Research, Society and Development, v. 9, n. 10, e3409108596, 2020
(CC BY 4.0) | ISSN 2525-3409 | DOI: http://dx.doi.org/10.33448/rsd-v9i10.8596

A review ethnopharmacology of Rosaceae fruit species

Revisão etnofarmacológica das espécies frutíferas de Rosaceae

Revisión etnofarmacológica de especies frutales de Rosaceae

Received: 09/18/2020 | Reviewed: 09/25/2020 | Accept: 09/28/2020 | Published: 09/29/2020

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Abstract

This study aims to carry out a bibliographic survey on ethnobotanical, ethnopharmacological and pharmacological information on Rosaceae species. The species addressed were *Eriobotrya japonica* (yellow-plum), *Fragaria vesca* (strawberry), *Malus domestica* (apple), *Prunus domestica* (plum), *Prunus persica* (peach), *Pyrus communis* (pear) and *Rubus brasiliensis* (raspberry) grown in the garden Medicinal of Universidade Paranaense (UNIPAR) - Campus 2. For this study, the databases were taken from national and international scientific journals without restriction of year of publication. As a result, a category of use was identified, part used, form of preparation, popular use, pharmacological and phytochemical studies for each species. Thus, it is observed that all fruit species are popularly used a medicinal, with records of ethnopharmacological, pharmacological and phytochemical studies. Medicinal plants are very widespread and used, being considered as an important therapeutic resource. However, despite the pharmacological records found, new scientific investigations are still needed to ensure the safer and more effective use of these species by the population.

Keywords: Pharmacological action; Popular use; Medicinal plants.

Resumo

Este estudo tem como objetivo realizar um levantamento bibliográfico sobre informações etnobotânicas, etnofarmacológicas e farmacológicas de espécies de Rosaceae. As espécies abordadas foram *Eriobotrya japonica* (ameixa-amarela), *Fragaria vesca* (moranguinho), *Malus domestica* (maça), *Prunus domestica* (ameixa), *Prunus persica* (pêssego), *Pyrus communis* (pera) e *Rubus brasiliensis* (framboesa) cultivadas no Horto Medicinal da Universidade Paranaense (UNIPAR) - Campus 2. Para este estudo, as bases de dados foram retiradas de periódicos científicos nacionais e internacionais sem restrição de ano de

publicação. Como resultado, identificou-se categoria de uso, parte utilizada, forma de preparo, uso popular, estudos farmacológicos e fitoquímicos para cada espécie. Assim, observa-se que todas as espécies frutíferas são utilizadas popularmente como medicinais, com registros de estudos etnofarmacológicos, farmacológicos e fitoquímicos. As plantas medicinais, são muito difundidas e utilizadas, sendo consideradas como um importante recurso terapêutico. No entanto, apesar dos registros farmacológicos encontrados, novas investigações científicas ainda são necessárias para garantir o uso mais seguro e eficaz dessas espécies pela população.
Palavras-chave: Ação farmacológica; Uso popular; Plantas medicinais.

Resumen

Este estudio tiene como objetivo realizar un relevamiento bibliográfico sobre información etnobotánica, etnofarmacológica y farmacológica de especies de Rosaceae. Las especies abordadas fueron *Eriobotrya japonica* (ciruela-amarilla), *Fragaria vesca* (fresa), *Malus domestica* (manzana), *Prunus domestica* (ciruela), *Prunus persica* (melocotón), *Pyrus communis* (pera) y *Rubus brasiliensis* (frambuesa) cultivadas en el jardín Medicinal de la Universidade Paranaense (UNIPAR) - Campus 2. Para este estudio, las bases de datos fueron tomadas de revistas científicas nacionales e internacionales sin restricción de año de publicación. Como resultado, se identificó una categoría de uso, parte utilizada, forma de preparación, uso popular, estudios farmacológicos y fitoquímicos para cada especie. Así, se observa que todas las especies frutales se utilizan popularmente como medicinales, con registros de estudios etnofarmacológicos, farmacológicos y fitoquímicos. Las plantas medicinales están muy extendidas y se utilizan, considerándose como un importante recurso terapéutico. Sin embargo, a pesar de los registros farmacológicos encontrados, aún se necesitan nuevas investigaciones científicas para garantizar un uso más seguro y eficaz de estas especies por parte de la población.
Palabras clave: Acción farmacológica; Uso popular; Plantas medicinales.

