Growth of *E.coli O157:H7* in ground meat and meat products

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Background. *Escherichia coli O157:H7* has now been recognized as a food poisoning pathogenic bacterium for some years and the numbers of outbreaks have been increasing recently. According to Padhye and Doyle (1992) it can cause intestinal disorders in milder outbreaks but fatal hemolytic uremic syndrome (HUS) is seen in more severe cases (Hinkens et al., 1996). Among other cases, *E.coli O157:H7* has been involved in food poisoning outbreaks, where fermented dry sausage was the food vehicle, (Hinkens et al., 1996). Since fermented sausages is part of the Danish diet, it would therefore be of interest to see to which extent this bacterium would survive and propagate in Danish fermented sausages. Glass et al.(1992) have shown that *E.coli O157:H7* can be inactivated at 27°C after 10 and 17 days respectively at pH 3.5 or 4 if pH is controlled with HCl, but if lactic acid is used as acidulant, inactivation will take place within 24 hours and 7 days respectively at pH 3.5 and 4.0. Buchanan and Klawitter (1992) investigated interactions between pH, NaCl, temperature and availability of oxygen on growth of *E.coli O157:H7*. They found that the effect of the various parameters was significantly increased when they were considered together. However, the effect of anaerobic conditions was very minimal, if any.

Objectives: To examine the possibilities for survival and growth during storage in three selected products: ground beef, sliced Bologna type sausage and sliced fermented dry sausage,the two former products at 5 and 10°C, the latter at room temperature.

Methods: Fresh ground beef in modified atmosphere retail packages was purchased directly from the manufacturer and was inoculated with known amounts of a laboratory strain, whereafter the meat was vacuumpackaged and stored for 14 days. Bologna type sausage was purchased from a freshly vacuumpackaged lot, inoculated in the laboratory, resealed and stored for 5 weeks. Fermented dry sausage was purchased whole, sliced under hygienic conditions in the laboratory, inoculated and vacuumpackaged, after which it was stored for 5 weeks. The products were initially examined for salt, moisture and pH. Total counts and lactic acid bacteria determinations were made by standard methods. Determination of *E.coli O157:H7* was made as follows: After pre-enrichment in EC medium (Difco Laboratories) added Novobiocin, separation was made using Dynabeads anti-E.coli O157 (Dynal A/S, Norway). After removal from the beads, the suspension was seeded on cefixime/potassium tellurite-sorbitol MacConkey agar(CT-SMAC). After outgrowth, suspect colonies were confirmed by agglutination with Test Latex, codes DR 621 and DR 622M (Oxoid).

Results: The results of the chemical analyses of the fresh products are as follows:

Product	NaCl	Water	Salt/water ratio	pH
Bologna type sausage	2.2	60.41	3.64	6.2
Fermented dry sausage	4.5	25.83	17.4	4.5
Ground beef	-	-	-	5.6

Microbiological findings.

Ground beef: Figures 1 and 2 show total counts and numbers of *E.coli O157:H7* inoculated with 10 cells per gram in packages stored at 5°C and 10°C.

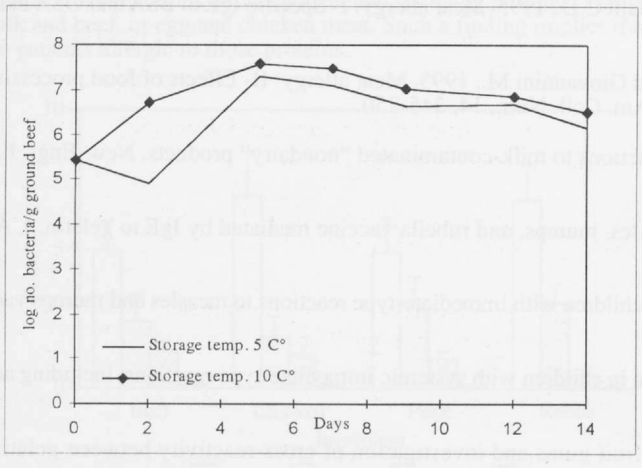

Fig.1. Growth curves for total counts in vacuum-packaged ground beef stored at 5°C and 10°C.

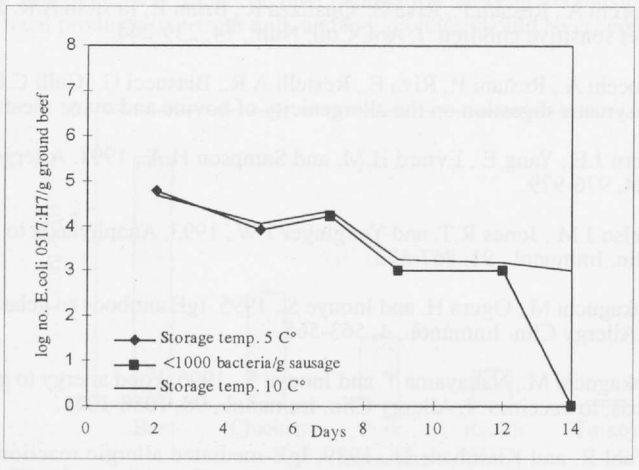

Fig.2. Growth curves for *E.coli O157:H7* in vacuumpackaged ground beef inoculated with 10 cells per gram beef, stored at 5°C and 10°C.

