Ghayur et al., 2008)
Salvia sclareoides bread. (Lamiaceae)	(1beta,3beta)-lup-20(29)-ene-1,3,30-triol, nepetidine, nepeticin, lupendiol, (1beta,11alpha)-dihydroxy-lup-20(29)-en-3-one , ursolic acid, sumaresinolic acid, hederagenin	(Rauter et al., 2007)
Hosta plantaginea (Lamb.) Asch. (Asparagaceae)	8-Demethoxy-10-O-methylhostasine	(Y.-H. Wang et al., 2007)
Skimmia laureola (DC.) Siebold & Zucc. ex Walp. (Rutaceae)	quinoline 5-one, ribalinin, methyl isoplatodesmine	(Rahman et al., 2006)
Detarium microcarpum Guill. & Perr. (Fabaceae)	3,4-epoxyclerodan-13E-en-15-oic acid, 5α,8α(2-oxokolavênico acid), 3,4-dihydroxyclerodan-13Z-en-15-oic acid	(Cavin et al., 2006)
Stephania Venous (Blume) Spreng. (Menispermaceae)	stearanine, cyclanoline, N-methyl stepholidine	(Ingkaninan et al., 2006)
Sarcococca saligna Müll.Arg. (Buxaceae)	2-hydroxysalignarin-E (=(2′E,20S)-20-(dimethylamino)-2β-hydroxy-3β-(tigloylamino)pregn-4-ene; 1), 5,6-dihydrosarconidine (=(20S)-20-(dimethylamino)-	(Atta-your-Rahman et al., 2004)

	3β-(methylamino)-5α-pregn-16-ene; 2), salignamine (=(20S)-20-(methylamino)-3β-methoxypregn-5,16-diene; 3), 2-hydroxysalignamine (=(20S)-20-(dimethylamino)-2β-hydroxy-3β-methoxypregn-5,16-diene; 4), salignarin-F (=(2′E, 20S)-20-(dimethylamino)-4β-hydroxy-3β-(tigloylamino)pregn-5-ene; 5), salonin-C (=(2′E, 20S)-20-(dimethylamino)-3β-(tigloylamino)pregnna-4,14-diene; 6) e N-[formyl(methyl)amino]salonin-B (=(20S)-20-[formyl(methyl)amino]-3β-methoxypregna-5,16-diene; 7) were isolated from the MeOH extract of Sarcococca saligna, together with the six known alkaloids dictyoflebin (8), epipacisamine-D (9), saracosine (10), iso-N-formylchonemorphine (11), sarcodinine (12) and alkaloid-C (13).	
Ballota limbata Benth. (Lamiaceae)	diterpenoids (derivatives)	(V. U. Ahmad et al., 2004))
Salvia miltiorrhiza Bunge (Lamiaceae)	diterpenoids (derivatives)	(Y. Ren et al., 2004)
Murraya paniculata Kaneh. (Rutaceae)	murranganone, paniculatin	(Choudhary et al., 2002)
Fatoua villosa Nakai (Moraceae)	zeatin	(Heo et al., 2002)

Source: Author (2023)

Inhibition of the enzyme acetylcholinesterase and butyrylcholinesterase causes increased acetylcholine in the synaptic cleft, this causes AD progression to slow. AChE is responsible for the transmission of nerve impulses in vertebrates and invertebrates and hydrolysis of ACh (Tuzimski & Petruczynik, 2022) . Butyrylcholinesterase has a role in cholinergic hydrolysis (ACh) and hydrolysis of organic compounds such as choline esters, butyrylcholine and succinylcholine, among others, such as the alkaloid cocaine and heroin and acetylsalicylic acid (ASA). In the study it is possible to see in (Table 2) studies d (Stefanello, 2003) the plants that have a double inhibitory action of AChE and BChE can be seen of great therapeutic interest for pharmaceutical industries and researchers, their isolated compounds are able to benefit public health and several people with Alzheimer's disease, totaling 121 documents collected in the Scopus database.

