



## Effects of irradiation in medicinal and eatable herbs

Paula M. Koseki<sup>a</sup>, Anna Lúcia C.H. Villavicencio<sup>a,\*</sup>, Mônica S. Brito<sup>a</sup>,  
Ligia C. Nahme<sup>a</sup>, Kátia I. Sebastião<sup>a</sup>, Paulo R. Rela<sup>a</sup>,  
Ligia B. Almeida-Muradian<sup>b</sup>, Jorge Mancini-Filho<sup>b</sup>, Paulo C.D. Freitas<sup>b</sup>

<sup>a</sup>IPEN-CNEN/ISP, Departamento de Aplicações Industriais, Instituto de Pesquisas Energeticas e Nucleares,  
Travessa R, No. 400, Cidade Universitária, CEP 05508-910 São Paulo, Brazil

<sup>b</sup>FCF/USP, Departamento de Alimentos e Nutrição Experimental-Av. Prof. Lineu Prestes, 580-Bloco 14,  
Cidade Universitária, CEP 05508-900 São Paulo, Brazil

### Abstract

For ages, herbs have been used as medicine and food. Nowadays, the interest in phytotherapeutics is increasing as well as the consumer attention. Some biochemical compounds synthesized by plants as alkaloids, phenolics, flavonoids, essential oils, tannins and vitamins, influence the composition of these plant pharmacologicals, which may produce various reactions in the human body. The microbial contamination in these raw plant materials is common, and the radiation processing is one appropriate technique for the reduction of microorganism. In herbs used as food products, the changes in total  $\beta$ -carotene and flavonoids upon the radiation treatment were tested. The powdered and dehydrated herbs were irradiated with <sup>60</sup>Co gamma rays applying doses of 0, 10, 20 and 30 kGy. The botanical species investigated were rosemary (*Rosmarinus officinalis* Linné), watercress (*Nasturtium officinale* R. Br), artichoke (*Cynara scolymus* Linné) and sweet basil (*Ocimum basilicum* Linné). The alterations in the active principles in the herbs following increasing doses of radiation were analyzed employing various methods of extraction and chromatography. © 2002 Elsevier Science Ltd. All rights reserved.

**Keywords:** Phytotherapeutics; Gamma-radiation; Essential oils; Flavonoids

### 1. Introduction

The Brazilian Pharmaceutical industry has a US\$9 billion market, and is, therefore, among the 10th largest in the world. Around 30% of the marketed drugs registered by the Federal Health Office are classified as phytopharmaceutical, representing 20–25% of the local pharmaceutical market (Petrovick, 1999). In addition, Brazil exports considerable quantities of medicinal plants, extracts and isolated substances, reaching the value of US\$22 million per year (Sharapin, 1996).

Despite their importance, 70% of the phytopharmaceutical resources have not been sufficiently studied, in order to provide the necessary confirmation of their efficacy and safety, as every medicine actually demands (Petrovick et al., 1999). Since ethylene oxide was no more allowed as a sterilization process in herbs, the legal use of irradiation process is increasing in Brazil.

*Rosmarinus officinalis* Linné is a plant that has eatable and medicinal properties. Rosemary extract is already commercialized as antioxidant, and its actions are due to the phenolic compounds (Sant'Ana and Mancini-Filho, 1999). *Nasturtium officinale*, also known as watercress, is largely cultivated in Brazil. Despite the nutritional value, this vegetable has important medicinal properties as depurate and diuretic (Oliveira et al., 1991). Artichoke (*Cynara scolymus*) is used as diuretic in the treatment of

\*Corresponding author. Fax: +55-11-3816-9186.

E-mail addresses: villavic@net.ipen.br (A.L.C.H. Villavicencio), jmancini@usp.br, lenach@usp.br (J. Mancini-Filho).

diabetes, due to the flavonoidic property (Oliveira et al., 1991). The leafy parts of basil (*Ocimum basilicum*) have great uses in cooking, besides the tonic and anti-septic properties.

This paper intends to report whether high doses of radiation affects the characteristics or amount of phenolics, flavonoids, essential oils, tannins and  $\beta$ -carotene (pro-vitamin A) of these studied plants.

