

TEXAS AGRICULTURAL EXPERIMENT STATION

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College Station, Texas

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AN ANNOTATED BIBLIOGRAPHY

NATIONAL COOPERATIVE PROJECT
CONSERVATION OF NUTRITIVE VALUE OF FOOD

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FOREWORD

The National Cooperative Project Conservation of the Nutritive Value of Foods is organized among research workers by key commodity committees. The Office of Experiment Stations appoints a key person for each commodity from each of the four regions of the country—Northeastern, North Central, Western and Southern—and from the Bureau of Human Nutrition and Home Economics. One of these is designated as national chairman.

Research with any commodity may be closely coordinated within a region or on a national basis, but this procedure is not compulsory.

Studies by agricultural experiment stations, or by the U. S. D. A. on conserving the nutritive value of foods are eligible to become part of this project.

The national chairman of each key commodity is responsible for collecting and publishing an annotated bibliography for the use of other workers in the field. The annotated bibliography on lamb, covered in this publication, was carried to January, 1946. Much of the abstracting was done by Mrs. Annie B. Smith, formerly research assistant in food preparation.

In order that findings from one laboratory may be made available to other workers in the project as quickly as possible a system of Progress Notes has been devised. These may be available many months before the research can be published through the usual channels. Progress Notes from the Texas Agricultural Experiment Station which have been published previously are:

1. Effect of Roasting on the B-Vitamins in Meat. Progress Report 890-1. Sylvia Cover, Barbara A. McLaren, and P. B. Pearson.
2. Suitability of Left and Right Muscles for Study of Vitamin Retention in Meat. Progress Report 890-2. Sylvia Cover, Esther M. Dilsaver, and Rene M. Hays.
3. The B Vitamins in Dehydrated Vegetables. Progress Report 911-3. M. K. Sheybani, P. B. Pearson, and R. W. Luecke.
4. Storage Factors Affecting the Quality of Dehydrated Vegetables. Progress Report 931-4. H. M. Reed.
5. Influence of Salt on the Judging of Cooked Vegetables. Progress Report 965-5. Jessie Whitacre.

LAMB . . . AN ANNOTATED BIBLIOGRAPHY

ALPHABETICAL LIST BY AUTHORS

A

1. ALEXANDER, L. M. (Bur. of H.E.)
1932. COOPERATIVE MEAT INVESTIGATIONS. SUMMARY OF RESULTS OF COOKING MEATS.
Am. Soc. of Animal Prod. 303-311, Jan. 1932.

A very general summary is given of the accomplishments of research studies done by the various experiment stations, the U.S.D.A. and the Institute of American Meat Packers on the national project, "A Study of Factors Which Influence the Quality and Palatability of Meat." Included were discussions of the work done to standardize methods for conducting experiments so that results could be measured and compared. Especial mention was made of the advantage of using a meat thermometer for determining degree of doneness. Work done on lamb showed that in roasting upwards of 2,500 legs of lamb with the oven temperature and the meat temperature constant, a range from 24 to 60 minutes per pound was observed. Legs from well-fattened lambs tended to cook more rapidly in relation to their weight than legs from poorly finished lambs. Ripened lamb cooked more quickly than strictly fresh lamb. The cooking losses of lamb were increased by the high temperature used in searing.

2. ALEXANDER, L. M. (Bur. of H.E.)
1932. EXPERIMENTS TO DETERMINE THE EFFECT OF INITIAL SEARING IN THE ROASTING OF BEEF, LAMB, AND PORK.
U.S.D.A. Report to Annual Conference Cooperative Meat Investigations, Chicago, Ill., August, 1932.

Six pairs of lamb legs of different grades were roasted to the same medium-done stage. The left legs were roasted by the standard method (seared 20 min. at 265°C., finished at 125°C.) and the corresponding right legs were roasted at 125°C. constant temperature (without searing). The figures for shrinkage, cooking time, palatability, and resistance to searing were calculated. Four more pairs of lamb legs were seasoned with salt, pepper, and flour, and cooked in the same way as the 6 pairs of legs, but they were not tested for palatability in the usual manner. Lamb roasts cooked at constant low temperature without searing had dull or very pale external fat coloring. Lamb legs cooked almost to the well-done stage were considerably more attractive in appearance when seared than when unseared. Searing decreased the number of minutes per pound of cooking time. The cooking losses of the seared roasts were greater than the unseared. These cooking losses consisted almost exclusively of fat. Palatability tests and tests of the resistance to searing revealed no consistent differences associated with the searing of lamb legs.

3. ALEXANDER, L. M. and CLARK, N. G. (Bur. of Home E. and Bur. of A.I.)
1933. EXPERIMENTS COMPARING CONSTANT TEMPERATURE METHODS OF ROASTING BEEF AND LAMB WITH THE STANDARD METHODS.
U.S.D.A. Report of Annual Conference Cooperative Meat Investigations, Chicago, Ill., August 1933.

Thirty pairs of lamb legs of different grades were roasted to the same medium-to-well-done stage (76°C.). The left cuts were roasted by the standard method (seared 20 minutes at 265°C., finished at 125°C.), and the corresponding right cuts were roasted at 3 different constant oven temperatures (125°, 150°, and 175°C.) without searing. Comparisons were made as to the appearance, uniformity of cooking, palatability (flavor of fat and lean, desirability of aroma, quantity of juices, and tenderness) shrinkage, time required for cooking, and fuel consumed. The constant oven temperature of 150°C. lessened the desirability of the fat, the quantity of the juices, and the tenderness of the meat. At 125°C. shrinkage was lower than by the standard method; at 150°C. it was about the same, and at 175°C. it was higher. The length of time required for cooking was longer at constant 125°C. than when the standard method was used and shorter when either 150°C. or 175°C. constant oven temperatures were used. The constant oven temperatures of 125°, 150°, and 175°C. required less gas than the standard method.

4. ALEXANDER, L. M. and CLARK, N. G. (Bur. of H.E. and Bur. of A.I.)
1934. SHRINKAGE AND HEAT PENETRATION DURING THE ROASTING OF LAMB AND MUTTON AS INFLUENCED BY CARCASS GRADE, RIPENING PERIOD, AND COOKING METHOD.
U.S.D.A. Tech. Bull. 440: 1-26, 1934.

A total of 1,167 legs of lamb and mutton, representing different breeds, ages, sex, and feeding rations were graded, ripened from 2 to 24 days, and roasted by one of seven different methods, differing from each other in oven temperatures and in the stage of doneness to which the meat was cooked. Results obtained showed that lamb lost less in weight during roasting and took less time to cook as the ripening period increased. Variations in the grades of lamb influenced the shrinkage and rate of heat penetration as follows: (1) Choice grade lamb and mutton lost the most as drippings, and as the carcass grade became poorer the drippings loss decreased; (2) shrinkage due to evaporation loss was not consistently related to carcass grade; (3) there was no significant difference in the number of minutes per pound required to roast Choice, Good and Medium grades, but Common and Cull grade lamb took longer to cook in proportion to the weight. Differences in oven temperatures and stages of doneness showed that higher oven temperatures caused greater shrinkage and cooked the meat more quickly. Searing in itself did not reduce shrinkage, but actually made roasts lose more weight, though the loss was mainly fat. Low-oven temperatures held down shrinkage except when the time required was excessively long in proportion to the weight of the roast.

5. ALEXANDER, L. M. and YEATMAN, F. W.
1928. LAMB AS YOU LIKE IT.
U.S.D.A. Leaflet 28 (1928), pp. 8
(E.S.R. 60:89, Jan. 1929.)

This illustrated leaflet contains directions for roasting leg of lamb with the use of meat thermometers, and for the preparation and serving of broiled lamb chops, roast saddle, roast stuffed shoulder, roast stuffed breast, lamb stew, and curry of lamb. A mint or water-cress stuffing is suggested for the shoulder and one of forcemeat for the breast.

B

1. BARBELLA, N. G., HANKINS, O. G., and ALEXANDER, L. M.
1936. THE INFLUENCE OF RETARDED GROWTH IN LAMBS ON FLAVOR AND OTHER CHARACTERISTICS OF THE MEAT.
Proc. Am. Soc. Animal Prod., 29th Annual Meeting, 1936, 289-294. (C.A. 32:981, 1938.)

The longissimus dorsi muscle from lambs that had been retarded in growth by receiving restricted amounts of a grain-with-roughage ration contained less protein and fat and more water than did the muscle from lambs receiving adequate amounts of the same ration. Also the ratio of water to protein was higher, and the albumin fraction of the protein was consistently lower. The meat was rendered less tender and less desirable in flavor by retarding the growth of the lamb.

2. BEACH, E. F., MUNKS, B., and ROBINSON, A.
1943. THE AMINO ACID COMPOSITION OF ANIMAL TISSUE PROTEIN.
Jour. Biol. Chem., 148 (2):431-439, 1943.
(E.S.R. 91:213, August, 1944.)

The amino acid composition of the protein mixtures of 10 edible muscle meats (beef, veal, lamb, pork, chicken, turtle, codfish, salmon, frog legs, and shrimp) and of 6 beef organs is presented. The determinations of amino acid distribution included arginine, histidine, lysine, tyrosine, tryptophane, phenylalanine, serine, threonine, cysteine, and methionine, seven of which are nutritionally essential for optimal animal growth. The protein mixture which makes up voluntary muscle tissues is similar in the groups studied. Larger differences in amino acid composition were found among the beef organs than among the muscle proteins of different species. The data demonstrate the amino acid pattern to which animal muscle must conform in the synthesis of tissue protein.

3. BEALL, J. A. and PURDY, D. I. (Okla. A.E.S.)
1943. CURED LAMB FOR VARIETY IN OKLAHOMA FARM MEALS.
Oklahoma Sta. Bull. 264:1-6, 1943.
(E.S.R. 89:132, Jul. 1943.)

Lamb cured by a method recently developed and involving chilling, brining, and light smoking is recommended for use in varying the farm family menu. Recipes for utilization of the cured lamb are given.

4. BEALL, J. A. and PURDY, D. I. (Okla. A.E.S.)
1943. METHODS OF CURING LAMB FOR FARM FAMILY USE IN OKLAHOMA.

Okla. Sta. Tech. Bull. 17:1-11, 1943.
(E.S.R. 89:500, Nov. 1943.)

In this attempt to find the best methods of handling and preserving lamb under farm conditions in Oklahoma, comparisons were made of different times and temperatures of chilling the carcass (the leg being used in all cases), including 48 hours at 35°C., 12 hours at 35°, 12 hours at 70°, and no chilling, and also of different cures—dry cure and brine of different concentrations. Analysis of the data for 2 years indicated that the brine method is more satisfactory than the dry cure, and that the longer storage period at cooler temperatures gives a better product, particularly in the flavor of the lean. Percentage of shrink was much higher in the dry-cured than the brine-cured, but cooking losses were much less.