It is possible to observe the percentage of studies in relation to the botanical families and the authors, there are a total of 51 families mentioned in table 2, and using the percentage of studies dividing the number of families individually by the total document it is possible to observe that 1% of the researches are related to the families *Annonaceae, Asparagaceae, Amaranthaceae, Anacardiaceae, Combrateceae, Cornaceae, Crassulaceae, Caprifoliaceae, Convolvulaceae, Celastraceae, Dioscoreaceae, Iradaceae, Juncaceae, Lythraceae, Lauraceae, magnoliaceae, Myrtaceae, Nelumbonaceae, Nitrariaceae, Polygonaceae, Pedaliaceae, Rhamnaceae, Ranunculaceae, Scrophulariaceae, Stemonaceae, Vitaceae* with 1 survey each.

The researches carried out in the families Asteraceae, Apiaceae, Acanthaceae, Araliaceae, Berberidaceae, Buxaceae, Clusiaceae, Gentianaceae, Liliaceae, Malvaceae, Menispermaceae, Myristicaceae, Orchidaceae, Pireraceas, Plantaginaceae, Papaveraceae and Rosaceae, totaled 2%, - 2 to 3 files each. 3% contains the families *Moraceae, rubiaceae with* 3 articles

Apocynaceae, Zingiberaceae comprise 4% with 5 documents, *6%* Lamiaceae *with 7 articles, 7% Rutaceae* with 8 articles*, and with the* highest rate of appearance we have the family *Fabaceae* with *11%* totaling 13 documents presented.

The *Fabaceae was named for the first time 1789 commonly known as leguminosae is a characteristic family with the presence of flowers distributed in different geographical regions, cultivated for economic interest in the world is considered the third largest existing terrestrial family surpassed only by* the families Asteraceae *and* Orchidaceae *According to* (Christenhusz & Byng, 2016) World Flora Online *(2023) the families* Fabaceae It has about 70,898 synonyms and 789 genera.

This family has a specific chemical particularity, for example, the isoflavonoid pterocarpans discovered in *Fabaceae;* and many of the compounds present are toxic and others are strongly found such as kaempferol, quercetin and myricetin (or myricetin). The subclass papilionoideae makes up the largest subfamily of the *Fabaceae*, isoflavonoids being found in a large proportion of them (Machado et al., 2020)

For a long time the use of herbal medicines has always been used pharmacological and plant studies for treatment related to the central nervous system (CNS), has been studied and raised for example Tettevi et al (2022) prepared a review on African plants and foods related to the treatment of Alzheimer's disease listing several plants with benefits for memory, anticholinesterase and neuroprotective inhibition, in which he addressed phenotypes related to Alzheimer's and the family *Fabaceae* among others. The author in the intention of showing applications in the study of plants for Alzheimer's listed the benefits of vegetables and the possible neuroprotectors exposing extracts and compounds isolated from plants with Anti-Alzheimer's activities, boasted the species Cheng, Lin e Lane (2021) *Glycyrrhiza inflata* B. *(Fabaceae)* and its benefits for Alzheimer's in aqueous extract and its isolated compounds.

The study carried out by the authors by the plant Alhawarri et al (2023) *Cássia timoriensis DC, Cássia grandis Lf* both belonging to (*Fabaceae)* isolated three compounds luteolin, cinnamic acid, 4-hydroxycinnamic acid with promising activities for Alzheimer's, *in addition to these plants' other important plants of the Fabaceae family such as* Pongamia pinnata (*L.) Pierre,* Caragana balchaschensis *(*Kasn. ex Kom.) Pojark, *Castanopsis cuspidata var. sieboldii* (Makino) Nakai, *Astragalus membranaceus* Fisch. ex Bunge, *Acacia auriculiformis A.* CUNN Ex. Benth., *Erythrina caffra Blanco, Cassia obtusifolia L., Tephrosia purpurea (L.) Pers., Pueraria Lobata, Xylia Xylocarpa*

(Roxb.) W. Theob., Detarium Microcarpum Guill. & Perr. They obtained admirable results for the treatment of AD.

The pharmacological treatments currently used are substances whose action is to increase the levels of acetylcholine in the brain is these plants that act on the central nervous system in cholinergic action are expressly relevant for medicine. In particular plants produce two types of substances called primary metabolites responsible for plant and secondary development that include essential oils (OE) (terpenes) being entirely of plant origin, these substances make available interests to pharmaceutical, cosmetic and food industries (Akman, et al 2023). These terpenes have the ability to cross biological barriers through interactivity with endogenous molecules (Ali et al., 2017)

