Chapter 1
Antioxidants in Brazilian Plant Species

Rene A.S. Campos, Fabio Vianello, Luciana F. Fleuri, Valber A. Pedrosa, Paola Vanzani, and Giuseppina P.P. Lima

Abstract Brazil presents a huge variety and diversity of plant species and several studies showed the antioxidant potential of most of these Brazilian species. In general, antioxidants can be defined as a heterogeneous family of natural molecules, which are present in low concentrations, and can prevent or reduce the oxidative damage in organisms. Among the most studied antioxidants in plants, besides vitamins, polyphenols, such as flavonoids, carotenoids, and thiols, stand out. This chapter highlights the antioxidant properties of some Brazilian fruits, medicinal plants, herbs, and seasonings and proposes a review about the characteristics of Brazilian flora species, which were found to show antioxidant properties.

Keywords Phenolic compounds • Vitamins • Carotenoids • ROS

Abbreviations

ABTS 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)
BHT Butylhydroxytoluene
DPPH 1,1-Diphenyl-2-picryl-hydrazyl

R.A.S. Campos • L.F. Fleuri • V.A. Pedrosa • G.P.P. Lima (✉)
Department of Chemistry and Biochemistry, Insituto de Biociências, Campus de Botucatu, Universidade Estadual Paulista (UNESP), São Paulo, Brazil
e-mail: gpplima@ibb.unesp.br

F. Vianello
Department of Comparative Biomedicine and Food Science, University of Padua, viale dell’Università 16, 35020 Legnaro, Padova, Italy

Regional Centre of Advanced Technologies and Materials, Department of Physical Chemistry, Palacky University in Olomouc, Olomouc, Czech Republic

P. Vanzani
Department of Molecular Medicine, University of Padova, Padova, Italy

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IC_{50}	The half maximal inhibitory concentration. The concentration of antioxidant needed to reduce the amount of radical by 50 %
ROS	Reactive oxygen species

1.1 Introduction

Brazil is a country of continental dimension, recognized for its great biodiversity. The richness of plant species is one of the highest in the world, with an estimated occurrence of almost 34,000 species, of which 54.2 % are endemic (Scariot 2010). This number may be even higher and some estimates indicate that there are over 56,000 species of plants, nearly 19 % of world flora (Giulietti et al. 2005).

However, despite the uncertainty about the composition and potential of the flora, the occupation of forest areas, whether for use of forest resources or their transformation into agricultural or urban areas, has caused the accelerated loss of natural resources and associated traditional knowledge (Brandão et al. 2013). Thus, new strategies must be implemented to promote the use and conservation of this heritage.

Since the seventeenth century, travelers and scientists from Europe had collected several Brazilian native plants species, used as foods or medicines, in the treatment of chronic and degenerative diseases. However, even today, most of these species have not undergone any evaluation to confirm their benefits and verify their potential use as a source of bioactive compounds. There is also the need for agronomical studies, as well as ecological and conservational ones (Oliveira et al. 2012).

Since it was proposed that aging is the result of cumulative damages caused by free radicals, in the mid-twentieth century (reviewed by Gutteridge and Halliwell 2010), researchers aimed to prove the benefits of a vegetal rich diet, source of natural antioxidants. It is believed that this may retard the aging process. Since then, several epidemiological studies have shown that the consumption of fruits and vegetables is associated with a lower incidence of chronic and degenerative diseases (Hartman et al. 2006; Zibadi et al. 2007).

The term “antioxidant” refers to a molecule that protects a biological target against an oxidative damage. In cells and tissues this damage is mainly caused by reactive oxygen species (ROS). By definition, ROS are oxygen radicals including hydroxyl, $OH^{\bullet}$ or superoxide, $O2^{\bullet-}$, some other reactive molecules, such as H_2O_2, and non-oxygen derived radicals, among which reactive species of nitrogen, chlorine, transition metal ions, and sulfur can be found (Valko et al. 2007; Halliwell 2011).

