CHILL-ON

Growth of *Pseudomonas* spp. and *Staphyloccoccus* spp. in chicken breast under different temperature conditions

Liane Aldrighi Galarz, Gustavo Graciano Fonseca & Carlos Prentice

Laboratory of Food Technology, Department of Chemistry, Federal University of Rio Grande (FURG), P.O. Box 474, 96201-900 Rio Grande RS, Brazil
dqmprent@furg.br

Introduction

Because most chicken is sold fresh, it is essential to maintain the shelf-life of the product as long as possible.

The need for fresh food supply to distant markets has increased the interest in procedures for extending the shelf life of products. Obviously, this time should include not only the time needed to reach the market but an additional period to stay at the refrigerator for sale and then at the consumer's home, who may want to use the product some days after purchasing. Therefore, this issue becomes a great challenge to producers.

CHILL-ON

www.chill-on.com

Objectives

The present study focused on monitoring the changes in microbial flora (*Pseudomonas* spp and *Staphylococcus* spp.) of raw, salted and cooked chicken breasts stored aerobically at 2, 4, 7, 10, 15 and 20 °C, respectively, and define the shelf life of these products based on microbiological counts and overall quality of the products. Moreover, it aimed to provide data for the future construction of predictive models.

Materials and Methods

Raw materials:
raw chicken breast (RB)
salted chicken breast (SB)
cooked chicken breast (CB)

Temperature conditions: 2, 4, 7, 10, 15 and 20°C

Sampling: according to the evaluated temperature

Microbiological determinations:
Pseudomonas spp. - Pseudomonas agar base plus CFC supplement (25°C, 48 h)
Staphylococcus spp. - Baird-Parker agar with sterile 1% potassium tellurite solution and sterile egg yolk emulsion (35°C, 48 h).

Materials and Methods

Growth parameters:

Exponential growth phase (EGP)

linear region on an ln (X) vs. time plot for the microbial growth data ($CFU.g^{-1}$)

Maximum specific growth rate (μ_{max})

the slope of the EPG

Maximum counting (X_{max})

logarithm of the highest value for microbial counting

Shelf life

time necessary to reach the microbial counting established as safe (literature).