EOs are mostly found in flowers, leaves, seeds and are usually isolated by hydrodistillation method where the extract is in direct interaction with water at the time it goes into boiling transports volatile compounds such as oil. (Ali et al., 2017) OE as examples of *ducosterol, alpha-spinasterol* among others presented in table 2- contains inhibition activity of the enzyme acetylcholinesterase ensuring new target molecules for the treatment of Alzheimer's. (Abbas-MOHAMMADI et al., 2022)

The therapy for Alzheimer's as well as the pathology itself has several unknowns as over the years the progression of the pathology causes numerous physiological processes such as lipid peroxidations which is a chain reaction caused by organic substances called fatty acid (hydrocarbons) that cause changes in the cell membrane influencing the permeability, fluidity and activity of the cell that can be coated by antioxidant drugs that make peroxidation impossible (BUTTERFIELD, 2020 ; YIN et al., 2016).

Several researchers demonstrate that the use of plants with antioxidant activity containing substances such as vitamin C, vitamin E, beta-carotene can benefit memory loss, these antioxidant compounds have the ability to neutralize free radicals inhibiting health problems. But free radicals do not only cause harm to the human being their normal production is important for cellular respiration and our survival, only their development can cause diseases to be human (LAUER et al., 2022).

The instability in antioxidant defense and increase of free radicals present in the brain produces *stress* oxidative which is another factor associated with Alzheimer's, as well as the occurrence of senile plaques formed by the abnormal metabolization of the amyloid beta protein, neurofibrillary tangles formed by the excess of Tau proteins that arose due to the action of hyperphosphorylation. All these events cause complications in the brain producing symptoms prevalent in various neurological pathologies (Griñán-Ferré et al., 2021) .

These insertions lead to severe brain atrophy, neurodegeneration and neuroinflammation mediated by innate cells present in the brain mentioned in thes authors: neuroinflammation comes from tissue damage caused by neurotoxic substances, which produces several complex chemical actions and because Alzheimer's is quite hermetic and multifactorial, the initial state of neuroinflammation is not yet known, it is only known that Machado et al (2020) Astrocytes and microglia found near senile plaques can trigger the process of the participation of immune system compounds.

Considering the pathophysiology of the disease, biochemical research with the intention of discovering treatment, it was possible to contact in the brain variations of the enzyme MAO-A and B in high amounts, indicating that the activity of MAOs may also be the reason for AD progression. MAOs have the ability to activate beta-secretase and gamma-secretase action by amplifying the disordered generation of amyloid plaques. (Behl et al., 2021)

A study carried out by on the plant (Mahnashi et al., 2021) *Notholirion thomsnianum* (Royale) Stapf, isolating the flavone 2-(3,4-dimethoxyphenyl)-3,7-dihydroxy-4H-cromen-4-one, in its tests showed that the flavone exhibited excellent inhibition of the enzymes AChE and BChE, also contacted the inhibition of the inflammation signaling pathways COX-1 and COX-2, which may contribute to neuroinflammation and in the antioxidant test the authors denoted a relevant increase in antioxidant enzymes caused by the isolated. Similar results can be found in several studies as shown in table 3. Plant species with antioxidant, anti-inflammatory and neuroprotective activity.

Table 3. Plants with antioxidant, anti-inflammatory and neuroprotective activity in Alzheimer's disease

Plants and Families	**Anti-Alzheimer's Compounds**	**Author**
Nardostachys jatamansi (D. Don) DC. *(Caprifoliaceae)*	actinidine, glaziovine	(Krishnan et al., 2022)
Rubus chingii Hu. (Rosaceae)	ellagic acid, tiliroside and kaempferol-3-o-rutoside	(Wu et al., 2022)
Prangos uechtritzii Boiss. & Hausskn. (Apiaceae)	(+) -Falcarindiol and imperatorin	(Albayrak et al., 2022)
Atractylodes macrocephala Koidz. (Asteraceae)	Biatractylolide	(Q. Hu et al., 2022)
Agathophora alopecuroides (Delile) Fenzl ex Bunge, Bassia indica (Wight) AJScott (Amaranthaceae)	N-trans-feruloyl-3-methoxytyramine, N-trans-feruloyltyramine, S-(−) -3-(4-hydroxy-3-methoxyphenyl) -N-[2-(4-hydroxyphenyl) -methoxyethyl] acrylamide, N-trans-caffeoyltyramine	(Othman et al., 2022)
Ocimum basilicum var. basilicum album (L.) Benth. (Lamiaceae)	5,7-dihydroxy-3′,4′,5′-trimethoxyflavone and 3-hydroxy-3′,4′,5′-trimethoxyflavone	(Singh et al., 2022)
Nelumbo nucifera Gaertn. (Nelumbonaceae)	Neferine	(Tang et al., 2022)
Bacopa occultans (Hiern) Hutch. & Dalziel (Plantaginaceae)	bacoside-A3	(Q.-K. Bai & Zhao, 2022)
Geophila repens (L.) IM Johnst (Rubiaceae)	genistin, quercetin-3-D-galactoside, 9,12,15-octadecatrienoic-acid methyl-ester, phytol, retinal,	(Dash et al., 2019)

