STUDY OF A TRADITIONAL INTERMEDIATE MOISTURE MEAT PRODUCT: "TASAJO". I.-PROCESSING METHOD AND CHEMICAL COMPOSITION

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INTRODUCTION

Preserving meat through combined salting and drying is a very old practice: South American **charqui** (Berberien, 1971); North American **pemmican** and **jerky** (Acton and Dick, 1976); South African **biltong** (van der Riet, 1982) and Central European **bundnerfleisch** (Souci **et al.**, 1968) are all classical examples of meats preserved through this simple but efficient procedure.

Food technology has evolved, particularly since the advent of mechanical refrigeration, towards milder preservation techniques, less dependent on intense salting, drying or smoking. Consumer preference has trailed, tending to favor foods of milder flavors and textures, which can be kept fresh for longer periods, even though they are more perishable. Consequently, not much research is done nowadays on traditional products.

Studies carried out on traditional food preservation methods improve our understanding of the basis for their effectiveness (Shin **et al.**, 1985) or lead to alternative products, obtained through more productive or controllable technologies (Rath, 1980).

The **tasajo** manufactured in Cuba is a version of South American **charqui**: sun-dried, salted beef (Bifani **et al.**, 1984). It is a very expensive product, made from prime beef cuts, with a very low yield (typically 45-50 % on the green weight), through a slow and laborious process. The product develops a very peculiar flavor, highly appreciated by many consumers.

The aim of this paper is to describe the processing method usually employed in Cuba and present data on the chemical composition of the product.

MATERIALS AND METHODS

A survey was made of the variants of the traditional 30-day process usually employed by different manufacturers.

The basic manufacture procedure is as follows: prime beef joints are cut in large sheets (or "blankets", as they are called) of meat, of variable size, but with a maximum width of 3-4 cm. Each "blanket" is spray-pumped in 6 to 8 points with a 20° Bé. brine, up to a 20 % weight increase, and is left immersed in a brine of the same concentration, at 2°-4° C, during 3 to 5 days.

The meat "blankets" are then drained, rubbed with coarse-grain salt and put into salting vats, completely covered with salt, alternating layers of salt and meat, also in refrigeration, for 4 days. They are then washed with brine to remove the adhering salt and are set for sun-drying.

The meat is exposed horizontally to the sun, in such a way that the shadow side is also well ventilated. During the day (which counts as one "sun" as to the drying process), the "blankets" are turned over once, so that both sides get the same degree of exposition to the sun.

At the end of every day of drying, the product is stored indoors, piled up under heavy weights, in an effort to "press it out".

In those conditions, the product receives three "suns" during the first week of drying, followed by four hopefully consecutive ones. Cloudy days are traditionally counted as "half-suns", the same as partial sun exposures due to afternoon showers, very common in the summertime. Tradition calls for a "seven-sun" process, which is usually applied over a 20- to 30-day period.

Moisture (AOAC, 1980), fat (ISO, 1973), crude protein (N x 6.25; ISO, 1978), NaCl (Venegas & Andújar, 1979) and pH determinations were carried out on samples taken daily from a production line, along the process of four batches selected over a 10-month period.

Samples of at least 500 g were passed three times through a meat mincer with a 3 mm plate, mixing thoroughly after each operation. The homogenized samples were packed in plastic bags and kept in frozen storage until analyzed, not more than a few days later.

Quality control lab results for moisture, NaCl, $NaNO_2$ and pH of the finished product over a 5-year period were also compiled and analyzed.

The water activity of the finished product was measured with an electronic hygrometer (Novasina, Zürich).

RESULTS

Table 1 shows quality control laboratory results for pH, moisture and NaCl content in finished **tasajo**.

Table 1.- Results of chemical analyses by the quality control laboratory in samples of finished **tasajo**.

	pH	Moisture	NaCl	NaNO2
Mean value	6.0	30.1	23.4	18.3
Std. dev.	0.19	7.79	5.70	7.05
No. of samples	69	72	75	10

$NaNO_2$ analyses were discontinued early in this plant, since results showed levels to be much lower than the permissible limit.

The most remarkable aspect of these results is their considerable variability. Except for pH, standard deviations range from 25 to 38 % of the mean value. This is typical of the product, as it will be further demonstrated later on, and is due to a great number of sources of variability throughout the process, from the unevenness in the thickness of the meat "blankets", to the unpredictability of the drying conditions.

Figure 1 shows the pH value of tasajo samples in-process. Results show no definite trend, whereas variability is considerable. The lack of a tendency towards acidification is consistent with the absence of sugars in the formulae, but a moderate rising of pH would not have been surprising (Körmendy & Gantner, 1962; Mihalyi & Körmendy, 1968). The extremely high NaCl concentrations reached in the product might bear significance in this respect.