The body’s antioxidant defenses against ROS produced during cellular aerobic respiration can be of endogenous, enzymatic, or nonenzymatic nature, or supplied by the diet. When natural defenses are overwhelmed by excessive production of pro-oxidants, oxidative stress occurs, which is a serious imbalance between the generation of reactive species and antioxidant protection, causing excessive oxidative damage which can affect proteins, lipids, and nucleic acids, oxidizing both cellular and extracellular macromolecules, and causing injury to tissues and affecting the immune system (Limón-Pacheco and Gonsebatt 2009; Gutteridge and Halliwell 2010).

Various natural antioxidants are present in plant samples. Among them, carotenoids, such as carotenes and xanthophylls, polyphenols, such as flavonoids and phenolic acids, and vitamins C, E, and A are the most studied. Protective effects of nutritional antioxidants in health come from their ability to scavenge free radicals by acting as a hydrogen or electron donor or by directly reacting with them (Oliveira et al. 2009).

Polyphenols show a higher antioxidant capacity in vitro than ascorbic acid and tocopherols. These compounds are present in significant quantities in most vegetables and fruits, reinforcing the importance of polyphenols consumed from the diet, and emphasizing their availability and effects in vivo (Pulido et al. 2000). Hundreds of polyphenols, with a wide diversity of structures and molecular masses, exist and information about their consumption, bioavailability, and metabolism is currently partial and incomplete (Saura-Calixto 2011).

The diversity of antioxidant structure and properties makes difficult to separate and quantify these compounds in vegetable matrixes. Thus, in recent years, several methods have been developed to measure the total antioxidant activity, antioxidant capacity, or total antioxidant potential. Among them, the total phenols assay by Folin–Ciocalteu reagent, DPPH (1,1-diphenyl-2-picryl-hydrazyl) (Brand-Williams et al. 1995), trolox equivalent antioxidant capacity—TEAC (Van den Berg et al. 1999), total radical antioxidant potential—TRAP (Evelson et al. 2001), ferric reducing ability of plasma—FRAP (Benzie and Strain 1996), oxygen radical absorbance capacity—ORAC (Cao and Prior 1999), and lipid peroxidation assay (Zhang et al. 2006) are the most representative. These assays are based on hydrogen atom or electron transfer and measure the capacity of an antioxidant to reduce an oxidant, which changes its color when reduced. The degree of color change is correlated with the concentration of antioxidant in the sample. Synthetic antioxidants, such as BHT, trolox, gallic acid, rutin, and ascorbic acid, or plant extracts with recognized antioxidant power, such as *Gingko biloba*, are used as standards to calibrate the measurements in laboratory.

The research area about the properties of natural antioxidants has grown in recent years, due to the increasing restrictions about the use of synthetic antioxidants and public awareness about health issues. Hence, various researches are focused on the identification and characterization of novel antioxidants from natural sources (Shahidi 2000).

The research for new plant products, as a source of antioxidants, has received great attention in Brazil. This can be verified from the literature recently produced in the country, such as “screening studies.” The most studied plant materials are represented by fruits, conventional or “exotic” vegetables, teas and spices, medicinal plants, plant products, such “cachaças” (spirits), essential oils, and industrial wastes.

1.2 Fruits

The Amazon region presents a great variety of fruit species, characterized by different aromas and flavors, which may represent potential alternatives, economically attractive sources of antioxidants. A study on Brazilian fruits highlighted acerola (*Malpighia glabra*), cashew (*Anacardium occidentale*), mangaba (*Hancornia speciosa*), umbu (*Spondia tuberosa*), açaí (*Euterpe oleracea*), uvaia (*Eugenia pyriformis*), and murici (*Byrsonima crassifolia*) as a good source of antioxidants, when measured by the DPPH antioxidant capacity and compared with BHT. In this study, the antioxidant activity was related to the high levels of vitamin C and phenolic compounds present in these fruits. Acerola presented 1,360 mg/100 g of vitamin C and 1,060 mg/100 g of polyphenols (Rufino et al. 2009).

