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**METHODS OF CURING LAMB FOR FARM
FAMILY USE IN OKLAHOMA**

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Methods of Curing Lamb for Farm Family Use in Oklahoma*

By J. A. BEALL and DAISY I. PURDY**

THE PROBLEM

The experimental work reported in this publication was undertaken in an effort to find a method of handling or preserving lamb under farm conditions in Oklahoma. It was not intended to evolve a method of curing lamb commercially, or of storing it for long periods of time.

This experiment was also designed to determine the chilling temperature that may be used under farm conditions at different seasons, and to determine the value of salting meat while hot as practiced by a good many farmers of this section. It was undertaken to ascertain the percentage of shrink in lamb by the dry and brine methods of curing and the effect of this shrink upon the cooking loss. An effort was also made to work out some recipes to facilitate the use of and increase the consumption of cured lamb.***

REVIEW OF LITERATURE

The Bureau of Animal Industry (1) conducted studies in curing and aging lamb with varying results. A sweet pickle with a salinometer reading of 75°, made of 6 pounds of salt, 3 pounds of brown sugar, 3 ounces of saltpeter, and water, was used at a temperature of about 38° F. All cuts were then smoked for a uniform period. Loins cured for 20 days in this pickle were judged to be too salty and of poor quality, especially with reference to flavor of fat, when boiled 21 days after removal from cure. Legs, weighing up to 6 pounds, cured for 29 days were judged as palatable though slightly too salty after 11 days storage; and such legs were unsatisfactory after 89 days storage, due to excess saltiness and to rancidity. Legs weighing more than 6 pounds, cured for 45 days, and boiled 7 days after removal from cure were judged more palatable than the lighter weight legs. After 105 days stor-

* Lamb-curing methods recommended as a result of the tests reported in this technical bulletin are described in Oklahoma Agricultural Experiment Station Bulletin B-264, "Cured Lamb for Variety in Oklahoma Farm Meals," by J. A. Beall and Daisy I. Purdy.

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*** The recipes which were developed are given in Bulletin B-264.

age these heavier legs had decreased in palatability, though they were still superior to the lighter legs. The salt content of the cuts ranged from about 8 to 10 percent as they came from the smokehouse and from 10 to 12 percent as they came from storage.

The Bureau of Home Economics (2) studied about 350 cuts of meat from experimental animals to determine their palatability as affected by the feed, sex, and age of the animals and the curing and storing methods used.

As part of the studies of lamb and mutton cured and stored for varying lengths of time, loins, legs weighing up to 6 pounds, and legs weighing more than 6 pounds were cooked for palatability tests. On the whole, the results indicate that with the methods employed it is impracticable to store the cured loins and that cured legs can be stored successfully for a short time, but that heavyweight legs were more palatable than lightweight legs. The fat of cured lamb and mutton, however, soon became rancid, presenting serious problems and confirming previous work.

The palatability records of 1,222 legs of lamb have been summarized by Warner and Alexander (5) to study the effect of ripening upon the tenderness of the meat. Comparisons were made to see whether the consumer would obtain a more desirable product from lamb that was freshly chilled or from lamb that had been ripened for a definite length of time. All these 1,222 legs of lamb were cooked and sampled under as nearly the same conditions as could be maintained according to the directions given in the project outline of cooperative meat investigations.

The judges used a cooked-meat grading chart (3) adopted for the cooperative meat investigations project. The ratings were recorded by consecutive numbers from 1 to 7 on the following descriptions: extremely tough, very tough, tough, slightly tough, moderately tender, tender, very tender.

Mechanical tests were made in addition to the chewing tests and were recorded as "shearing strength." Low tenderness scores were associated with high resistance to shearing and vice versa. The results of the judges and mechanical tests revealed no significant difference between the average tenderness of the left legs and that of the corresponding right legs.

The results in this experiment showed that, on the average, ripening for from 7 to 10 days after slaughter increased the tenderness of legs of lamb, but after 10 days little change was found.