1. Introduction

Medicinal plants play an important role in promoting health and culture in regions of Brazil, where several communities have this type of knowledge (Franco, Ferreira & Ferreira, 2011). It is understood that Ethnobotany and Ethnopharmacology are valuable tools for the recovery of various traditional knowledge, as well as its applicability in the scientific community, through the combination of information acquired in traditional communities, with

chemical and pharmacological studies (Sales, Sartor & Gentilli, 2015). Traditional communities are important for the conservation of nature, by valuing their identities and their important knowledge in traditional medicine; in improving their living conditions and ensuring their participation in the construction of public policies (Rocha, Neffa & Leandro, 2014).

It is noted through several studies on phytotherapy programs and actions that the insertion of phytotherapics and medicinal plants in primary health care has optimized access to other types of therapies. In addition to the synthesis of medicines, it provides the strengthening of the implementation of public policies, encouraging local development, as well as the recovery of traditional knowledge of communities (Alencar et al., 2020). These, in turn, are factors that contribute to scientific research and the development of the critical view of professionals with the population, on the importance of using medicinal and herbal plants (Rocha, Neffa & Leandro, 2014).

Brazil has great potential for the development of phytotherapy, as it stands out for having great plant diversity, in addition to the use of medicinal plants, linked to traditional knowledge and technologies. In addition, it is observed that the popular and institutional interest has been growing in order to strengthen Phytotherapy in SUS (Unified Health System), since from the 1980s, several documents were drawn up emphasizing the importance of the introduction of medicinal and herbal plants in primary care in the public system (Brasil, 2006; Brasil, 2016).

In this context, Universidade Paranaense - UNIPAR has been subsidizing scientific research since 1996 with the implantation of the Medicinal Vegetable Garden on Campus 2 of UNIPAR, in a total area of 30,000 m^2, where in 1997, the cultivation of different species began, covering various classes, such as, spice, fruit, ornamental, vegetables, forage, toxic and medicinal (Canzi et al., 2012). In view of the importance of medicinal plants and the richness of species in the Medicinal Garden of UNIPAR, the present study aimed to carry out a bibliographic review on species belonging to the Rosaceae family. Thus, in this study, the main therapeutic actions of the species are addressed, aiming at their popular use (ethnobotany) and their mechanisms of action, presenting their pharmacological and or toxicological effects (ethnopharmacology). In addition, the information exposed here may guide research as pre-clinical experimental models that may or may not have their popular use validated through their plant extracts or their major compounds.

2. Methodology

To carry out this study, followed the norms for the elaboration of scientific research obtained by Pereira et al. (2018), scientific articles were selected, available in the electronic databases: Medline, Pubmed, Scielo and Google Scholar without restriction of the year of their publications from the object of study now proposed. The studied species belong to the Rosaceae family cultivated in the Horto Medicinal of Campus 2 of Universidade Paranaense, located in Umuarama/PR. To review the scientific names of the species and respective authors, the Missouri Botanical Garden database was used, following the classification system according to APG-Angiosperm Phylogeny Group (Tropicos, 2020).

3. Results and Discussion

The species researched in this work total seven species, whose data are summarized in Table 1. These data show how these plants are popularly used in the treatment of diseases; which actually have proven pharmacological activities.

Rosaceae family, includes ornamental and fruit species, has about 100 genera and 3000 species, with a cosmopolitan distribution, concentrated in the Northern Hemisphere. In Brazil there are some 25 native species distributed in nine genera. Rosaceae is one of the main families from an economic point of view, due to the production and consumption of its various fruits, such as apple, pear, peach, strawberry, among others. In addition, with ornamental species, in widespread worldwide use, which is the case of rose bushes (Souza & Lorenzi, 2008).

Among the Rosaceae species analyzed in this study, it was found that, they are considered fruitful and are also used as medicinal *Eriobotrya japonica* (Thunb.) Lindl., *Fragaria vesca* L., *Malus domestica* (Suckow) Borkh.), *Prunus domestica* L., *Prunus persica* (L.) Batsch, *Pyrus communis* L. and *Rubus brasiliensis* Mart.