Another study on economically important fruits, camu-camu (*Myrciaria dubia*) and acerola (*Malpighia emarginata*), displayed a considerable amount of vitamin C: 1,882 and 1,357 mg/100 g, respectively. Açaí (*Euterpe oleracea*) and jussara (*Euterpe edulis*) showed large amount of different antioxidants: 111 and 192 mg/100 g anthocyanins, 91.3 and 375 mg/100 g flavonoids, and 20.8 and 21.5 mg/100 g chlorophyll, respectively. Puça-preto (*Mouriri pusa*) was also considered an excellent source of anthocyanins showing 103 mg/100 g, as well as murta (*Blepharocalyx salicifolius*) with 143 mg/100 g, jambolão (*Syzygium cumini*) with 93.3 mg/100 g, jabuticaba (*Myrciaria cauliflora*) with 58.1 mg/100 g, and camu-camu with 42.2 mg/100 g. The fruits of gurguri (*Mouriri guianensis*) are a rich source of carotenoids with 4.7 mg/100 g. The richest fruits in polyphenols were camu-camu with 1,176 mg/100 g, acerola with 1,063 mg/100 g, and puçá-preto with 868 mg/100 g, indicating that these fruits are excellent sources of bioactive compounds (Rufino et al. 2010).

Camu-camu has demonstrated an antioxidant activity, determined by the DPPH method, of 119 % higher than pure α-tocopherol. Researchers also studied murta, guriri, carnauba, jabuticaba, and puçá-preto (Rufino et al. 2011a). In a recent in vivo study, the camu-camu juice also showed antigenotoxic activity, being able to reduce DNA damage caused by H_2O_2 (Da Silva et al. 2012a, b). Ascorbic acid is the main component responsible for the antioxidant capacity; however, this fruit contains also phenolic compounds, ellagic acid derivatives, anthocyanins, flavonoids (rutin and its derivatives) and flavones (derivatives of naringenin and eriodictyol), and hydrolyzed tannins, providing additional evidence about the importance of this fruit as a source of bioactive compounds (Chirinos et al. 2010).

In açaí fruits (*Euterpe oleracea*), the highest antioxidant capacity was observed (1.82 mmol BHT equivalent/100 g fresh weight) among frozen fruit pulps sold in Brazil, followed by cashew (*Anacardium occidentale*), apple (*Malus domestica*), and blackberry (*Morus nigra*) (Hassimotto et al. 2009). In a variety of açaí, the "BRS Pará," a high fiber (71 %) and oil (20.8 %) content and a high antioxidant capacity were found, being higher than the virgin olive oil, demonstrating considerable potential for nutritional applications (Rufino et al. 2011b). The antioxidant activity of açaí pulp is mainly related to its polyphenol content. High concentrations of phenolic compounds were found in immature fruits, especially flavones, such as orientin and homoorientin. Thus, extracts from immature fruits may also be attractive, due to their content of bioactive compounds (Gordon et al. 2012).

Jussara (*Euterpe edulis*), from Southern Brazil, showed high content of polyphenols (2,610 mg/100 g) and anthocyanins (1,080 mg/100 g) (Borges et al. 2011). Its pulp extracts showed strong antioxidant capacity, by the DPPH and FRAP methods, and significant protective effects on stress tests in vitro, compared to gallic acid controls (Borges et al. 2012).

Jabuticaba (*Myrciaria cauliflora*), which may be considered a Brazilian cherry, is known to be a rich source of anthocyanins, similar to other cherries, such as blackberry. Recently, it was demonstrated that frozen and dried jabuticaba peel can be a good source of phenolic compounds with 556.3 mg/kg fresh matter, possessing a very high antioxidant capacity (Leite-Legatti et al. 2012). Other fruits, which are good sources of flavonoids, are pitanga (*Eugenia uniflora*), acerola, and cashew, containing several flavonoids, such as myricetin, quercetin, and kaempferol (Hoffmann-Ribani et al. 2009). Recently, a study on red and white jabuticaba wines showed a higher antioxidant activity than grape wine, and close to the values of BHT (Barros et al. 2010).