Figure 2 shows the variation in moisture content of **tasajo**, expressed on a fat-free basis, during its manufacturing process. Moisture loss is almost linear with time, not restricted to the sun-drying phase, but rather beginning at the very start of the process. This is due partly to a dilution effect on the meat components, caused by salt absorption, and also by an actual loss of water to the immersion brine. The brine used in the process has a concentration of 20° Bé (**ca.** 21.5 % salt, w/w), just above the lower limit reported by Callow (1931) to cause this effect.

The variability appreciated in Table 1 is confirmed here, probably due, not only to the unevenness in the thickness of the meat "blankets", but also to irregular fat covering, variations in brine injection level between pieces of meat and even between separate portions of the same piece and lack of reproducibility in drying conditions.

Salting times, for instance, varied during the time of the experiment between 4 and 10 days, whereas 4 should be the maximum.

Figure 3 presents the variation in the concentration of NaCl in the "brine" of the product:

$$\frac{\%\ NaCl}{\%\ NaCl + \%\ H_2O}$$

After only about 3-4 days processing, a "brine" concentration of 15 % is reached, corresponding to a aw of ca.

0.85, according to the estimation procedure of Krispien **et al.** (1979). This level of aw is generally recognized as safe for the preservation of meat products at ambient temperature (ICMSF, 1980).

In the final stages of the process, the so called "brine concentration" in the product is higher than salt solubility would allow. This only reflects the fact that solid salt is present in the product.

Aw measurements in samples of finished product gave a result of 0.74, corresponding to the aw of saturated brine.

In Figure 4, NaCl data are presented as % of the non-fat solids. Thus expressed, this concentration increases very rapidly during the first 4-5 days, after which it varies considerably, but around a rather constant value of 45-50 %.

This may be due to intense salt absorption during the first stages of the process, particularly during immersion in brine. During dry salting there is also salt absorption, but some osmotic drying also occurs (brine exudation, actually), so that the proportion between the salt and the rest of the solids remains more or less constant.

Figure 5 shows the variation in protein content during the process. Apart from the great variability between samples, it can be appreciated that, as the process advances into the drying phase, the tendency towards an increase in protein content (due to a simple concentration effect) becomes more obvious.

Extrapolating the trend in the graph would give about 35 % protein in the product after 30-day processing, which is normal.

Proximate composition of the product is easy to estimate from data such as those in Table 1. It is enough to start with the composition of lean muscle and allow for expected salt level and a drying loss usually around 50 %. Table 2 shows the result of one such estimation, together with actual analytical results of two samples, one of them of Cuban **tasajo** and the other of a similar product from Brazil: **charqui**.

Table 2.- Proximate composition of **tasajo**. "A": estimated data; "B": actual sample of Cuban **tasajo**; "C": sample of Brazilian **charqui**. Data in g per 100 g sample.

	Moisture	Protein	Fat	NaCl
A	33.6	39.2	3.6	22.0
B	33.6	39.6	3.1	20.3
C	44.3	25.7	12.6	15.7

The most significant difference in composition between the Brazilian sample and the other data lies in the moisture results. If the Brazilian sample had been dried to a further 20% weight loss, its moisture content would be 30.4 % and its salt content 19.6 %, quite similar to the other two. The higher fat content of the Brazilian sample would explain its lower protein content.

Thus, obtaining a more stable product is basically a matter of controlling salt absorption and drying loss, something that can be done properly, in a much shorter time than is done at present.

CONCLUSION

Although the results of the survey followed reasonable overall trends, sample-to-sample variation is considerable, due not only to raw material variability, but also to lack of regularity in the manufacturing process.

Adequate control of salt absorption and drying loss should suffice to ensure a much more stable composition of the product, while processing times can probably be shortened substantially.

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Figure 1.- pH vs. processing time
"Tasajo" manufacture

