Injection of a salt suspension into bacon cuts

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INTRODUCTION

The microbiological stability of sliced vacuum packed bacon depends on the water activity (a_w), the pH, the nitrite content, the bacterial contamination and the storage temperature (1,2,3).

In the past most important preservative of Wiltshire cured bacon was probably the large amount of salt. Brine percentages (x 100) of 10 - 14% were considered normal. These values correspond to a_w-values of about 0.92 and 0.88 respectively which prevent growth of pathogenic micro-organisms, especially under anaerobic conditions. Differences in brine percentages between parts of each were probably of minor importance as a result of the high averages.

However at present there is a strong trend to lower the salt content. Brine percentages of 6 - 7 (4) and 3 -5 (5) can be calculated from relevant data in several publications. The keeping quality of bacon with a fairly low average salt content might be strongly affected by varying brine percentages in the same bacon cuts from different carcasses or even in different parts of one bacon cut.

The complex system of a bacon cut (bone, fat, lean meat) and the relatively simple injection system are two factors that are responsible for the inhomogeneous distribution of curing ingredients (6). The batchwise tank cure seems to be inefficient with respect to equalization.

Experiments were carried out in the Netherlands to obtain a more uniform distribution of curing salt by injection with a new type of multineedle apparatus, shortening of tank curing and application of a salt suspension.

MATERIAL AND METHODS

- Two types of Protecon multineedle apparatus were used. The standrad type P1 440 - 5 (direct brine supply to the needles from joint needlehead by constant pressure) and the new type P.1 - Volume injector (indirect brine supply totheree-needle-groups by way of piston chambers)
- A salt suspension consisting of a salt saturated brine to w hich an extra quantity of microsalt is added (water 70% , salt 24% , microsalt 6%). To prevent sediment formation, a very finely pulverized

  salt (microsalt) was used and the brine had to be kept in constant motion through the whole system.
- In experiment 1 two groups of 40 middles, bone in -rind on- weight about 10 kg, were injected. One group with a standard injector, following the usual batchwise processing method, the other group with the new injector, following a more individual processing method. The injection brine of the standard injector contained 19.8 % m/m NaCl. Gain of about 20 - 23 % of green weight.

  The injection was followed by a two-day batchwise tank curing and a there-day piled up draining (4 layers). The cover brine contained 17.9 % m/m NaCl.

  Temperature during the curing and draining period was 5ºC.

  The brine in the new injector contained 23.7 % m/m NaCl. About 23 % of green weight gain after injection. A 7-minute individual tank cure was applied after injection, followed by a five-day draining at 5ºC. During the draining period the middles were packed two in vacuumbags filled up with a gas mixture of CO_2 and N_2. The cover brine contained 21.6 % m/m NaCl.

  After draining there middles from each group were deboned. Back and bellies were separately sliced. Each three slices were vacuum packed. Dividing the packages of each back and belly into 10 groups - starting with the collar and ending at the hamside - in the contents of a package of each group the initial total aerobic count, the moisture and NaCl contents according to ISO-standard or comparable methods, were determined. The remaining packages were stored at 7ºC for some weeks; sebsequently a bacteriological examination was carried out.
- For experiment 2 only the differences with experiment 1 are described. Forty middles were injected with the new injector, using a salt suspension. This salt suspension contained 27.4 % NaCl. Gain of about 17 % of green weight.

  After a short individual tank cure, a 24-hour draining was applied to dispose of excessive drip formed in vacuum bags between draining and maturation, as described in experiment 1.

RESULTS OF EXPERIMENT 1

The different patterns of average brine percentage and variation coefficients of sliced bacon prepared with the standard multineedle and a new type multineedle including individual curing, are recorded in figures 1 and 2 respectively. In the latter the patterns for the average brine percentage as well as the variation coefficient shows more homogeneity.

Figure 3 shows the differences of average brine percentages and variation coefficients between backs and bellies prepared with the standard type and with the new type of multineedle. In this figure also smaller differences with the new type of multineedle are observed.

Differences in average aerobic counts and variation coefficients of vacuum packed sliced bacon from backs and belliers are recorded in figures 4 and 5. In accordance with the levels of brine percentages in general, there is no difference in keepability. However, the variation coefficients of bacon prepared with the new type of injector and stored for two weeks are lower, which means that the quality is more uniform.

However, due to the increase in weight after injection, the bacon prepared with the new type of multineedle and individual, short curing times was unacceptable in terms of quality (moisture/protein ratio of 4.1 and average amount of drip 3% in the vacuum bags after draining).