5. BESLEY, A. K., and HINER, R. L.
1937. SALT PENETRATION IN CURING LAMB LEGS.

Proc. Am. Soc. Animal Prod. 30:250-254, 1937.
(C.A. 32:5517, 1938.)

Three groups of legs, averaging approximately 4, 5, and 6 pounds in weight were placed in brine cure consisting of NaCl—6 pounds, sugar—3 pounds, saltpeter—3 ounces, and water—4 gallons to 100 pounds of meat, maintained at approximately 38°F. At intervals of 4-5 days, beginning with the 12th day in cure, representative legs of each group were sampled. Usually the rectus femoris and the semimembranosus, and in some cases the gracilis, carried more salt than the other leg muscles. Salt appeared to penetrate with much greater difficulty into the adductor and vastus intermedius and only after 30 days in cure did the salt content of these muscles approach that of the surrounding meat. Size of leg and time in cure seemed to be the principal factors controlling the rate of salt absorption by the meat.

6. BESLEY, A. K., and HINER, R. L.
1938. THE EFFECT OF AGING ON THE MOISTURE AND SALT DISTRIBUTION IN CURED LAMB LEGS.

Proc. Am. Soc. Animal Prod. 31:267-271, 1938.
(C.A. 33:5532, 1939.)

Aging lamb legs for 30 days at 68°F. and 25-30% relative humidity appeared to shift the salt between muscles. Excepting the cuter muscles (gracilis and vastus internus), this resulted in a fairly even distribution of salt throughout the aged leg. The salt movement during aging was accompanied by a continuation of the general dehydration process which occurred during smoking.

7. BLAKESLEE, L. H. (Michigan)

1935. STUDIES IN LAMB FEEDING.
Michigan Sta. Quart. Bull. 17(4):192-196, 1935.
(E.S.R. 73:666-667, 1935.)

In order to study the advisability of the maximum use of hay and the substitution of straw or cornstalks for part of the hay, 10 lots of lambs were fed varying diets of alfalfa hay, shelled corn, ground oat straw, linseed cake, corn fodder, and corn silage. Data obtained was studied to determine which groups made the larger gains, and which gains were least expensive. Among other results it was noted that the carcass grades of the lots fed oat straw or cornstalks un-supplemented with protein graded lower in the coolers than those receiving hay alone or hay and silage.

8. BONSMMA, F. N. (Univ. Pretoria, South Africa.)

1939. FACTORS INFLUENCING THE GROWTH AND DEVELOPMENT OF LAMBS, WITH SPECIAL REFERENCE TO CROSS-BREEDING OF MERINO SHEEP FOR FAT-LAMB PRODUCTION IN SOUTH AFRICA.
Univ. Pretoria Pubs. 1(48):214, 1939.
(E.S.R. 84:375, Mar. 1941.)

Groups of lambs, representing 13 different crosses, including first crosses of Merino, Ryeland, Romney Marsh, Dorset Horn, Border Leicester, and Southdown rams on Merino ewes, and second crosses of Ryeland and Southdown rams on certain of the crossbred ewes, were used in studies of factors determining the birth weight of lambs, milk production of sheep in relation to fat lamb production, the weight growth, changes in body proportions as influenced by breed and sex, and the comparative values of the carcasses resulting from different crosses. Among other results were the following: Significant improvements resulting from crossing the Merino with various mutton rams were the improvements shown in mutton quality of the progeny, increased earliness of maturity, higher dressing percentage, greater size of the eye muscle, and increased thickness of back fat. The Southdown X Merino produced the best first-cross carcass, followed by the Ryeland X Merino. The second crosses were definitely superior to the first crosses in carcass quality, with the Southdown X Dorset Horn-Merino excelling in this respect, and the Southdown X Border Leicester-Merino next in order.

9. BOSE, SARASLUPADE.

1939. THE NUTRITIVE VALUE OF PAPAINE-MUTTON BROTH.
India Jour. Med. Res. 27(1):65-73, 1939.
(B.A. 14:49, 1940.)

Digestion of 300 grams of mutton mince, with 5 grams of powdered papain as estimated by formal titration, oxidizable matter content, and total N content, was complete after 2 hours at 60°C. With half

the quantity of papain the digestion was delayed by 1 hour. Of the above 3 estimations used to follow the course of digestion the formal titration was the simplest. The transformation of protein was complete after 2 hours of digestion. The only change that took place after that period was the slow transformation of proteose to peptone. The growth of the Cholera vibrio on papain-mutton agar at different stages of digestion showed that the maximum growth was obtained after 2 hours of digestion which was also the period of complete digestion as determined by chemical analysis.

10. BOSMAN, S. W., and BONSMMA, H. C. (Coll. Agric. Grootfontein, Middleburg, C. P.)

1944. EARLY WEANING OF LAMBS FOR SAVING WINTER CEREAL PASTURE.
Farming in South Africa 19(222):573-580, 1944.
(B.A. 19:710, 1941.)

Weaning lambs on cereal pastures at 6 weeks and at 8 weeks of age, and removing the ewes to veld, resulted in net savings in cereal pasture of 29% and 22.9%, respectively, when compared to allowing both ewes and lambs to remain on the cereal pasture until the latter reached marketable age. Weaning at 6 weeks retarded the growth of lambs and resulted in carcasses of lower grade but when weaned at 8 weeks the set-back suffered in body gains was insignificant.

11. BOSMAN, S. W., and BONSMMA, H. C.

1945. EXPERIMENTS WITH CROSSBRED SHEEP FOR SAVING WINTER CEREAL PASTURE. PARTIAL GRAZING VS. CONTINUOUS GRAZING.
Farming in South Africa 20(227):91-104, 1945.
(B.A. 19:1788, 1945.)

Allowing ewes with lambs on veld access to succulent wheat pasture for 2-3 hours daily stimulates milk production. A 71.5% saving in feed costs was made when this system was compared to continuous grazing of the cereal, and 40.5% was saved where grazing of the cereal was continuous for a month after lambing and partial thereafter. If the ewes are in good condition at lambing there are no detrimental effects on rate of growth of lambs or on grade of carcasses.

12. BRADY, D. E., FREI, P., and HICKMAN, C. W. (Idaho)

1942. EFFECT OF FREEZING RATE ON QUALITY OF FROZEN MEATS.
Food Res. 7(5):388-393, 1942.
(B.A. 17:1165, 1943.)

Slow-frozen (0°F.) pork, lamb, and beef had a higher evaporation rate during storage than quick-frozen (-15°F.) The smallest cooking loss occurred in quick-frozen steaks broiled while frozen; thin cuts should be cooked without thawing. Palatability was not affected.

13. BRANAMAN, G. A. (Ill. A.E.S.)

1940. SOME FACTORS IN LAMB PRODUCTION ASSOCIATED WITH SIZE AND TYPE IN MUTTON SHEEP.
J. Agr. Res. (U.S.) 60(7):473-483, 1940.
(E.S.R. 83:670-671, Nov. 1940.)

Trials were conducted to compare the rate and efficiency of gain and the quality of carcass produced by purebred Southdown and Hampshire lambs and by crossbred lambs from grade western ewes mated to Southdown, Hampshire, and Shropshire rams. When full-fed appropriate rations, the purebred ewes of each breed consumed feed approximately in proportion to body weight. However, the feed consumption of the lambs when fed a maintenance ration or when full-fed for rapid growth and fattening was more nearly in proportion to the three-fourths power function of body weight. Hampshire yearling lambs on full feed digested nitrogen significantly more efficiently than Southdown lambs. Coefficients of digestibility for other nutrients were similar for the two lots. A 120% Hampshire lamb crop was found necessary to produce lean meat in Choice carcasses as efficiently with respect to total feed as a 100% Southdown lamb crop. Well-fed Hampshire single lambs attained Choice market finish approximately 6 weeks younger than Southdown single lambs or Hampshire twins. Southdown lambs of Choice market quality gave higher yields of dressed carcass, boneless meat, and separable lean meat than Hampshire lambs of similar finish. In tests with crossbred lambs, those sired by Southdown rams were of greatest value, followed in order by those sired by Hampshire and Shropshire rams. The Hampshire-sired lambs were slightly heaviest, while the Southdown-sired lambs were highest in market grade.

14. BRIGGS, H. M. (Okla. A.E.S.)

1937. A STUDY OF THE VALUE OF CORN, COTTONSEED MEAL, ALFALFA HAY, PRAIRIE HAY, AND WHEAT PASTURE FOR FATTENING LAMBS.
Southwest Sheep and Goat Raiser 7(2):8-21, 1937.
(E.S.R. 78:679, May 1938.)

In a lamb-feeding experiment reported by the Oklahoma Agricultural Experiment Station, a variation from the usual feeding trial procedure was introduced in that the amount of feed intake was regulated so that approximately equal average daily gains were made by all lots. When all rations contained adequate amounts of protein this method gave a direct measure of the energy value of the feeds studied for fattening purposes. Three lots of lambs on a uniform allowance of alfalfa hay received corn and cottonseed meal at the rates of 1.16 and 0, 1.05, and 0.1, and 0.54, and 0.71 pounds per lamb daily, respectively. When fed at the rate of 0.1 pound per

lamb daily, cottonseed meal was worth 141% more in productive value than the corn it replaced, but at the higher level of feeding it had a value of only 85% that of corn. Three lots receiving a constant allowance of corn and cottonseed meal but varying amounts of alfalfa and prairie hay indicated that with adequate protein in the ration the productive value of prairie hay was 79% that of alfalfa. A combination of alfalfa and prairie hay (0.3:1) was no more efficient than prairie hay alone. Comparing the rate of gain of both light and heavy lambs on wheat pasture with and without grain indicated that grain feeding was not economical. The light lambs made more rapid gains than the heavy lambs, but did not finish quite so well. The percentage of shrinkage, dressing percentage, and market grades of the various lots of lambs are presented.

15. BRIGGS, H. M. (Okla. A.E.S.)

1940. COMPARATIVE VALUE OF CORN, OATS, AND BARLEY IN FATTENING LAMBS.

Southwest Sheep and Goat Raiser 10(9):28, 1940.
(E.S.R. 84:230-231, Feb. 1941.)

In a feeding trial of 100 days' duration in which feed intake was controlled to permit approximately equal gains in all groups of lambs, shelled corn, whole oats and barley were compared. All groups received equal amounts of cottonseed cake and alfalfa hay. Oats and barley had values of 96.6 and 92.4%, respectively, that of corn when each was fed singly. When fed to replace one-half of the corn, oats and barley had values of 89 and 72.1%, respectively that of the corn replaced. A mixture of oats and barley was slightly more valuable than the combination of corn and barley. Lambs fed corn as the only grain yielded the highest and those fed barley the lowest grading carcasses.