In another study on Amazonian fruits, a high content of bioactive compounds in fruits of cutite (*Pouteria macrophylla*), followed by jambolão (*Syzygium cumini*), araçá (*Psidium guineense*), and murici (*Byrsonima crassifolia*), was found, and a great number of phenolic compounds, assigned as hydrolyzable tannins, proto-anthocyanins, flavonols, and flavonolols, were identified (Gordon et al. 2011).

The fruits of cutite (*Pouteria macrophylla*) were recently recognized as equivalents to other Amazonian fruits characterized by high nutritional value and can be considered as rich sources of polyphenols for human diet. Fresh fruits demonstrated a high antioxidant activity, when compared to other fruits widely consumed and marketed in Brazil (da Silva et al. 2012b).

A study on jenipapo (*Genipa americana*), umbu (*Spondia purpurea*), and siriguela (*Spondia purpurea*) revealed the presence of phenols, tannins, anthocyanins, proto-anthocyanins, flavonoids, leucoantocianins, catechins, flavonones, anthraquinones, anthrones, coumarins, triterpenoids, sterols, and saponins in samples of peels and seeds. The seeds and peels of seriguela and umbu showed the highest antioxidant activity and the lipid peroxidation assay indicated that jenipapo pulp is a promising source of antioxidants (Omena et al. 2012).

Other promising Brazilian palm fruits, regarding their antioxidant content, are the fruits of guariroba (*Syagrus oleracea*), jerivá (*Syagrus romanzoffiana*), and macaúba (*Acrocomia aculeata*). Among these fruits, jerivá can be considered a good source of carotenoids (1.2 mg/g), and all these fruits possess significant amounts of tocopherols (mainly α-tocopherol). Additional studies on antioxidant activity and toxicity of compounds present in these palm fruits were reported (Coimbra and Jorge 2011).

Bioactive compounds and antioxidant capacity of licuri (*Syagrus coronate*) were evaluated (Belviso et al. 2013). It was found that licuri fruits contain 1.21 and 2.78 mg/g of total polyphenols, in roasted and raw fruit samples, respectively. There was an increase in the antioxidant capacity when the fruit was roasted, due to the increased amount of phenolic compounds, particularly those belonging to the class of flavan-3-ols.

The mucuja chestnut (*Couma rigida*), inajá (*Maximiliana maripa*) jenipapo (*Genipa americana*), buriti (*Mauritia flexuosa*), and uxi (*Endopleura uchi*) showed high concentrations of phytosterols. The pulps of buriti and uxi contain large amounts of α-tocopherol and vitamin E, suggesting that these fruits could be interesting sources of bioactive compounds (da Costa et al. 2010).

In fruits of camarinha (*Gaylussacia brasiliensis*), a high amount of phenolic compounds (492.8 mg/100 g) and anthocyanins (240.4 mg/100 g fresh fruit) was observed. A correspondingly high antioxidant capacity was determined: 1.96, 1.66, and 0.67 mmol trolox equivalents/100 g fresh fruit, by ABTS, DPPH, and FRAP assays, respectively (Bramorski et al. 2011). A good correlation between the content of polyphenols and antioxidant capacity of the extracts was observed. The research highlighted the potential of this fruit as an important source of bioactive and nutritional compounds, available in this typical Brazilian plant.

The araçá-boi fruit (*Eugenia stipitata*), from Brazilian Amazon, is rich in terpenoids, volatile compounds, fiber, and vitamin C. The fruits, known for their antioxidant activity, were investigated and showed 184.5 mg/100 g phenolic compounds. The ethanol extracts of araçá-boi fruits showed high antimutagenic activity in vivo, suggesting their use as preventive agents against cancer (Neri-Numa et al. 2012).

In bacupari fruits (*Rheedia brasiliensis*), 7-epiclusianone was discovered. This substance, despite having a low antioxidant activity, was able to protect cells against mutagenic effect at doses of 5–15 mg/kg, and it can be used in the future as a potential agent in the prevention of cancer (de Carvalho-Silva et al. 2012).

