Evaluation of cactus pear (*Opuntia spp.*) extracts as promising bioactive ingredients for colon cancer therapy

Instituto de Tecnologia Química e Biológica | Av. da República, 2781-901 Oeiras, Portugal
www.itqb.unl.pt

Joana Poejo[1], Ana A. Matias[1,2,3], Sara Nunes[1], C. Semedo[3], M.R. Bronze[1,2,3], Catarina M.M. Duarte[1,2], Ana Teresa Serra[1,2]
[1]ITQB/UNL; [2] IBET, Apartado 12, 2781-901 Oeiras, Portugal; [3] iMED, FFUL, Av. das Forças Armadas, 1649-019, Lisboa, Portugal.

AIM: Develop natural ingredients from cactus pear and evaluate their potential use as natural chemotherapeutic agents on colon cancer

Introduction

Colorectal cancer is the second most frequent malignant disease in Europe. Epidemiological data suggests that the ingestion of phytochemicals from fruits and vegetables may contribute to reduce the incidence of cancer in humans. Cactus (*Opuntia spp.*) fruits and cladodes have been widely used as food and in folk medicine. The aim of this project is to evaluate the anticancer properties of **Opuntia bioactive extracts** in order to develop a promising natural **chemotherapeutic** or **chemopreventive** agent.

Opuntia products

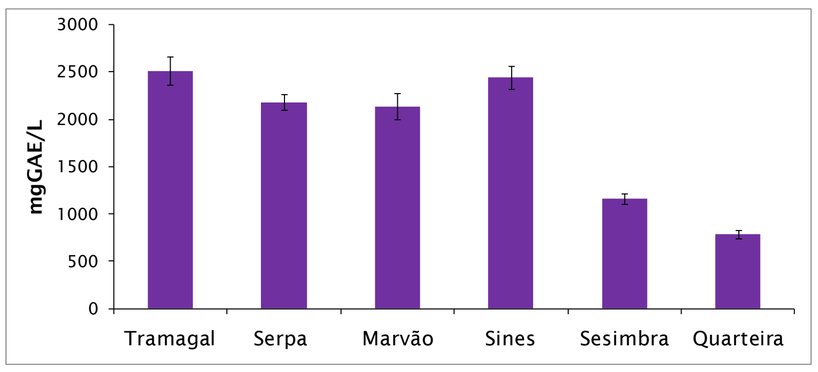
• **Fruits**: Cactus fruits were collected in six different regions of Portugal, named Tramagal, Serpa, Marvão, Sines, Sesimbra and Quarteira.

• **Juices**: Fruits were processed to obtain juices.

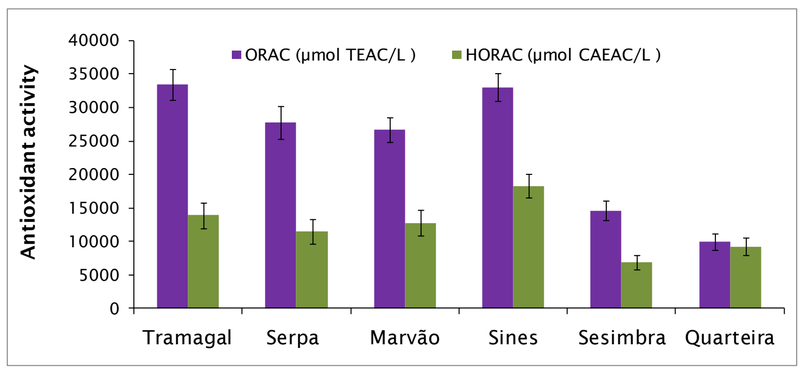
• **Extracts**: the most promising juices were submitted to an adsorption separation process using a microporous resin Amberlit® XAD-16 [1] in order to obtain bioactive igredients from Opuntia (BiO)