16. BRIGGS, H. M. (Okla. A.E.S.)

1941. FATTENING LAMBS ON CORN AND COTTONSEED MEAL AND ON PRAIRIE AND ALFALFA HAYS.

Okla. A.E.S. Bull. 252:1-14, 1941.
(B.A. 16:2250, 1942.)

An experiment was conducted with 120 white-faced Texas feeder lambs in each of 3 separate years to determine the relative values of cottonseed meal and corn grain and of prairie hay and alfalfa hay. Each year 6 lots, each consisting of 20 lambs, were fattened. Addition of 0.1 pound of cottonseed meal improved a ration of corn and alfalfa hay only 1 year out of 3. Lambs receiving large amounts of cottonseed meal became as fat and produced as desirable carcasses as corn fed lambs. Alfalfa hay proved to be more palatable than the prairie hay used in the study.

17. BRIGGS, H. M. and HELLER, V. G.

1942. THE EFFECT OF ADDING LARGE AMOUNTS OF COTTONSEED MEAL TO A LAMB-FATTENING RATION.

J. Animal Sci. 1:277-284, 1942.
(C.A. 37:915, Feb. 1943.)

Substitution of 181 grams cottonseed meal for an equal amount of shelled yellow corn in a lamb-fattening ration that contained 454 grams alfalfa hay resulted, on the average, in positive balances of calcium, phosphorus, magnesium, and nitrogen. Average phosphorus retention was increased from 5.4 to 9.6 grams and Ca storage reduced from 8.5 to 6.7 grams in the 10-day periods. Storage of magnesium and nitrogen was increased. Nitrogen intake was above what might be considered as the optimum level.

18. BURK, L. B., GIBBONS, C. E., and FOSTER, M. T.

1936. MARKET CLASSES AND GRADES OF LAMBS AND SHEEP.

U.S.D.A. Cir. 383:1-35, 1936.
(E.S.R., 75:389, Sept. 1936.)

This circular describes the standard classes and grades for sheep and lambs and discusses the need for such standardization. The basis of classification and the definitions and descriptions of market grades are discussed, together with the factors affecting grade and value. Schedules are presented showing how lambs and sheep are segregated into market classes according to classes, subclasses, ages, weights, and grades.

C

1. CALLAGHAN, A. R. and THOMPSON, D. S. (Austral. J. Dept. Agri. So.)

1940. AN INVESTIGATION INTO THE EFFECTS OF DELAYED SLAUGHTER ON EXPORT LAMBS.

Jour. Dept. Agr. So. Austral., 44(1):3-18, 1940
(E.S.R. 84:375-376, Mar. 1941.)

Simulating conditions existing at Australian slaughtering plants during the rush season when congested conditions frequently necessitate the holding of lambs for a considerable period before slaughter, 5 lots of lambs (33 per lot) were slaughtered 6, 24, 48, 72, and 96 hours, respectively, after removal from their dams. Dressing percentages based on the mean farm live weights were 54.96, 54.96, 53.72, 52.43, and 51.99%, respectively. There was no apparent loss of fat covering, or bloom, of the carcasses due to the delayed slaughtering. It appeared that the loss in weight of the carcass was due primarily to loss of moisture.

2. CLIFFORD, W. M.

1925. THE EFFECT OF SHORT PERIODS OF COLD STORAGE ON BEEF AND MUTTON.

Biochem. Jour. 19(6):998-1003, 1925.
(E.S.R. 55:261-262, Aug. 1926.)

The effect of cold storage on the content of total nitrogen, soluble nitrogen, amino nitrogen, carnosine, and creatine in two samples each of beef and mutton was determined. Portions of the meat were stored in glass jars to prevent evaporation at 25° and 35°F. for as long as 13 days. Samples were taken for analyses on the day of slaughter and at approximately 3-day intervals thereafter. It was found that meat stored at 35°F. began to develop a musty odor by the 6th day. The frozen meat was in good condition throughout the frozen period, but ice spicules developed on the 6th day, and there was considerable drip when this meat was thawed out. It is concluded that the changes in meats during the storage periods of 10 to 13 days are physical, since no uniform alterations were apparent in the chemical constituents determined.

3. CLINE, J. A. and ECKBLAD, I. M. (Missouri)

1937. THE INFLUENCE OF THE CONDITION OF THE EWE ON THE COOKING QUALITY OF MUTTON.

Missouri Sta. Bull. 387:70-71, 1937.
(E.S.R. 78:274, Feb. 1938.)

In this progress report the carcasses from old thin ewes, old fat, and young fat ewes were compared as to cooking losses, cooking time, palatability, and serving values.

4. CLINE, J. A. and SWENSON, A. (Missouri A.E.S.)

1935. THE ROASTING OF BEEF, LAMB, AND PORK.

Missouri Sta. Bull. 358:79, 1935.
(E.S.R. 75:131, Jul. 1936.)

Among other studies, this progress report summarizes studies by Cline and Swenson on searing v. constant temperature methods of roasting beef ribs, leg of lamb and pork loin.

5. COLE, C. L. (Michigan)

1942. RELATIONSHIP OF RATE OF GROWTH IN LAMBS TO BODY MEASUREMENTS AND CARCASS VALUE.

Michigan Sta. Quart. Bull. 25(2):120-121, 1942.
(E.S.R. 88:668, May 1943.)

A study was made of the relation of body measurements to average daily gains in 32 lambs weighing approximately 85 pounds. Results showed that average width of the individual had the highest relation to rate of gain. However, the most rapid gaining lambs were not necessarily those that graded highest when slaughtered. The thickness of fat over the eye muscle was the most important factor in slaughter grade but had little influence on the rate of gain.

6. COLEMAN, J. M.

1928. LAMB-RAISING TRIALS, 1928.

Agr. Gaz. N. S. Wales 40(7):517-519, 1929.
(E.S.R. 63:468, Sept. 1930.)

Rams of the Dorset Horn, Ryeland, and Border Leicester breeds were mated to lots of 59 Merino ewes each at the Bothurst Experiment Farm, New South Wales. In the respective lots an 86.4, 66, and 62.7% lamb crop was raised. In the lot bred to the Ryeland rams, there was a greater loss at lambing, and the carcasses of the lambs of this cross were very uneven and of poor quality. The Dorset Horn cross produced the best dressing carcasses and made a higher average return per ewe than the Border Leicester cross, which, in turn, was better in this respect than the Ryeland cross. (A summary of another experiment is also given.)

7. COOK, L. J. (Australia)

1935. RAISING EXPORT LAMBS ON SUBTERRANEAN CLOVER PASTURE LANDS.

Jour. Dept. Agr. So. Austral. 39(1):35-44, 1935.
(E.S.R. 75:822, Dec. 1936.)

This article presents data on the results of mating purebred Southdown, Dorset Horn, Suffolk, English Leicester, and Ryeland sires to thrifty comeback ewes (Merino rams X half-bred English Leicester-Merino ewes) with regard to efficiency of lambing, weight, carcass quality, market value of lambs, return of lamb value per ewe that bred, and returns per ewe less lamb grazing costs. Rather pronounced differences were noted in the net returns from lambs resulting from the different crosses. It was concluded that the raising of fat lambs on improved pasture was quite satisfactory, particularly when they were grazed on well-fertilized pasture and dropped sufficiently early to enable them to be marketed before grass approached maturity.

8. COVER, S.

1937. THE EFFECT OF TEMPERATURE AND TIME OF COOKING ON THE TENDERNESS OF ROASTS.

Texas A.E.S. Bull. 542:1-61, 1937.

To determine the effect that oven temperature and the time of cooking has on the tenderness of roasts, paired beef, pork, and lamb roasts, representing 5 different cuts, were roasted at two different oven temperatures—125°C. (low) and 225°C. (high). The leg of lamb roasts were cut back of the flare of the ilium where the bone is round or slightly wedge-shaped. These roasts were cooked to the well-done stage, or until an internal temperature of 80°C. was

reached. Tenderness was tested by the "paired-eating method," the judges using a five-point grading chart for comparisons. Oven temperatures seemed to be a more important factor in producing tenderness in some roasts than others. The well-done rump roasts were much more tender cooked at a low oven temperature than at a high oven temperature, while there was but little difference in the results of cooking for the well-done leg of lamb roasts. The apparent relationship between tenderness and oven temperature observed in these tests seemed to be much better explained on the basis of a difference in the time required for cooking—the well-done chuck roasts requiring about six hours longer cooking time at the low oven temperature than at the high oven temperature, while the well-done leg of lamb roasts required less than two hours longer. In none of the cuts did the low oven temperature produce roasts, all of which scored "very tender." The low oven temperatures required a longer total time per pound than did the high oven temperature method, yet less gas was required.

9. COVER, S., MACKEY, A. K., MURPHEY, C. E., MILLER, J. C., BASS, H. T., BELL, C. L., and HAMALAINEN, C.

1944. EFFECTS OF FATNESS ON TENDERNESS OF LAMB. Texas Sta. Bull. 661:1-28, 1944.

This study covers a period from 1937-1942, and is concerned with the selection of comparable animals, the production of differences in fatness, and the estimation of tenderness in the meat. Six experiments are given in detail with critical appraisal of methods and results. Paired lambs similar in sex, breeding, conformation, and fleece covering, and differing by not more than 2 pounds initial weight were used. One lamb of each pair was full-fed, and the other limited-fed so that it would gain only enough to keep it in a healthy condition. Both lot-feeding and individual feeding were used. The paired-eating method was used for testing tenderness in paired lambs, but observations were recorded also from weighted adjectives, mechanical shear, and chemical analyses for collagen content. Results showed that it was doubtful that fatness influences tenderness in lamb to any marked extent, and therefore its use as a criteria of tenderness in buying lamb has doubtful practical value.

D

1. DANN, W. J. and HANDLER, P.
1942. THE NICOTINIC ACID CONTENT OF MEAT.

Jour. Nutr. 24(2):153-158, 1942.
(E.S.R. 88:858-859, Jun. 1943.)

Data are reported on the nicotinic acid content of various cuts of meat purchased in local retail stores. The analyses were made by the chemical procedure of the authors, using completely decolorized digests of the tissue. The effect of cooking was examined, using several types of meat. Most of the cuts showed considerable variation from one sample to another, but there was no evidence that the various muscle meats differed in nicotinic acid content. Thus, nicotinic acid, expressed in micrograms per gram fresh weight, varied from 40 to 82 micrograms in beef muscle meats, from 54 to 102 micrograms in lamb muscle, from 49 to 91 micrograms in veal muscle, and from 61 to 80 micrograms in chicken leg muscle; the chicken breast muscle, however, was much richer, containing from 110 to 181 micrograms per gram. Kidney and liver (from beef, pork, veal, and chicken) were richer than the muscle meats in nicotinic acid. In general 1/3 to 1/2 of the nicotinic acid was lost in cooking, as calculated on the basis of the dry weight of the meat.