Among 11 fruits produced in the Northeastern Brazilian region, it was verified that murici (*Byrsonima crassifolia*) and mangaba (*Hancornia speciosa*) possess a high antioxidant activity, determined by DPPH and ABTS assays, correlated with their polyphenol content, and were proposed as good sources of antioxidants (Almeida et al. 2011).

In one of the first studies with native plants of the Brazilian Cerrado, the aqueous and ethanolic extracts of pequi (*Caryocar brasiliense*) peel and ethanolic extracts of seeds of cagaita (*Eugenia dysenterica*) and ariticum (*Annona crassiflora*) pell showed significant levels of phenolics compounds (209.3, 208.4, 136.99, and 136.96 mg/100 g, respectively) and high antioxidant potential, requiring further studies (Roesler et al. 2007).

Pequi pulp (*Caryocar brasiliense*) is rich in lipids and dietary fibers and presents a high content of phenolic compounds (209 mg/100 g), indicating that it could be considered a food with high antioxidant capacity. A correlation between its high levels of unsaturated fatty acids with phenolic compounds and carotenoids was found (De Lima et al. 2007).

The pulp of cagaita (*Eugenia dysenterica*) shows 34.1 mg/100 g of vitamin C, contributing significantly to the daily needs of this vitamin, especially for families and vulnerable groups in Cerrado areas, characterized by high levels of food insecurity (Cardoso et al. 2011).

Moreover, among native fruits of Brazilian Cerrado, it was observed that the pulp of marolo (*Annona crassifolia*) presents a good antioxidant activity (13.16 mmol Trolox equivalents/100 g), a large amount of phenolic compounds (739.37 mg/100 g), and 59.05 mg/100 g ascorbic acid. These results were similar to jenipapo (*Genipa americana*), murici (*Byrsonima crassifolia*), graviola (*Annona muricata*), and sweet passion fruit (*Passiflora alata*) (de Souza et al. 2012). The lipid fraction of the seeds of *Annona crassifolia* presents significant amount of bioactive substances, especially phytosterols, tocopherols, and unsaturated fatty acids, presenting significant antioxidant capacity and oxidative stability (Luzia and Jorge 2013).

The pulp of several tropical fruits marketed in frozen form in southern Brazil contains high levels of polyphenols and good total antioxidant activity, especially acerola (*Malpighia glabra* L.) and mango (*Mangifera indica*). Among the fresh products, baguaçu (*Eugenia umbelliflora*) stands out as a powerful antioxidant, due to its content in anthocyanins (Kuskoski et al. 2006).

Three species of fruits native of southern Brazil, the ariticu-do-mato (*Rollinia sylvatica*), coquinho-azedo (*Butia capitata*), and mandacaru-de-três-quinas (*Cereus hildmannianus*), showed considerable amount of vitamin C and phenolic compounds, but *B. capitata* showed the highest antioxidant capacity, similar to some varieties of plum (Pereira et al. 2013).

In blackberry (*Rubus* sp.), another common plant in southern Brazil, it was found that some cultivars present high levels of phenolic compounds (600–1,000 mg/100 g) and considerable antioxidant activity. It was found that the content of phenolic compounds is not correlated with antioxidant activity of the fruit, which is probably related to vitamins and anthocyanins (Vizzotto et al. 2012).

The antioxidant capacity of four species of *Citrus* produced in Brazil was assessed. The peel of "Ponkan" tangerine showed the highest total antioxidant capacity, correlated with vitamin C and phenolic compound content. In addition to pulp, citrus peels are a good source of bioactive compounds and minerals, and their composition and properties should be explored (Barros et al. 2012).

The phenolic compound content and antioxidant activity of pomace from the winemaking of grape varieties, widely produced in Brazil, were investigated. Cabernet Sauvignon pomace was found to have the highest content of total phenolic compounds (74.75 mg/g), the highest antioxidant activity, and reducing power, while Bordeaux varieties showed the highest lipid peroxidation inhibition power. Thus, these varieties showed to be a good source of antioxidant compounds (Rockenbach et al. 2011).