Table 1. Ethnobotany, ethnopharmacology and pharmacology information on fruit species of Rosaceae cultivated in the Medicinal Garden of Campus 2 of Universidade Paranaense, Umuarama/PR.

Scientific name	Popular name	Use category	Used part	Preparation	Popular use	Farmacological action	Phytochemistry	References
Eriobotrya japonica (Thunb.) Lindl.	Yellow plum	Fruit	Leaves	Decoction and Infusion	Antiasthmatic, antitussive, facilitating childbirth, hypotensive, soothing, throat infection and hypertension	Anti-inflammatory, antifungal, antioxidant and antigenotoxic	Flavonoids and tannins	Ritter et al. (2002) Barros et al. (2007) Zar et al. (2014) Rashed & Butnariu (2014) Messias et al. (2015) Mokdad-Bzeouich et al. (2015)
Fragaria vesca L.	Strawberry	Fruit	Leaves	Decoction	Anti-inflammatory, antidiarrheal, against hepatitis, asthmatic bronchitis and blood pressure control	Anti-inflammatory, antioxidant, control of dyslipidemia and prevention of cardiovascular diseases	Flavonoids, anthocyanins and vitamin C	Ritter et al. (2002) Pernia et al. (2004) Alvarez-Suarez et al. (2014) Messias et al. (2015)
Malus domestica (Suckow) Borkh.	Apple	Fruit	Fruit and Peel	Decoction and Infusion	Diuretic, energetic, soothing, cholesterol control and intestinal problems	Dyslipidemia control, antioxidant, anti-inflammatory and chemopreventive activity	Phenolic compounds, tannins, chlorogenic compounds, flavonoids and prociandines	Curti (2003) Barata-Silva et al. (2005) Zessner et al. (2008) Teixeira et al. (2014) Franco (2014)
Prunus domestica L.	Plum	Fruit	Fruit Leaves Peel	Fresh Decoction	Diuretic, energetic, soothing, cholesterol control and intestinal problems	Dyslipidemia control, antioxidant, anti-inflammatory and chemopreventive activity	Phenolic compounds, tannins, chlorogenic compounds, flavonoids and prociandines	Amelia (2009) Silva, Dreveck & Zeni (2009) Jungles (2013) Rendina et al. (2013) Lima, Pires & Vieira (2014) Teixeira et al. (2014) Dantas & Torres (2019) Bonesi et al. (2019)
Prunus persica (L.) Batsch	Peach	Fruit	Fruit and Leaves	Infusion and Decoction	Used for headache, flu and hypotensive	Antioxidant, acetylcholinesterase inhibitor and antimicrobial	Chlorogenic acid, flavonoids and phenolic compounds	Mendes et al. (1999) Barata-Silva et al. (2005) Suh et al. (2006) Gettens et al. (2016) Rossato (2009)

Scientific name	Popular name	Use category	Used part	Preparation	Popular use	Farmacological action	Phytochemistry	References
Pyrus communis L.	Pear	Fruit	Fruit, Seeds and Leaves	Fresh	Laxative, antiseptic, for stomach disorders and for kidney stones	Hypoglycemic agents, antioxidant, antiradical and antimicrobial activity	Flavonoids, steroids, alkaloids, carbohydrates, tannins, phenolic compounds, saponins	Jalali et al. (2009) Arican et al (2013) Velmurugan & Bhargava (2013) Dolatkhahi et al. (2014) Sharma et al. (2015) Sroka et al. (2019)
Rubus brasiliensis Mart.	Raspberry	Fruit	Leaves and Fruit	Infusion, Decoction and Fresh	Diuretic, astringent, laxative, antispasmodic, tonic, antidiarrheal, high blood pressure, cholesterol control, labyrinthitis, menopause, obesity, osteoporosis and kidney diseases	Hypnotic, anticonvulsant and muscle relaxant	Phenolic and flavonoid compounds	Nogueira & Vassilieff (2000) Messias et al. (2015) Bieski et al. (2012) Sartori, Costa & Ribeiro (2014)

Source: Authors.

The *E. japonica* is a fruit tree of Asian origin very common in Brazil, whose yellow fruits are edible and the leaves, as exposed in ethnobotanical studies on this species show the use of leaves by infusion or decoction, as antiasthmatic, antitussive, birth facilitator, hypotensive, soothing, throat infection and hypertension (Ritter et al., 2002; Barros et al., 2007; Messias et al., 2015).