2. DARBY, W. J. and DAY, P. L. (Univ. Ark.)

1938. THE RIBOFLAVIN CONTENT OF MEATS.
Jour. Nutr. 16(3):209-218, 1938.
(E.S.R. 80:853, Jun. 1939.)

Using the rat-growth method, the authors found the biologically active riboflavin content of various meats to be as follows: Pork liver 9.2, fresh ham 1.2, lamb chops 1.1, cured ham 0.81, beef brisket 0.74, and bacon 0.36 rat units of riboflavin per gram of meat. In terms of the biologically equivalent amount of crystalline riboflavin, the values are 23, 3, 2.8, 2, 1.9, and 0.9 micrograms of riboflavin per gram, respectively.

3. DE CLERCQ, A.

1942. THE ARGININE CONTENTS OF DIFFERENT KINDS OF MEAT AND FISH.
Kon. Vlaamsche Acad. Wetensch., Letteren Schoone Kunsten Belgie, Klasse Wetensch., Versl. Meded. 1939, 33-5; Chem. Zentr. 1942, II, 230.
(C.A. 37:4488-4489, Aug. 1943.)

The percentage of arginine, determined colorimetrically with α -Naphthol on the fat-free dry substance is: for beef 0.067, pork 0.056, mutton 0.059, cod 0.056, haddock 0.050, ray 0.029, shark 0.043 and shrimp 0.084.

4. DEVANEY, G. M. and MUNSSELL, H. E.

1935. VITAMIN D CONTENT OF CALF, BEEF, LAMB, AND HOG LIVER.
Jour. H.E. 27(4): 240-241, 1935.
(E.S.R. 73:732, Nov. 1935.)

The calf, beef, and hog livers used in this study at the Bureau of Home Economics, U.S.D.A., were purchased every few days at local markets. Livers from 7- to 8-month-old lambs were obtained twice

during the experimental period from the slaughterhouse and kept in a frozen condition until used. The Steenbock rickets-producing diet was used with the line test technic. At least 1 rat from each litter was given 0.2 unit of the international standard viosterol in peanut oil solution. In estimating the vitamin D potency, the procedure of Dyer was followed, using a curve of reference relating the degrees of healing to the number of international vitamin D units. The values thus obtained were calf liver 0.095, beef 0.47; hog 0.44, and lamb liver 0.17 international units per gram of fresh material. Liver in general may be considered a significant source of the vitamin.

5. DIXON, J. K. and KIDSON, E. B. (Cawthron Inst., Nelson, N. Z.)

1941. THE EFFECT OF A HEAVY DRESSING OF A SOUTHLAND LIMESTONE ON THE HEALTH OF LAMBS AT MORTON MAINS.
New Zealand Jour. Sci. and Tech. 23(1A):47A-50A, 1941.
(B.A. 16:1807, 1942.)

Trials with weaned and unweaned lambs on pastures fertilized with cobalt and with limestone containing a small amount of Co are reported. Unweaned lambs grazed on the plots treated with Co or limestone gained 14-16 pounds during the 19 weeks the experiment was conducted; those with the no-Co plots averaged only a 2-pound gain. For the weaned lambs similar results are reported. Livers of lambs grazed on the plots treated with either Co or limestone showed a higher Co content than those taken from the lambs grazed on the control.

6. DUBOIS, C. W., TRESSLER, D. K., and FENTON, F. (N. Y. A.E.S.)

1940. INFLUENCE OF RATE OF FREEZING AND TEMPERATURE OF STORAGE ON QUALITY OF FROZEN MEAT.
Inst. Food Technol. Proc., 1:167-179, 1940.
(E.S.R. 86:268, Feb. 1942.)

Paired, rolled rib roasts of beef weighing approximately 3 pounds from right and left sides of the same aged carcass were wrapped in cellophane, inserted in a stockinette, and each pair frozen at various temperatures by different methods. Records were kept of the drop in temperature in the center of the roasts, and the amount of leakage. Microscopic examination of paraffin sections of the meat, and palatability tests on the cooked roasts were made. Frozen pork, lamb, and veal chops and beefsteaks wrapped in moisture- and vapor-proof packages were stored at various temperatures. Results indicated that the more rapidly the meat was frozen, the better its all-round quality, although even the slowest frozen roast was tender, juicy, and of good flavor. Samples of the frozen pork, lamb, and veal chops and beefsteaks held at 0° or lower were still in good condition at the end of 14 months, but at storage temperatures of 10° and 15° the fat of the samples became somewhat rancid in from 3 to 5 months. Consequently, storage temperatures greater than 0° should not be recommended for meat.

7. DU TOIT, T. A. (So. Africa)

1934. FAT-LAMB BREEDING AT THE POTCHEFSTROOM SCHOOL OF AGRICULTURE.
Farming in So. Africa, 9(96):108-111, 1934.
(E.S.R. 71:681-682, Nov. 1934.)

In an effort to retain the desirable characteristics of the Blackhead Persian and at the same time eliminate the uneven distribution of fat and lean in the carcasses, Blackhead Persian ewes were crossed with rams of the Dorset Horn, Oxford, Suffolk, and South-down breeds. The undesirable fat tail of the Blackhead Persian was absent in the cross-bred lambs. The so-called triangular-cross lambs, Suffolk, Oxford, and Dorset rams crossed on Suffolk-Persian ewes, had more symmetrical carcasses and were earlier maturing than first-cross lambs.

E

1. EDGAR, G. (Vet. Res. Sta., Glenfield, Austral.)

1942. EXPERIMENTS ON COPPER STORAGE IN THE LIVER OF SHEEP.
Australian Vet. Jour. 18(1):28-31, 1942.
(B.A. 16:1422, 1942.)

An examination of results of liver analyses on experimental sheep receiving 25 milligrams Cu per day in addition to that contained in normal ration indicated that the amount of Cu stored in the liver can rise, within 228 days, to high levels compared with those found in cases of enzootic jaundice.

2. EHRICH, R. H.

1936. HISTORY AND DEVELOPMENT OF MUTTON SHEEP IN GERMANY.
Jour. Heredity 27(8):323-328, 1936.
(B.A. 11(5):1099, May 1937.)

Post-war economic conditions are held responsible for the development of the dual-purpose type of sheep. Hybrids between native stock and French "Merino precoce" rams introduced into Germany about 1870 became known as Mutton-Merinos. The Mele breed, a cross between the English Border-Leicesters and pure Merinos, has been successfully introduced. The Oldenburg breed is very old and probably contains some Cotswold blood. They are hardy, good breeders, and quite heavy. The Wurttemberg hybrid sheep is very old and

the exact origin is unknown. The black-faced Mutton sheep of East Prussia is a cross between the Hampshire and the Oxfordshire. Its mutton quality is very good and the wool is of a desirable grade and quantity.

3. ELVEHJEM, C. A. (U. Wisconsin)

1942. MEAT AND HUMAN HEALTH.

Jour. Amer. Dietetic Assoc. 18(3):145-148, 1942.
(B.A. 17:939, 1943.)

A summary of the mineral and vitamin content of muscle and organs of hogs, sheep and cattle, as compared with certain vegetable sources.

4. EVVARD, J. M., CULBERTSON, C. C., HAMMOND, W. E., and HENNESSY, K. K.

1926. SOYBEAN HAY FOR FATTENING LAMBS.

Iowa Sta. Bull. 234:155-183, 1926.
(E.S.R. 55:262-263, Aug. 1926.)

In a study of the relative values of red-clover hay and soybean hay for fattening lambs, 5 lots of 30 head each, averaging about 55 pounds in live weight, were selected and fed for 65.5 days. All lots were full-fed shelled corn, corn silage, and block salt, and received 0.15 pound of cottonseed meal per head daily. The roughage in the various lots was red clover hay, whole soybean hay, ground soybean hay. Data on feed consumption per unit of gain, shrinkage, dressing percentages, and comparative finish of the different lots was obtained. The results indicated that whole soybean hay had a somewhat higher feeding value than red-clover hay.

F

1. FILINGER, G. A. and MACKINTOSH, D. L. (Kansas State)

1941. PRESERVING FOODS IN FROZEN FOOD LOCKERS.

Kansas Sta. Cir. 209:1-29, 1941.
(E.S.R. 87:305-306, Aug. 1942.)

The suggestions offered in this circular are based on trade practices and on research conducted at this and other stations. General directions for preserving fruits and vegetables concern preparation, packing, and containers. A separate section on preserving meats in frozen food lockers deal with slaughtering, packaging, wrappers, freezing, and the cooking of the frozen cuts, and suggests appropriate seasons and live weights at which to slaughter. The appendix includes a time-table for cooking thawed and unthawed cuts; suggestions regarding the use of frozen food lockers; charts showing wholesale and retail cuts of beef, pork, veal, and lamb; and the recommended sanitary regulations of the Kansas State Board of Health.

2. FOSTER, J. E. and HOSTETLER, E. H. (North Carolina)

1939. CHANGES IN MEAT AND WOOL CHARACTERISTICS RESULTING FROM THE USE OF PUREBRED MUTTON RAMS ON NATIVE EWES.

North Carolina Sta. Tech. Bull. 60:1-27, 1939.
(B.A. 14:271, 1940.)

Detailed studies were made of the quality and quantity of meat and wool secured from the offspring of (1) native ewes by native rams, (2) native ewes by purebred Shropshire and Hampshire rams, (3) second-, third-, and fourth-generation females from group 2 by purebred rams in each instance, and (4) purebred Hampshire ewes and rams. The results are given as follows (with the exception of those pertaining to wool characteristics): The first-cross ewes by both Shropshire and Hampshire rams were materially heavier, both as yearlings and when mature. The second crosses did not show an increase in live weight over the first crosses, but all showed improvement in body conformation and quality. The Hampshire crosses excelled the Shropshire crosses in weight but did not show as much quality, while the Shropshire crosses excelled both in weight. Purebred Hampshire lambs made most rapid gains, followed in order by Hampshire crosses, Shropshire crosses, and native. The Shropshire crosses were much larger, deeper, and wider but not higher than the natives, while the Hampshire crosses were larger and higher but not wider or deeper than the Shropshire crosses, and the purebred Hampshire were larger in every respect than the other breeds. The native carcasses, both lamb and mature, were markedly inferior to the others in finish, color of lean and fat, and marbling, while the Shropshire crosses slightly excelled the Hampshire crosses in these factors.

