

1. TITLE: MICROWAVE PROCESSING FOR COOKED HAMS

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2. KEYWORDS: COOKED HAM; BRINE; PROCESSING; MICROWAVE**3. BACKGROUND:**

The usual processing of cooked hams in steam or in a steam heated water bath is long lasting, involving large costs in time and energy. Aiming to minimise these costs, we have assayed a method for rapid cooking, replacing the usual steam heat generation by microwave heating.

4. OBJECTIVES:

Shortening the cooking and the overall processing time for cooked hams.

5. METHODS:

One kilogram pieces of mechanically deboned pork ham meat, injected at 60 % (w/w) with a commercial curing brine ^(a), were tenderised, tumbled and stuffed into Cryovac BC300 casings, suitable for direct cooking.

A comparative study between the usual heating operation of the water bath and the one using microwaves was performed: in the usual processing, 1kg pieces of the above mentioned cured ham meat (at a temperature of 7°C), were cooked in a water bath steam-heated at 72°C for as long as 70°C was reached at the coldest point of the product, and 66°C held by at least for 20 minutes; for microwave cooking assays, twin pieces were immersed in tap water held at 72°C in a glass container immediately transferred to a microwave oven, operated at the maximum energy level till to obtain the same heating temperatures of the conventional processing.

All pieces were immediately cooled at + 7°C in iced water and stored in the fridge at + 2°C.

^(a) Courtesy of Dr. Jorge Brandão, Fricarnes S.A., Mem Martins, Portugal.

Temperatures were controlled by thermometers suitable for microwave heating, the bulb placed near the centre of the pieces.

Twin samples from the two ways processed pieces were tested by gravimetric (weight loss), sensorial (appearance, colour, odour, taste, texture), microbiological (total plate count, coliform and *E. coli* bacteria, *Clostridia* spores, *Staphylococci*) and chemical (moisture, fat, protein, ash, carbohydrate content) analysis, against the same microbiological tests performed on the starting raw cured ham meat.

6. RESULTS AND DISCUSSION:**Cooking time**

In the steam heated water bath the temperature of 70°C in the thermic centre of the product was reached in two hours.

In the microwave heated the same temperature was reached in 35 minutes.

Cooling time

The temperature of 7°C was reached in 5 hours for both groups of pieces.

Yield

There were no significant losses of weight, both cooking procedures holding all the brine water injected into the meat.

Sensorial Analysis:**Table I**

A panel of seven trained people performed a triangular assay: three samples (100 g of 1 mm thick ham slices), two of them sampled from the meat portions cooked in steam heated water bath and one from those cooked by microwaves. Every panellist retrieved the different ham (milder pink colour of the microwave processed). In a second round, the following attributes: appearance, colour, texture, odour and taste, were rated zero to five. The panel gave the same total mark for both cooking procedures, rating higher for texture the microwave processed. The stronger pink colour of the conventionally cooked was preferred, long lasting heating improving the yield of the N-haempigments formed.

Table I - Effect of treatment on the sensorial attributes of cooked pork ham

Treatment	Appearance	Colour	Texture	Odour	Taste	Total
Water bath	4.5	4.5	4.5	4.5	4.5	22.5
Microwave	4.5	4.5	4.5	4.5	4.5	22.5
Water bath	4.5	4.5	4.5	4.5	4.5	22.5
Microwave	4.5	4.5	4.5	4.5	4.5	22.5

Microbiological Analysis:

Table II shows that conventional and quick microwave cooking of raw cured meats with similar microbiological content has produced an equivalent killing effect, the remaining flora being within the microbiological specification of this staple which is expected to have a shelf-life of 4 months under refrigeration at 0-5°C.

7.CONCLUSIONS:

Microwave cooking of 1 kg pieces of cured ham meat shortens the processing time, without remarkable changes in yield, sensorial, microbiological and chemical specifications, affording low cost in time and energy for similar yield, acceptance and shelf-life.

8.PERTINENT LITERATURE:

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9.DATA TABLES

TABLE I: Sensorial analysis

	Appearance	Colour	Odour	Taste	Texture
Steam Heating	4	4	4	4	3
Microwave Heating	4	3	4	4	4

TABLE II: Microbiological Analysis

	Total Plate Count CFU/g	Coliforms/g (30°C)	Faecal coliforms/g (45,5°C)	Sulfite Reducing <i>Clostridia</i> spores/g (44°C)	<i>Staphylococcus aureus</i> /g
Raw Brine Cured Ham Meat	$3,3 \times 10^5$	$>10^2 <10^3$	$<10^2$	<10	<1
Steam Heating	10^2	<10	<1	<1	<1
Raw Brine Cured Ham Meat	$6,8 \times 10^5$	$<10^2$	$<10^2$	<10	<1
Microwave Heating	$3,5 \times 10^2$	<10	<1	<1	<1

TABLE III: Chemical Analysis (%)

	Moisture (Weight loss 105°C)	Crude Protein (Nx6.25)	Fat (Ether Extract)	Total Ash	Carbohydrate
Raw Brine Cured Ham Meat	78,0	14,68	2,6	3,83	0,9
Steam Heating	77,2	14,96	2,5	3,81	1,5
Microwave Heating	76,0	16,69	2,5	3,39	1,4