A study carried out by Zar et al. (2014) with the aqueous extract of *E. japonica* leaves, in cell and animal models, demonstrated the anti-inflammatory effects and the underlying mechanisms of yellow plum leaves *in vitro* and *in vivo*. The same authors showed that especially fraction C, acted by inhibiting the production of pro-inflammatory mediators including NOSi- (Nitrous Oxide Synthase Inducible), NO (nitrous oxide), IL-6 (interleukin 6), NETCS (Normal Expressed T Cells and Secreted) and TNF-a (Tumor Necrosis Factor Alpha). They conclude that mitogen-activated protein kinase (MAPK) and NF-jB (Nuclear Factor Kappa) pathways were involved in the inhibition of mouse paw edema by fraction C, thus confirming the *in vivo* anti-inflammatory effect of leaves of *E. japonica*.

Rashed & Butnariu, (2014) also studied the effects of *E. japonica* leaf extract, in which the results showed that this extract has an antioxidant action and a significant inhibition of the growth of *Candida albicans*. Phytochemical analysis of the extract showed the presence of carbohydrates, terpenes, tannins and flavonoids. In addition, three triterpene acid species (oleanolic, ursolic, corosolic) and four flavonoids (naringenin, quercetin, kaempferol 3-O-β-glucoside and quercetin 3-O-α-ramnoside) were isolated and identified. Among them, ursolic acid demonstrated a significant activity in the elimination of DPPH radicals (1,1-diphenyl-2-picrilhidrazil) in various degrees and kaempferol 3-O-β-glycoside showed an important antifungal and antioxidant effect (Rashed & Butnariu, 2014).

Studies carried out by Mokdad-Bzeouich et al. (2015), investigated the protective effect of aqueous extracts and FTO (Flavonoides Total Oligomers) of E. japonica leaves against DNA damage induced by 2-aminoanthracene (2-AA), aflatoxin B1 (AFB1), nitrofurantoin and methylmethanesulfonate (MMS), as well as its antioxidant potential. These authors confirm, in this study, that the extracts used of *E. japonica* are effective antioxidants, since FTO performed the degradation of deoxyribose by removing hydroxyl radicals, while the aqueous extract demonstrated chelating abilities. Therefore, it is known that the prevention of the genotoxicity of some carcinogenic substances was probably due to the antioxidant capacity of the extract.

The species *Fragaria vesca* L., popular strawberry, is a low plant, with tasty fruits also used in cooking. Ethnobotanical studies have recorded the use of strawberry leaf tea as anti-

inflammatory, anti-diarrheal, against hepatitis, asthmatic bronchitis and in the control of blood pressure (Ritter et al., 2002; Messias et al., 2015).

In vitro studies by Pernía, Grecia & Araujo (2004), show the anti-inflammatory effect of the aqueous extract of the fruit of *F. vesca*, which is related to the antioxidant properties of its polyphenols. In the present study, the aqueous extracts was separated using chromatographic columns on silica gel, in which the fractions were recognized by chromatography on paper, to identify the polyphenols. Anti-inflammatory activity was determined by inhibiting the hyaluronidase enzyme. The active fractions were compared with aspirin, a steroidal anti-inflammatory that inhibits the hyaluronidase enzyme, therefore related to anti-inflammatory processes. Fractions 1 and 5 of the strawberry extract, as well as the crude extract, showed an inhibitory action by the enzyme hyaluronidase, equal to or higher than aspirin.

The anti-inflammatory and antioxidant activity of polyphenols may be related to flavonoids and, possibly, due to their free radical scavenging properties, as well as the inhibition of enzymes such as: cyclooxygenase, myeloperoxidases, NADPH oxidase and xanthine oxidase, which play an essential role in the inflammatory response (Pernía, Grecia & Araujo 2004).

An *in vivo* study carried out by Alvarez-Suarez et al. (2014), involved healthy volunteers, who had their food supplemented, daily with 500g of fresh strawberries for a month. In this study, the following were evaluated: circulating plasma lipid profile, cellular markers of antioxidant status, oxidative stress and platelet function. Being measured at the beginning, at the end that is, after 30 days and after 15 days from the end of the study. The results obtained in this study show a reduction in the lipid profile, in the levels of total cholesterol, low-density lipoprotein cholesterol and triglycerides, while the high-density lipoprotein remained unchanged. There was also an increase in the total antioxidant capacity of plasma and vitamin C levels after the consumption of strawberry fruits, in addition to a reduction in spontaneous and oxidative hemolysis.