3. FOX, H. D. (Nebraska)

1926. CORN SUPPLEMENTS AND SUBSTITUTES FOR FATTENING LAMBS.

Nebraska Sta. Bull. 211:1-22, 1926.
(E.S.R. 55:60-61, Jul. 1926.)

The comparative value of a basal ration of shelled corn and alfalfa hay with and without various supplements and changes in the basal ration was studied in two experiments. Seven lots of 30 lambs were used in the first experiment, and 6 lots of 21 lambs were used in the second. At the conclusion of the experiments, data were obtained from the packing house, giving for each lot the dressing percentage, the percentage of fat, and the grade of the carcasses. Results showed that supplementing the basal ration of corn and

alfalfa with linseed meal, or corn silage, or both, resulted in larger gains, higher dressing percentages, and greater profits per head. Barley gave slightly better results than corn, but the practice of feeding barley during the first half and corn during the last half of the feeding period gave better results than when either grain was fed throughout the test. Additions of small amounts of alfalfa molasses meal to corn, linseed meal, and alfalfa hay improved the ration, but when alfalfa molasses meal replaced the hay the results were not so good. Cracked corn was superior to shelled corn, but ground ear corn appeared to furnish too much bulk when fed with alfalfa molasses meal.

5. FRENCH, M. H. (Vet. Lab., Mpwapwa, Tanganyika Territory)

1944. DEVELOPMENT OF LIVESTOCK IN TANGANYIKA TERRITORY. VI. THE DEVELOPMENT OF MUTTON QUALITIES IN MASAI AND GRADE BLACK-HEADED PERSIAN SHEEP.

Empire Jour. Exp. Agric. 12(48):207-218, 1944.
(B.A. 19:1789, 1945.)

Data are presented confirming the poor mutton quality of the carcasses of indigenous fat-tailed sheep. Attempts to improve this quality must increase the proportions of leg and shoulder joints in the total carcass and reduce the subcutaneous fat deposits. Neither the crossing of local breeds amongst themselves nor with other imported fat-tailed breeds will improve mutton quality. Crossing with black-headed Persians increases the proportion of fat in the carcass so that the age of slaughter becomes less than for indigenous types. Adult black-headed Persian crosses yield poorer quality carcasses than local sheep. Observations are made on an attempt to improve local sheep by crossing them with black Welsh mountain rams.

H

1. HACKEDORN, H., SINGLETON, H. P., and SOTOLA, J.

1937. LAMB FEEDING EXPERIMENTS.

Washington A.E.S. Bull. 351, Sep. 1937.

A report is made of 14 years' study of various feeds, feed combinations, and methods of feeding "cut-back" lambs. Records of feeds consumed, number and duration of feedings, gains made, and prices brought for the lambs were recorded. The different cuttings of alfalfa varied in desirability of nutrients in the order of first, third and second cuttings, respectively. In general, grinding or steam-rolling wheat, oats, or barley, or chopping potatoes for lambs were not profitable. Potatoes fed at the rate of 1 to 1 1/3 pounds per head daily, squash, carrots, and rutabagas fed at the rate of 2 pounds per lamb daily, and beet molasses fed at the rate of one-half to 1 pound per lamb daily increased the gains and financial returns of the lambs. When fed with alfalfa hay, corn was 20 to 25 percent better than a mixture of one part corn and two parts wheat.

2. HALLIDAY, E. G. and NOBEL, I. (Univ. of Chicago)

1932. RECENT DEVELOPMENTS IN THE SCIENCE OF COOKING.

J. of the Amer. Dietetic Association VIII, No. 1:1-24, May, 1932.

A very general summary is given of the research being done in 1932 in the field of human nutrition. The results of different experiments being carried on were compared. Included in this discussion was the recommended method for roasting lamb. The lamb roast should first be seared at 249°C. (480°F.) and then cooked at a low oven temperature of 257-300°C. until the interior temperature reaches 79°C. (175°F.) for slightly under-done meat and 83°C. (182°F.) for well-done meat. The use of metal skewers reduces the cooking time from 3 to 6 minutes per pound. The roast is better when cooked in an uncovered pan without the addition of water.

3. HAMMOND, J.

1932. GROWTH AND DEVELOPMENT OF MUTTON QUALITIES IN THE SHEEP.

Edinburgh: Oliver and Boyd, 1932, pp. XXVI+597, (pls. 53).
(E.S.R. 67:298, Sep. 1932.)

This monograph was prepared to give an insight into the scientific principles involved in the production of meat from the physiological, anatomical, and practical standpoints. The biological problems involved in animal breeding in general and in meat production in particular are discussed in detail. A section, study of the leg of mutton, was prepared in conjunction with A. B. Appleton.

4. HAMMOND, J. (Animal Nutrition Inst., Cambridge)

1940. SOME FACTORS AFFECTING THE QUALITY AND COMPOSITION OF MEAT.

Chem. and Indust. (London) 59(29):521-525, 1940.
(B.A. 16:54, 1942.)

Carcasses of young animals have a lower proportion of desirable cuts, and a higher proportion of bone than those of older animals. Fat develops largely on mature animals. When animals are made to grow fast in early life and slow later, the early developing tissues

(bone and muscle) are encouraged to grow to their limit while the growth of the later developing fat is checked, producing a heavy but lean carcass. Tenderness is believed due to size of muscle bundles or "grain" of the meat. Flavor and color are so closely correlated that color is a practical guide to flavor. Dark color and strong flavor develop in older animals by muscle use. Fat color is due to carotene pigments which develop with age or on a diet high in green grass. Fat consistency is associated with the melting point of the fat. Exterior fat is generally softer than kidney fat since fats are generally just fluid at the existing body temperature. Since pigs have lower body temperature than sheep their fat is softer.

5. HAMMOND, J.

1942. ANIMAL PRODUCTION IN THE POST-WAR WORLD.
Chem. & Indust. (London) 61(26):283-284, 1942.
(B.A. 17:463, 1943.)

Dairy products, pork and bacon, beef, lamb and mutton are discussed in relation to their probable importance in the post-war world.

6. HANKINS, O. G.

1945. QUALITY IN MEAT AND MEAT PRODUCTS.
Ind. Eng. Chem. 37:220-223, 1945.
(C.A. 39:1937, May 1945.)

The many factors influencing the wholesomeness, appearance, composition, tenderness, flavor, juiciness, and nutritive value of meats are discussed. Animal factors such as breeding, age, sex, feeding or rate of growth are especially of great influence. Significant relations in respect to processing, preservation, preparation including refrigeration, ripening, curing, smoking, freezing, dehydration, cooking, and other operations are discussed. Emphasis is placed on recent developments, especially dehydration and freezing.

7. HANKINS, O. G. and ELLIS, N. R. (U.S.D.A.)

1939. FAT IN RELATION TO QUANTITY AND QUALITY FACTORS OF MEAT ANIMAL CARCASSES.
32nd Annual Proc. Amer. Soc. of Animal Prod., pp. 314-319, 1939.

A summary was given of unpublished data gleaned from work done by several different experiment stations on the relation of the fatness of an animal to desirability of the dressed carcass and the meat. Hogs, lambs and cattle were studied, and the effect of fatness on the proportion of dressed carcass, the changes in yields and composition of cuts, the color of meat, and the relative tenderness was discussed. A study of the proportions of cuts which are associated with differences in fatness revealed that with lambs the increases with fattening are in the loin and ribs, and the decrease in leg, shoulder, neck, and breast. Increase in fatness contributed little to changes in color of lean. Variations in tenderness are caused mainly by factors other than fatness.

8. HANKINS, O. G., et al.

1944. MEAT DEHYDRATION.
U.S.D.A. Circ. 706:1-46, 1944.
(C.A. 39:1231, Mar. 1945.)

Besides dealing with processes of dehydration, this investigation included studies of packaging, storage, chemical and bacteriological changes, compressibility, rehydration and the nutritive value and palatability of the products. Dehydration saves 60-70% in weight, and about 65-73% in volume. Of the 8 processes studied, the vacuum rotary method gave indications of combining the most good points. Meat processed by this method had good rehydration capacity, thiamine retention, palatability and keeping quality, and other desirable characteristics. Studies of packaging and storage showed that metal cans were the best containers for dehydrated meats and kept them in satisfactory condition for long periods. The protein of dehydrated pork, beef, and mutton is of relatively high growth promoting value and digestibility. Thiamine content is most affected by the dehydration process. Losses in riboflavin and nicotinic acid are relatively small.

9. HANKINS, O. G. and FOSTER, M. T. (Beltsville Research Center)

1940. APPROXIMATE PHYSICAL COMPOSITION OF THE PRIMARY CUTS FROM LAMB CARCASSES OF DIFFERENT MARKET GRADES.
U.S.D.A. Mimeographed Release.

Fifty-one lamb carcasses were graded by a three-man committee into one of the following grades: Prime, Choice, Good, Commercial, Utility, and Cull. The carcasses were then divided into six primary cuts, i.e., leg, rib cut, shoulder, loin, neck, and breast. These cuts were analyzed and the varying amounts of fat, lean, edible portion, and bone and ligament for the different grades were tabulated.

10. HANKINS, O. G. and HINER, R. L.

1942. QUALITY OF MEAT AS AFFECTED BY FREEZING TEMPERATURES.
Vet. Bull. 36(1):67-79, 1942.
(B.A. 16:1384, 1942.)

Freezing increased the black color of lean pork as much as 10%. The oxidation of fat from pork is accompanied by a yellow color. Fats of beef and lamb are fairly resistant to oxidation change. Desiccation causes a spongy appearance of lean meat. Freezing

seemed to have no effect on the nutritive value of meat. For the most palatable meat, the storage should not be more than six months at 0°F.

11. HANKINS, O. G. and HOWE, P. E. (Natl. Agr. Res. Cen., Beltsville, Md.)

1938 & 1942. THE APPROXIMATE COMPOSITION OF CUTS FROM LAMB CARCASSES OF DIFFERENT DEGREES OF FATNESS.
U.S.D.A. Mimeographed Release.

Data were presented in table form on the carcass composition of 74 lambs, varying widely with respect to breeding and weight as well as ether-extract (fat) content of the edible portion of the dressed carcasses. The trimmed leg, rib, shoulder, loin, neck and breast cuts of these lambs were subjected to physical analysis and the first three cuts mentioned to both physical and chemical analysis. No procedures were given.

12. HANNA, M. I.

1933. ANALYSES OF COOKED MEATS DEPRIVED OF VISIBLE FAT.
Jour. Amer. Dietet. Assoc., 9(3):188-198, 1933.
(E.S.R. 71:872, Dec. 1934.)

