DANISH MEAT
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F-value calculator – a tool for calculation of acceptable F-value in canned meat reduced in NaCl

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INTRODUCTION

Canned meat products are usually protected against growth of *C. botulinum* by combination of heat, sodium chloride and sodium nitrite. When meat products are reduced in NaCl for health reasons, they need a higher heat treatment to maintain same level of protection against *C. botulinum*. We developed a new tool for calculating the F-value, necessary to obtain equivalent safety for canned meat when reduced in NaCl, compared to the original combination of aqueous salt and F–value. The tool is available at http://dmripredict.dk.

MATERIALS & METHODS

A spore mixture of three gas producing strains of the closely related species *C. sporogenes* (putrefactive 93R, putrefactive 3679 and putrefactive 1075) were used for spiking the chopped pork meat during production of the canned luncheon meat (pH 6.0; 144 ppm $NaNO_2$).

26 different meat batters with various aqueous salt content (1.66 – 3.54%) were spiked at 5.000 spores/g (calibrating series) and 11 were spiked at 100 spores/g (validation series). 70 cans of inoculated meat batter were autoclaved at 112 °C until the requested F-values (0.51 to 3.25) were obtained. After cooling, the cans were challenged at 37°C (calibrating series) or 25°C (validation series) and visually examined for blown cans for up to 120 days.

By fitting corresponding values of time and percent blown cans (MicroFit 1.0), the "time to 50% of the cans were blown" ($bomb_{50}$) was estimated as a measure for the observed "relative shelf life". It is assumed that the relative shelf life in days (*Ds*) is a function of F-value (F), aqueous salt in the product (WPS) and storage temperature (T). A model of the type

$$\ln(Ds) = \ln(K) + a * \ln(F) + b * \ln(wps)$$

was hypotesized, where a and b are constants that are to be determined experimentally and K is a temperature dependent constant. The data for determining the constants (a, b and K) consisted of simultaneously fitted values of "$bomb_{50}$", actual measured F-values and aqueous salt. PLS regression (Unscrambler ver 9.2, CAMO Norway) was used to determine a, b and K.

RESULTS

- The best fitted values for a = 0.200; b = 0.642 and K = 12.01 giving the formula $D_s = 12.01 * F^{0.200} * WPS^{0.642}$
- A tool for prediction of the necessary increase in F-value in NaCl-reduced luncheon meat (F-value: 0.51-3.25 and aqueous salt: 1.66-3.54)
- Accuracy factor = 1.21 and Bias factor = 1.15 (fail safe model)
- The F-value calculator is available at http://dmripredict.dk

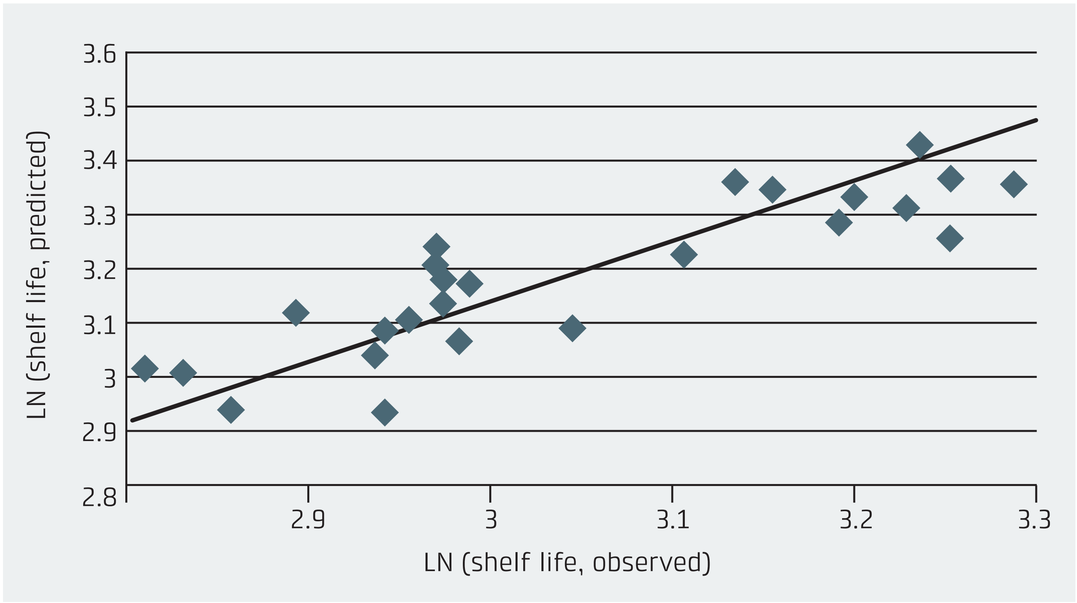

Figure 1. LN of predicted shelf life vs. observed, Calibration set (N=26). R^2 = 0.75

