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THE INFLUENCE OF A VIBRIO-STRAIN ON THE RIPENING OF DRIED HAMS

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The use of bacterial pure cultures in dry sausage has become common during the past few decades; Similarly attention has also been directed at the use of starter cultures in the curing of dried hams and associated products - even in cooked hams. Previously a Vibrio-strain was used as "Equinitre" preparate in meat curing. We have isolated several bacteria strains suitable for use as starter cultures in the curing of hams. A Vibrio-strain (V. 21) proved to influence the quality of raw hams most beneficially.

Materials and methods

1. Isolation and properties of the Vibrio-strain

As described earlier (Petäjä etc. 1972) we isolated from curing brines a Vibrio-strain, corresponding to the properties of the Vibrio costicolus-strain studied by FLANNERY, DOETSCH & HANSEN (1952).

In our collection this strain had the number 21. It is a gram-negative curved rod. In old cultures it can also take the form of a small coccus.

Vibrio 21 is fermentative and forms acid from glucose, fructose, galactose, mannose, sucrose, maltose, mannitol and glycerol. It is neither proteolytic nor lipolytic, but strongly nitrate reducing.

Vibrio 21 does not grow in media without salt (NaCl). It grows well up to 10^9 - 5 x 10^9/ml when aerated in a broth containing

tryptone, yeast extract and 2 % NaCl. It does not grow in temperatures above +28°C (optimum +25 - +26°C).

2. Processing of the hams

The hams were prepared from the different parts of the ham joint. In every test series similar representative portions from different joints were used. We made dried hams by two different curing methods viz.,

a) Trimmed hams put in the net were injected with 10 % of their weight of saturated brine containing 1 % glucose and 0,3 % KNO_3. After that the hams were kept a week under pickling brine which contained 10 % NaCl, 1 % glucose and 0,3 % KNO_3.

b) The hams were injected with the brine containing 15 % NaCl and then rubbed with dry salt without cover pickling.

The amount of inoculation of Vibrio 21 in injected brine in both methods was 5×10^6 cells/g ham and in cover brine 5×10^6/ml brine.

We also prepared micrococcus hams with Baktoferment (Rudolf Müller & Co., Giessen, BRD) using micrococcus inoculations in the brines as great as those in the vibrio hams. Further, we prepared hams with mixed culture inoculations containing $2,5 \times 10^6$ vibrios and $2,5 \times 10^6$ micrococci/g ham.

Cured hams were ripened a week in the "Autotherm" air conditioning cabinet at 19°C.

3. Microbiological methods

The hams and brines were plate counted in media containing 2 g tryptone, 8 g yeast extract, 20 g NaCl and 15 g agar in one liter of water. From the plates were counted the total number of bacteria and the numbers of Vibrio 21 and micrococci. Vibrio 21 formed characteristic colonies which were fluorescent at the edges.

4. Organoleptic evaluation of the hams

The hams were evaluated by three experts using a scale of 1-4. Colour, consistency and flavour were investigated. The following kinds of hams were thus evaluated:

- control
- vibrio
- micrococcus ham (Baktoferment)
- micrococcus + vibrio ham

Results

1. Microbiological studies

a. The cover brines

In micrococcus + vibrio brine the number of micrococci increased from 6×10^5 to 10^7 the first day and thereafter stayed nearly constant up to the 7th day. The number of vibrios rose from 7×10^5 to 10^8/ml during the first four days (Fig. 2) and stayed unchanged after that. The numbers of other bacteria in inoculated brines varied between 10^3 and 10^4/ml and numbers in control pickling brines increased from 10^5 to 10^7 in seven days.

b. The hams

The numbers of micrococci and vibrios in the vibrio-micrococcus hams increased during the first two days from 2×10^5 to 10^7/ml. Thereafter remaining at that level. The numbers of other unspecified bacteria in inoculated hams stayed at the level of 10^4 per ml (Fig. 2). The bacteria in control hams increased from 10^5 to 4×10^7.

In hams which were placed in the Autotherm immediately after injection (Method b) the number of vibrios stayed at the level 10^4 - 10^5/g all the time. Micrococci grew as well here as in pickled hams.