	stigmasterol, n-hexadecanoic acid, β-sitosterol	
Acorus calamus L. (Acoraceae)	α-asarone	(Venkatesan, 2022)
Rhinacanthus nasutus (L.) Kurz (Acanthaceae)	Rhinacanthin-C	(Rakkhittawattana et al., 2022)
Munronia henryi Harms (Meliaceae)	Munronin V	(Yan et al., 2022)
Myrsine seguinii H.Lév. (Primulaceae)	(2R,3S)-4"-O-galloylisoastilbin, (2R,3R)-4"-O-(4"-Hydroxybenzoyl)astilbin, (2R,3R)-3"-O-E-Feruloylastilbin	(H.-J. Lee et al., 2021)
Xysmalobium undulaum (Apocynaceae)	acetylated glycosydated crotoxogenin, xysmalogenin-3, β-d-glucopyranoside	(Thakur et al., 2021)
Eucommia ulmoides Olive. (Eucommiaceae)	ulmoidol	(Han et al., 2021)
Litchi chinensis Sonn. (Sapindaceae)	Jasmonates, terpenes (derivatives)	(X. Zhang et al., 2021)
Silybum marianum (L.) Gaertn. (Asteraceae)	silibinin A	(Esselun et al., 2021)
Erythrina corallodendron var. orientalis L. (Fabaceae)	10,11-Dioxo-6,7a-erythraline epoxide	(Aboelmagd et al., 2021)
Murraya koenigii (L.) Spreng. (Rutaceae)	9-Benzyl-9H-carbazol-4-ol	(Yano, Nakashima, Kasa, et al., 2020)
Nelumbo nucifera Gaertn. (Nelumbonaceae)	Asimilobine, N-methylasimilobine	(Yano, Nakashima, Oda, et al., 2020)
Quercus serrata Thunb. (Fabaceae)	triterpenóides (derivatives)	(May et al., 2020)
Elaeagnus glabra f. oxyphylla (Elaeagnaceae)	procyanidin B3, procyanidin B4 and helichrysoside (13)	(Y. J. Kim et al., 2020)
Xanthoceras sorbifolia Bunge (Sapindaceae)	barrigenol (derivatives)	(W. Li et al., 2020)
Corydalis tomentella Franch. (Papaveraceae)	isoquinolines	(Y.-M. Wang et al., 2020)
Ceiba pentandra (L.) Gaertn. (Bombacaceae)	cinchonain	(Abouelela et al., 2020)
Garcinia mangostana (Clusiaceae)	α-mangostin	(Pole et al., 2020)
Zingiber officinale Roscoe(Zingiberaceae)	[6] -gingerol, [8]-gingerol and [6]-shogaol	(Simon et al., 2020)
Xanthoceras sorbifolium bunge (Sapindaceae)	3-*O*-[*β*-D-glucopyranosyl (1→6)] -(2'-angeloyl)-*β*-D-glucopyranosyl-28-*O*-*β*-D-glucopyranosyl(1→6)[*α*-L-rhamnopyranosyl(1→2)-*β*-D-glucopyranosyl]-21-*O*-acetyl-16-deoxybarringtogenol C	(Thing et al., 2020)
Isodon japonicus (Burm.f.) H.Hara (Lamiaceae)	Rosmarinic Acid	(Sun et al., 2019)
Abronia nana S.Watson (Nyctaginaceae)	boeravinone x	(E.-J. Yang et al., 2019)
Lawsonia inermis L.(Lythraceae)	1,2,4-Trihydroxynaphthalene-2-O-β-D-glucopyranoside	(Dhouafli et al., 2019)
Sophora tonkinensis (Fabaceae)	sophotokin	(Xia et al., 2019)
Cirsium maackii Maxim. (Asteraceae)	luteolin	(Wagle et al., 2019)

