USE OF BIG SIZE CONTAINERS FOR CURED CANNED MEAT.

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SUMMARY: This paper studies the use of 603 x 900 tins for chopped pork. It was found that convection was the prevailing mechanism. It was determined that the heat treatment for the product was 67 min. at 121 ºC for a tropical conserve, (Ft = 11) with cooling for 57 min. Incubation tests at 37 and 55 ºC were negative. Sensorial assesment provided good results. Firmness measured as the maximum shearing strength was 57 kg.

INTRODUCTION: The application of heat in the preservation of food allows to obtain food products fit for long storage. The so-called commercial sterility enables to remove viable organisms and prevent spore growth in non-cold storage conditions as reported by Stumbo (1973) and León (1983).

Container capacity used in the meat industry is highly varied and heat treatment is associated with container size, which ranges from 0,12 to 4 kg.

There are reports in the literature on the use of No. 10 cans (603 x 700) for canning chile con carne, meat with vegetables and fish products (López, 1987). In addition, No. 12 cans (603 x 900) are regularly used in the vegetable industry for packing tomato and pepper paste.

Our industry supplies a variety of canned meat products designed for social consumption which could be packed in No. 12 cans, such as chopped meat in brine. The objective of this paper is precisely to determine their heat treatment.

MATERIALS AND METHODS: This paper studies the possibility of using the 603 x 900 (No. 12) can plate container for the product chopped pork for being the one with the highest volume of industrial production and being designed for social consumption.

For studying heat treatment it is necessary to take a deep insight into two aspects:

a) To define the heat delay point and to establish the heat transfer mechanism that controls the process in this product.
b) To determine the sterilization parameters.

a) <u>Determination of the slowest heating point.</u>

The procedure used in this study has been described elsewhere (Ball, 1951; Stumbo, 1973). Chopped pork was mixed with 2,2% common salt and 0,25% curing salt; water at ambient temperature was added until the 80/20 meat-water ratio was reached.

Five experimental runs with two containers each were made. Thermocouples were placed inside the containers (geometrical center of the container and 1/4 away from the bottom) and readings were made every two minutes by means of an electric thermometer. This procedure was carried out in a static retort at 121 ºC with water until temperature in the container reached 2-3 ºC under sterilization temperature. Then it passed to water cooling to ambient temperature and overpressure air, until temperature in the target points was lower than 50 ºC (Stumbo, 1973; Felmingham, 1974 and López, 1987).

With the time-temperature data for each position, we proceeded to straight line adjustment by linear regression and thus the correlation factor for each one of them were found. From the adjusted straight lines, the mean heating rate (fh) for each position was determined. They were compared by means of Student´s t test and the point of highest heat delay was determined.

b) Determination of sterilization parameters.

Containers were packed with meat and brine at 95 ºC and a 15 minutes exhauster time at 90 ºC was used.

Afterwards, thermocouples were placed in the coolest spot of the container in order to derive the time-temperature data at 121 ºC. Six experimental runs were made with five containers each, making two readings from each run and obtaining twelve readings of the critical point.

The process was designed bearing in mind the minimum sterilization value (F) required for **Clostridium botulinum** (2,52 min). Accordingly, the heating stage was stopped when the product reached a heating F-value = 4, which ensures the 12D concept as the minimum reported by Stumbo (1973), León (1983) y López (1987). Cooling is made at overpressure with air and water until a temperature lower than 50 ºC is reached.

The total sterilization value (Ft) was calculated as the sum of the lethal rates accumulated in heating (Fc) and cooling (Fe) (Stumbo, 1973; Wirth et al., 1981; Sliebing, 1985 and López, 1987) according to the method developed by Patashnik (1953).

Incubation tests were made at 37 and 55 ºC for 10 days (Horwitz, 1980) with the sterile containers. Additionally, the presence of aerobic and anaerobic sporulated organisms was determined.

The sensorial test of the manufactured product was made according to a scale of 7 points (by attributes) ranging from excellent to extremely bad.

We determined as control parameter the maximum shear strength (by means of Kramer´s cell in an INSTROM No. 1140 Universal texturometer, at a rate of 10 cm/min) and its value was compared to that of the traditional product packed in a 300 x 409 cans.

RESULTS AND DISCUSSION: Values of heating rate (fh) calculated for the positions studied (table 1) indicate that the point of greater heating delay is found at 1/4 of the height from the container bottom ($p < 0,01$), so the prevailing heat transfer mechanism is convection.

This is in agreement with the views of Stumbo (1973); Lund (1975) and Flaumenbaum (1981) related with behaviors distant from the purely conductive and convective due to the characteristics of the product (chopped pork in brine).

Rodrigo et al (1982) suggest a dependence on the solid-fluid ratio. In the experiments, we started from a 80/20 meat/water ratio and at the end a 56/44 ratio with 30% of juice release. Lawrie (1987) says that meat-released fluids under these temperature conditions may amount to even 60%, inducing the prevalence of convective currents in the system.

Table 2 shows the results of the process parameters. After the exhauster, temperature in the cold point was 48 ºC on the average. Eventhough the 60 ºC temperature proposed for this container size was not reached (López, 1987), the exhauster helps to reduce the length of time of the process due to the dependence among the length of time of the process, F-value, and the initial temperature of the product. F-value for 4,47 average heating is a guarantee for the process, since it represents 60% above the value required for destroying **Cl. botulinum** (2,45 min). In spite of not being the most heat-resistant, **Cl. botulinum** is the only organism that may produce toxins and is able to multiply itself in a weakly acid medium (Flaumenbaum, 1981; Michiels, 1982). This sterilization value continues to increase up to total average values of 11,6 to obtain a commercial sterility according to Ingram classification (1977). This value agrees with that proposed by Stumbo (1975) for No. 10 containers. The length of time required for obtaining this F-value is 67 min. at 121 ºC and a safe product is obtained due to the negative results of the incubation tests at 37 and 55 ºC.

Results of the physico-chemical analysis are within the standardized parameters for this product. 3,1% of brine in the finished product is comparable to that reported by Hauschild (1985) for similar products, which together with pH values, meet Leistner (1970) requirements in his obstacle theory.

In sensorial test, mean values of 6 and 5 were obtained in flavour and taste respectively; 5,8 was found for consistency for a product from "good" to "very good".

The values of texture test (Table 3) indicate that there are no significant differences in the hardness of the products treated with heat in both types of containers.

CONCLUSIONS: The 603 x 900 can may be used in meat products, with convection being the best transfer mechanism in the case of chopped meat. The heat treatment required is 67 min at 121 ºC with 57 min of cooling time.

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Table 1.- Average heating rate values at different positions.

	correlation coef.	fh
geometrical center	0.984	98.24[a]
stand. dev.		5.39
¼ away from the bottom	0.978	310.25[b]
stand. dev.		8.04

[a],[b] Mean values without letter in common differ at p<0.01

Table 2.- Average process parameter values.

	initial temp.(ºC)	process time(min)	internal temp.(ºC)	cooling time(min)	F-value
Mean value	48.9	67.8	117.1	57.4	11.66
Standard dev.	6.64	10.08	1.2	7.35	1.62

Table 3.- Average textural values.

Container	hardness (kg)	significance
300 x 409	88.67	N.S.
603 x 900	97.07	