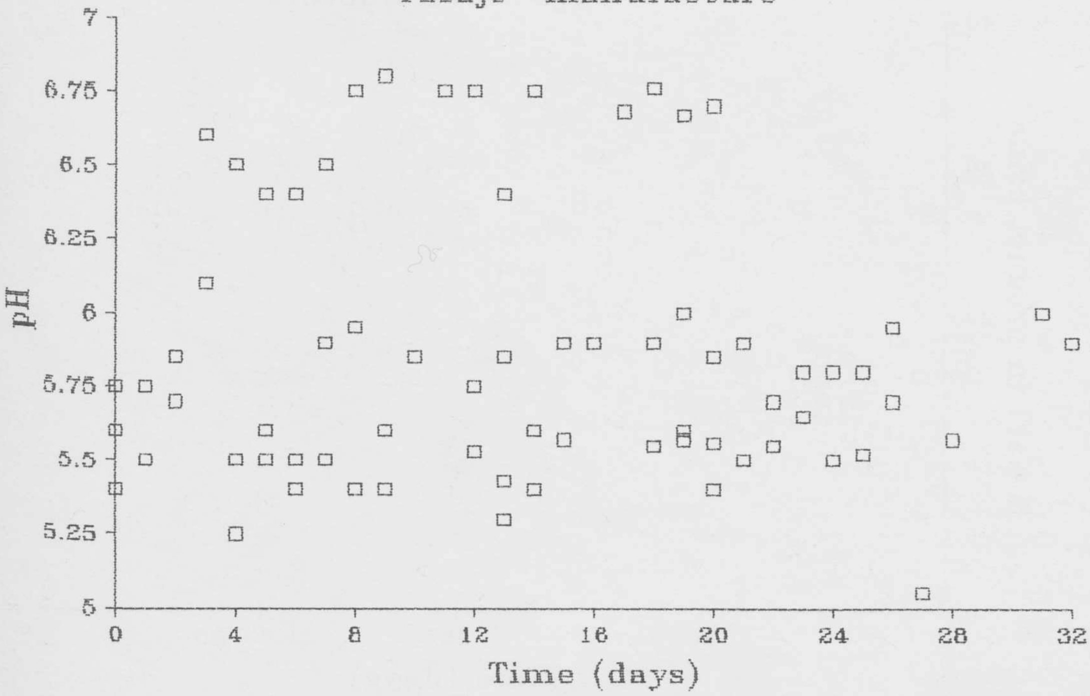

Figure 2.- Moisture loss in processing
"Tasajo" manufacture

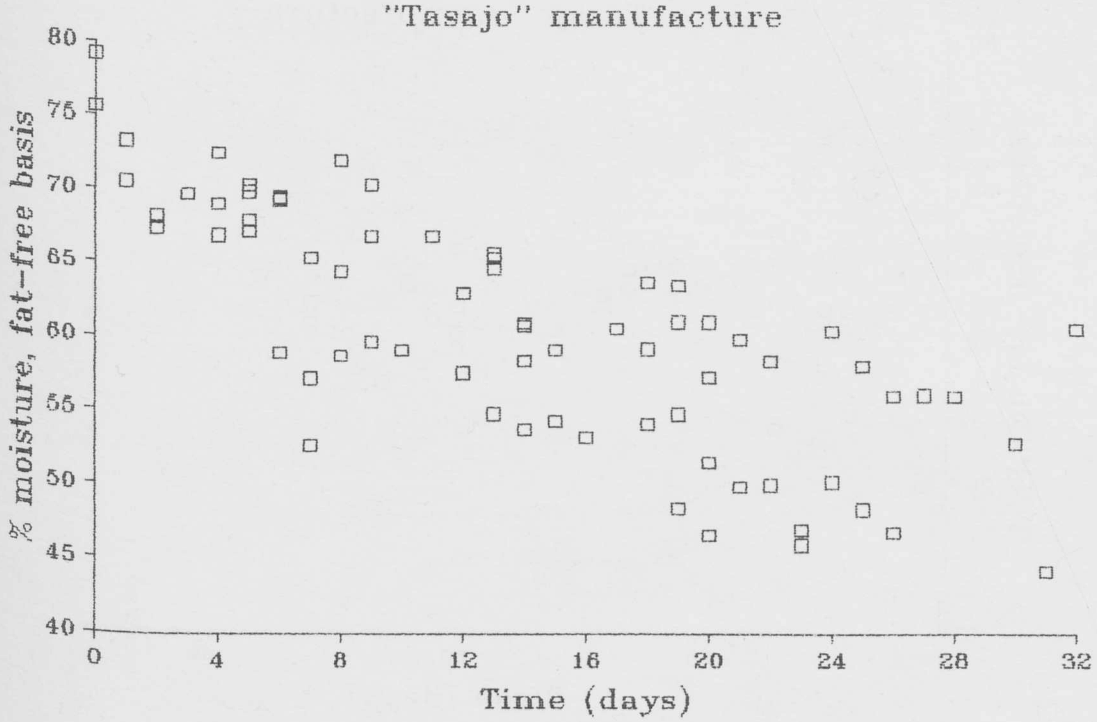

Figure 3.- NaCl in product brine

