STATUS SUMMARY: Lethality attained in dried non-fermented beef products

Background: Many dry-cured and/or dried beef products historically have been made without fermentation or cooking steps. Biltong is a South African product made by drying seasoned and salted beef strips. Droëwers is a related South African sausage product made using seasoned and salted ground beef or beef pieces, which are dried. Basturma is a product traditionally made in Armenia and neighboring countries from whole-muscle beef pieces which are dry-cured, rinsed, pressed and dried, and then coated with a spice paste. If these beef products are sold as ready-to-eat, the processes used to make them must have enough lethality to cause a "5-log" reduction both in the number of *Escherichia coli* O157:H7 cells and the number of *Salmonella* cells.

Research Study: Researchers inoculated beef strips (for biltong), ground beef (for droëwers) and beef rounds (for basturma) with *Salmonella* spp. and *E. coli* O157:H7 and manufactured the inoculated beef into the intended product.

- Biltong strips were dried at 68 - 74°F and 38 – 64% Relative Humidity for 17 – 26 days.
- Droëwers beef was dried at 68 - 74°F and 38 – 64% Relative Humidity for 12 – 21 days. The biltong and droëwers were dried to a water activity of about 0.60, and then were vacuum-packaged and stored an additional 7 days at 68 - 74°F.
- Basturma beef rounds were dry-cured at 44°F and 50% Relative Humidity for 7 days. The purge which accumulated in the dry-curing step was discarded, another dry-cure mixture was applied and then the dry-curing continued under the same conditions for 14 more days. After dry-curing, the rounds were soaked in tap water in four sequential 15-minute treatments and then dried at 70, 75 or 81°F for 2 days. The Relative Humidity in 70 and 75°F trials cycled beween 12 h at 65% and 12 h at 80%. In the 81°F trial, Relative Humidity was held constat at 70%. The dried rounds were then pressed for 12 h under refrigeration, and then re-hung to dry for 4 days under the conditions for the 70, 75, or 81°F drying treatments described above. The finished product was then coated with a spice paste, and dried: 4 days at 70°F with the cycling % Relative Humidity, 5 days at 75°F with the cycling % Relative Humidity, and 6 days at 81°F with constant 70% Relative Humidity.
- Numbers of surviving *Salmonella* and *E. coli* O157:H7 were determined at key steps in each process. The pH, water activity, and % water-phase salt, defined as (% salt x 100) / (% salt + % water), of the finished product were measured.

Research Results: Three batches of biltong made by the researchers had pH, water activity, and % water-phase salt values of 5.6, 0.75, and 15.4; 5.5, 0.67, and 15.8; and 5.5, 0.62 and 21.5. The corresponding values for droëwers were 5.5, 0.62, and 19.1; 5.4, 0.60, and 19.6; and 5.4, 0.60, and 22.2. Three batches of basturma had pH, water activity, and % water-phase salt values of 5.6, 0.87, and 13.1; 6.0, 0.95, and 8.3; and 5.6, 0.84, and 18.0.

Even with an added 7-day post-processing storage period, insufficient lethality was attained in the processes for making biltong and droëwers. The reduction of *Salmonella* on biltong ranged from 3.1 to 4.2 logs. The reduction of *E. coli* O157:H7 was 2.8 to 4.4 logs. For droëwers, the reduction of *Salmonella* achieved after the manufacturing process and post-processing storage was 2.3 to 3.4 logs. The corresponding reduction of *E. coli* O157:H7 was 2.4 – 3.1 logs.

Greater lethality was obtained in the process for making basturma. Reduction of *Salmonella* ranged from 4.5 to 5.1 logs, with reduction of *E. coli* O157:H7 ranging from 4.9 to 5.4 logs.

Recommendations: Based on these studies we cannot recommend any critical limits for the processes of making biltong and droëwers that achieve **sufficient lethality**. It is possible that adding an antimicrobial step, such as spraying the beef raw materials with an organic acid, would increase the overall process lethality to desired levels. Further research would be needed to validate such a **combination** of processing steps.

Similarly, additional lethality would be needed for a basturma process to be considered validated for a ready-to-eat product.

Some basturma is sold as a raw, not ground product. In this case, the process studied here could be considered valid for ensuring that the basturma is safe before final cooking by the consumer. The inclusion of one or more additional antimicrobial steps to the basturma-making process may validate that process for producing a safe item in the HACCP category of "product with secondary inhibitors, not shelf-stable". Further research would be necessary, however, to validate such step(s).

Note, spices have increasingly been linked to foodborne illness outbreaks. Any spices added to a finished product, i.e. a spice paste applied to ready-to-eat basturma, should have received a pasteurization treatment or be affirmed to be pathogen-free prior to application to the finished product.

References:

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