## 2. Experimental

### 2.1. Samples

Local herb companies in São Paulo, Brazil, provided dehydrated samples of rosemary (*Rosmarinus officinalis* Linné), watercress (*Nasturtium officinale* R. Br), artichoke (*Cynara scolymus* Linné) and sweet basil (*Ocimum basilicum* Linné).

### 2.2. Irradiation

The samples were irradiated on plastic package in a  $^{60}\text{Co}$  Gammacell 220 (AECL) installed in IPEN (São Paulo, Brazil). The applied radiation doses were 0, 10, 20 and 30 kGy, and the dose rate was 5.8 kGy.

### 2.3. Sample analysis

**Flavonoids and essential oils analysis:** Thin layer chromatography was used to analyze flavonoids and essential oils, according to Wagner and Bladt (1995).

**Phenolic and tannins analysis:** The determination of the concentration of phenolic compounds was performed according to Swain and Hills (1959) and the tannins were quantified as described by Price et al. (1978).

**$\beta$ -carotene analysis:** The open-column chromatographic method of Almeida and Penteadó (1987) was performed to analyze and quantify total  $\beta$ -carotene and its pro-vitamin A activity.

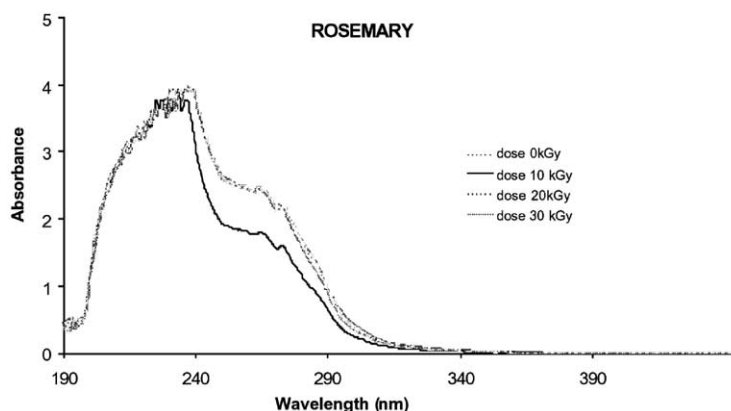


Fig. 1. Absorption spectrum of rosemary extracts irradiated at different doses of radiation.

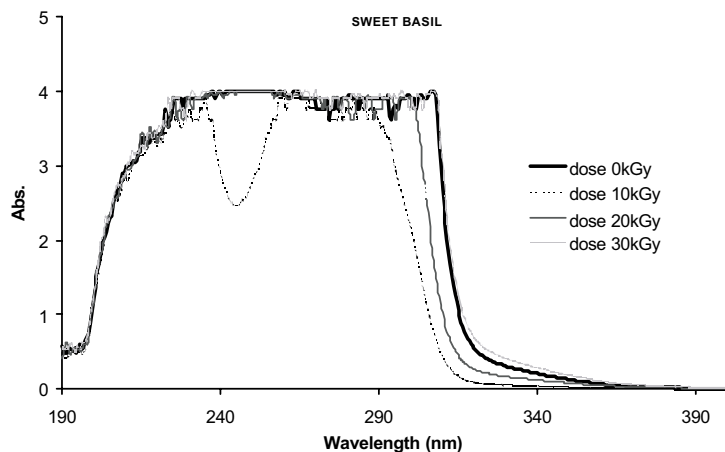


Fig. 2. Absorption spectrum of sweet basil extracts irradiated at different doses of radiation.

### 3. Results and discussion

#### 3.1. Flavonoids and essential oil analysis

Chromatographic analysis of different extracts irradiated at increasing doses indicated that there were no great differences in the chemical constitution of the herbs. The basil extracts presented no change in the color on increasing the irradiation doses (results are similar in other herbs extracts).

Absorption peaks of essential oils of rosemary were observed at 224 nm (acute) and about 272 nm (diffuse) as shown in Fig. 1. On the other hand, sweet basil presented peaks at 233 nm (acute) and about 306.5 nm (diffuse) as observed in Fig. 2. The samples showed similar curves, presenting no changes in the chemical compounds (except for the radiation dose of 10 kGy).

