Influence of the initial cell number on the growth fitness of *Salmonella* Enteritidis in raw and pasteurized liquid whole egg

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Introduction

The microorganisms of the genus *Salmonella* are the second most commonly reported causative agent of foodborne outbreaks in the European Union and constitute one of the major public health challenges worldwide.

One of the most important sources of *Salmonella* contamination is eggs and egg products. Thus, raw and undercooked eggs are still the most frequently identified products as responsible for foodborne *Salmonella* infections in the European Union (45.6% of *Salmonella* outbreaks in Europe in 2018).

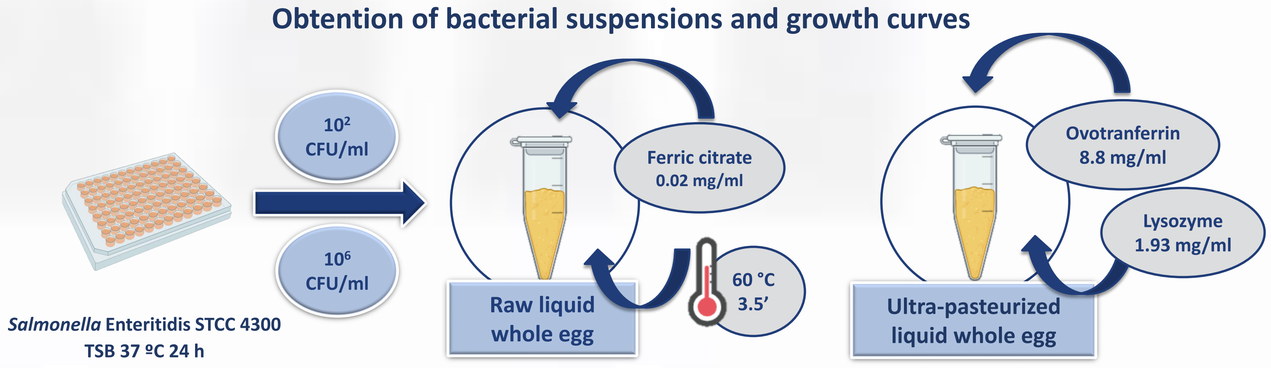
***Salmonella* growth and survival in egg and egg products has been widely studied, in particular, that of the serovar Enteritidis, because it is the predominant serovar in foodborne diseases associated to the consumption of these products. Growth models have been developed in order to predict the growth of *Salmonella* in egg products in an effort to establish the optimal temperature and time for its conservation and distribution. Nevertheless, there are still some aspects, such as the influence that the initial cell number and/or the physiological state of cells have on *Salmonella* growth fitness and resistance to stress, that are still not fully known.**

Objective

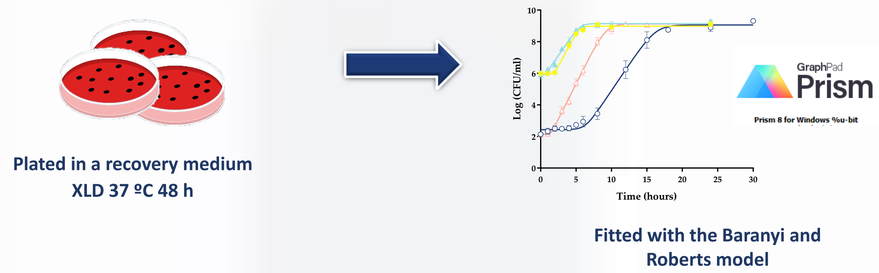
The aim of this work was to study the influence of the initial cell number on the growth fitness of *S.* Enteritidis in raw and pasteurized liquid whole egg. In addition, the potential mechanisms underlying the results obtained were explored.

Materials and Methods

Obtention of bacterial suspensions and growth curves



Growth curve fitting and statistical analysis



Results and discussion

Dose effect

The influence of the initial contamination dose on *S.* Enteritidis growth fitness was analyzed in raw and commercial ultra-pasteurized liquid whole egg by obtaining growth curves starting at 10^2 (low dose) or 10^6 CFU/ml (high dose) in both media.

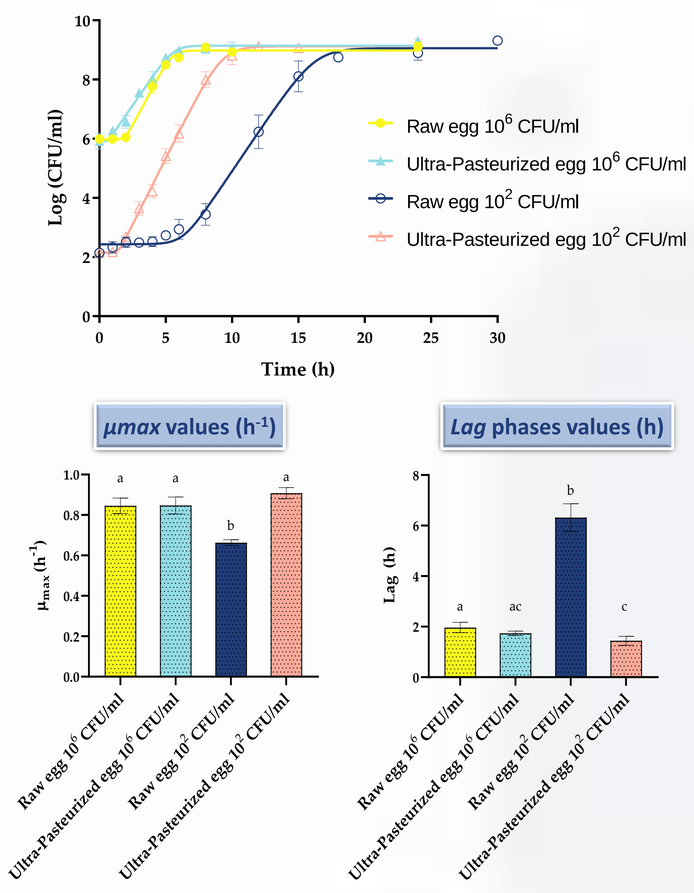


Figure 1. Effect of the inoculum dose, 10^2 or 10^6 CFU/ml, on the growth fitness of *Salmonella* in raw and ultra-pasteurized liquid whole egg.