1.3 Medicinal Plants

In a study on leaves, barks, and fruits of 15 Brazilian plants, murici (*Byrsonima crassifolia*), pata-de-vaca (*Bauhinia macrostachya*), embaúba (*Cecropia palmata*), cedro-cheiroso (*Cedrela odorata*), chapeu-de-sol (*Cordia exaltata*), cipó-de-carijó (*Davilla kunthii*), cipó-caboclo (*Davilla rugosa*), verônica (*Dalbergia subcymosa*), ingá (*Inga edulis*), and barbatimão (*Stryphnodendron barbatiman*) were considered good sources of antioxidants. A high correlation between flavonoid, phenolic compound content, and antioxidant activity was found (Silva et al., 2007). Subsequently, it was confirmed that extracts of murici (*Byrsonima crassifolia*), cipó-de-carijó (*Davilla rugosa*), and ingá (*Inga edulis*) can be considered good sources of polyphenols and that leaves of *I. edulis* are the best source of polyphenols with antioxidant properties (Souza et al. 2008).

Saratudo (*Byrsonima japurensis*), an Amazonian plant, popularly considered as a potent anti-inflammatory drug, and traditionally used for gastrointestinal and genitourinary diseases, was also recently studied. The aqueous extract of saratudo bark, obtained by infusion at 5 %, showed significant antioxidant activity ($IC_{50} = 42.5$ μg/mL), as determined from the inhibition of lipid peroxidation. This activity was higher than that showed by BHT, tested under the same conditions (Guilhon-Simplicio et al. 2012).

In another screening of medicinal species, it was found that angico (*Anadenanthera macrocarpa*), aroeira (*Astronium urundeuva*), jurema-branca (*Mimosa verrucosa*), and quixabeira (*Sideroxylon obtusifolium*) were effective in reducing the oxidation of DNA. The extracts of *A. macrocarpa* showed a high antioxidant activity ($IC_{50} = 54$ μg/mL) (Desmarchelier et al. 1999).

Moreover, in another screening on 71 extracts of 16 different species, the ethanolic extracts of leaves of angico (*Anadenanthera peregrina*) and monjolo-sabão (*Pseudopiptadenia contorta*) showed higher antioxidant activity than rutin ($IC_{50} = 14.16$), measured by the DPPH method. This study also highlighted the good antioxidant properties of ethanolic extracts of leaves of *Vitex polygama* and *Vitex litoralis*, leaves and flowers of *Lantana trifolia*, and aerial parts of *Hyptis tetracephala*, in comparison with the standardized extract of *Ginkgo biloba* leaves ($IC_{50} = 40.72$). The partition of the extracts in hexane, dichloromethane, ethyl-acetate, and n-butanol was also studied, and the leaves and flowers of *Lantana trifolia*, the leaves and bark of *Vitex poligama*, and the aerial parts of *Hyptis elegans* and *Raphiodon echinus* showed high antioxidant activity, when compared to rutin. Plants belonging to the Verbanaceae family, e.g., maria-preta (*Vitex polygama*) and gervãozinho-do campo (*Verbena litoralis*), showed lower IC_{50} values than other plant extracts (Mensor et al. 2001).

Further screening about the properties of extract from medicinal species, in particular from carnaúba (*Copernicia cerifera*), guariroba (*Syagrus oleraceae*), pata-de-vaca (*Bauhinia variegata*), and hortelã-bravo (*Hyptis fasciculata*), showed interesting antioxidant activity, e.g., $IC_{50} < 60$ μg/mL, suggesting the presence of good sources of DPPH free radical scavengers. Tests carried out on yeasts, however, demonstrated that only the extracts from *C. cerifera*, *S. oleraceae*, and *Mauritia vinifera* presented protective effects against BHT incubation (Silva et al. 2005).

