



# Phenolic profile of *Cynara scolymus* L. and *Silybum marianum* (L.) Gaertn and related antimicrobial properties

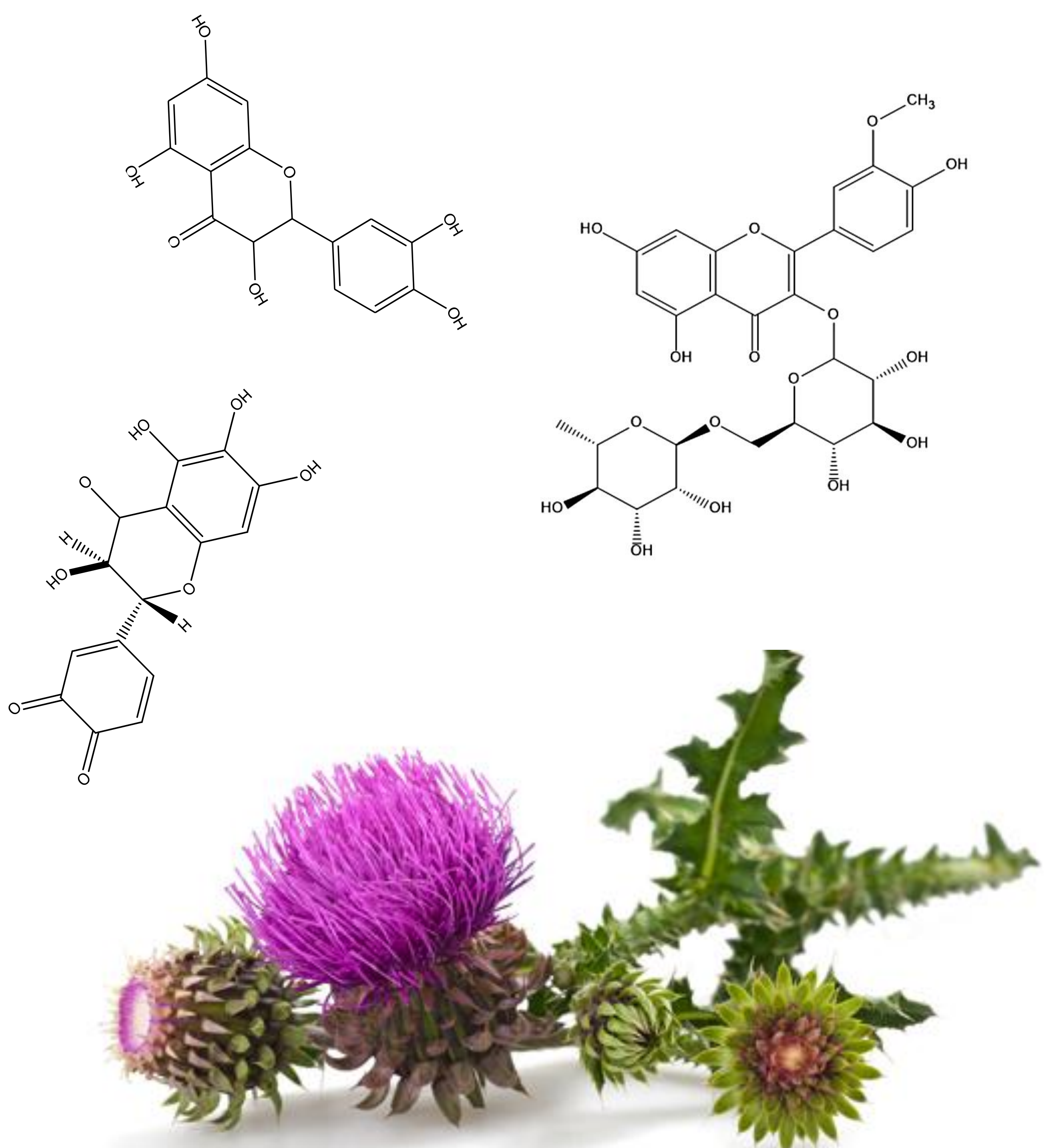
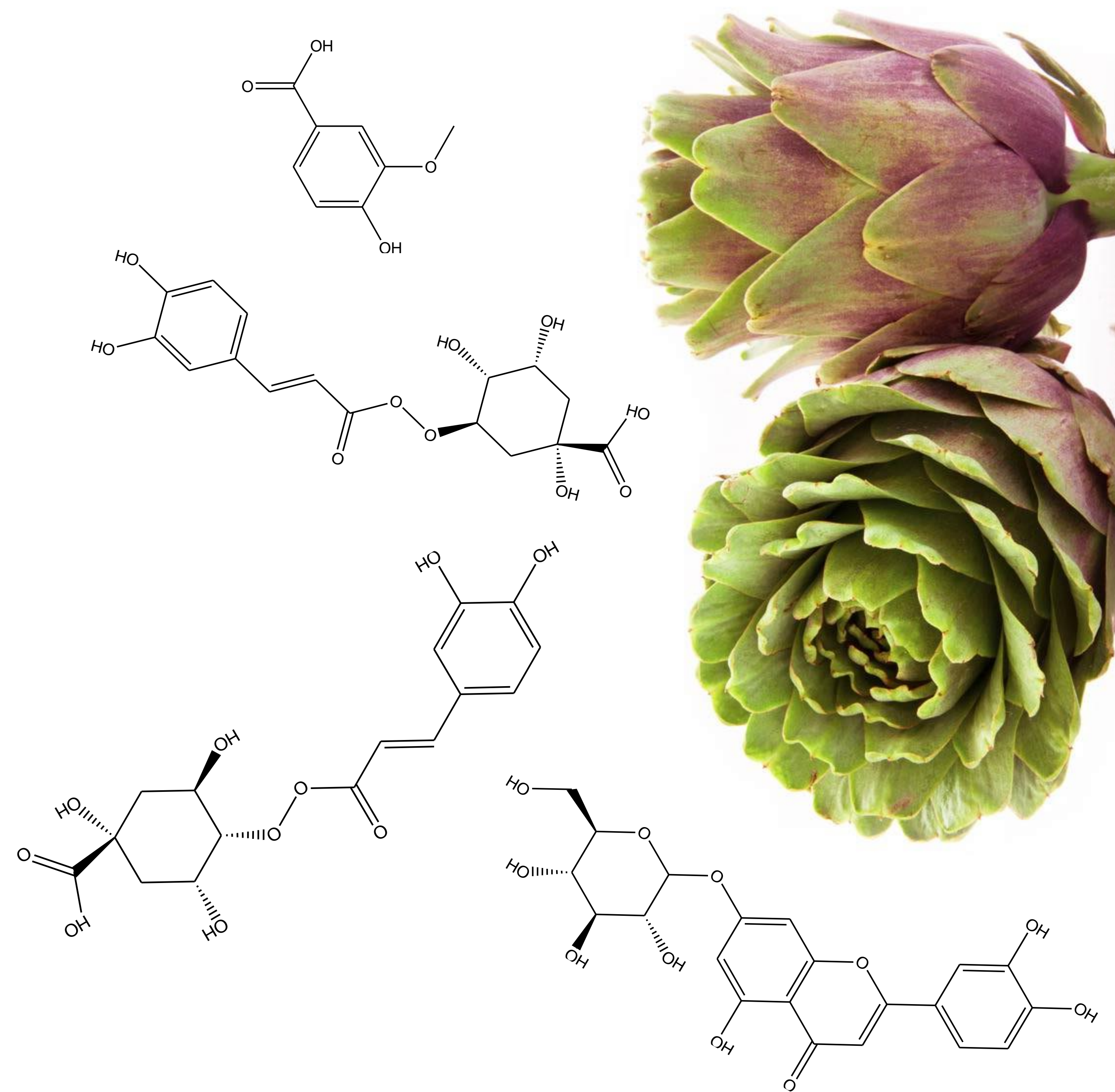
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## Introduction and objectives