Opuntia Juices

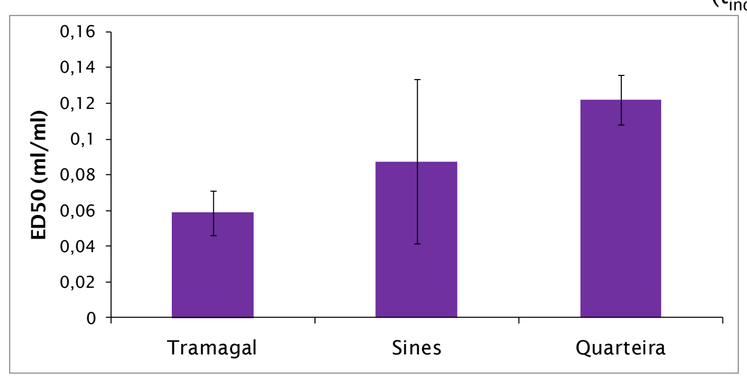
Total phenolic compunds



Antioxidant activity



Antiproliferative effect on HT29 (t_{inc}= 96h)



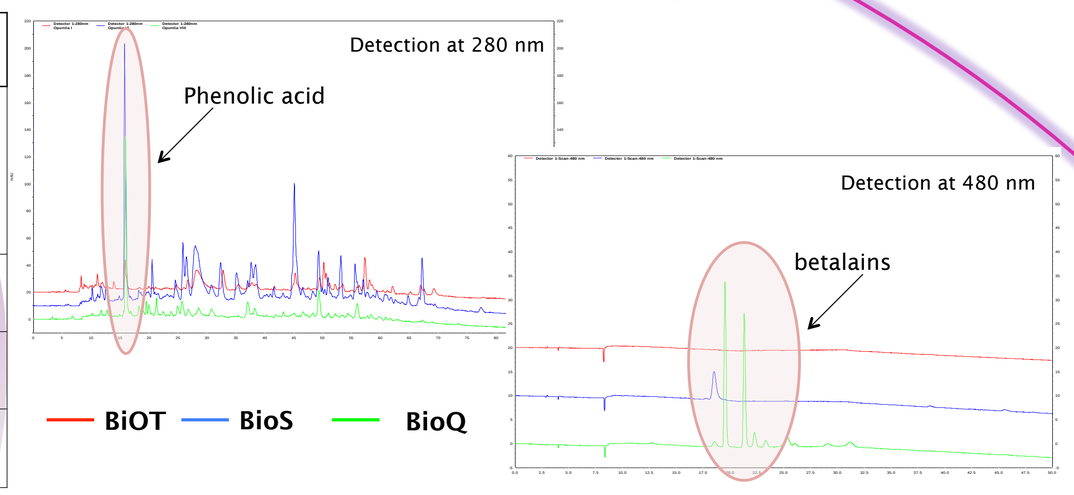
• Opuntia juices from **Tramagal** and **Sines** had the highest values of polyphenols and antioxidant activity (ORAC and HORAC)
• Higher correlations were obtained between the total phenolic content of fruit juices and ORAC values (r= 0.992) than with HORAC results (r= 0.652)

• Only juices from **Tramagal, Sines** and **Quarteira** demonstrated antiproliferative effect on human colon cancer cells, being Tramagal the most effective in inhibiting cancer cell growth.

