

Epigallocatechin-3-gallate enhances sterilization of irradiated whole bovine casein and protects alpha and beta caseins from gamma radiation: depending on polyphenol/protein ratio

Saloua Kouass Sahbani¹, Beyram Trifi², and Salah Kouas³

¹University of Sherbrooke Faculty of Medicine and Health Sciences

²Institut National de Recherche et d'Analyse Physico-chimique

³Affiliation not available

September 23, 2022

Abstract

The increasing use of milk proteins in medicine requires the development of effective processes for sterilization of milk formulations. We found that epigallocatechin-3-gallate (EGCG) was able to reduce bacterial flora in total casein, depending on the concentration of EGCG. Furthermore, the combination of EGCG and gamma radiation reduced the dose D10 to 0.88 kGy and 0.63 kGy with 250 and 500 μ M EGCG, respectively, instead 2.01 kGy without EGCG. We also examined the effect of gamma radiation on alpha- and beta-casein in the absence and presence of epigallocatechin-3-gallate (EGCG). Milk proteins in solution were exposed to different doses of gamma radiation with and without EGCG. Unirradiated and irradiated samples were analyzed by SDS-PAGE and matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-MS). Our results suggest that EGCG (10 μ M) protects α - and β -casein from degradation and subsequent polymerization, possibly by scavenging oxygen and protein free radicals generated during irradiation. Although we used a ratio of polyphenols to protein that was higher for alpha-casein (1/5) than beta-casein (1/10), beta-casein was better protected with EGCG. According to previous studies, this result could be explained by differences in protein primary structure and its interaction with EGCG. The interaction of EGCG with casein is hydrophobic rather than hydrophilic, so the interaction with β -casein is stronger than with α -casein. In conclusion, we found that low EGCG concentrations enhances the sterilization of total casein by gamma radiation and it provided an excellent radioprotection of α - and β -casein, especially β -casein, against degradation and aggregation.

Hosted file

Manuscript.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>

Hosted file

Figure 1.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>

Hosted file

Figure 2.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>

protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio

Hosted file

Figure 3.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>

Hosted file

Figure 4.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>

Hosted file

Figure 5.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>

Hosted file

Figure 6.docx available at <https://authorea.com/users/510254/articles/587395-epigallocatechin-3-gallate-enhances-sterilization-of-irradiated-whole-bovine-casein-and-protects-alpha-and-beta-caseins-from-gamma-radiation-depending-on-polyphenol-protein-ratio>