Schinus polygamus var. chilensis F.A. Barkley (Anacardiaceae)	Agathisflavone	(Dumitru et al., 2019)
Lycoris ×chejuensis Kurita & P.S. Hsu (Amaryllidaceae)	7-deoxy-trans-dihydronarciclasine	(D. Zhao et al., 2019)
Pithecellobium Clypearia (Jack) Benth. (Fabaceae)	(2 R ,3 R)-7,8,3 ′,4′-tetrahidroxidihidro-flavonol	(Y.-X. Wang et al., 2017)
Reynoutria sachalinensis Nakai (Polygonaceae)	1-Decanol, campesterol, ergosterol peroxide, quercetin and isoquercitrin	(Eom et al., 2017)
Pyrola decorate H. Andr (Pyrolaceae)	Betulin, ursolic acid , monotropein	(X. Yang et al., 2017)
Angelica gigas var. minor Momiy. (Apiaceae) Scutellaria baicalensis Georgi (Lamiaceae)	decursin, Wogonin	(H. W. Lee et al., 2017)
Aframomum melegueta var. violaceum (Ridl.) K. Schum. (Zingiberaceae)	Gingerol	(El Halawany et al., 2017)
Monsonia angustifolia E. Mey. (Geraniaceae)	justicidin A	(Chun et al., 2017)
Akebia quinata (Thunb. ex Houtt.) Decne. (Lardizabalaceae)	akequintoside F, collinsonidin, akebonic acid, hederagenin, asperosaponin C	(Chowdhury et al., 2017)
Pteris multifida Poir (Pteridaceae)	2b,15α-dihydroxy-ent-kaur-16-ene, pterokaurane P1	(J. W. Kim et al., 2017)
Fumaria officinalis (Papaveracea)	Parfumidine, sinactine	(Chlebek, Novák, et al., 2016)
Sophora flavescens Aiton (Fabaceae)	maackiain	(H. W. Lee et al., 2016)
Siegesbeckia pubescens (Asteraceae)	5,3′-dihydroxy-3,7,4′-trimethoxyflavone	(D.-S. Lee et al., 2016)
Valeriana amurensis P.A. Smirn. ex Kom. (Caprifoliaceae)	(+)-medioresinol-4,4'-di-O-β-D-glucopyranoside, (+)-syringaresinol-4,4'-di-O-β-D-glucopyranoside, prinsepiol-4-O-β-D-glucopyranoside , (+)-8,8'-dihydroxy-pinoresinol-4,4'-di-O-β-D-glucopyranoside, prinsepiol, and 6 iridoids of jatamanin A, 7-hydroxy-8-(hydroxymethyl)-4-methylenehexahydrocyclopenta[c] pyran-1(3H)-one , 4-hydroxymethyl-cyclopenta[c] pyran-7-carboxaldehyde , patriscabroside III , jatamanin E, patrinoside .	(Wan et al., 2016)
Sophora flavescens Aiton (Fabaceae)	Maackiain	(H. W. Lee et al., 2016)
Uncaria rhynchophylla Miq. (Rubiaceae)	Uncarinic Acid C	(Yoshioka et al., 2016)
Prunus persica (L.) Batsch (Rosaceae)	methyl amygdalinate	(X. Zhao et al., 2016)
Corydalis cava (L.) Schweigg. & Körte (Papaveraceae)	(-) -corycavamine, (+) -corynoline	(Chlebek, De Simone, et al., 2016)
Corydalis cava (Fumariaceae)	(-) -corycavamine, (+) -corynoline	(Chlebek et al., 2011)
Zelkova serrata Makino (Ulmaceae)	7-Hydroxycalamenene	(Yen et al., 2016)