The phytochemical analysis of strawberry fruits, carried out in the same study, showed a high concentration of vitamin C and anthocyanins. In summary, based on the results obtained, it is understood that the polyphenols and vitamin C, from the strawberry fruit, seem to be the most likely chemical constituents responsible for the effects in the prevention of cardiovascular diseases, in which the fibers were particularly recognized for their significant effect on cholesterol (Alvarez-Suarez et al., 2014).

Such results may explain, in part, the role of a diet rich in fruits and vegetables in the prevention of cardiovascular diseases and other chronic diseases mediated by oxidative stress (Alvarez-Suarez et al., 2014).

Malus domestica is one of the most cultivated fruits in the world, being present on all continents, with greater concentration in Asia. While in Brazil, the South region concentrates the highest production (Mello, 2006). Ethnobotanical studies report that the peels and fruit *in natura* through decoction or infusion are used as diuretic, energetic, soothing, cholesterol control and intestinal problems (Barata-Silva, Macedo & Gomes, 2005; Teixeira et al., 2014).

In the pharmacological study carried out by Curti, (2003), six animals (rats) were used in each treatment group. With the exception of the control group, the other groups received 5%, 15% and 25% fresh apples in the diet for 30 and 60 days. The groups showed a reduction in triglyceride levels when compared to the control group after 30 days and not significant at HDL-C levels. The groups with 15% and 25% apple diets showed reductions in blood levels of total cholesterol and LDL-C and an increase in the content of excreted cholesterol, compared to the control group. Only the 25% diet showed a reduction in liver cholesterol levels. Based on these results, it was concluded that the apple helps in the control of dyslipidemia in rats, although in the period of 60 days, the blood levels of total cholesterol, LDL-C, HDL-C and triglycerides of the rats of the three test groups, with 5 %, 15% and 25% of fresh apples in the diet, were similar to the control group. In this study, the author emphasizes that in relation to the centesimal composition of the apple, 200g was able to supply 14.5% of the total recommended fibers and 55% of vitamin C, in addition to 0.38g/100g of phenolic compounds and 0.16g/100g of tannins (Curti, 2003).

Evaluating the antioxidant activity of the apple, using the FRAP (Ferric Reducing Antioxidant Potential) and DPPH, Franco (2014), methods showed that such activity is related to the phenolic content present in the fruit, being higher in the skin. The same author explains that flavonols are part of the fruit's composition, being the component that most contributes to the phenolic content and antioxidant activity, followed by hydroxybenzoic acids, dihydrochalcones, hydroxycinnamic acids and anthocyanins (Franco, 2014). According to Kokotkiewicz, Jaremicz & Luczkiewicz (2010), the regular consumption of fruits with antioxidant compounds, in the end, can have beneficial effects in preventing the appearance of cancers.

The anti-inflammatory potential *M. domestica* is addressed in the study by Zessner et al. (2008), the polyphenol-enriched apple juice extract was fractionated by various techniques and analyzed in a series of *in vitro* test systems that evaluated the antioxidant effects, the

modulation of the carcinogenic metabolism, anti-inflammatory and anti-hormonal activities and the potential antiproliferative. The analyzes indicated that the potential for eliminating the DPPH radical is related to the chlorogenic compounds, flavonoids and procyndins present in the apple. The results indicate that several apple juice compounds contributed to anti-inflammatory effects, more strongly, the 90% inhibition of Cox-1 activity (Cyclooxygenase-1) at a concentration of 400 µg/mL was determined at elution fraction A7.6 and all tested subfractions. This potent inhibition by the Cox-1 subfractions was attributed to epicatechin, while the activity of fraction A7.6 was associated with the elution of quercetin. The anti-inflammatory potential was also associated with late elution subfractions containing procyanidins. Analyzes show that procyanidins alone or associated with low molecular weight compounds contribute to the measurement of potential chemopreventive activities in cancer.