EXPERIMENTAL PROCEDURE

In the first year's tests, 24 "good" western lambs, fattened on corn and alfalfa hay, were selected and divided into four lots of six each. The allotments were made on a basis of sex, weight, grade, and probable killing qualities. All lots were slaughtered under identical conditions insofar as possible, and were then chilled as follows:

- Lot I Chilled 48 hours at 35° F.
- Lot II Chilled 12 hours at 35° F.
- Lot III Chilled 12 hours at 70° F.
- Lot IV No chill. Placed in cure immediately.

The carcasses were cut according to the standard method and the lots sub-divided into two groups each. One of the sub-groups of each lot was cured by the 5-4-2 dry method and the other was cured by the 8-2-2 brine method (U. S. D. A. Farmers Bulletin 1172). When the lamb had received the designated 30-day cure it was given a cool smoke and stored at room temperature for 7 days.

The methods used in cutting, grading, slaughtering, sampling, cooking and palatability tests were those adopted by the Cooperative Meat Investigation Committee (3). Only the legs were used in these tests, and their average weight was about 5½ pounds each. The curing temperature was held at approximately 34° F.

The test was repeated in the following year, but with some variation. In the first year's experimentation, brown spots were noted around the bone of the cured legs, indicating that there had not been complete salt penetration. To test the original formula more thoroughly, the legs from the 24 lambs were divided into four lots for the curing, as follows:

LOT I (Check Lot)

6 gal. water.
8 lbs. salt.
2 lbs. sugar.
2 oz. sodium nitrate
30 days in cure.

LOT II

6 gal. water.
8 lbs. salt.
2 lbs. sugar.
3 oz. sodium nitrite
30 days in cure.

LOT III

6 gal. water.
8 lbs. salt.
2 lbs. sugar.
3 oz. sodium nitrate
30 days in cure.

LOT IV

6 gal. water.
8 lbs. salt.
2 lbs. sugar.
2 oz. sodium nitrate
40 days in cure.

The brine method and the 35° F. chill at 48 hours were used, that being the most desirable combination from the standpoint of flavor, shrinkage, and uniformity of cure.

The cuts were removed from the cure after the allotted time, soaked for two hours in lukewarm water, allowed to dry overnight, and given a light smoke. After seven days the legs were cut through the thickest point parallel to the aitch bone and salt penetration measurements were made by tracings.

The data for the two years were combined and analyzed as one. Analysis of variance was made according to Snedecor's (4) method.

RESULTS AND DISCUSSION

There was very little difference in the results obtained in the first year as compared to those obtained in the second. In most cases the different factors studied reacted about the same between the cures and between the temperatures, except that in the second year the difference between the effect of the cures on the flavor of the fat was slightly more significant in favor of the brine; the difference in temperature was slightly more significant in favor of the 48-hour chill at 35° F.

Aroma

The data indicate that there is no significant difference in aroma between the cures. Both the dry and the brine cure gave about the same results with each chilling method. The effect of temperature on aroma was quite highly significant, as indicated by Table I.

TABLE I.—*Effect of Chilling Temperature on the Odor of Cured Lamb Legs.*

		DEGREE OF ODOR	TYPE OF ODOR
Lot I	(48 hours at 33° F.)	4*	Briny, fresh to sweet
Lot II	(12 hours at 35° F.)	4	Pungent to sweet
Lot III	(12 hours at 70° F.)	3*	Spilled, stale, flat, musty, sour and rancid
Lot IV	(No chill)	4	Spilled, flat, musty, rancid

* Sheet 5 of the Grading Chart for Cooking Cured Meats, recommended by the National Meat Investigations Committee (3), designates 4 as slightly pronounced and 3 as perceptible.

The interaction of the legs to the different conditions of cure and temperature was quite uniform in the first year, but some difference in the second year was probably due to error.