Lycium barbarum Mill. (solanaceae)	dicaffeoylspermidine (derivatives)	(Zhou et al., 2016)
Garcinia mangostana L.(Clusiaceae)	α-Mangostin, Gartanin, Garcinone C, C-Mangostin	(S.-N. Wang et al., 2016)
Serjania erecta Radlk. (Sapindaceae)	vitexin	(Guimarães et al., 2015)
Angelica shikokiana Makino ex Y. Yabe (Apiaceae)	quercetin, hyuganin E, isoepoxyterixin.	(Mira et al., 2015)
Vitis thunbergii var. taiwaniana F.Y. Lu (Vitaceae)	miyabenol C	(J. Hu et al., 2015)
Acer nikoense (Miq.) Maxim. (Sapindaceae)	Acerogenin A	(D.-S. Lee et al., 2015)
Origanum glandulosum Desf. (Lamiaceae)	Rosmarinic acid, globoidnan A	(Bash et al., 2014)
Disporum viridescens (Maxim.) Nakai (Colchicaceae)	(+) -dihydrodehydrodiconiferyl alcohol-9-O-β-d-glucopyranoside, (−) -9′-hydroxypinoresinol	(Cho et al., 2014)
Jatropha multifida L. (Euphorbiaceae)	Apocynin	('T Hart et al., 2014)
Torreya yunnanensis WCCheng & LKFu (Taxaceae)	(±) -Torreyunlignans (derivatives)	(Z.-B. Cheng et al., 2014)
Celastrus orbiculatus Thunb. (Celastraceae)	(M)-bicelaphanol A	(X. J. Wang et al., 2013)
Orobanche minor Sm. (Orobanchaceae)	acteoside (1a)	(Kurisu et al., 2013)
Lycoris radiata (L'Hér.) Herb. (Amaryllidaceae)	1,2-Di-O-acetyllycorine, 1-O-acetyllycorine	(Xin et al., 2013)
Perilla frutescens (L.) Britton (Lamiaceae)	Luteolin	(G. Zhao et al., 2012)
Uncaria rhynchophylla Miq. (Rubiaceae)	hynchophylline, isorhynchophylline	(Xian et al., 2012)
Valeriana amurensis P.A. Smirn. ex Kom. (Caprifoliaceae)	sesquiterpenoids (derivatives) lignans(derivatives)	(Q. Wang et al., 2012)
Ginkgo biloba L. (Ginkgoaceae)	Isorhamnetin	(Xu et al., 2012)
Itoa orientalis Hemsl. (Salicaceae)	Xylocoside G	(Yu et al., 2012)
Erigeron annuus Sessé & Moc. (Asteraceae)	Caffeic acid	(Jeong et al., 2011)
Eleutherococcus senticosus Maxim. (Araliaceae)	eleutheroside B, eleutheroside E, isofraxidin	(Y. Bai et al., 2011; Jeong et al., 2011)
Euclea crispa subsp. Crispa (Ebenaceae) Crinum macowanii Baker (Amaryllidaceae)	3-oxo-oleanolic acid, natalenone, lycorine, hamayne	(Kwon et al., 2011)
Iris tenuifolia Pall. (Iridaceae)	3′-hydroxy-5,7-dimethoxy-4-O-2′-cycloflavan, 3′-hydroxy-5-methoxy-6,7- methylenedioxy-4-O-2′-cycloflavan	(Cui et al., 2011)
Siegesbeckia glabrescens (Asteraceae)	3, 4'-dimethylquercetin, 3, 7-dimethylquercetin, 3-methylquercetin and 3, 7, 4'-trimethylquercetin	(Lim et al., 2011)
Pueraria lobata (Willd.) Ohwi (Fabaceae)	genistein, biochanin A	(Choi et al., 2010)

Rhodiola rosea L. (Crassulaceae)	salidroside	(Na et al., 2010; L. Zhang et al., 2010)
Eragrostis ferruginea P. Beauv. (Poaceae)	Tricin	(Na et al., 2010)
Hypericum perforatum L. (Hypericaceae)	hyperforin	(Denmark et al., 2006)
Uncaria rhynchophylla (Miq.) Jacks. (Rubiaceae)	(+) -catechin, (-) -epicatechin	(Hou et al., 2005)
Flemingia macrophylla (Willd.) Kuntze ex Merr. (Fabaceae)	flemingichromone, osajin, 5,7,4'-trihydroxy-6,8-diprenylisoflavone, 5,7,4'-trihydroxy-6,3'-diprenylisoflavone, aureole	(Shiao et al., 2005)
Turmeric longa L. (Zingiberacea)	calebin-A, curcumin, bisdemethoxycurcumin, 1,7-bis(4-hydroxyphenyl)-1-heptene-3,5-dione	(S.-Y. Park & Kim, 2002)

