

Mariana Tavares², Filipa Correia², Susana Maia³, Maria Margarida Gonçalves¹, Cristina Marques³, Paulo Figueiredo², Benilde Mendes¹

¹ Departamento de Ciências e Tecnologia da Biomassa, Unidade de Biotecnologia Ambiental, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa

² Departamento de Nutrição, Instituto de Investigação Científica e Tecnológica da Universidade Atlântica

³ Instituto de Ciências Médicas e Farmacêuticas, Faculdade de Farmácia da Universidade de Lisboa

Introduction

Breast milk is generally considered the best nutrition option for children of less than one year of age. In the first months of life, breast feeding is the source of essential nutrients but also of immunity defense factors that cannot be found in formula-milk. The nutrition of the mother plays a fundamental role in its state of health and consequently in the quality of its breast milk. The determination of the antioxidant activity of breast milk allows a global characterization of its value not only as a nutrient but also as a functional food with relevance in the minimization of the oxidative stress of the newborn. These studies can contribute to the definition of appropriate diets for the breast-feeding period and for the selection of appropriate milks to be used with premature infants.

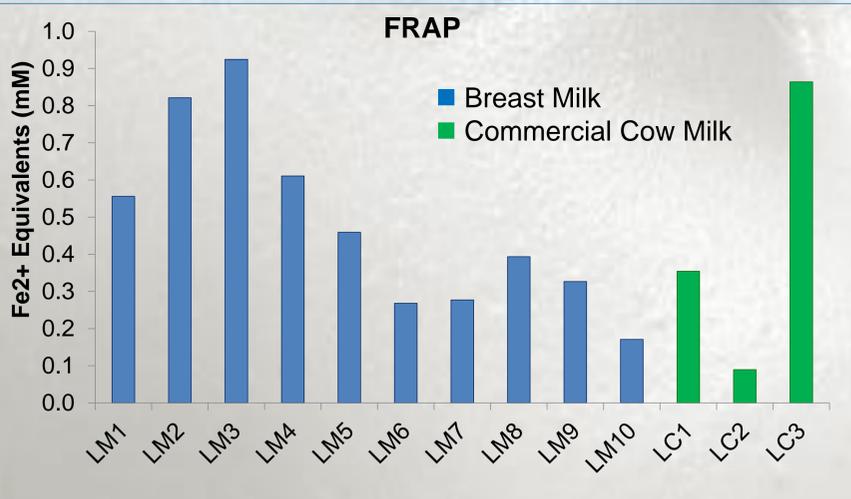
Objectives

The purpose of this work is to measure the antioxidant activity of breast milk, formula-milk and commercial cow milk using three tests of antiradical activity (sequestration of DPPH radical and sequestration of superoxide anion radical), a test of reduction power (ferric reduction antioxidant power) and the Folin-Ciocalteu test for phenolic compounds.