The method followed in most of the analyses reported consisted in first extracting the fat in a Soxhlet apparatus from duplicate 2-gram samples of the meat with all visible fat removed and then using the fat-free meat for the usual nitrogen determinations. This technique was adopted after preliminary comparisons of the percentage of protein in six different lots of cooked meat before and after fat extraction had shown insignificant differences. Data are reported on 7 samples of beef cooked in different ways, 1 each of calves' liver, duck, and salmon, 2 each of tongue, sweetbreads, veal, lamb, ham, bacon, and turkey, 3 each of pork and chicken and 4 of rabbit. In most cases of well-cooked meat deprived of visible fat, the protein content was not far from 30% and the fat approximately 5%. The light meat of fowl and rabbit contained even less fat.

13. HARPER, C., BURK, L. D., and SPENCER, D. A.

1931. FEEDING AND CARCASS TESTS.
Natl. Wool Grower, 21(5):11-15, 1931.
(E.S.R. 67:158, Aug. 1932.)

Carcass tests were made by the U.S.D.A. Bureau of Animal Industry on lambs fed cooperatively with the Indiana Agricultural Experiment Station. Results showed that the average grade of carcasses in the Rambouillet lot was low Good, while in the Corriedale, Hampshire-Rambouillet, and Hampshire-Corriedale lots the average grade was Good. There were more Choice and fewer Medium grade carcasses in the last three lots than in the first lot. The live grades of the lambs checked rather closely with the carcass grades.

14. HARRIS, R. S., MOSHER, L. M., and BUNKER, J. W. M.

1943. NUTRITIONAL AVAILABILITY OF Fe IN MOLASSES.
Biol. Res. Lab., Mass. Inst. Tech., Pub. 157; Intern Sugar J. 45:215-216, 1943.
(C.A. 38:5536-5537, Oct. 1944.)

Subclinical hypochromic anemia is curable by foods (molasses) containing an abundance of readily available Fe. Chemical and biological tests were conducted with ordinary 1st, 2nd, and 3rd factory molasses containing 3.2, 6.0 and 11.3 mg. % of Fe, the "nutritionally available" Fe being 97, 85 and 54% respectively. Fe "availability" varies considerably with various foods, being 100, 70, 50 and 24% with eggs, beef liver, beef kidney, and mutton, respectively. It does not depend on the total Fe content of the food.

15. HENDERSON, L. M., WAISMAN, H. A., and ELVEHJEM, C. A. (Wis. A.E.S.)

1941. THE DISTRIBUTION OF PYRIDOXINE (VITAMIN B₆) IN MEAT AND MEAT PRODUCTS.
Jour. Nutr. 21(6):589-598, 1941.
(E.S.R. 86:427-428, Mar. 1942.)

The growth response of male albino rats receiving the basal ration, which was devoid of vitamin B₆ but contained adequate amounts of the other vitamins, plus supplements of the meat under test was compared with the response of negative control animals receiving the basal ration only, and with that of standard controls receiving the basal ration supplemented with crystalline vitamin B₆ at levels of 50, 75, and 100 mcg. per 100 grams of ration. The assay period extended over 5 weeks and the method used was essentially that of Conger and Elvehjem. The results of the bio-assays of the various kinds of organ and muscle tissues are reported on dry- and fresh-weight bases. Kidney and muscle were the richest sources, containing from 20 to 30 micrograms per gram dry basis (from 3 to 7 micrograms per gram fresh basis), while heart and liver were somewhat lower, with from 10 to 15 micrograms per gram dry basis, (from 2.5 to 3.5 micrograms per gram fresh basis). Spleen, pancreas, brain, and lung were poor sources, containing less than 8 micrograms per gram on the dry basis. Of the cooked meats, the fried samples showed least destruction, but roasting and stewing caused losses of from 20 to 50 percent. Commercial processing (drying and tenderizing) of various meat samples resulted in similar losses. Fish muscle, like beef, lamb, pork, and veal, was rich in the vitamin, but dark chicken muscle was a poor source.

16. HILDITCH, T. P. and PEDELTY, W. H.
1941. SHEEP BODY FATS. I. COMPONENT ACIDS OF THE FATS FROM ANIMALS FED ON HIGH AND LOW PLANES OF NUTRITION.
Biochem. J. 35:932-939, 1941.
(C.A. 36:4169, Jul. 1942.)
- Two groups of ewes were fed on restricted and full diets until the live-weight equalled 70 and 150 pounds, respectively; then the diets were interchanged and continued until the weights were completely reversed. Animals from each group were killed at intervals. The composition and fat acids of the perinephric and external-tissue fats were determined for each animal. Certain differences were observed between these fats and pig and ox fats. The composition of the increased fat in the animals on full diets was determined by difference. The increase was due chiefly to palmitic, stearic and oleic acids, and in later stages the latter predominated. The same composition was found for the fat lost by ewes fed on a full diet and then changed to a restricted diet.
17. HIRZEL, R. (Onderstepoort Lab., Pretoria, So. Africa)
1939. FACTORS AFFECTING QUALITY IN MUTTON AND BEEF WITH SPECIAL REFERENCE TO THE PROPORTION OF MUSCLE FAT AND BONE.
Onderstepoort Jour. Vet. Sci. and Animal Indust. 12(2): 379-550, 1939.
(B.A. 15:1351, 1941.)
- The measurement of certain parts of the carcass was used as comparison scale of livestock show winners. Fat was the most important factor in determining carcass quality; back fat was more important than rib fat. Muscle increase was responsible for added weight of winning carcasses; fat increase, for non-winning carcasses. Weight is more influential than breed or age in determining fat/lean ratio. With weight increase due to age, fat, muscle, and bone are increased in this order. Muscle increases faster in young animals, fat in old animals. Increase in weight influences proportion of fat, muscle, and bone more than age. Fatness, breed, and age influence marbling in this order of importance. Scale of points for judging sheep carcasses suggested are based on measurements. The flavor of meat and fat does not vary much within the species. Good flavor is usually associated with marbling; flavor increases with age.
18. HOAGLAND, R. and SNIDER, G. G.
1925. VITAMIN A IN BEEF, PORK, AND LAMB.
Jour. Agr. Res. (U.S.) 31(3):201-221, 1925.
(E.S.R. 54:390, Mar. 1926.)
- Ten lots of round of beef, 6 of pork loins and 1 of pork tenderloin, and 6 lots of lamb were tested for their vitamin A content by feeding experiments with rats. The meat used was in all cases trimmed free from fat and connective tissues, ground, mixed with water and toluol in the proportion of 800 grams of meat, 400 cc. of water, and 40 cc. of toluol, and dried in shallow pans in a current of air at 60°C. Of the beef, 15 and 30% did not furnish sufficient vitamin A for normal growth, while 50 and 95% brought about growth at nearly normal rate. Pork gave even less satisfactory results than beef, 50 and 95% proving inadequate. Irregular results were obtained with the lamb. Three of the 6 samples tested caused no increase in growth when fed at 15 and 30% levels. 1 a fair amount of growth at 30%, and 2 good growth at a 20% level. In general the data reported substantiate the general opinion that lean meat is a poor source of vitamin A.
19. HOAGLAND, R. and SNIDER, G. G.
1930. VITAMIN G IN CERTAIN MEATS AND MEAT BY-PRODUCTS.
Jour. Agr. Res. (U.S.) 41(3):205-220, 1930.
(E.S.R. 63:793, Dec. 1930.)
- The vitamin G content of 3 lots of beef (round steak) and 1 each of pork tenderloin, smoked ham, lamb (shoulder), beef liver, pork liver, beef kidney, and beef spleen was determined by testing fat-free, ground, and dried samples on rats. Beef, pork and lamb muscle appeared to contain approximately the same quantities of vitamin G, from 15 to 25% of the dried material being sufficient for excellent growth. Beef spleen was about as rich in vitamin G as the muscle meats, but beef and pork liver and beef kidney were from 5 to 8 times as rich in vitamin G as the muscle meats.
20. HOLMES, A. D., TRIPP, F., and SATTERFIELD, G. H.
1936. BEEF, HOG, CALF, AND LAMB LIVERS AS SOURCES OF VITAMIN A.
Food Res. 1(5):443-455, 1936.
(E.S.R. 78:726, May 1938.)
- The vitamin A content of fresh beef, hog, calf, and lamb livers was determined by the colorimetric method. From the data reported it is evident that calf liver is superior to the other livers as a source of vitamin A, containing an average of 535 Lovibond blue units per gram as compared to beef 252, lamb 235, and hog 182 units per gram of liver.
21. HOSTETLER, E. H. and HALVERSON, J. O.
1934. NORTH CAROLINA STATION REPORT, 1934, pp. 50-59.
(E.S.R. 78:230, Feb. 1938.)
- Results are briefly reported on the meat and wool characteristics resulting from the use of purebred mutton rams on native ewes.
22. HULTZ, F. S. (A.E.S., Laramie, Wyo.)
1940. A SCORING SYSTEM FOR SHEEP BREEDERS.
Southwestern Sheep and Goat Raiser 11(3):35-37, 1940.
(B.A. 16:2030, 1942.)
- A description is given of the system of evaluating the carcass and wool of sheep in the sheep-breeding project of the station.
23. HUNGERFORD, C. W. (Univ. of Idaho E.S.)
1944. RESEARCH ACTIVITIES STRESS FOOD PRODUCTION FOR WAR.
The News Letter, College of Agri., Univ. of Idaho, Nov. 1944.
- A summary of the research program of the Idaho Agricultural Experiment Station during 1943-1944 brought out the outstanding contributions made to the study of "Food Production for War." A study concerning lamb gave results as follows: Broiling fresh lamb chops resulted in a loss of approximately 35% of the thiamin. Fresh lamb contained 1.04 micrograms of thiamin per gram of tissue and the cooked lamb 0.68 micrograms per gram. Muscle meat of lamb is not a very rich source of thiamin. Glandular tissues of lamb contain three to six times more thiamin than lean muscle meat. Lamb chops should be broiled frozen to conserve the largest percentage of thiamin.
24. HUNT, W. E. (Maryland A.E.S.)
1935. FATTENING THIN NATIVE LAMBS. I. IMPROVING THE MARKET GRADE THROUGH FEEDING. II. CARCASS AND MEAT STUDIES.
Maryland Sta. Bull. 379:45-127, 1935.
(E.S.R. 75:93, Jul. 1936.)
- Three trials were used in this study to compare the profitableness of feeding various rations (shelled corn, peanut meal, clover hay, fish meal, cottonseed meal) over varying periods of time (98 to 138 days) to fatten low-Medium and Cull lambs. Data were recorded to show which gains were the most rapid and economical, and the carcass grades of the lambs before and after fattening. Studies were also made on the carcasses from these lambs to determine the varying dressing percentages, the amounts of edible lean, fat, and the like, the distribution of the increased weight, and the palatability of the various cuts. The increase in carcass weight resulting from gains made a substantial improvement in the quality of the carcasses. The increase in the amount of fat accounted for a little more than one-half of the increase in the weight of the loin and rib, while the increase in fat about equalled the increase in weight of lean in legs, shoulder and breasts. The amount of edible material increased from 70.8% in low-medium feeders to 77.8% in the carcasses of lambs fed 102 days and to 79.3% in the carcasses of lambs fed 138 days. A comparison of the palatability of leg and shoulder roasts showed that on the average the shoulders were more tender and more juicy than the leg roasts. Shoulders and legs scored about equal in desirability of flavor of lean and fat, and of aroma. Leg roasts from the lower quality carcasses scored higher in the desirable factors than the shoulders from the same carcasses. The percentage of evaporation loss, of dripping loss, and of total cooking loss was greater for legs than for shoulders. The time required per pound of raw weight to roast the legs was a little less than the time required per pound of shoulders.
25. HUNT, W. E., MEADE, D., and CARMICHAEL, B. E. (Coop. U.S.D.A.)
1938. EFFECT OF CASTRATION OF LAMBS ON THEIR DEVELOPMENT AND QUALITY OF MEAT.
Maryland Sta. Bull. 417:259-278, 1938.
(E.S.R. 80:812, Jun. 1939.)
- In three trials, comparisons were made of ram and wether lambs similarly fed and slaughtered at ages varying from 5 to 52 weeks. There was no significant difference in the average rate of gain of rams and wethers either on pasture or in dry lots. The rams tended to be slightly heavier at younger ages, but there was little difference between lots at 44 to 52 weeks of age. The wethers excelled in dressing percentage at all ages except at 5 and 15 weeks of age, the average dressing percentage being 49.5 and 47.4 for wethers and rams, respectively. Little difference was noted in the chilling shrink of the carcasses. There was a small advantage in average carcass grade in favor of wethers, particularly at 1 year of age. The wethers showed a greater weight of fat and a higher percentage of fat in the rib cuts than did the rams, especially at older ages. The weight and percentage of blade and arm bones and weights of head, caul fat, and pelt averaged greater for the rams. The wethers had a higher plumpness index for both leg and shoulder, a darker red color of shoulder muscle and more tender leg muscle (mechanical shear test) than the rams. Shoulder roasts showed cooking losses of 15.6 and 16.4% for wethers and rams, respectively, but no significant differences were noted in aroma, texture, tenderness, juiciness, or desirability and intensity of flavor of fat and lean in the shoulder roasts from the two lots.
- I
1. Author not given.
1934. INDIANA STATE RPT. 1934, pp. 21-71.
(E.S.R. 73:218, Aug. 1935.)
- Information is given of studies with beef, swine, sheep, and poultry. Sheep studies produced results on the effect of feeds on the quality of lamb carcasses.