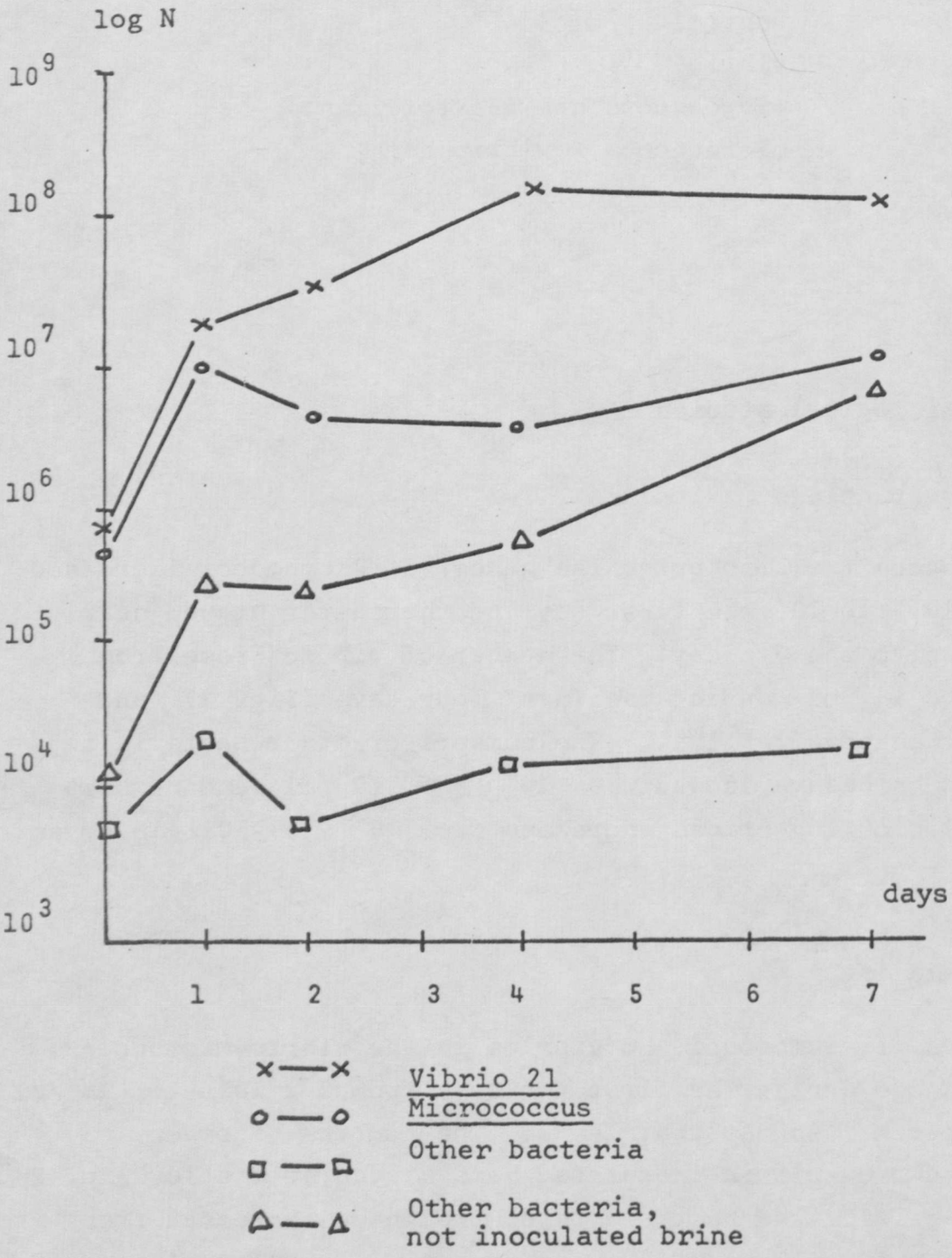

Fig. 1. The numbers of bacteria in the inoculated curing brines.