Results and Discussion

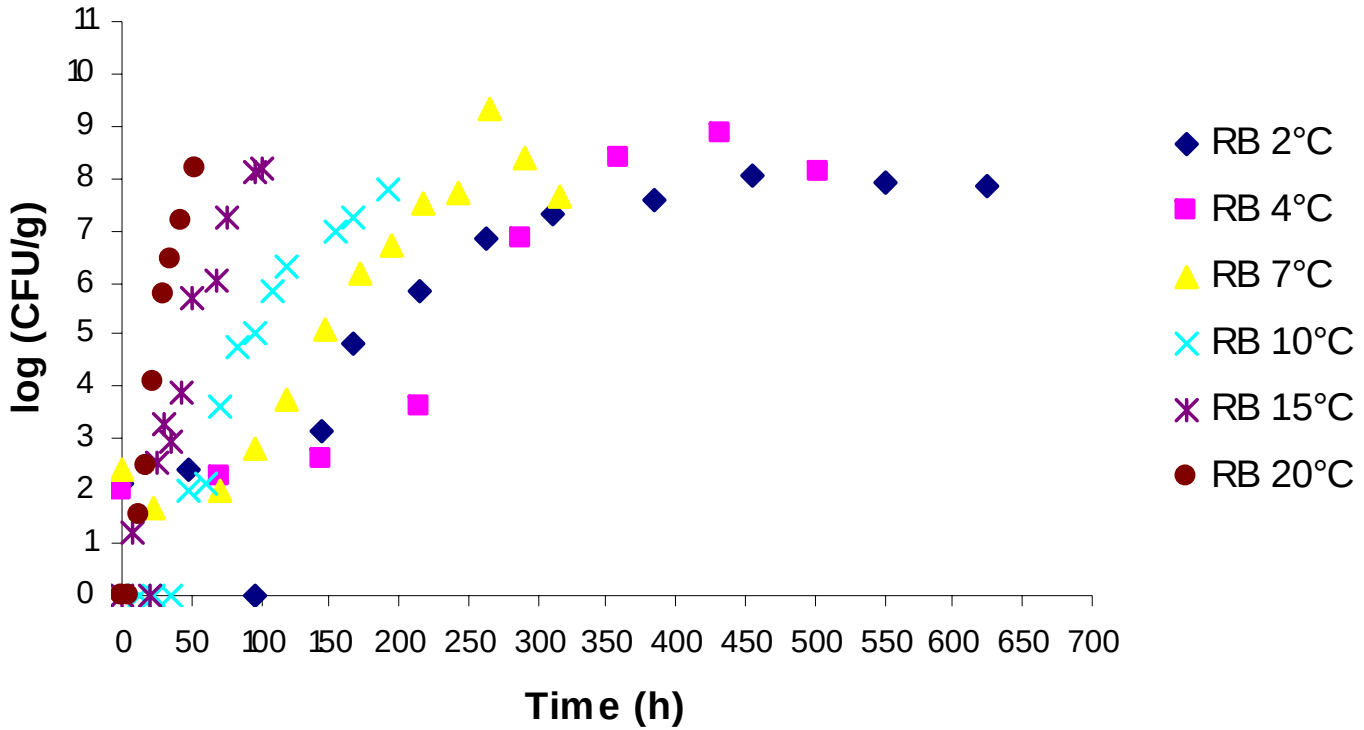

Fig 1A. Growth curves for *Pseudomonas* spp. at the temperatures of 2, 4, 7, 10, 15 and 20°C. RB: raw breast