J

1. JOHNSON, L. E. (S. Dak. A.E.S.)

1944. THE RELATIONSHIP OF FEEDER GRADE, INITIAL WEIGHT, TOTAL GAIN, FINISHED GRADE, AND CARCASS GRADE OF LAMBS.

Jour. Anim. Sci. 3(3):224-232, 1944.
(B.A. 18:1765, 1944.)

A total of 8,494 lambs were fattened in groups of about 100 each in 11 feeding seasons on rations consisting of one or more grains, a legume hay, one or more beet by-products, and with and without protein supplements and minerals. Measurements were made and analyzed as to feeder grade of the lambs. Considerable relationship was shown in all lambs marketed at one time between initial weight, feeder grade, finished grade, and B.A.E. carcass grade, but packer carcass grades were only slightly related to the other measurements. The use of more than one of the measures studied in predicting gain, finished grade and carcass grade of the lambs did not seem practical, and the multiple correlations were only slightly better than the simple correlations. Standardization of lamb carcass grade seems needed on the basis of value and for the daily purchase of live animals. In general, the lambs increased about one grade during fattening.

2. JOHNSON, I. B. and L. E. (S. Dak.)

1944. FATTENING RANGE LAMBS ON SOUTH DAKOTA FEEDS.

S. Dak. Sta. Bull. 373:1-20, 1944.
(E.S.R. 91:581, Nov. 1944.)

Sixteen years' results are reported of feeding lambs on farm grains and roughages with and without protein supplements and with and without beet by-products at the U.S.D.A. Belle Fourche Field Station. The feeding experiments were made with lots of usually 100 lambs each, ranging in weight from 60 to 70 pounds at the start. The length of the feeding periods ranged from 97 to 160 days, with the finished weights averaging 97 pounds. The average daily gain of 0.28 pound with corn and alfalfa hay was slightly better and the profit slightly superior to barley and alfalfa. The returns per lamb were increased by the addition of pressed beet pulp and beet tops to the concentrates of corn, barley, wheat, and oats fed with alfalfa hay rations. Lambs that were one grade above average as feeders were one-half grade above average when fat, and their carcasses were one-third grade above average. Lambs that were one grade below average as feeders were only one-half grade below average when fat and their carcasses were only one-third grade below average.

3. JONES, J. M. and STANGEL, W. L.

1938. EFFECT OF CALCIUM SUPPLEMENTS ON GAINS OF LAMBS FED SORGHUM FODDER OR SORGHUM SILAGE AS THE ROUGHAGE PORTION OF THE FATTENING RATION.

Tex. Agr. Expt. Sta. Bull. 563:5-47, 1938.
(C.A. 33:6400, Aug. 1939.)

The influence of pulverized limestone or pulverized oyster shell, each of high Ca content, on the gains made by lambs fed sorghum roughage in fattening rations was studied. Lambs in the check groups fed alfalfa hay as roughage in fattening rations made significantly greater and more consistent gains than those receiving sorghum fodder without Ca supplement. In each of the 6 tests of this series, fattening lambs fed sorghum fodder or sorghum silage as the roughage portion of the ration and supplemented with pulverized limestone or pulverized oyster shell, consumed larger amounts of roughage, made larger gains, finished better and yielded heavier carcasses than those that did not receive the Ca supplement. These tests indicated that sorghum silage made from properly matured feed crops, and when supplemented with approximately 0.4 ounces pulverized oyster shell, is more desirable in the lamb-fattening ration than sorghum-fodder.

K

1. KAMMLADE, W. G. (Ill. A.E.S., Urbana)

1945. FEEDING TEXAS LAMB.

Sheep and Goat Raiser 25:28-30, 1945.
(B.A. 19:1426, 1945.)

Soybean meal was used effectively to replace a portion or all of the corn in a lamb-fattening ration. When soybean meal furnished the entire concentrate gains were satisfactory but carcass grades were lower than when corn was used as a major portion of the concentrate in the fattening ration. Feeding soybean meal proved a safe method of getting lamb quickly on full-feed. An outbreak of infectious arthritis or rheumatism (streptococci arthritis and pericarditis) is reported.

2. KAMMLADE, W. G., MITCHELL, H. H., and BULL, S.

1941. UREA AS A SOURCE OF PROTEIN FOR SHEEP.

Agric. News Letter (Du Pont) 9(1):4-6, 1941.
(B.A. 17:148, 1943.)

In testing the value of urea in feeds 30 Texas fine-wool yearling wethers were used. Half of them were fed soybean oil meal, and half of them urea in sufficient quantities to provide equal amounts of N. All sheep had access to salt, water, corn silage and alfalfa hay in

the same quantities. The test extended over 84 days. During the first 4 weeks of this experiment, the group being given urea fed more slowly than the other group, suggesting that urea was unpalatable. The difference in the costs of the rations used and the gains in weight were not significant, but continuation of the trials seems desirable. In palatability tests of the carcasses of both groups the use of urea did not seem to impair the flavor of the meat; in 3 cases the meat of urea-fed animals was rated superior. In 4 cases of lambs not fed urea, their roasts were favored over the urea-fed carcasses.

3. KAMMLADE, W. G. and TERRILL, S. W. (U. Illinois, Urbana)

1943. FEEDING LAMBS SHORN AND IN THE WOOL.

Nation. Wool Grower (33) (5):21-23, 1943.
(B.A. 18:307, 1944.)

Results of feeding 3 lots of full fleeced and 3 lots of shorn lambs different proportions of corn and soybean oil meal, with corn silage, showed no justification of the claims that shearing results in faster, more economical gains, and greater profits. Dressing percentages were comparable in all lots, if the average fleece weight of the shorn lambs is subtracted from the live weight of the unshorn lambs. Feeding 1 pound soybean oil meal to 7 pounds corn is sufficient to meet the protein requirements of fattening lambs fed a low protein roughage.

4. KEITH, T. B. and HENNING, W. L.

1933. A COMPARISON OF FEEDER LAMBS.

Penn. A.E.S. Bull. 288, 1933.
(B.A. 10(6):1503, (1936.)

A comparison was made of the value of 223 fine wool, 165 native mutton, 223 choice western, and 58 medium western lambs as sources of feeder lambs 1928-1932. The feed required per unit of gain was greater for the native fine wool than for either the native mutton or western feeder lambs. The 6 lots of native fine wool lambs had an average dressing percentage of 40.5-46.6; four lots of native mutton lambs, 47.1-49.6, and the 6 lots of choice western lambs, 46.8-50.

5. KELLOGG, M. (S. Dak. A.E.S.)

1936. VITAMIN B IN LAMB TISSUES AND ORGANS.

South Dakota Agr. Expt. Sta. Bull. 306:1-43, Dec. 1936.

The determinations of vitamins B₁ and B₂ (G) in the body was made by feeding lamb tissues and organs to young rats, on a diet adequate save for the vitamin that was being tested. Lambs fed adequate diets supplied the tissues and organs that were used for feeding. Meat, liver, kidney, heart, tongue, brain, pancreas, and thymus from the same lambs were used in testing for vitamins B₁ and B₂ (G). Fresh tissues and organs were used for the vitamin B₁ tests and canned tissues and organs were used for the vitamin B₂ tests. Vitamin B₁ is fairly evenly distributed in lamb tissues and organs varying from one to three Sherman units per gram. Vitamin B₂ (G) varies considerably in lamb tissues and organs. On the basis of growth response, thymus is the richest source, followed in order by heart, kidney, liver, pancreas, tongue, brain, and meat. In general lamb tissues and organs contain more units per gram of vitamin B₂ (G) than of vitamin B₁. The estimated values for vitamin B₁ are given as meat 2+, liver 2+, kidney 3+, heart 3, tongue 1-, brain 2, and pancreas 2 Sherman units per gram of fresh material. Corresponding values for B₂ (flavine) are meat 1.3, liver 6.6, kidney 6.6, heart 10, tongue 2, brain 1.6, pancreas 3.3, and thymus 10 units per gram of canned material. These values indicate that vitamin B₁ is fairly evenly distributed in lamb tissues and organs, while vitamin B₂ (flavine) varies widely.