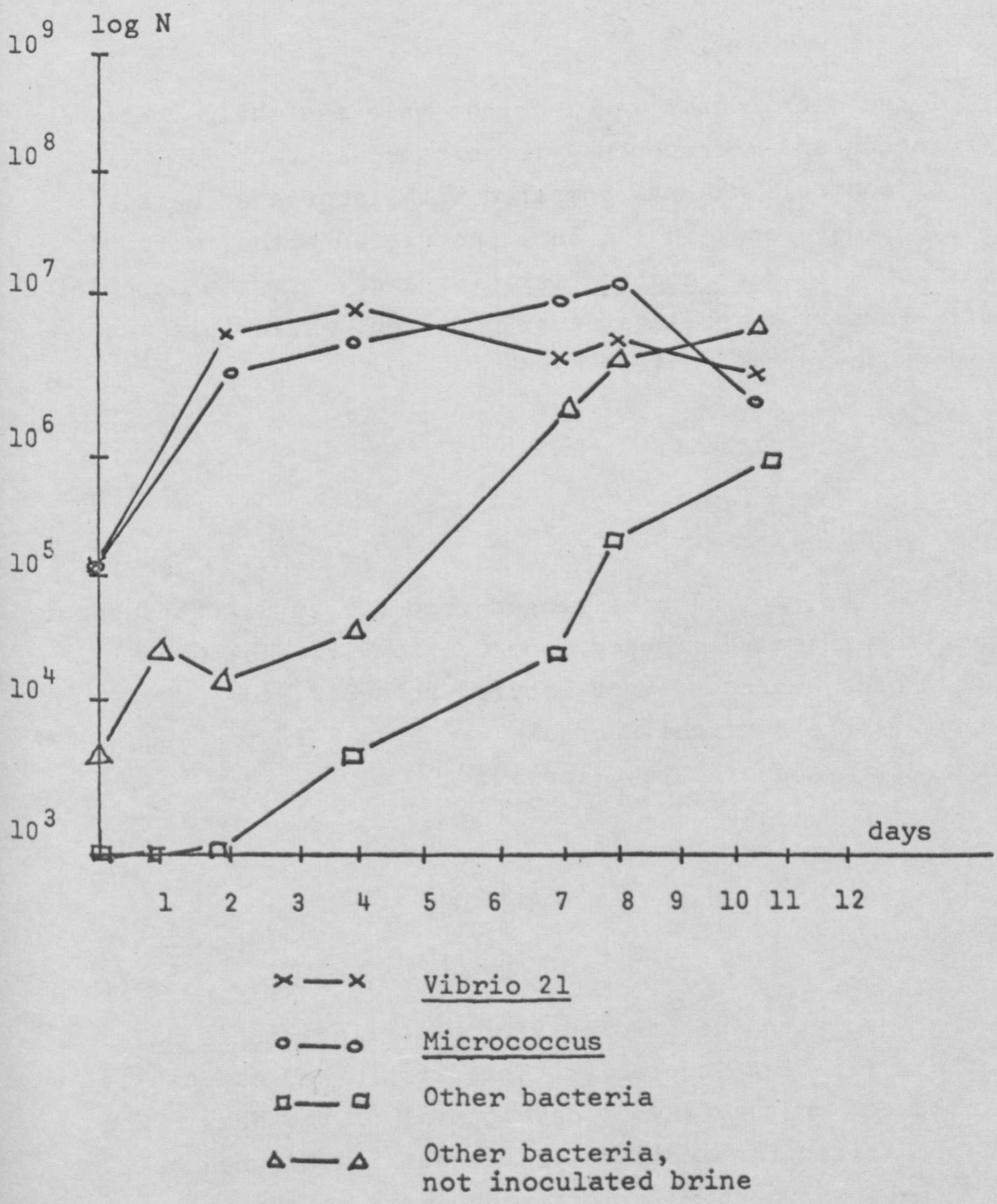

Fig. 2. The numbers of bacteria in the inoculated dried hams.

2. Organoleptic evaluation

In organoleptic evaluation the hams inoculated with vibrios proved to be the best. Micrococcus hams were good but their consistency was not as good as that of the vibrio hams. The consistency of the micrococcus-vibrio hams was also poorer than that of hams inoculated with vibrio alone.

The colour of the vibrio hams was a bright pale red while that of the micrococcus and micrococcus-vibrio hams was dark red. The flavour of controls was raw compared with inoculated hams. The best flavour developed in the hams inoculated either with Vibrio-strain or with Micrococcus-Vibrio-strains. In the inoculated hams the off flavour of spoilage never occurred, while this was often considerable in the control hams.

3. pH-value

The pH-values of the control hams ranged from 5,9 to 6,2 throughout. In vibrio hams the pH-value dropped from 6,1 to 5,7. The pH of micrococcus hams decreased very little, from 6,2 to 6,0. In micrococcus-vibrio hams the decrease was from 6,1 to 5,8. The pH-values are means of 5 test series.

Summary

Inoculation of hams with the studied Vibrio-strain (Vibrio 21) influenced their ripening favorably. This strain had especially favourable influence on the flavour development of the hams. The inoculation prohibited the spoilage of the hams. This can be explained by the lower numbers of other bacteria in the inoculated than in the control brines and hams.