RESULTS OF EXPERIMENT 2

A sal suspension was used in order to obtain a sufficient level of brine percentage and not to exceed a moisture/protein ratio of 3.7. Figure 6 shows the average brine percentages and variation coefficients of sliced bacon, prepared with the new type of multineedle and a salt suspension. The patterns are more homogeneous in comparison with those of the bacon prepared with the standard multineedle. Even the variation coefficients are lower. The same effects are recorded in figure 7 with respect to the average aerobic counts and variation coefficients.

CONCLUSIONS

- A more uniform distribution of curing salts can be reached by using multineedle apparatus according to the principle of brine supply to the needles by piston chambers.
- A sufficient salt level can be reached by using salt suspension of short tank curing time.
- More homoeneous distribution of injection brine generally resulted in a better keeping quality.

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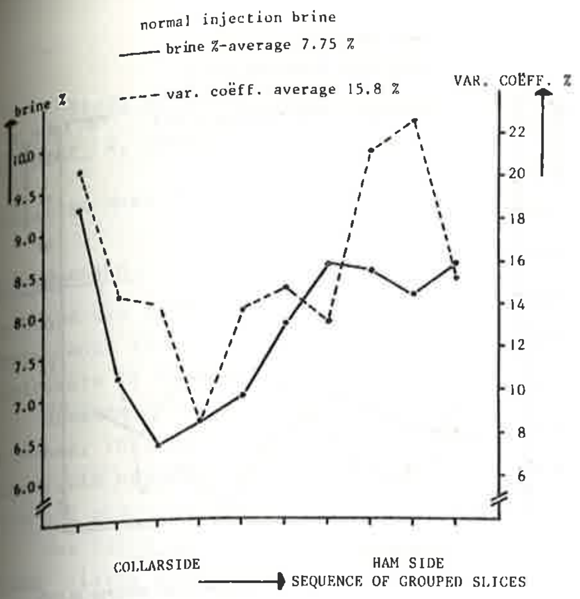

Figure 1

Average brine percentages and variation coëfficients of grouped slices from 3 middles, injected with standard type multi needle (a)

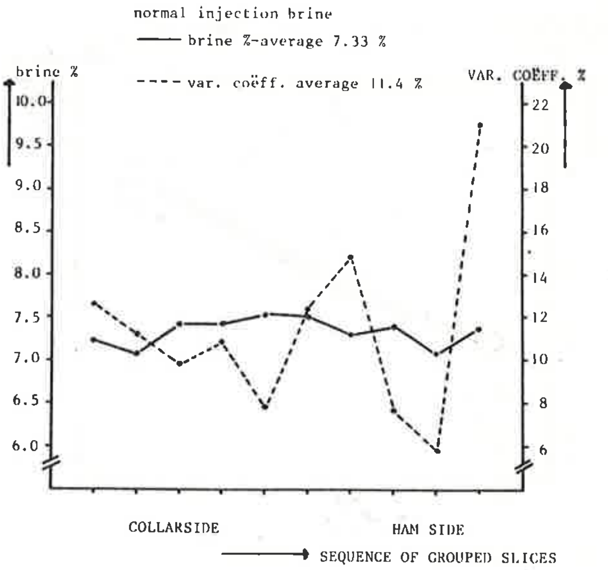

Figure 2

Average brine percentages and variation coëfficients of grouped slices from 3 middles, injected with new type multi needle (b)

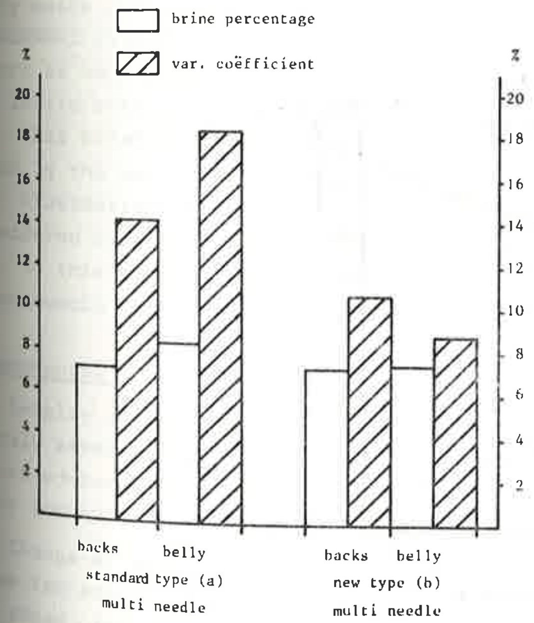

Figure 3

Average brine percentages and variation coëfficients of grouped slices from 3 middles

