Stress response of *Listeria monocytogenes* to a lethal stress after a pre-exposure to sublethal conditions

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INTRODUCTION

Listeria monocytogenes is an important foodborne pathogen responsible for human cases of listeriosis (Farber and Peterkin, 1991). Its ubiquitous in nature and its ability to withstand adverse environmental conditions (Lou et al., 1999) makes the control of *L. monocytogenes* a challenge for the food industry.

In fact, *L. monocytogenes* are exposed to different types of stresses during food processing, distribution and storage (Leistner, 1995). The effects of these treatments on the viability of *L. monocytogenes* are of great interest as they could influence its response and ability to survive (Hill et al., 2002; Samelis and Sofos, 2003). Furthermore, the knowledge of the adaptive response of this pathogen is crucial in order to predict potential cross protection occurring during food processing.

In the present study, the response of two strains of *L. monocytogenes (*isolated from *alheira*, a fermented traditional Portuguese sausage) to a lethal temperature, in the stationary and in the exponential phase of growth, was evaluated when cells were previously exposed to a sublethal condition (temperature and pH).

METHODOLOGY

➢ **Stress response of *Listeria monocytogenes* to a lethal stress after a pre-exposure to sublethal conditions**

Strains (Felício et al., 2007)

L. monocytogenes FSL_F7_001

L. monocytogenes FSL_F7_010

Stationary phase
(growth in TSBYE, at 37 ºC, for 24h)

Exponential phase
(growth in TSBYE, at 37 ºC, for 4h)

Sublethal conditions (30 min)

BPW at 42 ºC

BPW adjusted to pH 3.5 and 4.5 (HCl) at 37 ºC

BPW adjusted to pH 5.5 (Lactic acid) at 37ºC

Lethal conditions (30 min)

BPW at 55 ºC

Centrifugation

(7000 rpm for 6 min)

Resuspended

(in BPW pre-heated at 37 ºC)

Lethal conditions (30 min)

BPW at 55 ºC

➢ **Enumeration:** Aliquots that were obtained at each defined interval were serially diluted and plated using the drop counting technique onto the TSAYE plates and further incubated at 37 ºC for 24 to 48 h.

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RESULTS AND DISCUSSION

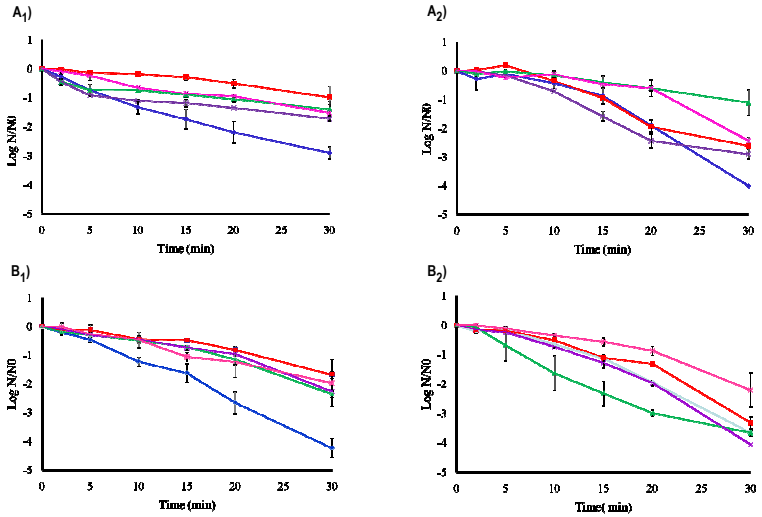

Fig. 1 Effect of lethal stress at 55 ºC on the survival of *L. monocytogenes* strains FSL_F7_001 (A) and FSL_F7_010 (B) in stationary phase (1) and exponential phase (2) after exposure to sublethal conditions, for 30 min: ( ) 42 ºC, ( ) pH 3.5 with HCl, ( ) pH 4.5 with HCl and ( ) pH 5.5 with lactic acid; and only subjected to lethal stress of 55ºC ( ) Error bars indicate variability between assays.

Significant ($P < 0.05$) higher survival rates were observed when both *L. monocytogenes* strains, in the stationary phase, were pre-exposed to the sublethal treatments investigated (Fig.1 A_1 and B_1).

Considering the exponential phase of growth and for *L. monocytogenes* strain FSL_F7_001, the survival was not affected by the pre-exposure to 42 ºC ($P > 0.05$). However, significant differences were observed for the other tested sublethal conditions (Fig. 1 A_2).

The survival at 55 ºC after a pre-exposure to pH 5.5 with lactic acid was significantly ($P > 0.05$) higher for *L. monocytogenes* FSL_F7_010 cells, in the exponential phase of growth. Concerning the other tested sublethal conditions no significant differences ($P < 0.05$) in the viability through heat challenge were observed (Fig. 1 B_2).

CONCLUSION

In general, pre-exposure of *L. monocytogenes* strains to the tested sublethal conditions (temperature and pH) resulted in higher survival to the subsequent lethal temperature conditions (55 ºC).

The adaptive response was shown to be strain/growth phase dependent.

Thermal processing is commonly used as a method to control foodborne pathogens in the food industry. Therefore, the knowledge of the adaptive response of *L. monocytogenes* strains is crucial in order to understand the cross protection occurring during food processing.

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