Opuntia bioactive ingredients

Polyphenolic content and antioxidant activity

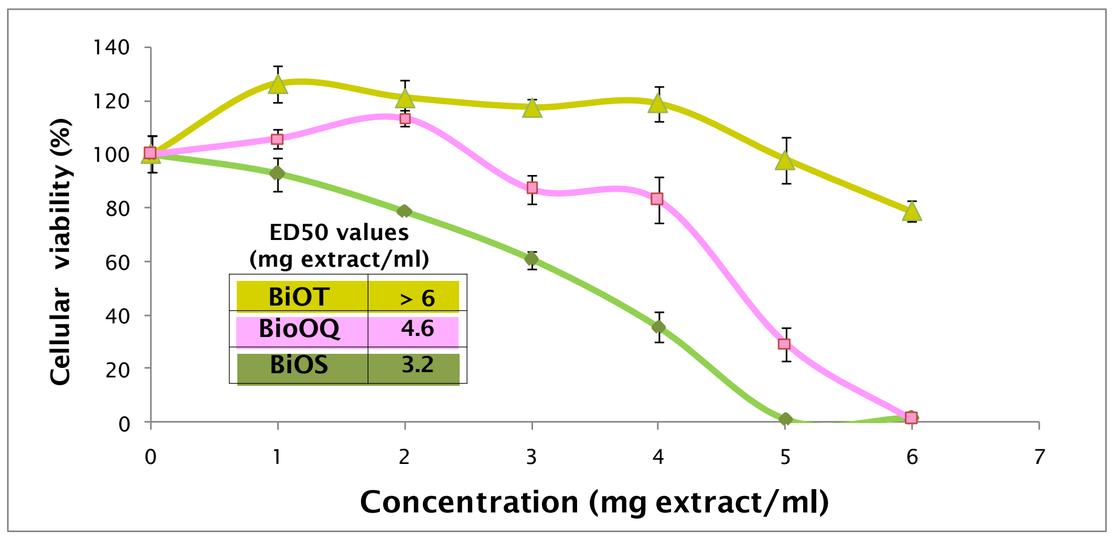
	BiOT (Tramagal)	BiOS (Sines)	BiOQ (Quarteira)
			
Total Polyphenols (mgGAE/g dw)	107	161	115
ORAC value (µmol TEAC/g dw)	1011	4165	1786
HORAC value (µmol CAEAC/g dw)	252	873	571



The extract with the highest values of polyphenols and antioxidant capacity was **BiOS**

The most interesting compounds that could be responsible for the antiproliferative effect are **betalains** and one **phenolic acid**

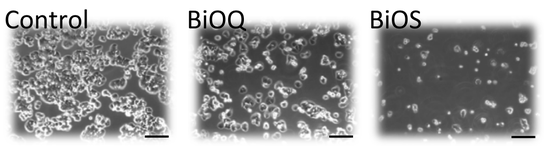
Antiproliferative effect on HT29 (t_{inc}= 72h)



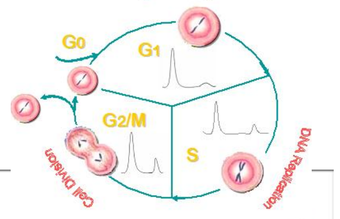
• Extracts **BiOS** and **BiOQ** showed higher antiproliferative effect on HT29 cell growth after 72h of incubation time
• None bioactive ingredients induced citotoxicity on Caco2 cell model

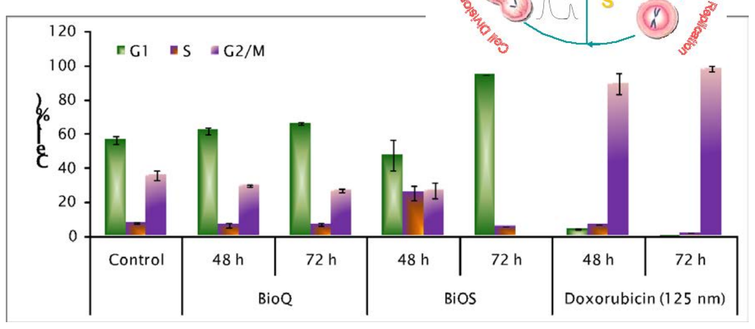
Cell cycle arrest

HT29 cells incubated with 5mg/ml of BiOS and BiOQ



Incubation time: 48h (scale bar: 200 µm)





BiOS and BiOQ induced cell cycle arrest on **G1 phase**

Conclusion

• Cactus pear juices contain bioactive compounds with antiproliferative properties that can be used as sources of high added-value ingredients
• BiOS and BioQ are promising natural agents to be included in cancer therapy as these extracts induce cell cycle arrest in a different checkpoint than a common chemotherapeutic drug (doxorubicin)[2].

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References:
[1] Serra A.T. (2010). Ph.D thesis; [2] Serra, A.T. et al. (2011), J Supercrit Fluids, 55, 1007-1013