The texture of the meat did not seem to be significantly affected by either the chilling temperature or the storage method.

Flavor of Fat

In the matter of fat flavor there was very little difference between the cures, especially the first year. However, in the second year a slightly significant difference was found in favor of the brine cure. The flavor was less pronounced and just a little sweeter. The influence of temperature on the flavor of fat was highly significant, as indicated by Table II.

TABLE II.—Effect of Chilling Temperature on the Flavor of Fat in Cured Lamb Legs.

		DEGREE OF FLAVOR	TYPE OF FLAVOR
Lot I	(48 hours at 35° F.)	5.5*	Sweet flat to slightly stale
Lot II	(12 hours at 35° F.)	4*	Sweet pungent, flat to sour
Lot III	(12 hours at 70° F.)	4.4	Musty, stale and spoiled
Lot IV	(No chill)	4	Sour, flat, stale to spoiled

* The official score sheet designates 5.5 as moderately pronounced and 4 as slightly pronounced.

Flavor of Lean

The flavor of lean seemed to be more markedly affected by the types of cure and the chilling temperature than by the other factors studied. There was a significant difference between cures. In every case the more desirable flavors were obtained in the brine-cured lots. Spoiled and musty flavors appeared first in the dry-cured lots.

Table III indicates the greater desirability of the longer chilling period upon the flavor of the lean, in both the dry and brine curing methods.

TABLE III.—Effect of Chilling Temperature Upon the Flavor of Lean in Cured Lamb Legs.

		DEGREE OF FLAVOR	TYPE OF FLAVOR
Lot I	(48 hours at 35° F.)	4.5	Flat, stale, sour
Lot II	(12 hours at 35° F.)	3.7	Flat, sour, musty
Lot III	(12 hours at 70° F.)	4.2	Pungent, sweet, briny
Lot IV	(No chill)	4.1	Pungent, sweet

Tenderness

Tenderness, another point studied, showed a highly significant difference between cures both years. Nearly all of the judging committee scored the brine-cured lots as tender and dry-cured lots as moderately tender.

There was no significant difference in juiciness of the different legs, either between cures or between chilling temperatures. The higher percentage of shrink ordinarily expected by dry-cure methods was true in this case. The dry-cured legs shrunk 11.5 percent and the brine-cured legs shrunk 5.7 percent while in cure. Shrink in curing does not seem necessarily to give a less juicy finished product, which is probably accounted for by the fact that the shrinkage loss in cooking is so much greater in the brine-cured legs.

TABLE IV.—Average Cooking Loss in Lamb Legs by Dry and Brine Method of Curing.

		Cooking Loss (Percent)
Brine Cure	Lot I (48 hours at 35° F.)	6.76
	Lot II (12 hours at 35° F.)	7.30
	Lot III (12 hours at 70° F.)	4.86
	Lot IV (No chill)	4.50
Dry Cure	Lot I (48 hours at 35° F.)	4.25
	Lot II (12 hours at 35° F.)	3.70
	Lot III (12 hours at 70° F.)	2.60
	Lot IV (No chill)	1.36

Salt Penetration

Lot I, or the check lot, seemed to have the poorest salt penetration of the group as noted by the large unshaded area in Figure 1. Lots II and III, Figs. 2 and 3, were about the same in the penetration of cure, and were more completely cured than Lot I. This seems to indicate that a little more sodium nitrate or nitrite is desirable from the standpoint of complete coloration.

All of the legs in Lot IV, Fig. 4, were completely cured, which fact leads to the conclusion that 40 days may be a more desirable length of time to leave lamb legs in an 8-2-2 curing solution than the original 30 days. It would also appear that time is more effective in salt penetration in lamb legs than is higher concentration of nitrates or nitrites.