Results and Discussion

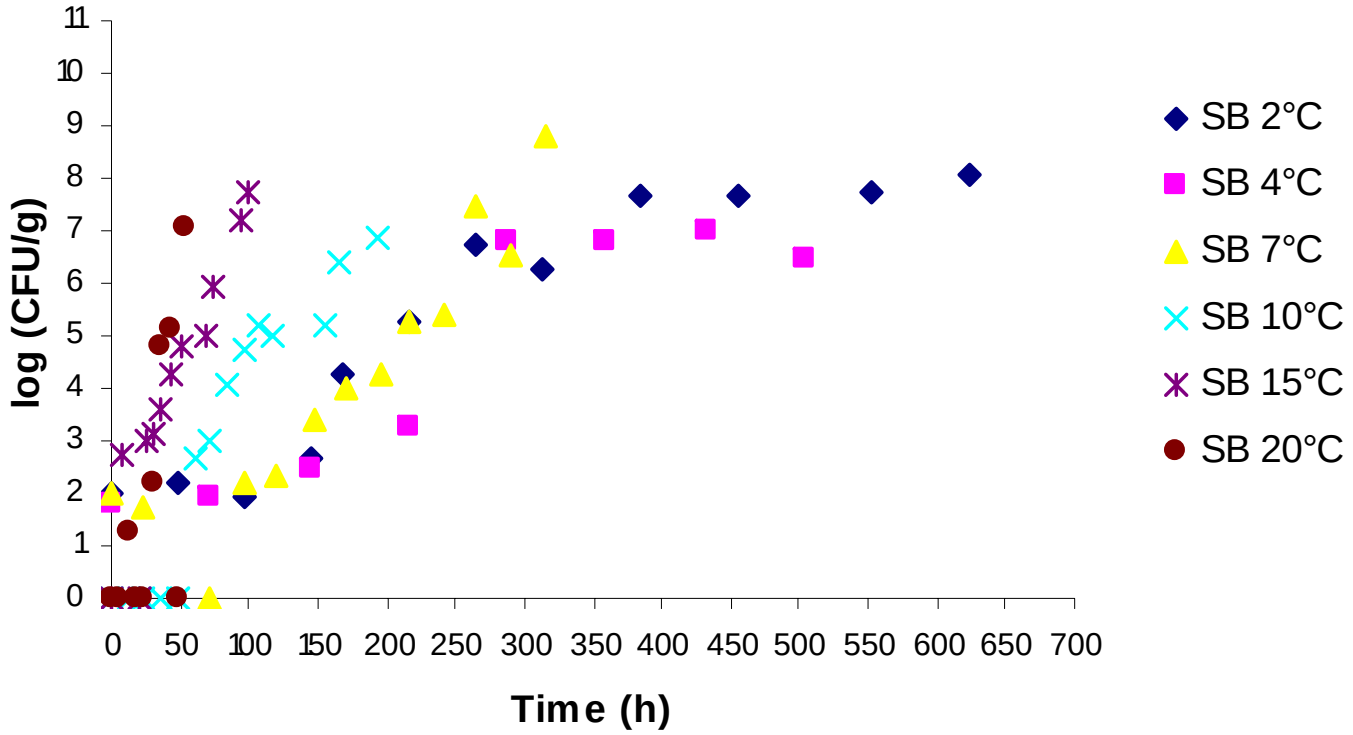

Fig 1B. Growth curves for *Pseudomonas* spp. at the temperatures of 2, 4, 7, 10, 15 and 20°C. SB: salted breast

Results and Discussion

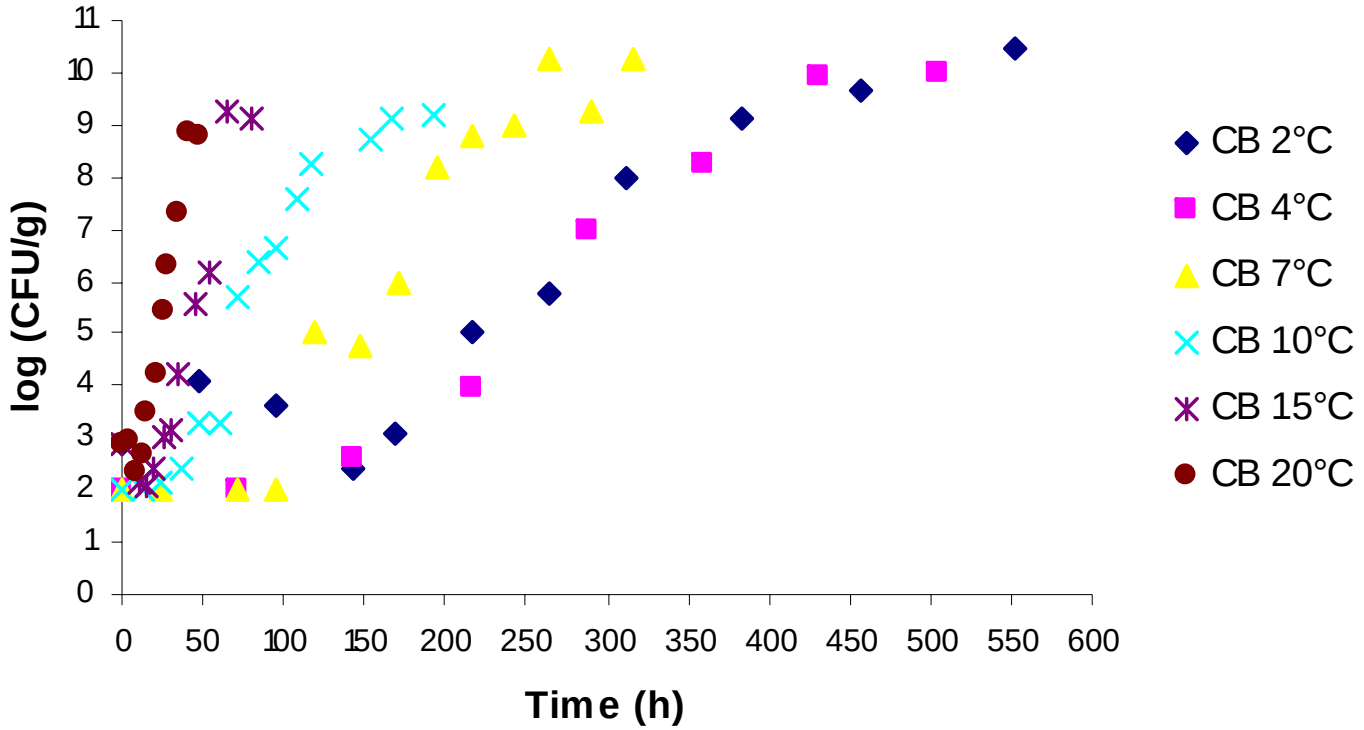

Fig 1C. Growth curves for *Pseudomonas* spp. at the temperatures of 2, 4, 7, 10, 15 and 20°C. CB: cooked breast