The same authors still cite previous publications that showed this important role of procyanidins in relation to the prevention of cancer. Moreover, they concluded that apples are a rich source of polyphenolic compounds with important activities in cancer chemoprevention, and should be investigated as part of cancer prevention strategies in humans (Zessner et al., 2008).

Prunus domestica L. is known as the European plum. It is believed that it originated in a region between Southeast Europe (Caucasus) and Southeast Asia. In addition to being a species with morphological variations, it is also one of the most widespread fruit plants worldwide (Castro, Nakasu & Pereira, 2008). According to ethnobotanical studies, the use of its fresh fruit and tea for the treatment of intestinal disorders are reported. While the peel is used as an anti-inflammatory, ovarian inflammation and healing and the leaves as hypotensive (Teixeira et al., 2014; Soares et al., 2009; Silva, Dreveck & Zeni, 2009; Lima, Pires & Vieira, 2014; Dantas & Torres, 2019).

A study carried out by Jungles, (2013), presented an extraction and purification process, characterizing the structure and gastric anti-ulcer activity of polysaccharides present in prunes. Polysaccharides were extracted from prunes using aqueous and alkaline extractions; then they went through processes for structural characterization. In addition to these analyzes, the gastroprotective activity of the crude aqueous extract was evaluated, observing the ability to inhibit the formation of gastric lesion, induced by ethanol in rats. The author concluded that the gastric antiulcer activity found was due to the presence of polysaccharides present in prunes, requiring further studies to elucidate such mechanisms of action (Jungles, 2013).

A study by Rendina et al. (2013) compared the effectiveness of several dried fruits in bone restoration, seeking to elucidate more information about the mechanism of action of these dried fruits. For that, each group of adult osteopenic ovariectomized mice received a 25% supplement of only one type of fruit. The plum was the only one to present an anabolic effect on the vertebral trabeculae, helping to prevent bone loss in mice. In addition to promoting the differentiation of osteoblasts, increasing the antioxidant activity of glutathione peroxidase (GPx). Therefore, the authors suggest that prunes may present a unique combination of nutrients and polyphenols, being responsible for the observed anabolic activity (Rendina et al., 2013).

In vitro studies carried out by Bonesi et al. (2019), report, for the first time, the antioxidant and neuroprotective effects from essential oils obtained through hydrodistillation of the leaves of *Prunus domestica* and *P. aermeniaca*. Considering that free radicals are related to neurodegenerative diseases, the oil of both species was evaluated by the 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), DPPH and β bleaching tests-carotene. Both samples showed similar activity in the elimination of radicals by the ABTS method. However, in the DPPH test, *P. domestica* was more active, as well as inhibiting lipid peroxidation, using the β-carotene acid bleaching system. Regarding AChE (acetylcholinesterase), only *P. aermeniaca* oil showed significant inhibition, while *P. domestica* oil was more active in inhibiting BChE (butyrylcholinesterase).

In this study, the authors investigated a composition of the two types of oils and observed that phytol was one of the dominant compounds in environments such as species. This compound is a common diterpene found in plants and with antioxidant and neuroprotective activity (Bonesi et al., 2019).

Prunus persica (L.) Batsch, more popularly known as peach, is a natural species from China that according to some studies, would have been taken to Persia and then spread to Europe. This species was introduced in Brazil around 1532 and is found in the states of Rio Grande do Sul, Santa Catarina and Paraná, where there are the best natural conditions for fruit production (Fortes & Osório, 2003).

According to the literature consulted, peach leaves are popularly used for infusion or decoction against headaches, as flu and hypotensive (Mendes et al., 1999; Barata-Silva, 2005).

A study by Gettens et al. (2016) evaluated the proximate composition and antioxidant activity of peach almonds, and analyzes were carried out on: moisture, proteins, lipids, ashes, fibers, carbohydrates and regarding antioxidant activity, obtaining as a result: 8.46 %;

26.10%; 42.73%; 4.1%; 3.63%, 19.8% and 38.1%, respectively. These authors point out that agro-industrial processes, such as drying the seed and storing it, may have influenced the antioxidant content present in the dried peach almond. It is understood, therefore, that almonds, in fresh form, would be more likely to have greater antioxidant activity compared to almonds in dehydrated form. Still, these results demonstrated that the peach almond is an important source of fibers, carbohydrates, minerals, lipids with essential fatty acid levels and antioxidants.

