INVESTIGATION OF HETEROPOLYSACCHARIDE-PRODUCING *LACTOBACILLUS PLANTARUM* TMW 1.1308 IN COOKED HAM

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Abstract – In this project the influence of *in-situ* produced exopolysaccharides on quality attributes of cooked ham was investigated. 20 hams were manufactured (without phosphate to not overlap EPS-induced effects), 10 with the exopolysaccharide-producing strain *Lactobacillus plantarum* TMW 1.1308 and 10 without this starter culture (control). The *in-situ* production of EPS (~ 24 mg/kg ham) did neither effect the yield nor the water holding capacity of cooked hams. The appearance of small pores in the final products may be due to the fact that no phosphate was used for cooked ham production. The strain *Lactobacillus plantarum* TMW 1.1308 is hence not recommended for cooked ham production.

Keywords – cooked ham, exopolysaccharides, *in-situ* formation

I. INTRODUCTION

Hydrocolloids and phosphates are generally used to improve quality attributes of cooked ham [1]. However, these additives have to be labeled. In contrast to that exopolysaccharide (EPS) formed by starter cultures do not have to be declared since they are formed *in-situ* during processing [2]. The EPS can be formed during the tumbling process and during the resting period [1]. Until now, only few attempts have been made to introduce EPS producing starter cultures to meat products. Dertli, Yilmaz et al. [3] produced Turkish-type fermented sausages (sucuk) with EPS producing starter cultures. Sausages that were manufactured with these cultures were harder, less adhesive and tougher.

Hypothesis:
EPS produced by *Lactobacillus plantarum* TMW 1.1308 during cooked ham processing increase both yield and water holding capacity of cooked hams.

II. MATERIALS AND METHODS

Preparation of cooked ham
40 top sides were evenly distributed into two groups (control samples without- and samples with starter cultures). The 20 control top sides were injected with 20% brine (water, nitrite curing salt, Schinken Top L, glucose) based on the weight of the muscle (120% weight). Afterwards, the top sides were tumbled for 8 h at 2 °C and 200 mbar. The remaining top sides were then injected with brine containing 10^9 CFU/mL *L. plantarum* TMW 1.1308 (microbial growth behavior was examined during processing using plate counts). Injected top sides were then also tumbled for 8 h. After 24 h (tumbling and resting time) at 2 °C, always two top sides were filled together into one casing (caliber 120) and put into a heating chamber. The hams were heated until a core temperature of 70 °C was reached by using a special heating program including four smoking steps and a final heating step.

Yield and storage test
The yield of the produced hams was determined by measuring the weight of the hams after filling and after heating. The water holding capacity of the produced hams was examined by storing 4 slices (thickness: 3 mm) for two weeks at 0 °C. The slices were arranged and packaged in vacuum bags (~200 mbar). The weight of the slices were determined directly after cutting and after two weeks of storage at 0 °C.

HPLC – EPS Quantification
The quantification of EPS was done using a modified method from Rühmkorf et al. [4]. 5 g of the homogenized sample was mixed with 14 mL of ddH_2O and again homogenized at 20000 rpm. The sample was then incubated at 50 °C for 3 h to dissolve cell wall connected polysaccharides.

Afterwards, proteins were precipitated with 10% (v/v) trichloroacetic acid and the supernatant then mixed with ethanol to precipitate the EPS (overnight). After centrifugation, the pellet was dissolved in ddH_2O and perchloric acid at a final concentration of 5% (v/v) to hydrolyze the polysaccharides. The remaining supernatant was then treated with an ion exchanger to remove salts and other ions. Finally, the solution was analyzed using a Rezex RHM column with a flow rate of 0.6 mL/min (ddH_2O) at 75 °C and EPS then detected with a refractive index detector at 40 °C.

III. RESULTS AND DISCUSSION

The number of viable cell counts of prepared hams after the resting period and tumbling time was ~10^8 CFU/g meat. Furthermore, the pH-value of the meat did not change during resting time (~5.5). In Figure 1 the final product is shown. As it can be clearly seen, a lot of cracks and holes can be found in products (cross section) that have been produced without starter cultures and phosphate (picture A). Furthermore, hams produced with the starter culture still exhibited small pores (picture B). These observations may be attributed to a too short resting time (insufficient crosslinking of proteins) or gas formation of the applied culture. Latter assumption could be disproved by performing a gas test in broth using Durham tubes.

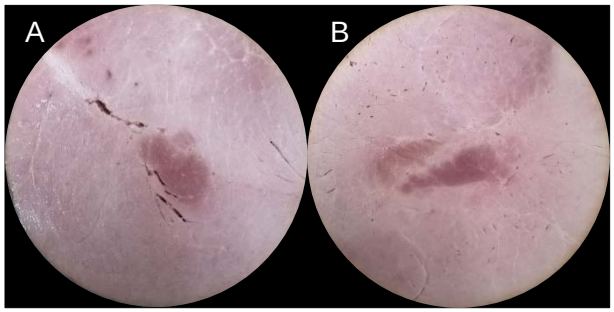

Figure 1. Pictures of cooked hams (A control; B with *L. plantarum* TMW 1.1308)

Figure 2 illustrates the yield and weight loss of the examined cooked hams. The application of the starter culture had no influence on the yield of the hams (Samples with *L. plantarum* TMW 1.1308: 105.37 ± 1.40; control samples: 105.37 ± 1.37). The water holding capacity of hams was also not increased compared to the control. Therefore, the amount of EPS produced during processing, which was found to be approx. 24 mg/kg ham (HPLC quantification), was not enough to improve the yield and water holding capacity of cooked hams.

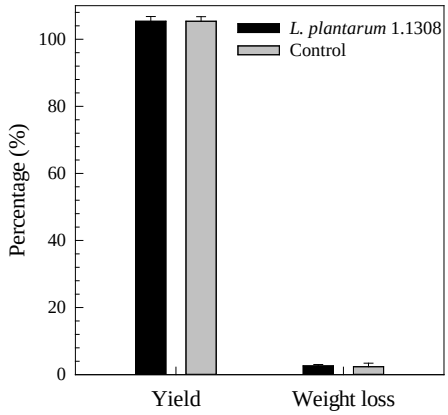

Figure 2. Yield and weight loss (storage test) of the prepared hams

IV. CONCLUSION

The results contradict the made hypothesis. EPS formed *in-situ* during processing did not affect yield and water holding capacity of cooked hams. However, differences were observed with regard to product appearance.

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