



Abstract

# Chemopreventive Potential of *Santolina chamaecyparissus* against MNU-Induced Mammary Cancer in Female Wistar Rats<sup>†</sup>

Tiago Azevedo<sup>1,\*</sup>, Jessica Silva<sup>1</sup>, Abigaël Valada<sup>1</sup>, Lara Anjos<sup>1</sup>, Tiane C. Finimundy<sup>2</sup>, Lillian Barros<sup>2</sup>, Manuela Matos<sup>1,3</sup> and Paula A. Oliveira<sup>1,4</sup>

<sup>1</sup> Centre for the Research and Technology of Agro-Environmental and Biological Sciences (CITAB), Inov4Agro, University of Trás-os-Montes and Alto Douro (UTAD), 5000-801 Vila Real, Portugal

<sup>2</sup> Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

<sup>3</sup> Department of Genetics and Biotechnology, School of Life and Environmental Sciences, University of Trás-os-Montes and Alto Douro (UTAD), 5000-801 Vila Real, Portugal

<sup>4</sup> Department of Veterinary Sciences, School of Agrarian and Veterinary Sciences, University of Trás-os-Montes and Alto Douro (UTAD), 5000-801 Vila Real, Portugal

\* Correspondence: tiagoazevedo99@gmail.com

<sup>†</sup> Presented at the 3rd International Electronic Conference on Foods: Food, Microbiome, and Health—A Celebration of the 10th Anniversary of Foods' Impact on Our Wellbeing, 1–15 October 2022; Available online: <https://sciforum.net/event/Foods2022>.

**Abstract:** Breast cancer is the most often diagnosed cancer worldwide, with the greatest fatality rate among women in 2021. *Santolina chamaecyparissus* L. has been shown to successfully inhibit cancer cells' proliferation, especially in the human breast adenocarcinoma (MCF-7) cell line. This study's goal was to evaluate the chemopreventive potential of a *S. chamaecyparissus* aqueous extract (SCE) on *N*-methyl-*N*-nitrosourea (MNU)-induced mammary cancer in female rats. This study was approved by the ORBEA under reference 834-e-CITAB-2020. Twenty-eight four-week-old female Wistar rats were divided into four groups: Control, MNU, SCE and SCE+MNU. SCE was supplemented in drinking water (120 µg/mL) ad libitum and replaced every 3 days due to the compounds' stability. A total of nineteen compounds were identified in the extract, with myricetin-*O*-glucuronide and 1,3-*O*-dicafeoylquinic acid being the main compounds found. At 50 days of age, the MNU was administered by intraperitoneal route. Humane Endpoint analysis was performed weekly. Induced animals were palpated twice a week. Tumour width (W) and length (L) were weekly measured with a calliper. Tumour volume was also determined [ $V = (W^2 \times L)/2$ ]. After twenty-one weeks, animals were sacrificed by a ketamine/xylazine overdose. Control and SCE animals did not develop any tumours. In the MNU group, the first tumour appeared during the ninth week; in SCE+MNU, it only appeared in the sixteenth week. No significant differences were found. However, the tumour incidence in SCE+MNU (28.57%) was lower than in MNU (57.14%). The MNU group had a higher mean tumour weight ( $2.31 \pm 1.13$  g) than the SCE+MNU group ( $0.39 \pm 0.02$  g) and a larger mean tumour volume ( $2.02 \pm 1.23$  cm<sup>3</sup>) than SCE+MNU ( $0.57 \pm 0.15$  cm<sup>3</sup>) ( $p > 0.05$ ). Despite the lack of statistically significant differences between groups, the absence of mortality in SCE+MNU, as well as the lower values in each parameter, suggest that *Santolina chamaecyparissus* has interesting potential as a chemoprotective agent. Histopathological analysis will help understand this extract's impact on oncogenesis.

**Keywords:** mammary cancer; MNU; natural compounds; Santolina; Wistar rats

**Supplementary Materials:** The following are available online at <https://www.mdpi.com/article/10.3390/Foods2022-12981/s1>.



**Citation:** Azevedo, T.; Silva, J.; Valada, A.; Anjos, L.; Finimundy, T.C.; Barros, L.; Matos, M.; Oliveira, P.A. Chemopreventive Potential of *Santolina chamaecyparissus* against MNU-Induced Mammary Cancer in Female Wistar Rats. *Biol. Life Sci. Forum* **2022**, *18*, 11. <https://doi.org/10.3390/Foods2022-12981>

Academic Editor: Antonio Cilla

Published: 30 September 2022

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

**Author Contributions:** Methodology and writing—original draft: T.A.; Investigation—T.A., J.S.; A.V.; L.A. and T.C.F.; conceptualization, supervision and project administration: L.B., M.M. and P.A.O. All authors have read and agreed to the published version of the manuscript.

**Funding:** The authors acknowledge the financial support by the Portuguese Foundation for Science and Technology (FCT) through a Doctoral Grant (2020.07999.BD, J.S.), and through national funds FCT/MCTES (PIDDAC) to CITAB (UIDB/04033/2020), CIMO (UIDB/00690/2020 and UIDP/00690/2020) and SusTEC (LA/P/0007/2021); L.B. thanks to the national funding by FCT through the institutional scientific employment program—contract for her contract.

**Institutional Review Board Statement:** This study was approved by an Ethics Review Body (“ORBEA—Órgão Responsável pelo Bem-Estar e Ética Animal” under reference 834-e-CITAB-2020.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Data is contained within the article.

**Conflicts of Interest:** The authors declare no conflict of interest.