#### 3.2. Tannins and phenolic analysis

Fig. 3(a) show the tannins standard curve. As we can observe in Fig. 3(b), sweet basil and artichoke do not show great variation in tannins content with an increase of radiation dose. Rosemary presents a small sensitivity to radiation treatment. Phenolic standard curve can be observed in Fig. 4(a). Phenolic's content has a small change also in rosemary after 10 kGy, as observed in Fig. 4(b).

#### 3.3. $\beta$ -carotene analysis

$\beta$ -carotene was not observed in watercress samples, and even this vegetable was considered as a source of

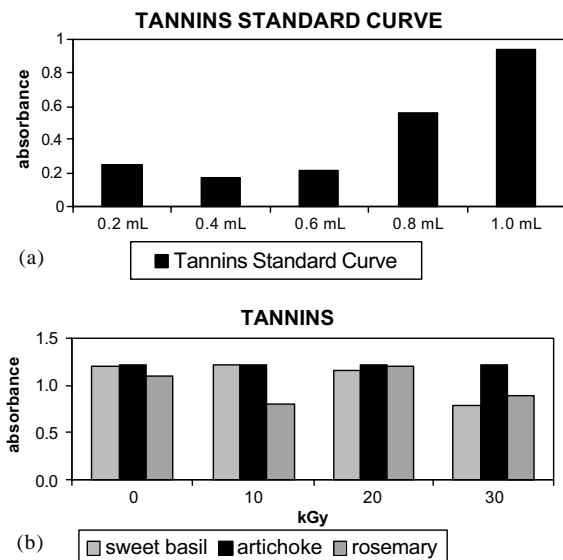


Fig. 3. (a) Tannin standard curve; and (b) tannin irradiation influence.

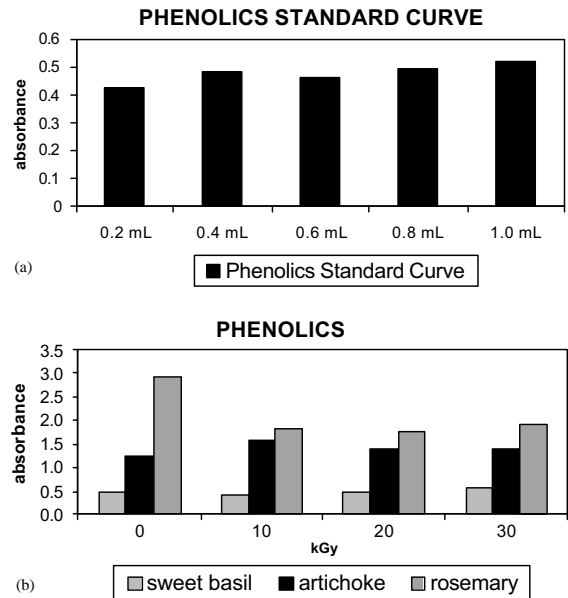


Fig. 4. (a) Phenolic standard curve; and (b) phenolic irradiation influence.

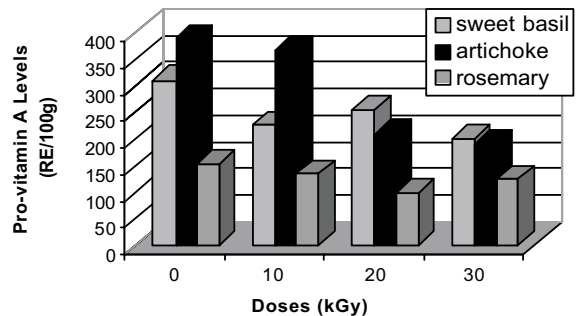


Fig. 5. Total  $\beta$ -carotene levels of sweet basil, artichoke and rosemary samples irradiated at 0, 10, 20 and 30 kGy.

carotenoids with pro-vitamin A activity (Oliveira and Marchini, 1998). Pro-vitamin A levels are slightly higher on non-irradiated samples of the herbs. However, there are no evidences that radiation caused a significant degradation of total  $\beta$ -carotene in the samples analyzed. In Fig. 5 the total  $\beta$ -carotene levels of sweet basil, artichoke and rosemary samples irradiated at 0, 10, 20 and 30 kGy can be observed.

### 4. Conclusions

From the described pharmacological tests carried out by this study, it is concluded that phytotherapies showed the identical therapeutical action as non-irradiated

preparations after exposure to a dose of 10, 20 and 30 kGy or ionizing radiation.

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