Carqueja (*Baccharis trimera*), widely used as anti-inflammatory, hypoglycemic, and remedy for digestive problems, was evaluated, as regards its antioxidant activity, by the DPPH method. The dried powder showed an $IC_{50} = 22.74$ μg/mL, comparable to vitamin E ($IC_{50} = 16.71$ μg/mL), suggesting good antioxidant properties (Dias et al. 2009).

In order to obtain purified fractions of polyphenols and antioxidant compounds, extraction processes from plant materials were considered. It was demonstrated that the most effective extraction process for obtaining antioxidants is represented by supercritical fluid extraction for cipó-de-são-joão (*Pyrostegia venusta*), common bean (*Phaseolus vulgaris*), nó-de-cachorro (*Heteropterys aphrodisiaca*), and ingá-cipo (*Inga edulis*), using ethanol as co-solvent, evidencing high recovery of antioxidant compounds and low manufacturing costs (Veggi et al. 2011).

The leaves of cashew (*Anacardium occidentale*) were studied about their phenolic compound content and antioxidant activity. Methanol extracts showed the highest amount of total phenolic content (307.3 mg/g dried mass), proving to be a powerful DPPH and ABTS scavenger, comparable to rutin and quercetin standards (Razali et al. 2008).

The leaves of ingá (*Inga edulis*) were also considered a promising source of antioxidants. In a recent study, a methanol–water extract of leaves was fractionated and phenolic compounds were identified as gallic acid, catechin, epicatechin, myrcetin-3-rhamnopyranoside, and quercetin-3-rhamnopyranoside. The crude dry extract showed a polyphenol content of 496.5 mg/g dry mass and an antioxidant capacity of 11.16 mmol trolox equivalents/g dry crude extract, measured by ORAC assay (Souza et al. 2007).

Silva et al. (2007) also found high antioxidant capacities in leaves and bark of *Byrsonima crassifolia*, *Inga edulis*, *Davilla kunthii*, and *Cecropia palmata*. According to authors, their great biomasses in the forest should stimulate further studies regarding their characterization and isolation of phenolic compounds.

Furthermore, some Brazilian spirits, popularly known as "cachaças," flavored by aging with woody plants, were studied. The spirits flavored with jatoba (*Hymenaea courbaril*) and chestnut (*Castanea* sp.) woods showed the highest levels of total polyphenols and tannins. The spirits flavored with louro-canela (*Aniba parviflora*), canela-sassafras (*Ocotea pretiosa*), and amendoim bravo (*Pterogyne* sp.) presented significant amounts of flavonoids, while they were more efficient in inhibiting lipid peroxidation than oak-flavored spirits used for comparison. However, oak spirits exhibited higher free radical scavenging capacity, against DPPH. The amendoim bravo (*Pterogyne* sp.) spirits proved to be the most potent antioxidant extract (Cardoso et al. 2008).

Finally, the antioxidant action of teas and most consumed Brazilian seasonings was evaluated by the DPPH method. Results showed that unfermented green tea (*Camellia sinensis*) was the most active ($IC_{50} = 0.14$ mg/mL), in which the main antioxidant compounds are represented by epigallocatechins. The most active seasoning was cinnamon (*Cinnamomum*) ($IC_{50} = 0.76$ mg/mL), in which eugenol was the main antioxidant reported (de Morais et al. 2009).

1.4 Conclusions

Results and findings reviewed in this chapter show the importance of Brazilian plant product as potential sources of extremely useful antioxidants, both for industrial purposes and human health. The knowledge about the content and the quality of polyphenols present in fruits and vegetables in poorly studied plant products is rapidly growing and the aim of the present review was the collection and the report of results from the world scientific community about the polyphenol content and antioxidant activity in these plant materials. This knowledge can drive the population to properly choose products with higher medicinal and functional power. The results described in this work hopefully will stimulate the continuity of research to evaluate the antioxidant power of isolated substances of studied species. Of course, other detailed agronomical, biochemical, and chemical research must be performed in order to elucidate the role of these substances, from the original plant to human beings.

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