Results and Discussion

Table 2. Growth parameters for *Pseudomonas* spp and shelf life of chicken breasts

T (°C)	Product	Initial counting (log CFU.g^{-1})	Maximum counting (log CFU.g^{-1})	μmax (h^{-1})	Shelf life (days)
2	CB	2 ± 0.0	9.9 ± 0.4	0.06 ± 0.00	13 to14
2	RB	2.2 ± 0.0	8.1 ± 0.0	0.07 ± 0.00	10 to 12
2	SB	2 ± 0.0	8.0 ± 1.2	0.07 ± 0.02	11 to 14
4	CB	<2.0 ± 0.0	9.3 ± 0.0	0.08 ± 0.00	11 to13
4	RB	2 ± 0.0	8.8 ± 0.0	0.07 ± 0.00	11 to13
4	SB	<2.0 ± 0.0	7.0 ± 0.0	0.05 ± 0.00	>21
7	CB	2 ± 0.0	8.9 ± 0.3	0.14 ± 0.01	8 to 9
7	RB	2.4 ± 0.0	9.3 ± 0.1	0.11 ± 0.01	7 to 8
7	SB	2 ± 0.0	8.8 ± 0.6	0.07 ± 0.00	10 to 11
10	CB	<2.0 ± 0.0	8.8 ± 0.3	0.22 ± 0.00	4 to 5
10	RB	<2.0 ± 0.0	7.8 ± 0.4	0.22 ± 0.00	5 to 6
10	SB	<2.0 ± 0.0	6.9 ± 0.2	0.21 ± 0.00	8
15	CB	<2.0 ± 0.0	8.9 ± 0.0	0.43 ± 0.00	2 to 3
15	RB	<2.0 ± 0.0	8.3 ± 0.1	0.38 ± 0.02	3
15	SB	<2.0 ± 0.0	8.2 ± 0.0	0.37 ± 0.00	3 to 4
20	CB	<2.0 ± 0.0	8.1 ± 0.0	0.56 ± 0.06	2
20	RB	<2.0 ± 0.0	8.2 ± 0.0	0.49 ± 0.01	1 to 2
20	SB	<2.0 ± 0.0	7.0 ± 0.0	0.53 ± 0.01	2