It will be seen that at both temperatures the numbers of *E.coli:H7* is decreasing during storage. During storage pH also declined from 5.6 to 5.2 at 5°C and to 5.1 at 10°C.

Bologna type sausages. Figures 3 and 4 show total counts and numbers of *E.coli O157:H7* inoculated at 42 cells per gram in packages stored at 5° and 10°C.

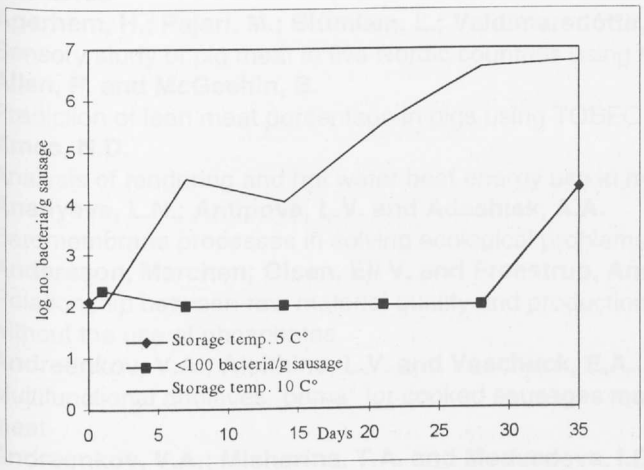

Fig. 3. Growth curves for total counts in vacuum-packaged, sliced Bologna type sausage stored at 5 C°and 10 C°.

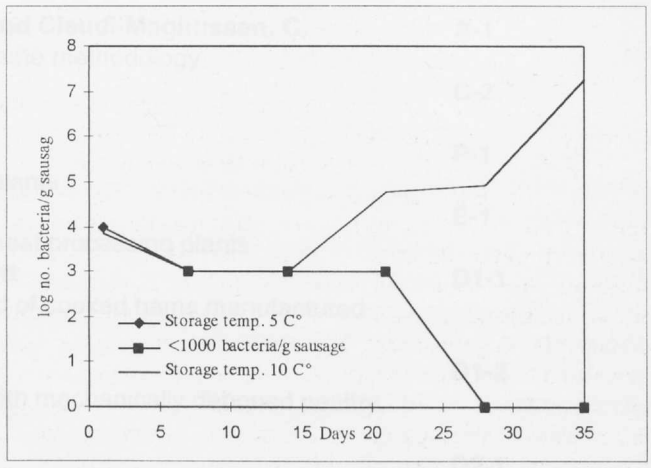

Fig. 4. Growth curves for *E.coli O157 H:7* inoculated with 42 cells per gram in vacuumpackaged Bologna type sliced sausage stored at 5 and 10°C.

It will be seen that no growth of *E.coli O157 H:7* takes place at 5°C whereas there is a significant increase after two weeks at 10°C. Because of the content of phosphate, no decrease in pH took place during storage.

Fermented dry sausage. When fermented sausages are ready for sale, they have a pH between 4.75 and 4.5 and a predominant lactic acid bacterial flora. Samples used for this investigation had a pH of 4.54 and a total bacterial numbers of $1.3 * 10^{4E}$ with lactic acid bacterial count of $1.4 * 10^{4E}$ per gram, i.e. a pure lactic acid bacterial flora. When the sausage was sliced and vacuumpackaged, batch 1 was inoculated with 4 cells, batch 2 with 400 cells per gram sausage. The inoculated packages were stored at room temperature and examined for presence of *E.coli O157:H7* as described above. After 1 day was found below 3 cells per gram and $6.3 * 10^{4E}$ *E.coli O157:H7* per gram sausage in batches 1 and 2 respectively, but on examining both batches after 7 days it was not possible to detect any. It thus appears that survival of this bacterium is not possible in this environment.

Conclusion: It is confirmed that *E.coli O157:H7* will survive in vacuumpackaged ground beef beyond the shelf life of the product. Survival and even growth will take place in a mildly cured meat product, but a combination of intrinsic and extrinsic factors and predominant growth of lactic acid bacteria, as found in fermented meat products, will prevent survival of *E.coli O157 H:7* even if the product is stored at room temperature.

References:

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