The initial inoculum dose significantly affected the growth parameters calculated in raw liquid whole egg but not in commercial ultra-pasteurized liquid egg

Thermal effect

In order to better understand the differences in *Salmonella* growth fitness observed when comparing raw and ultra-pasteurized commercial raw egg additional growth curves were obtained using whole liquid egg exposed to a conventional pasteurization treatment (60 °C/3.5 min).

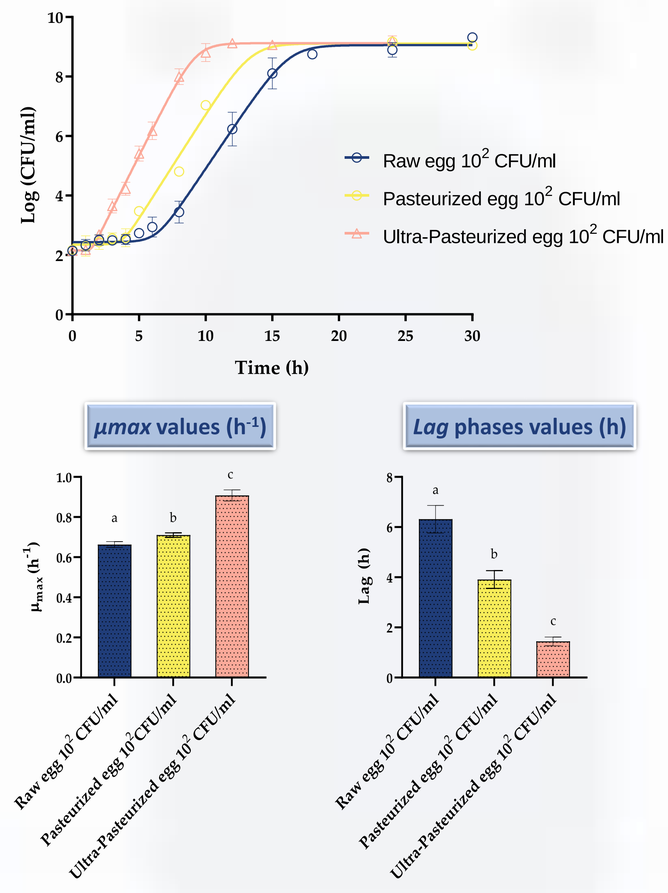


Figure 2. Influence of the intensity of the pasteurization treatment on the growth fitness of *S.* Enteritidis cells inoculated at 10^2 CFU/ml

The growth rate and *Lag* phase depends on the thermal history of the whole liquid egg when growth curves were started at the low inoculum dose

Antimicrobial proteins and iron effect

Commercial ultra-pasteurized egg was supplemented with antimicrobial egg white proteins (lysozyme and ovotransferrin) and raw egg was supplemented with iron.

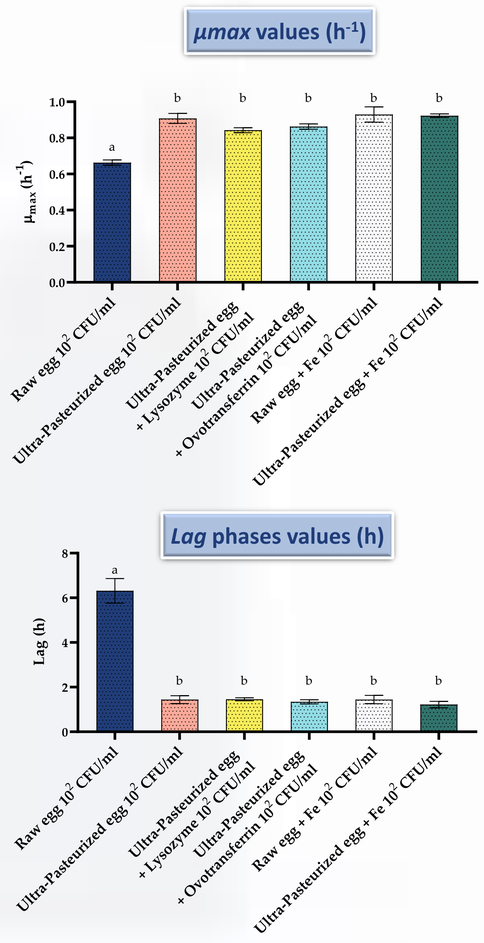


Figure 3. Effect of supplementation of antimicrobial egg white proteins and iron on the growth fitness of *Salmonella* in raw and pasteurized liquid whole egg inoculated at 10^2 CFU/ml

The addition of these proteins had no effect on growth parameters, however iron supplementation in raw egg increased growth rate and decreased the *Lag* phase

Conclusion

These results demonstrate that the initial dose and thermal history of the whole liquid egg can determine the maximum growth rate of *Salmonella* cells. They also indicate that lysozyme and ovotransferrin would not be responsible for the differences in growth rate found between raw and pasteurized whole liquid egg and that iron bioavailability would be playing a major role in this phenomenon.

Acknowledgemts

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