Results and Discussion

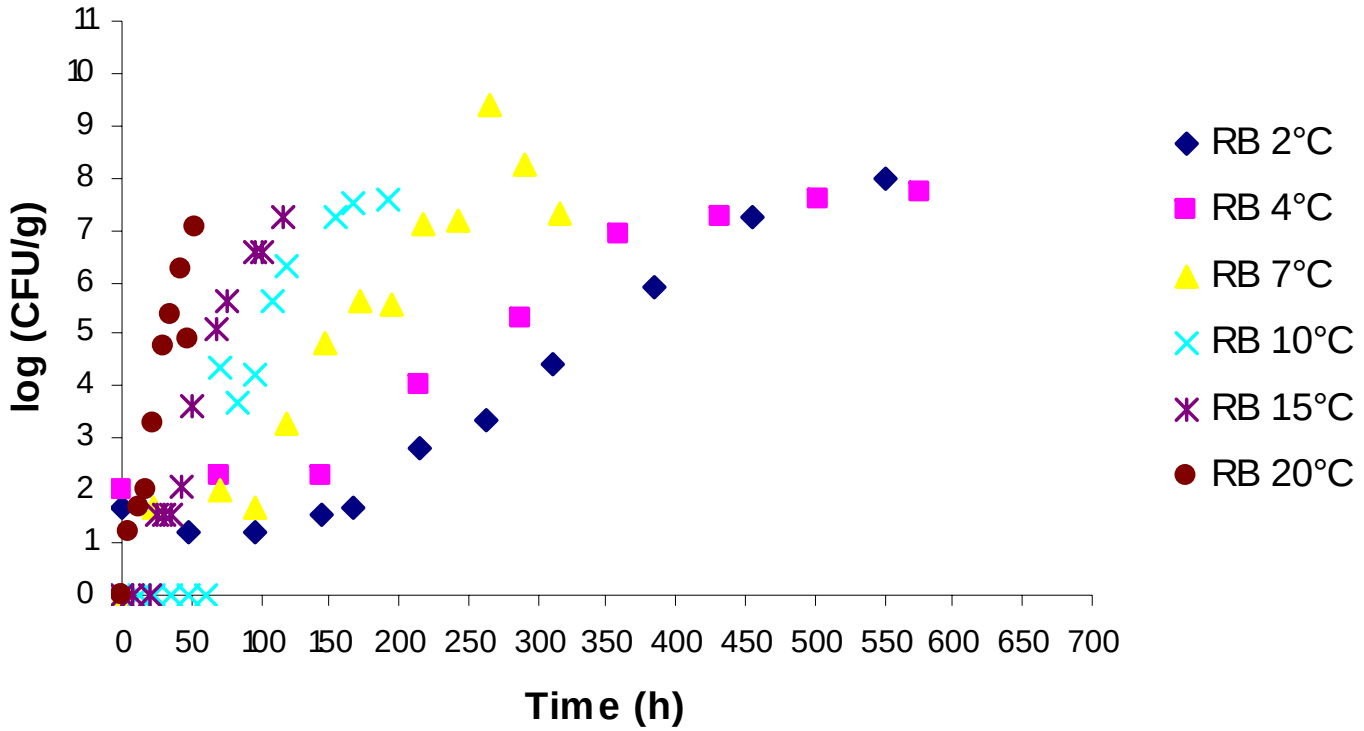

Fig 2A. Growth curves for *Staphylococcus* spp. at the temperatures of 2, 4, 7, 10, 15 and 20°C. RB: raw breast