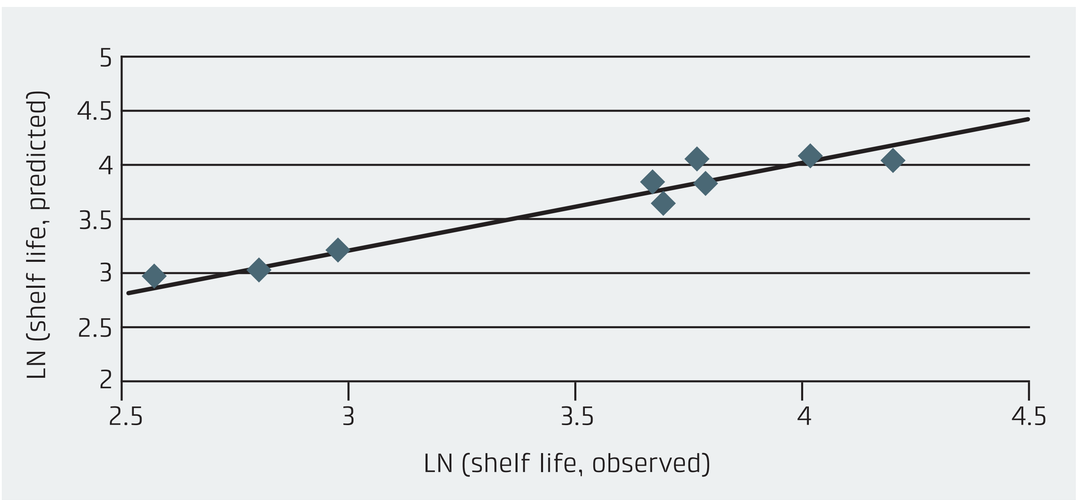

Figure 2. LN of predicted shelf life vs. observed, Validation set (N=11). R^2 = 0.96

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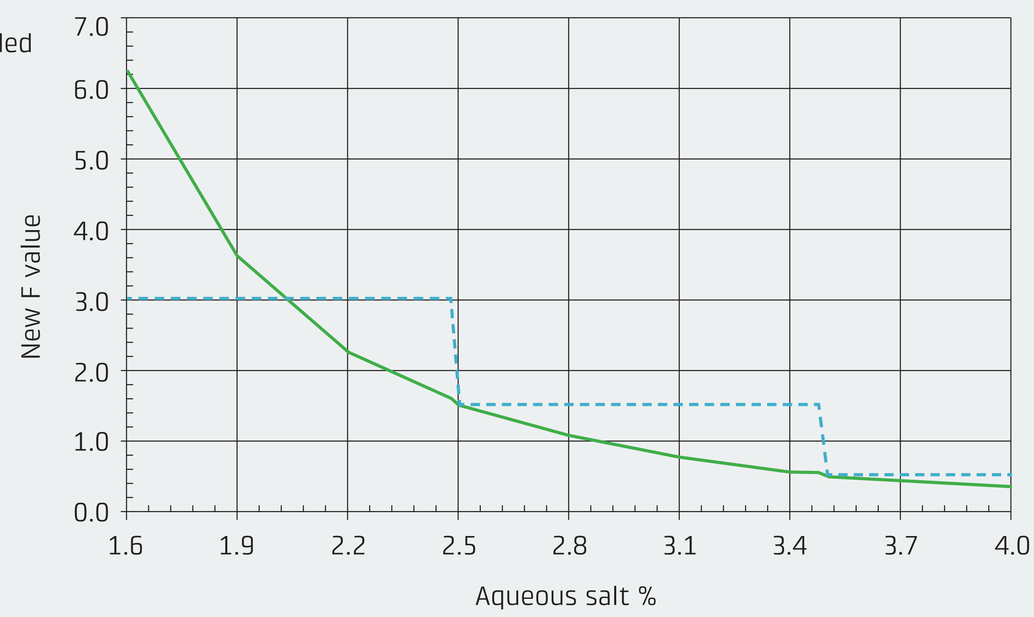
In-put values

Actual aqueous salt	Actual F-value	Requested aqueous salt
3.5	0.5	2.4

Out-put values

Necessary F-value	
1.68	
Log reduction *C. botulinum*, initial F-value	Log reduction *C. botulinum*, new F-value
2.4	8.4



Figur 3.
Example of user interface from the "F-value calculator". Full line shows combinations of aqueous salt and F-value having equal protection as a meat product with 3.5% aqueous salt, heat treated to F = 0.5.

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