*Cynara scolymus* L. (artichoke) and *Silybum marianum* (L.) Gaertn (milk thistle), belonging to the Asteraceae family, are medicinal plants with well-reported antioxidant and hepatoprotective effects. Widely consumed as infusions, these plants can also be found in several formulations to allow an easier consumption. The bioactivity of infusions, pills, and syrups based on artichoke and milk thistle was previously reported by our research group [1,2] and among the various phytochemicals present in these dietary supplements, phenolic compounds are pointed out as the most responsible for their beneficial properties.

With the aim of studying the antimicrobial activity and possible relation with the phenolic composition, two different formulations of each plant were assessed (pills and syrups). The phenolic profiles were obtained by HPLC-DAD-ESI/MS, and the antimicrobial activity was performed with clinical isolates from hospitalized patients, namely *Escherichia coli*, *Escherichia coli* spectrum extended producer of  $\beta$ -lactamases (ESBL), *Proteus mirabilis*, *Pseudomonas aeruginosa*, and methicillin-resistant *Staphylococcus aureus* (MRSA).



## Results and Discussion

Vanillic acid (5.58  $\mu\text{g/g}$ ) and luteolin-7-*O*-glucoside (2.2  $\mu\text{g/g}$ ) were the most abundant compounds in artichoke syrup, that did not reveal antimicrobial activity against the studied strains, which could be due to their low concentrations. On the other hand, artichoke pills presented a prevalence of 5-*O*-caffeoylquinic (28.2  $\mu\text{g/g}$ ), 1,3-dicaffeoylquinic (24  $\mu\text{g/g}$ ), and 4-*O*-Caffeoylquinic acids (13.3  $\mu\text{g/g}$ ); revealing the capacity to inhibit MRSA with a MIC value of 1.9 mg/g.

Regarding milk thistle, isorhamnetin-*O*-deoxyhexoside-*O*-hexoside, isorhamnetin-3-*O*-rutinoside, and isorhamnetin-*O*-deoxyhexoside-*O*-dihexoside were the major compounds detected in the syrup, in concentrations of 7.26, 5.75, and 3.64  $\mu\text{g/g}$ , respectively. This formulation proved to be able to inhibit the growth of *E. coli*, ESBL, MRSA and *P. aeruginosa*, with MIC values ranging from 0.2 to 1.3 mg/mL. Hydroxylated silibinin (1.565  $\mu\text{g/g}$ ) was the major flavonoid found in the pills, that revealed antimicrobial activity against ESBL, with a MIC value of 15 mg/mL, but did not inhibit the growth of the remaining bacteria. None of the studied samples was able to inhibit *P. mirabilis* at the studied concentrations (1000 and 26.4 mg/mL for the syrups of artichoke and milk thistle, respectively; 150 mg/mL for both pills).

Overall, the studied syrups and pills of artichoke and milk thistle revealed to be a good source of phenolic compounds, with some of these formulations revealing antimicrobial activity.

## Acknowledgments

The authors are grateful to FCT (Portugal) for financial support to C. Pereira (PEst-OE/AGR/UI0690/2014\_BI/CIMO/14/dietsuppl) and L. Barros (SFRH/BPD/107855/2015).

## References

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