Results and Discussion

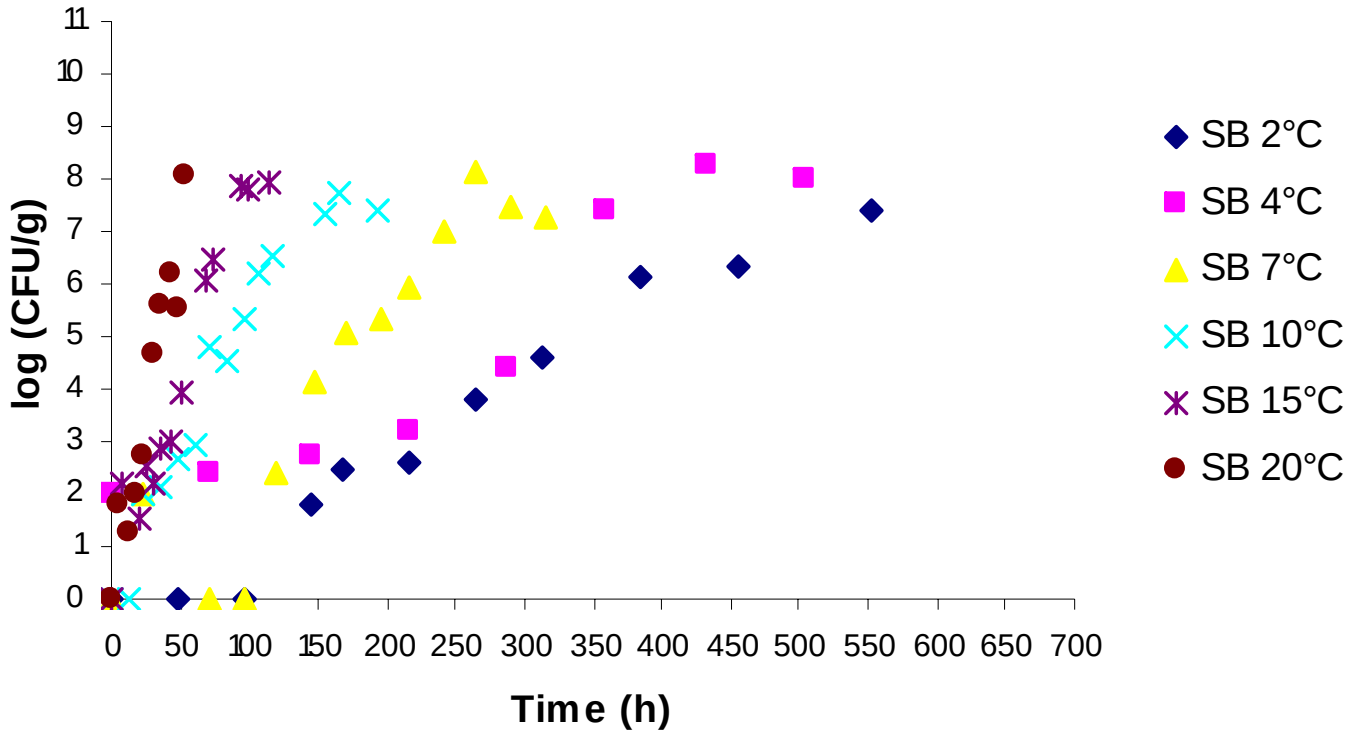

Fig 2B. Growth curves for *Staphylococcus* spp. at the temperatures of 2, 4, 7, 10, 15 and 20°C. SB: salted breast

Results and Discussion

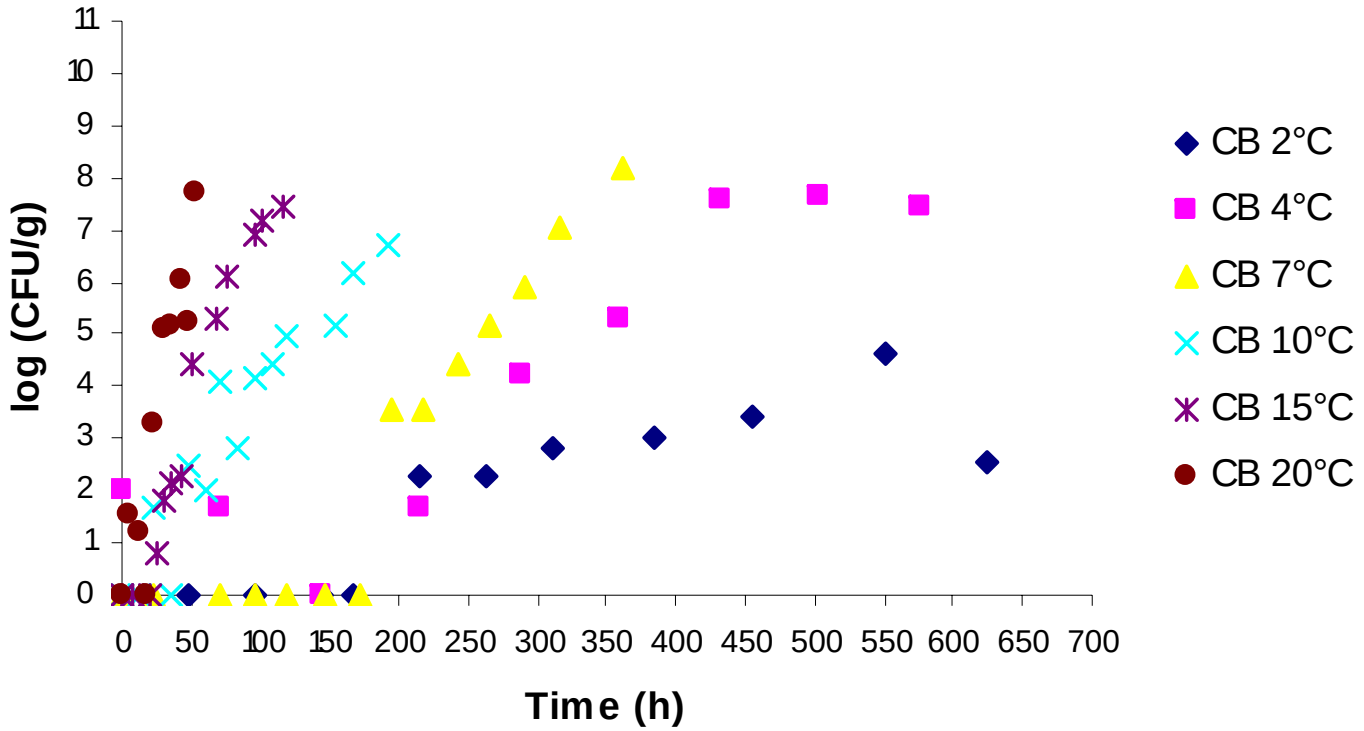

Fig 2C. Growth curves for *Staphylococcus* spp. at the temperatures of 2, 4, 7, 10, 15 and 20°C. CB: cooked breast

www.chill-on.com

Results and Discussion

Table 2. Growth parameters for *Staphylococcus* spp and shelf life of chicken breasts