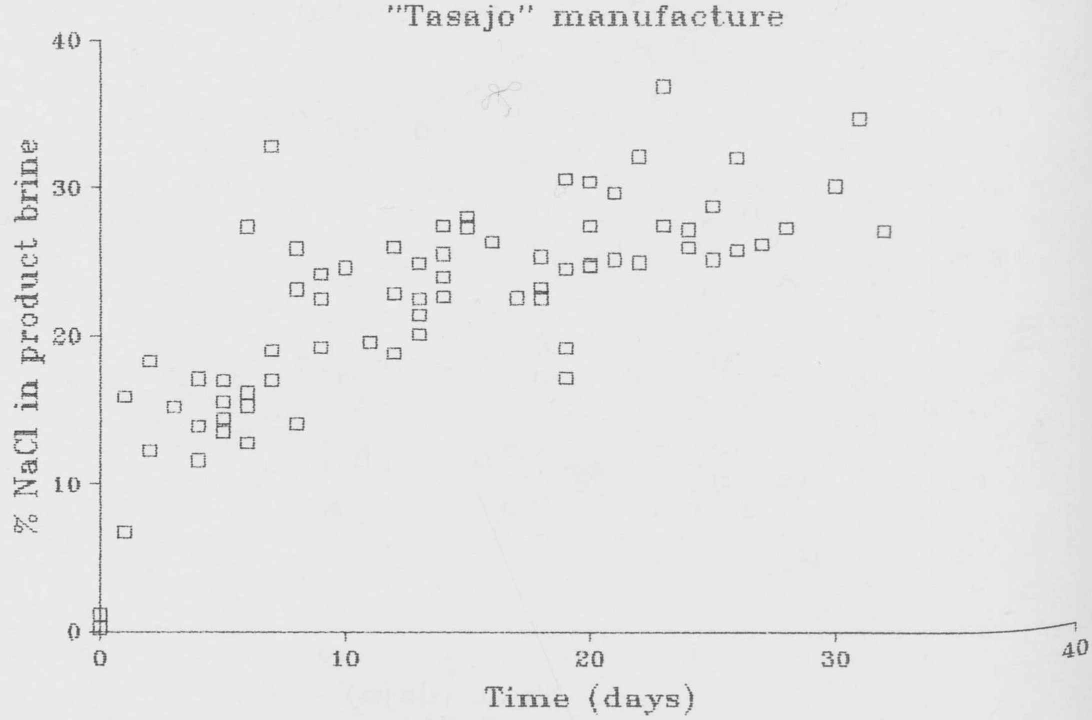

Figure 4.- NaCl as % of fat-free solids

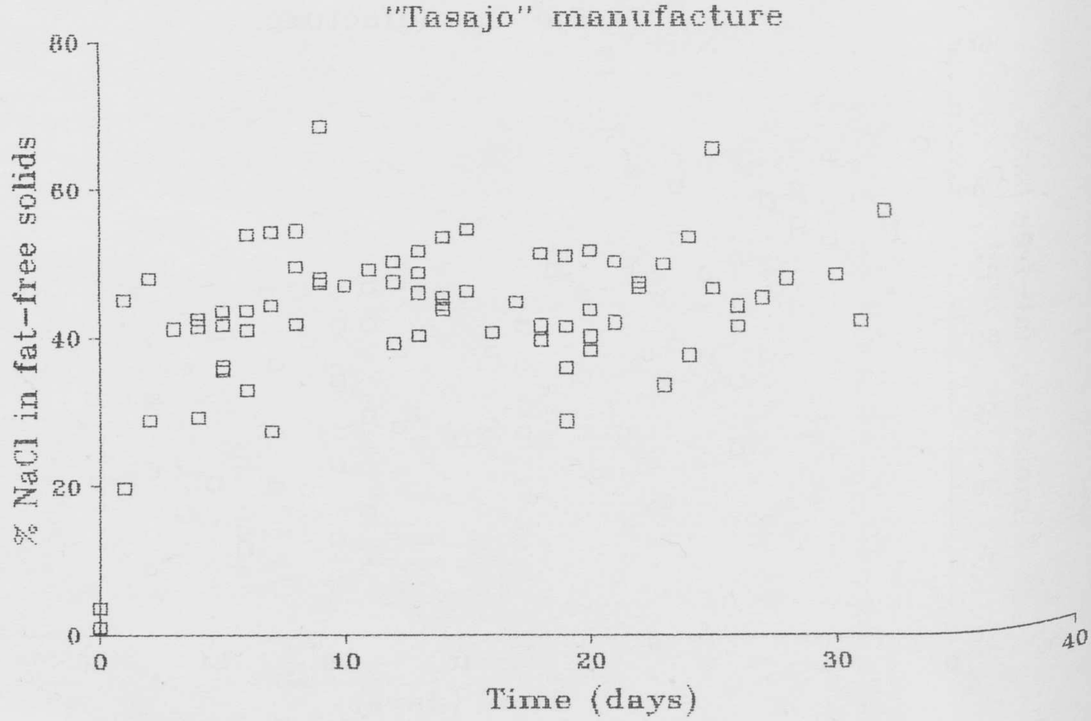

Figure 5.- Crude protein, fat-free basis

"Tasajo" manufacture