Table 3 shows the total of 50 botanical families. Applying the percentage, it is found that 1% of the families have anti-Alzheimer's activity, such as Acoraceae, Acanthaceae, Apocynaceae, Araliaceae, Anacardiaceae, Bombacaceae, Brassicaceae, Celastraceae, Colchicaceae, Crassulaceae, Eucammiaceae, Elaeagnaceae, Euphorbiaceae, Ebenaceae, Fumariaceae, Ginkgoaceae, Hypericaceae, Iridaceae, Lythraceae, Lardizabalaceae, Meliaceae, Nyctaginaceae, Orobanchaceae, Polygonaceae, Pyrolaceae, Pteridaceae, Plantaginaceae, Primulaceae, Poaceae, Rutaceae, Solanaceae, Salicaceae, Taxaceae and Ulmaceae, each with 1 document.

The families Clusiaceae, Geramiaceae, Nelumbonaceae and Rosaceae represent 2% of the plants mentioned in table 3, each containing 2 documents.

Apiaceae, Amaryllidaceae, Caprifoliaceae, Papaveraceae and Zingiberaceae exhibit 3% of the studies collected. 4% correspond only to the Rubiaceae family, which presented 4 articles. 6% correspond to the Lamiaceae family. The family Sapindaceae has 5 studies, representing 5% of the studies. 7% correspond to the Asteraceae family, with 6 published articles.

The most studied family, shown in the table, was the Fabaceae, with 11% of the research and 10 documents presented.

The medicinal plants mentioned in Table 3 in turn presented by families, species, isolated compound responsible for the pharmacological activity include antioxidant mechanism in the direct elimination of reactive oxygen species (ROS), in the activation of enzymes that have antioxidant activity, activity of metal chelating agent, reinforcement of the amount of α-tocopherol radicals, blocking of NAPDH, relief of oxidative stress caused by nitric oxide, addition of uric acid levels and increase of substances with antioxidant characteristics and antioxidant molecules of low molecular weight (Kurutas, 2016)

The antioxidant activity may be present in several chemical compounds isolated from plants, called natural antioxidant, used in several groups of secondary metabolites, such as flavonoids (catechins) and tannins (proanthocyanidins), among others. Catechins are formidable antioxidants thanks to the group of hydroxyls present in their molecules, the elimination of free radicals present in the body can also be generated by molecules that contain double bond in the phenolic ring, hydroxyl side chain molecules, anthocyanidin glycosylation among others, can also be classified as synthetic antioxidant widely used in the food industry (Collins et al., 2022)

The use of plant antioxidants has many contradictions by some researchers plus studies that point out that antioxidant supplementation by external means is one of the most favorable methods in progression in the development of therapies for neurological diseases caused by radicals' books. (Kasote et al., 2015)

5 CONCLUSIONS

Based on the analysis carried out, it can be concluded that there has been a significant development in the number of publications of studies related to plants, isolated compounds and Alzheimer's diseases over the years. Although there have been fluctuations, especially in the period of the COVID-19 pandemic, the number of publications has increased substantially, indicating a growing interest in this field of research.

The most productive author identified was Choi, JS, who contributed 17 papers addressing studies of plants, Alzheimer's disease, cholinergic disease, and neuroprotection. China and South Korea stood out as the main producers of articles on the subject, with a significant number of publications.

The high incidence of Alzheimer's disease in China may be a factor driving interest and research in this area. The rapid aging of the Chinese population and the increase in age-related problems, including appearance, pose challenges to public health and society as a whole. The costs associated with treating Alzheimer's disease are also long-lasting and likely to increase in the future.

The analysis of the advanced and themes revealed the importance of the keywords "Alzheimer's disease" and "plant extract" in the studies carried out. The collaboration between the researcher, evidenced by the network of co-occurrence of the keywords, demonstrates the construction of knowledge over time.

Studies on medicinal plants that inhibit the enzymes acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) have been highlighted as relevant to the development of drugs in the treatment of Alzheimer's disease. Methods such as Ellman's technique and thin layer chromatography were used to detect enzymatic inhibitory activity and track plant extracts.

In summary, productivity analysis has revealed a growing interest in research on plants, isolated compounds, and Alzheimer's disease. These studies aim to find therapeutic solutions for Alzheimer's disease, which pose a significant public health challenge in several countries, including China. The development of new medicines based on medicinal plants and the search for compounds that inhibit disease-related enzymes are promising areas of research.

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