The study by Rossato (2009), using the TRAP method (Total Relative Antioxidant Potential), using the AUC (Area Under the Curve), evaluated the peach's antioxidant potential. The values obtained demonstrate that the peels have greater antioxidant activity when compared to the pulps, which may result from the higher level of chlorogenic acid and flavonoids found in the peels. However, considering that consumers often eliminate the peel at the time of consumption and the pulp corresponds to 70% of the fruit, the chlorogenic acid content is higher when ingesting the pulp. In the same work, through the chromatographic results, the presence of flavonoids in the fruit peel was observed. Such compounds act as antioxidants and it is noted that due to their chemical structure, they are more effective when compared to synthetic antioxidants.

A study by Suh et al. (2006) used the aqueous extract of peach (EPP), in which the total cholinesterase activity was measured using the 9-amino-1,2,3,4-hydrochloride butyrylcholinesterase inhibitors as a comparison. tetrahydroacridine (tacrine) and tetraidopropylpyrophosphoramide (iso-OMPA).

The aqueous extract was fractionated using solvents, in which the largest inhibitory fraction was chloroform (75%). After oral administration of the aqueous extract in mice, AChE activity was measured by means of a radiometric assay, in which the cerebral hemispheres were homogenized and the plasma diluted in four volumes of assay buffer. It was observed that oral administration of EPP inhibited brain and plasma AChE activity in rats, since the effect of the extract on the brain was more potent compared to plasma inhibition. These results are suggestive that EPP administered orally satisfactorily penetrates the brain and inhibits AChE in a dose dependent manner, and can be considered a potent inhibitor (Suh et al., 2006).

In another study, by Gettens (2016) aimed to evaluate and characterize the functional and nutritional properties of peaches. Still, the hydroalcoholic extracts of the pulp and almond of the peach, passed tests to evaluate the antifungal and antimicrobial potential, being: Disc Diffusion Test, Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal

Concentration (MBC). Both presented significant levels of bioactive compounds. Antifungal activity was not found in any of the samples, whereas only fresh almond extract showed moderate activity against *Staphylococcus aureus*. The author points out that such activity may come from the presence of phenolic compounds and cyanide in fresh almonds.

In addition, the pulp and almond of the peach were dehydrated to obtain the flour. The results showed that peach flour is a source of fiber and minerals, where the addition to the formulation of cookies, can contribute positively to health, through the nutritional composition and antioxidant activity of the bioactive compounds found in peach (Gettens, 2016).

Pyrus communis, the popular pear, is among the species of Rosaceae cultivated in Garden, whose genus has more than 20 known species. In Brazil, it is among the most important of its kind and is considered a very tasty fruit (Nakasu et al., 2007). There are reports of the popular use of the fruit as laxative, antiseptic and for stomach disorders. Still, seeds and fruit are used for kidney stones (Jalali et al., 2009; Arican, Yelse & Genç, 2013; Dolatkhahi, Dolatkhahi & Nejad, 2014).

A study by Velmurugan & Bhargava (2013) aimed to evaluate the hypoglycemic and hypolipidemic effects of ethyl acetate (EAEPC) and ethanolic (EEPC) extracts obtained from the fruits of *P. communis*. For that, they used rats that were induced to diabetes, and then the extracts (200 mg/kg) and glibenclamide (5 mg/kg) were administered daily for 11 days in the test groups. As a result, the test groups showed significant antidiabetic and hypolipidemic activity compared to the control group. Phytochemical screening revealed the presence of flavonoids, steroids, alkaloids, carbohydrates, tannins and other polyphenolic compounds in pear fruits.

The authors concluded that both extracts demonstrated properties for preventing the formation of atherosclerosis and coronary heart disease. Therefore, they demonstrate that they can act as good oral and suggestive hypoglycemic agents for the treatment of diabetes mellitus and its complications (Velmurugan & Bhargava, 2013).