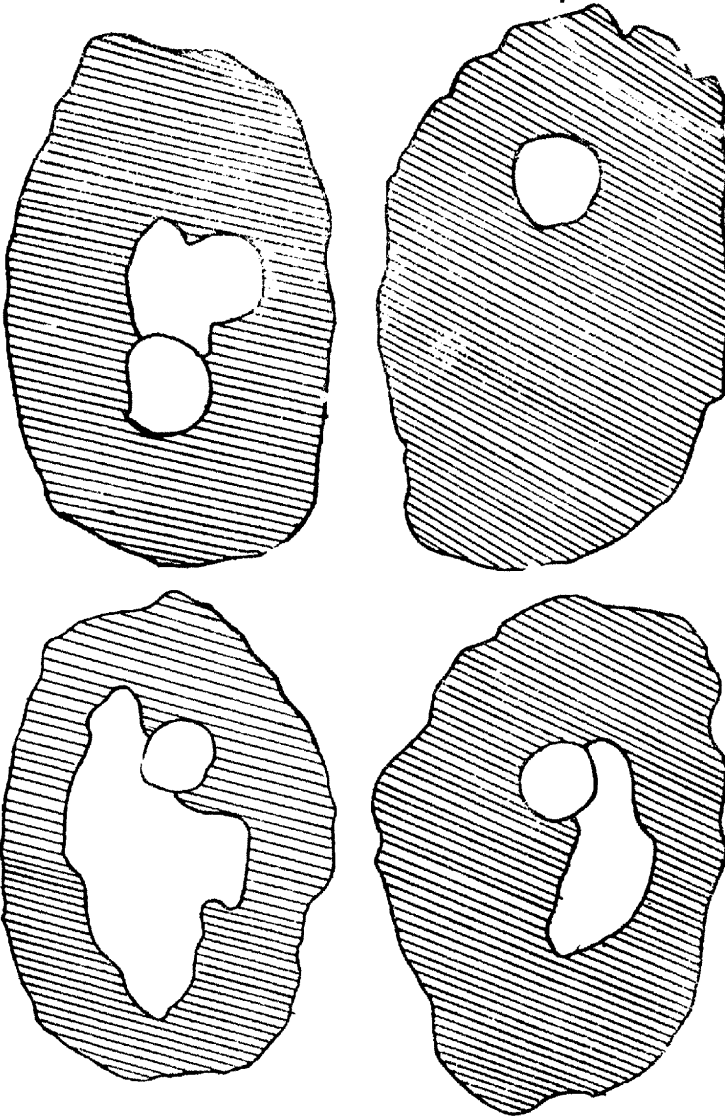


Figure 1.—Lot I. Note large uncured area.
Figure 3.—Lot III.

Figure 2.—Lot II.
Figure 4.—Lot IV. Completely cured.

SUMMARY

The results of these data seem to indicate that the brine method of cure produced a little sweeter, more desirable flavor in the fat of the cured lamb legs than did the dry method. Likewise, the longer chilling temperature seemed to be conducive to a sweeter flavor of fat; at least rancidity did not appear as it did in the shorter, warmer chilling periods.

Aroma of the entire sample, a factor which has considerable bearing on palatability, did not appear to be affected by the type of cure. However, it was markedly affected by the chilling method. Lot I was fresh and sweet and Lot IV showed a slightly pronounced spoiled odor.

The data evidenced the fact that the more desirable lean flavors are obtained by using the brine method of cure and the lower chilling temperature. Tenderness did not seem to be influenced by temperature, but was markedly more desirable in the brine-cured lots.

Percentage of shrink was much higher in dry-cured lamb than it was in brine cured, but the cooking loss was much less, so that in the final analysis one may conclude there is very little choice under farm conditions.

In brief, it may be concluded that a desirable product for the farm table may be prepared from lamb if it is chilled for approximately 48 hours at about 35° F., cured by the 8-2-2 brine method, and stored for only a short period of time.

Salt penetration seemed a little better in the cures with stronger concentrations of sodium nitrate or sodium nitrite. There also was some indication that 30 days may not be sufficient length of time in cure for complete penetration.

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