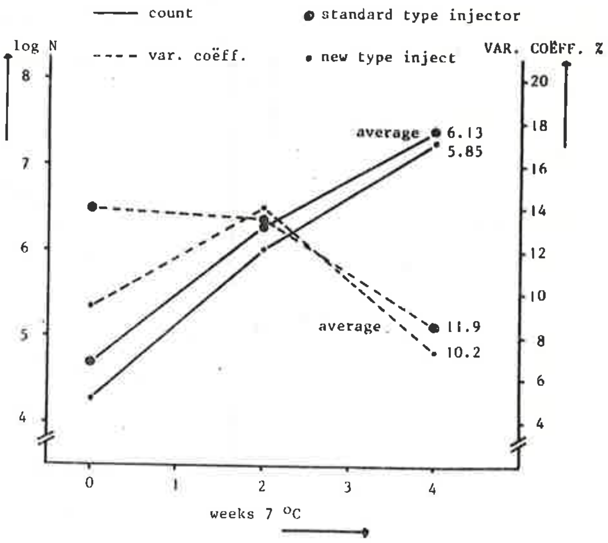

Figure 4

Average aerobic count/g and variation coëfficient of vacuum packed slices from 3 backs

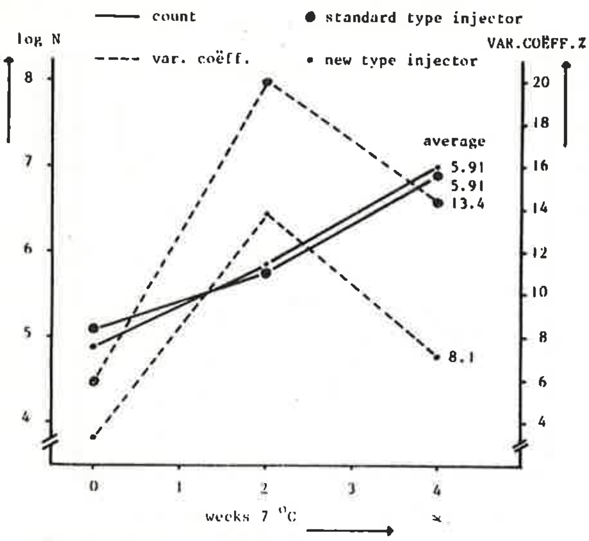

Figure 5

Average aerobic count/g and variation coëfficient of vacuum packed slices from 3 bellies

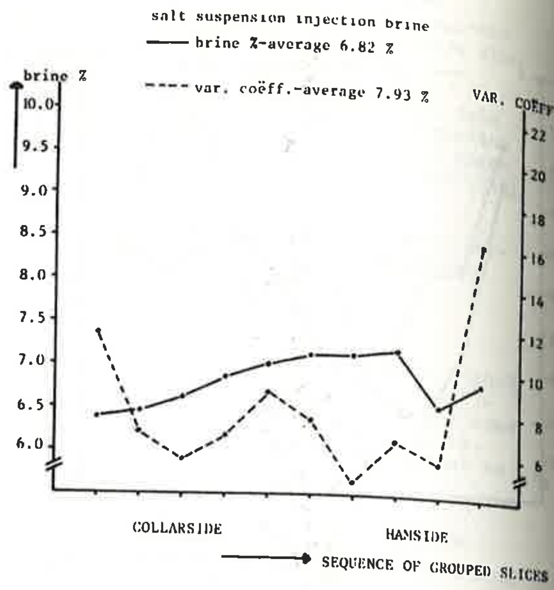

Figure 6

Average brine percentages and variation coëfficients of grouped slices from 3 middles injected with a new type multi needle (b)

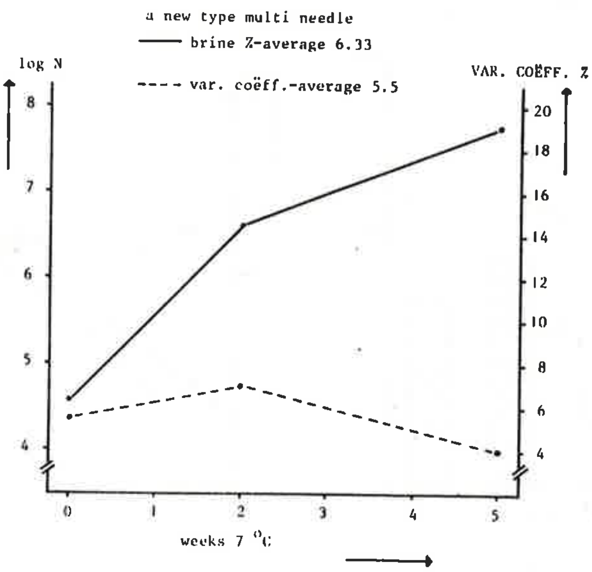

Figure 7

Average aerobic count/g and variation coëfficient of vacuum packed slices from 3 middles injected with a new type multi needle