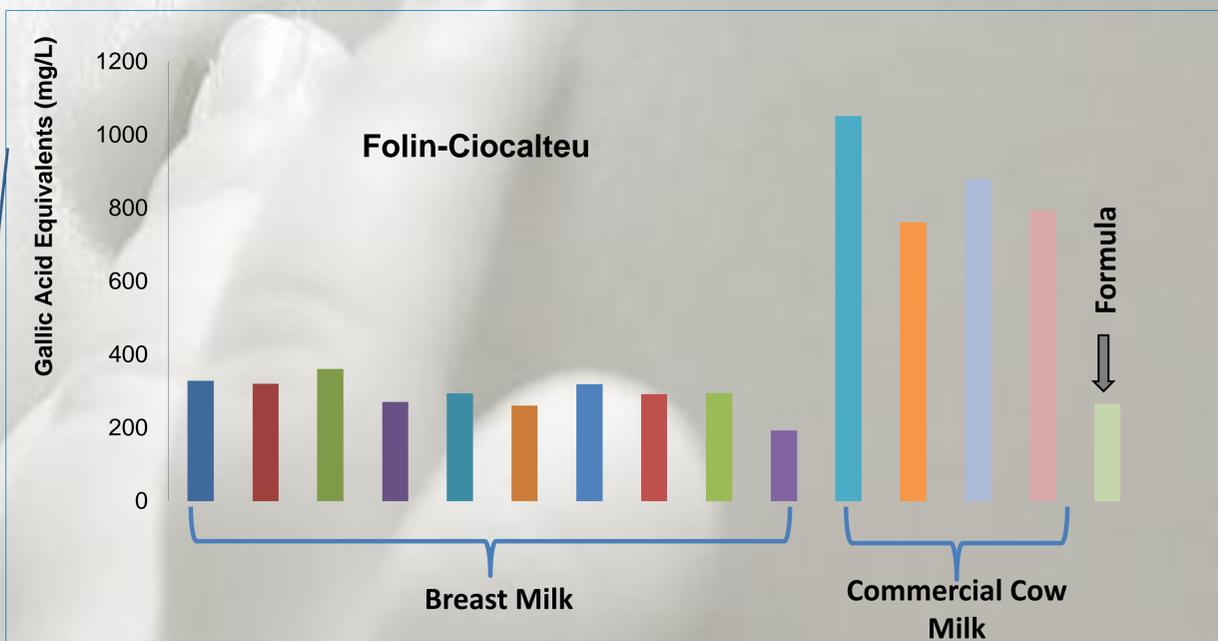
Methods

Breast milk samples were obtained from healthy mothers and collected in day care centers, medical centers or in their homes. Milk was collected in sterile containers and immediately frozen to -6°C; transport to the laboratory was made in appropriated refrigerated boxes and the samples were stored at -20°C until analysis. Commercial milk samples and formula samples were obtained in local markets and analysed immediately after opening. The antioxidant activity of the different milk samples was determined using the following tests: DPPH radical scavenging activity, ferric reduction antioxidant power (FRAP), Folin-Ciocalteu test and sequestration of the superoxide anion radical followed by photochemiluminescence (Photochem, AnalytikJena). The methods used in the characterization of the milk samples were also applied to a series of antioxidant standards such as ascorbic acid, tocopherol, trolox, uric acid, albumin and bilirubin.

Results

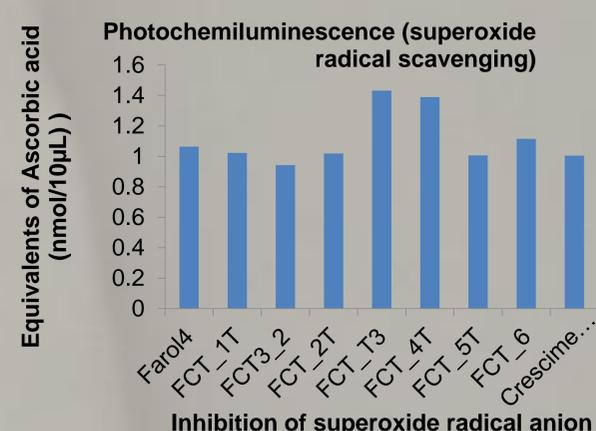
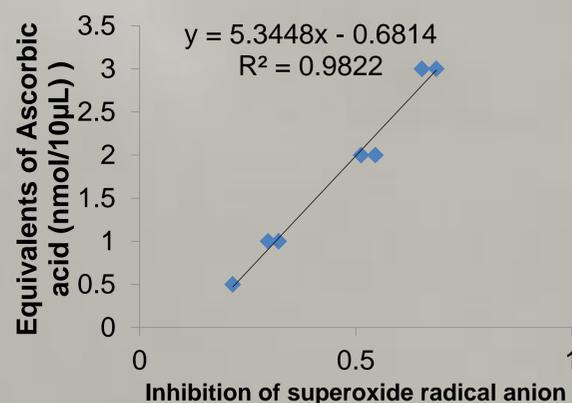


Breast milk and commercial cow milk showed some variability among samples indicating that this test of antioxidant activity (FRAP) is sensitive to several physiological factors like metabolic state, moment of the day, diet, genetic factors, etc.



- The high level of phenolic compounds of cow milk is expectable taking into account the animal data.
- Breast human milk presents lower content of phenolic compounds due to a more variable and non vegetarian diet.
- Formula milk presents a concentration of total phenolics similar to breast milk, what is adequate to prevent eventual allergic responses or similar adverse reactions in the newborn.

- LC1 and LC4 are commercial milks supplemented with vitamins and antioxidants so it is expectable that they will show a high DPPH scavenging activity.
- The human breast milk samples showed medium to high activity against DPPH radical in one case even higher than the supplemented commercial milk.



- Photochemiluminescence is able to detect the presence of antioxidant compounds in amounts as low as 0,5 nmol of ascorbic acid equivalents.
- Homogeneous results were obtained in this test for the various samples tested.

Conclusions

Formula-milk is supplemented with several antioxidant compounds and therefore shows values of antioxidant activity clearly higher than commercial cow milk and even higher than breast milk samples.

The nutrition habits of the mother and its metabolic state can strongly influence the antioxidant activity of its milk. Since milk is very complex sample and the various antioxidant tests were not very closely correlated it is possible that different milk components will be determinant for each test.