T (°C)	Product	Initial counting (log CFU.g^{-1})	Maximum counting (log CFU.g^{-1})	μmax (h^{-1})	Shelf life (days)
2	CB	2 ± 0.0	9.9 ± 0.4	0.06 ± 0.00	13 to14
2	RB	2.2 ± 0.0	8.1 ± 0.0	0.07 ± 0.00	10 to 12
2	SB	2 ± 0.0	8.0 ± 1.2	0.07 ± 0.02	11 to 14
4	CB	<2.0 ± 0.0	9.3 ± 0.0	0.08 ± 0.00	11 to13
4	RB	2 ± 0.0	8.8 ± 0.0	0.07 ± 0.00	11 to13
4	SB	<2.0 ± 0.0	7.0 ± 0.0	0.05 ± 0.00	>21
7	CB	2 ± 0.0	8.9 ± 0.3	0.14 ± 0.01	8 to 9
7	RB	2.4 ± 0.0	9.3 ± 0.1	0.11 ± 0.01	7 to 8
7	SB	2 ± 0.0	8.8 ± 0.6	0.07 ± 0.00	10 to 11
10	CB	<2.0 ± 0.0	8.8 ± 0.3	0.22 ± 0.00	4 to 5
10	RB	<2.0 ± 0.0	7.8 ± 0.4	0.22 ± 0.00	5 to 6
10	SB	<2.0 ± 0.0	6.9 ± 0.2	0.21 ± 0.00	8
15	CB	<2.0 ± 0.0	8.9 ± 0.0	0.43 ± 0.00	2 to 3
15	RB	<2.0 ± 0.0	8.3 ± 0.1	0.38 ± 0.02	3
15	SB	<2.0 ± 0.0	8.2 ± 0.0	0.37 ± 0.00	3 to 4
20	CB	<2.0 ± 0.0	8.1 ± 0.0	0.56 ± 0.06	2
20	RB	<2.0 ± 0.0	8.2 ± 0.0	0.49 ± 0.01	1 to 2
20	SB	<2.0 ± 0.0	7.0 ± 0.0	0.53 ± 0.01	2

Results and Discussion

✓ The effect of the temperature is clearly verified in this study. The increase of the temperature accelerates the development of the microorganisms. This can also be verified by the increase of the μ_{max} values with the temperature increase.

✓ At 2 and 4°C the curves are very close for the three products (RB, SB, and CB) and, in relation the SB the curves at 2, 4 and 7°C are almost overlapped, indicating that at this temperature range *Pseudomonas* spp. have a similar behavior for the studied products.

✓ The analysis of the curves indicates a large lag phase lag for *Staphylococcus* spp., especially in CB. By the analysis of Table 2, it is verified that the initial contamination of the products was quite small, always log <2.0. The maximum counting values were also low, almost always inferior to log 8.

Results and Discussion

✓The temperature increase reduced the shelf life of the three studied products, in relation to both microorganisms. When stored at temperatures of refrigeration (2, 4 and 7°C), the samples had presented little variation in the shelf lives, especially at 2 and 4°C. At higher temperatures (above 10ºC), each 5ºC of temperature rise reduced the shelf life to half of the time.

✓ The small deviation between the different products apparently indicates that both microorganisms acted similarly on the different substrates. The low initial contamination indicates that the products were proceeded from a hygienically adequate food processing. The maximum log countings observed from growth curves point toward a prevalence of *Pseudomonas* spp over *Staphyloccoccus* spp.

Conclusions and Perspectives

✓The maximum counting of the microorganisms maintained a general behaviour for the different products and temperatures.

✓In most of the cases, the maximum microbial counting was verified in cooked breast, followed by raw breast and then salted breast.

✓The data here generated can be useful in the generation of mathematical models for shelf life prediction of different types of chicken breast filets.

Acknowledgment

This study was supported by the European Commission (FP 6-016333-2).

We acknowledge Seara Cargill for providing the raw material.