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ScienceDirect

Procedia Food Science 5 (2015) 219 – 222

Procedia Food Science

International 58th Meat Industry Conference "Meat Safety and Quality: Where it goes?"

Growth of *Listeria monocytogenes* in traditional Austrian meat jelly products

Peter Paulsen[a], Nattakarn Awaiwanont[a,b], Frans J.M. Smulders[a,*]

[a]*Institute of Meat Hygiene, University of Veterinary Medicine, Vienna 1210, Austria*
[b]*Chiang Mai University, Chiang Mai 50200, Thailand*

Abstract

Individual components of a traditional meat jelly (cooked meat chunks, gelatin and preboiled vegetable) with differences in pH and a_w can constitute a niche for the multiplication of *Listeria*. *Listeria monocytogenes* counts remained stable in jelly over 21 days at 2 and 8°C, whereas in meat and vegetables, a >1 $\log_{10}$ unit increase was observed after 7 days at 2°C (or >5 $\log_{10}$ at 8°C). In the composed product, *Listeria* numbers remained stable at 2°C (21 days), but increased more than 1 $\log_{10}$ during 7 days at 8°C. Improving safety of jellied meat by lowering pH is discussed.

Peer-review under responsibility of scientific committee of The 58th International Meat Industry Conference (MeatCon2015)

Keywords: Listeria monocytogenes; meat jelly; pH; $a_{W,}$ non-homogeneous meat products

1. Introduction

Listeria monocytogenes is one of the most important bacterial pathogens in ready to eat foods. Invasive foodborne listeriosis in humans is a rare, but life-threatening event. In 2013, hospitalisation rate in the EU was the highest of all zoonoses under EU surveillance (99.1%), and case-fatality rate was 15.6%[1].

EU legislation[1] requires that levels of *L. monocytogenes* in RTE foods do not exceed 100 cfu/g of food

* Corresponding author. Tel.: +43-1-25077-3300; fax: +43-1-25077-3390.
E-mail address: frans.smulders@vetmeduni.ac.at

Peer-review under responsibility of scientific committee of The 58th International Meat Industry Conference (MeatCon2015)
doi:10.1016/j.profoo.2015.09.027

throughout their entire shelf-life. Depending on whether or not a product supports growth of this bacterium, the microbiological criterion at the end of the manufacturing process is either absence of *L. monocytogenes* in 25 g or <100 cfu/g. Some products are by default considered not to support growth (low pH, low a_w or shelf-life < 5 days). For RTE foods with other pH and a_W conditions or longer shelf life, growth of *L. monocytogenes* may be evaluated either by a challenge test/durability study or by predictive microbiology[3].

Recently, we have presented an approach to estimate the growth potential of *L. monocytogenes* for various groups of traditional Austrian cooked meat products, based on their pH, a_w and intended shelf life[4,5]. For this purpose, pH and a_w were measured from sample homogenates. Since some of the products under study were non-homogeneous (i.e. meat and vegetable chunks embedded in gelatin) and most likely differed both in pH and a_w, we were motivated to study if particular components of meat jelly would constitute niches for *L. monocytogenes* growth.

Nomenclature

a_w	water activity
cfu	colony forming units
L.m.	*Listeria monocytogenes*
LAB	Lactic Acid Bacteria
RTE	ready to eat

2. Material and methods

2.1. Growth of Listeria monocytogenes in whole jelly meat and in the separated main components

One unit (1 kg) of the finished product (ca. 1/3 cooked beef cubes 1x1x1 cm, ca. 1/3 pre-boiled vegetable cuts embedded in 1/3 gelatin) as well as of the main compounds (cooked beef cubes, pre-boiled vegetables and gelatin) were obtained from the manufacturer. Samples were portioned in ca. 20g units, and randomly assigned to control groups (non-inoculated) or groups which were inoculated with 10 µl of a *Listeria monocytogenes* (*L.m.*) cocktail (strain NCTC 11994 and 4 field strains - 14020, 13199, 13356/12 and 13047 - isolated from Viennese meat plants) at ca. 50 cfu/g.

Samples were then individually vacuum packed and stored at 2 or 8°C for up to 28 days (3 replicates per condition). Inoculum preparation was as described in the respective EC guidance[3]. Measurement of pH and a_w was conducted in control samples only, whereas enumeration of aerobic mesophilic count, lactic acid bacteria and *L.m.* was done for both groups using standard cultural methods. In addition, five complete products of various brands were separated into their visible main components, and the pH and a_w of these coponents were determined.

2.2. Growth of Listeria monocytogenes in gelatin fortified with different amounts of organic acids

Gelatin was prepared with addition of 1% NaCl. Since the addition of more than 1% vinegar (5% acetic acid) was not accceptable for sensory reasons, only variants with 1% vinegar were considered. Likewise, the addition of 0.5% lactic acid reduced the stability of the gel. Thus, three variants were tested: I: control with 1% NaCl (pH 6.3; a_w 0.988), II: 1% NaCl plus 1% vinegar (pH 5.0; a_w 0.991), III: 1% NaCl plus 1% vinegar plus 0.1% lactic acid (pH 4.75; a_w 0.986). Fortified gelatin products were inoculated with the strains mentioned above, at a targeted level of 4 $\log_{10}$ cfu/g. As regards storage, a short-time protocol was chosen (5 days at 7°C).

3. Results and discussion

Expectedly, a_w remained stable in the vacuum packed compounds over a 21 days period, with 0.972; 0.982; 0.965; 0.980 for the composed product, meat, gelatin and vegetables, respectively. Corresponding pH values were initially 5.6; 6.0; 4.8 and 6.7 and remained stable in jelly over 21 days (2 and 8°C), whereas in the other compounds