A study by Sharma et al. (2015), evaluated phenolic compounds, antioxidant activity and secondary metabolites, using the methanolic extract obtained from the fruit of the pear. The analysis were performed using the ABTS radical scavenging test and the FRAP test. The results revealed the presence of total phenolics, flavonoids, alkaloids and saponins. The evaluation of secondary metabolites by GCMS (Gas Chromatography Coupled to Mass Spectrometry) revealed the presence of compounds known to have industrial properties and therapeutic applications, being: 2-Furanomethanol, isosorbide, squalene, octadecanoic acid

(stearic acid) and 1-octadecdecanol (stearyl alcohol). Sharma et al. (2015), point out that even at lower concentrations, the tests exhibited high antioxidant power in the sample, probably due to the content of phenolic compounds and flavonoids in the sample.

A recent study, carried out by Sroka et al. (2019), used the dry leaves of *P. communis* and *P. pyrifolia* that were submitted to extraction procedures obtaining, as a result, four dry residues, for each sample of *Pyrus* leaf examined, being: methanol, water, ethyl acetate and residue obtained from the aqueous solution. The ABTS assay was used to measure the antiradical activity of the samples, while the antimicrobial activity of the extracts was measured by the diffusion method, using paper discs on Mueller-Hinton and Sabouraud agar plates. As a result, ethyl acetate from *P. communis* leaves showed the highest antiradical activity, while ethyl acetate from *P. pyrifolia* leaves obtained the highest antibacterial activity. Sroka et al. (2019) point out that the antibacterial activity is correlated with the concentration of hydroquinone, this statement being derived from studies carried out by Zbikowska et al. (2017).

Qualitative and quantitative analyzes showed the presence of high concentrations of hydroquinone, arbutin, chlorogenic, p-cumaric acids and their derivatives (Sroka et al., 2019).

The species *Rubus brasiliensis*, popularly known as raspberry or mulberry, has a wide geographical distribution in Brazil, occurring in the Northeast, Midwest, Southeast and South regions. According to reports in the literature consulted, the leaves are popularly used as diuretics. While the roots have astringent, diuretic and laxative functions. Buds and flowers are also used by infusion and decoction as antispasmodic. In addition, fresh fruits are consumed as a tonic and anti-diarrheal. Still, the infusion or tincture of the plant is used for hypertension, cholesterol, labyrinthitis, menopause, obesity, osteoporosis and for kidney diseases (Rodrigues & Carvalho, 2001; Bieski et al., 2012; Barcelos & Heiden, 2015; Messias et al., 2015).

A study by Nogueira & Vassilieff, (2000) investigated the hexanic extract of the leaves of *R. brasiliensis* on the ability to induce hypnotic, anticonvulsant and muscle relaxant effects and to elucidate the involvement with the GABAA system. The hexanic extract of *R. brasiliensis* was administered to mice at doses of 50, 100, 150 and 300 mg/kg orally and after 30 minutes the tests started. Only the dosage of 300 mg/kg of the extract reduced latency and increased the sleep time in the barbiturate-hypnotic test, prevented the attacks of pentylenetetrazole, and induced relaxation in all animals. Such effects are similar to those observed when using Diazepam, a typical benzodiazepine drug, tested under the same experimental conditions. Through these results, the authors indicate that the hexane extract of

R. brasiliensis leaves has a benzodiazepine agonist principle that induced hypnotic, anticonvulsant and muscle relaxant effects (Nogueira & Vassilieff, 2000).

A study by Sartori, Costa & Ribeiro (2014) aimed to evaluate the content of total phenolic compounds, flavonoids and the antioxidant activity of nine commercial frozen fruit pulps, among them, raspberry. Spectrophotometry was used for phenolic analysis, while the antioxidant activity was assessed using the DPPH radical scavenging capacity. Among the results, the highest content of flavonoids was observed for the raspberry pulp, while the orange pulp demonstrated greater antioxidant capacity with a percentage of 108.79% sequestration. In summary, all the frozen commercial fruit pulps evaluated in this study contained total phenolic compounds and flavonoids, however, the raspberry and orange pulps stood out.

4. Conclusion

This work showed that fruit species are very widespread and used by the population, being considered as an important therapeutic resource, especially in disease prevention. However, analyzing the pharmacological records found, there is still a need for more scientific investigations to make safe and effective use. Thus, the notes raised in this work, with the fruitful medicinal species, contribute to the enrichment of the information available in the literature, and which guide the conduct of future scientific research, well elaborated, in several animal and human models. In order to verify possible adverse effects and their efficacy in the treatment of the most varied diseases, considering that medicinal plants are therapeutic resources indispensable to health.

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