EFFECT OF LACTATE AND DIACETATE ON *LISTERIA MONOCYTOGENES* IN SLICED BOLOGNA-TYPE SAUSAGE AND FRESH SPREADABLE RAW SAUSAGE

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Background

Vacuum-packed sliced bologna and spreadable raw sausages must be classified from the microbiological point of view as highly perishable products and their shelf-life in cold storage is short. From the microbiological point of view, fresh spreadable raw sausages present a potential risk, because these meat products are characterised by high a_w and pH values when offered on the retail market.

Pathogenic micro organisms such as *Listeria monocytogenes* as well as food-spoilage micro organisms are potentially relevant as secondary contaminants when meat products are sliced and packed for sale in self-service shops because many such micro organisms can multiply at temperatures as low as 4°C. Therefore, consumption of pre-packed sliced bologna involves a certain residual risk for the consumer.

Objectives

In cooperation with PURAC biochem bv, the Institute of Microbiology and Toxicology of the Federal Centre for Meat Research investigated whether the addition of ingredients, PURASAL P HiPure 60 (potassium lactate) or PURASAL P Opti.Form 4 (formulation of potassium lactate and sodium diaetate) can extend the shelf-life of vacuum-packed sliced bologna and fresh spreadable raw sausages and thus can increase the safety of these meat products. The main emphasis was on the behavior/survival of *Listeria monocytogenes* and food-spoilage microorganisms.

The projected meat products were to come up to consumer expectations with regard to taste and appearance and they had to be stable and safe in the microbiological sense.

The content of *Listeria monocytogenes* is assessed in quantitative terms and the present assessment scheme is based on a tolerable level of 10^2 cfu/g. When values exceed this level, official measures are foreseen; they may be simple hygienic measures or even recall actions.

To improve the safety of prepacked meat products, a stability study was performed to examine the question of whether additional preventive measures such as use of PURASAL P and PURASAL P Opti.Form 4 can reproducibly prevent the multiplication of *Listeria monocytogenes*.

Methods

In the present study the effect of PURASAL P HiPure 60 potassium lactate, and PURASAL P Opti.Form 4 potasium lactate and sodium diacetate at various concentrations and under various conditions (temperature and period of storage) on the behavior/survival of *Listeria monocytogenes* in vacuum-packed sliced bologna-type sausage (Schinkenwurst, poultry bologna and Bavarian white sausage) and fresh spreadable raw sausage (Vespermettwurst and Zwiebelmettwurst) were investigated.

General recipes were developed for bologna (Schinken-Lyoner) and fresh spreadable raw sausage. The final products were tested for their sensory properties (according to the guidelines of the DLG) and for their physicochemical properties. Meat products containing different PURASAL additives and controls without PURASAL for comparison were prepared, inoculated with *Listeria monocytogenes* under standard conditions and stored at 4°C and 7°C for up to 35 days.

Results and Discussions

In the absence of PURASAL, *Listeria monocytogenes* counts on vacuum-packed sliced bologna and on Bavarian white sausage increase by a factor of more than 10^5 during a 3-week storage period at 4°C.

The growth potential of *L. monocytogenes* is diminished when vacuum-packed sliced bologna is prepared with 3% PURASAL and 2% nitrite curing salt (NCS).

Addition of 3% PURASAL P Opti.Form 4 was sufficient to suppress the growth of the *Listeriae* over a period of 3 weeks at a temperature of 4°C, sometimes even at 7°C. This was the case even when the products were inoculated with *Listeria monocytogenes* at densities as high as 10^3 cfu per gram.

Addition of 4% PURASAL P Opti.Form 4 clearly improved the stability of the vacuum-packed sliced bologna compared with the control product where microbial growth was observed after a storage period of 35 days at 4°C.When the sausage was inoculated with 100 *Listeria monocytogenes* cells per gram sliced sausage, no growth of these pathogenic microorganisms was detectable during storage for 35 days at 4°C. At a storage temperature of 7°C, vacuum-packed sliced bologna was found to be stable for up to 21 days. After storage for 28 days *Listeria* had increased by a factor of 10.

Further, it was investigated whether the addition of 3% PURASAL P (Opti.Form 4 and HiPure 60) can inhibit growth of *Listeria monocytogenes* in fresh spreadable raw sausage. The results show that addition of 2.5% NCS and 3% PURASAL did not affect the behaviour of *Listeria monocytogenes* when compared with the behaviour in the inoculated control batch. Positive aspects were the evidently higher colour intensity, the slower decrease of the pH value and the clearly lower a_w values in the sausages prepared with PURASAL.

Conclusions

Vacuum-packed sliced bologna-type sausages and fresh spreadable raw sausages must be considered high-risk products. The usual protective measures (addition of 2% NCS and refrigeration at 4°C – 7°C) are not sufficient to inhibit the growth of *Listeria monocytogenes* in vacuum-packed sliced bologna-type sausages. In the present study it was investigated to what extent different concentrations of PURASAL P can inhibit growth of *Listeria monocytogenes*.

During a 3-week storage period at 4°C *Listeria monocytogenes* counts increased by more than 4 orders of magnitude in vacuum-packed sliced bologna which was produced under conditions normal in practice.

Addition of 3% PURASAL P HiPure 60 inhibited the growth of *Listeria monocytogenes* at a temperature of 4°C only moderately whereas it was ineffective at 7°C.The growth of *Listeria monocytogenes* could be reduced or inhibited during storage for 35 days when the sliced bologna was prepared with 3% or 4% PURASAL P Opti.Form 4 and 2% nitrite curing salt and stored at 4°C.Sliced bologna was stable at 7°C for 21 days. During a 28-day storage period *Listeria* counts increased by an order of magnitude.

In Bavarian white sausage stored at 4°C, marked growth of *Listeria monocytogenes* was found after day 7. However, the addition of 3% PURASAL P Opti.Form 4 und 2% NCS caused growth inhibition of *Listeria monocytogenes* for up to 21 days. Later growth occurred at a slow rate. At a storage temperature of 7°C these products were stable until day 7.

Positive aspects were the evidently higher colour intensity, the slower decrease in the pH value and the clearly lower a_w values in the spreadable raw sausages prepared with PURASAL.

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