Food Microbiology 62 (2017) 99–105

Contents lists available at ScienceDirect

Food Microbiology

journal homepage: www.elsevier.com/locate/fm

Short communication

# Variability in the adaptive acid tolerance response phenotype of *Salmonella enterica* strains

Alexandra Lianou [a, 1], George-John E. Nychas [b], Konstantinos P. Koutsoumanis [a, *]

[a] Laboratory of Food Microbiology and Hygiene, Department of Food Science and Technology, School of Agriculture, Forestry and Natural Environment, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece

[b] Laboratory of Microbiology and Biotechnology of Foods, Department of Food Science and Human Nutrition, School of Food, Biotechnology and Development, Agricultural University of Athens, Iera Odos 75, Athens 11855, Greece

ARTICLE INFO

*Article history:*
Received 30 June 2016
Received in revised form
18 September 2016
Accepted 3 October 2016
Available online 4 October 2016

*Keywords:*
Acid adaptation
Acid tolerance response
*Salmonella enterica*
Strain variability

ABSTRACT

The objective of this study was the assessment of the stationary-phase, low-pH-inducible acid tolerance response (ATR) of different *Salmonella enterica* strains. For this purpose, 30 strains of the pathogen were grown in tryptone soy broth in the absence (non-adapted cultures) and presence (1% w/v; acid-adapted cultures) of glucose, and then subjected to 4-h acid challenge trials at pH 3.0. Surviving populations of each strain were determined at 1-h intervals, and the Weibull model was fitted to the derived microbiological data. Extensive variability in the acid stress responses of the tested *S. enterica* strains was observed, with the total population reductions (log CFU/ml) attained in 4 h of acid challenge ranging from 0.9 to 5.5 and from 0.6 to 7.0 for the non-adapted and acid-adapted cultures, respectively. As demonstrated by the model scale parameter $\delta$ and shape parameter $p$, the effect of acid adaptation on the inactivation curves was strain-specific. Although acid adaptation resulted in enhanced acid survival for the majority of the tested strains, there were strains exhibiting similar or decreased acid resistance compared to their non-adapted counterparts. Moreover, acid adaptation appeared to decrease the strain variability of $\delta$ whereas increasing the strain variability of $p$: the coefficient of variation of $\delta$ among the tested strains was 97.2 and 54.9% for the non-adapted and acid-adapted cultures, respectively, while the corresponding values for $p$ were 12.7 and 48.1%. The data of the present study, which is the first one to systematically evaluate the adaptive ATR of multiple *S. enterica* strains, clearly demonstrate that this phenotype (attempted to be induced by growing the pathogen in the presence of glucose) is strain-dependent.