6. KELLOGG, M. and PIERSON, E. M. (S. Dak. A.E.S.)

1941. NUTRITIVE VALUE OF FROZEN MEATS COMPARED WITH FRESH MEATS.

S. Dak. A.E.S. Progress Report to Conference on Co-operative Meat Investigations, May 1941.

The effect that freezing and three months' storage had on the vitamin B₁ content of lamb tissues and organs was determined. The loss of vitamin B₁ in the organs, liver, heart and kidney did not exceed 10%. The muscle tissue loss was 21% and the loss of vitamin B₁ in the frozen tongue was approximately 28%.

L

1. Author not given.

1934. LAMB FEEDING REPORT.

Sheep and Goat Raisers' Mag., 15(2):16-18, 1934.
(E.S.R. 72:675, May 1935.)

In cooperative tests between the Texas Agricultural Experiment Station and the Texas Technological College, six lots of 20 lambs each averaging 59.5 pounds per head were fed for 93 days. All lots received cottonseed meal and salt. Lots 1, 2, and 3 were fed milo head chops during the entire period, while lot 4 received this feed for the last 63 days and lot 5 for the last 33 days. Lot 1 was fed ground alfalfa hay, lot 2 sumac sorghum silage, lot 3 sumac silage plus 0.4 ounces of pulverized oyster shell per head daily, and lots 4, 5, and 6 cottonseed hulls. The average daily gains of the lambs, and the grades of the carcasses were recorded. The average daily gains in the respective lots were 0.5, 0.3, 0.4, 0.3, 0.3, and 0.3

pounds per head. Lot 1 gained 4.5 pounds more per head than lot 3 and 10.7 pounds more than lot 2. This difference emphasizes the importance of feeding approximately 0.4 ounces of a high calcium carbonate supplement per head daily when nonleguminous roughages are used. The addition of the grain supplement during the last 63 and 33 days of the test did not increase the gains or finish of the lambs materially. The cottonseed meal and hulls ration produced the poorest gains, but was somewhat more economical than the ration fed in lot 4. The carcasses of the lambs in the last three lots graded lower than those in the other lots.

2. LATSKE, E. (N. Dak.)

1934. COOKING AND CANNING MEATS.—PART 5, MEAT ON THE FARM.

North Dakota Sta. Circ. 51:1-63, 1934.
(E.S.R. 71:557, Oct. 1934.)

The methods and recipes in this bulletin, which has been prepared for the use of homemakers, are based upon the extensive experimental work carried on in several of the experiment stations and the Bureau of Home Economics, U.S.D.A., under the auspices of the cooking committee for the National Cooperative Meat Investigations. The first part is devoted to the place of meat in the diet, its selection at the market and care in the farm home, and the general principles of meat cookery. General directions are then given for roasting meats, with specific directions for beef, veal, fresh pork, cured ham, lamb and mutton, and for roasting various meats in a Dutch oven. Other topics include broiling and pan broiling steaks and chops; cooking the less tender cuts of meats, meat soups, cooking miscellaneous meats, poultry and game, carving hints, canning meat and the use of meat fats. A few recipes for the use of lard and about 50 special meat recipes are included.

3. LEONG, P. C.

1940. VITAMIN B₁ (THIAMINE) CONTENT OF FOODS.

J. Malaya Branch Brit. Med. Assoc. 4:66-107, 1940.
(C.A. 34:7019-7021, Oct. 1940.)

The vitamin B₁ content of a large number of foods was determined by the bradycardia method. The results are tabulated. Among other results, the following data was given: A large number of dried or preserved foods (including dried mutton) retained appreciable amounts of vitamin B₁. Pork (260), bacon (260) and ham (175) are especially rich in vitamin B₁. Beef, mutton and veal contain 40-60 I. U. thiamine/100 grams cooked material. The glandular organs are richer in vitamin B₁ than the muscles. The extent of destruction of vitamin B₁ on cooking depends on the method of cooking and on the nature of the food. The human vitamin B₁ requirement is discussed.

4. LILIENCRON, F. V. (Univ. Konigsberg)

1938. VERSUCHE UBER DIE EIWEISSPARENDE WIRKUNG DES GLYKOKOLLS BEI WACHSENDEN HAMMELN.

Zeitschr. Tierernahr. u. Tuttermittelk L:155-186, 1938.
(B.A. 15:2033, 1941.)

From the results obtained in 150 daily feeding experiments in which part of the protein was replaced by glycine, the authors concluded that no young wether lambs starting at 8 weeks of age should show any pathological symptoms on such a ration. Nor was there any difference in developmental growth in the experimental animals and the controls. But weight should not be taken as the only criterion. This apparent protein-sparing action of glycine, shown by the positive N-balance, may have been due to the paunch bacteria, so it cannot be stated definitely that glycine replaced the protein. However, slaughter studies showed that feeding the amino acid increased the fat content of the tissues.

M

1. MACKEY, A. K. and JONES, J. M.

1932. FATTENING LAMBS ON CORN, MILO, HEGARI, WHEAT, AND OATS, WITH COTTONSEED CAKE AND ALFALFA.

Texas Sta. Bul. 465:1-20, 1932.
(E.S.R. 68:656-657, May 1933.)

Six lots of lambs were fed for 112 days on varying diets of whole and ground threshed milo, whole oats, cottonseed, shelled corn, sorghum grain, and alfalfa hay. The average daily gains in the respective lots were calculated. In these lamb-fattening experiments, it was shown that the addition of cottonseed cake to a ration of alfalfa and grain resulted in a marked decrease in the amount of grain and hay required per unit of gain and when added to a ration of whole threshed sorghum grain and alfalfa increased the rate of gain. Cottonseed cake increased the appetite of the lambs and improved their carcasses because of the higher finish. There was no advantage in grinding threshed milo or hegari for lambs. When fed with cottonseed cake oats produced satisfactory gains, and when fed according to appetite effected a saving in alfalfa. Feeding ground ear corn with husks did not produce as much finish as shelled corn, but the lambs made good gains and required less grain and hay per unit of gain. Wheat and hegari or a combination of the two produced practically the same gains as shelled corn. The carcasses of lambs fed shelled corn showed more finish than those fed wheat, and wheat produced better finished carcasses than hegari. Light feeder lambs required less feed per unit of gain than medium weight lambs, but lacked in finish as compared to the heavier lambs when fed for the same length of time.

2. McCANCE, R. A. and SHIPP, H. L.

1933. THE CHEMISTRY OF FLESH FOODS AND THEIR LOSSES ON COOKING.

Medical Research Council. Special Report Series No. 187,
Nov. 1933 (H.M.S.O. London) 146 pp.

Part I deals with analytical methods, Part II with composition of flesh foods, and Part III with losses during cooking. The scientific approach to the subject and thorough treatment of it make this report very important.

3. McHARGUE, J. S., ROY, W. R., and HULL, F. E. (Ky. A.E.S.)

1930. THE NUTRITIONAL VALUE OF FRESH, COOKED, DRY, AND ALCOHOL-EXTRACTED LIVER.

Jour. Nutr. 3(1):49-60, 1930.
(E.S.R. 64:580, Apr. 1931.)

Data are reported on the mineral and nitrogen content of the moisture-free normal livers of several domestic animals, on the effect of feeding the air-dried livers to rats as a supplement to a synthetic ration, and on the ash content of the feces of the experimental rats. The analyses of the livers showed the copper content of calf, lamb, and steer livers to be approximately 10 times higher than that of the liver of hog, pig, horse, chicken, or rat, or cod-liver chum. The results for iron and manganese were slightly higher in the livers containing the smallest amount of copper.

4. McINTIRE, J. M., SCHWEIGERT, B. S., and ELVEHJEM, C. A. (Univ. of Wis.)

1943. THE RETENTION OF VITAMINS IN VEAL AND LAMB DURING COOKING.

Jour. Nutr. 26:621-630, 1943.

Paired cuts of veal and lamb were cooked by the different methods of roasting, braising, broiling and stewing. The vitamin content of the meat before and after cooking was determined by the following methods: thiamine—Hennessy ('42) with modifications by McIntire et al. ('43); nicotinic acid—Snell and Wright ('41); riboflavin—Snell and Strong ('39) with some modifications. Analyses indicated that almost the entire decrease in weight in the meat during cooking was due to loss of water. Meats roasted and broiled retained more moisture than those braised and stewed. Vitamin retention closely paralleled the moisture retention during cooking. The nicotinic acid retention in the meat was generally lower than riboflavin, but higher than thiamine. Vitamin content was retained according to the method of cooking in the following order: broiling, roasting, braising, and stewing. In fresh lamb and veal the average thiamine values were 1.7 and 1.74 mcg/gm., respectively, for riboflavin 2.8 and 3.15 mcg., and for nicotinic acid 58 and 67 mcg.

5. McINTIRE, J. M., SCHWEIGERT, B. S., and ELVEHJEM, C. A. (Wis. E.S.)

1944. THE CHOLINE AND PYRIDOXINE CONTENT OF MEATS.

Jour. Nutr. 28(4):219-223, 1944.
(E.S.R. 94:127, Jan. 1946.)

Choline was determined by the method of Engel and pyridoxine by a modification of the method of Atkin et al. in a number of fresh, cooked, and commercially prepared meats. Fresh muscle meat of veal, lamb, pork, and beef gave average choline values ranging from 68 milligrams per 100 grams in beef round to 120 in ham. Average pyridoxine values for the same meats ranged from 0.22 milligram per 100 grams in lamb sirloin chops to 0.41 in veal chops. No loss of choline was found upon cooking, retention of 87 to 114% being observed. Retention of only 14 to 42% of pyridoxine were observed with the best retention obtained in roasting.

6. McINTIRE, J. M., WAISMAN, H. A., HENDERSON, L. M., and ELVEHJEM, C. A.

1941. NICOTINIC ACID CONTENT OF MEAT AND MEAT PRODUCTS.

Jour. Nutr. 22(5):535-540, 1941.
(E.S.R. 87:150, Jul. 1942.)

Various organ and muscle tissues of beef, pork, lamb, and veal, and muscle tissue of fish and chicken were analyzed for their nicotinic acid content by a cyanogen bromide method essentially like that of Melnick and Field, but with slight modifications. The dried tissue analyzed represented samples previously assayed for nicotinic acid, thiamin, riboflavin, pantothenic acid, and pyridoxine. All of the tissues analyzed were found to contain a significant amount of nicotinic acid. Liver was the richest, containing from 50.8 to 94.5 milligrams per 100 grams on the dry basis, or from 13.2 to 29.8 milligrams with an average of 18 milligrams per 100 grams on the fresh basis. Kidney was next, with from 14.7 to 47.9 milligrams per 100 grams on the dry basis, or from 5.2 to 10.5 milligrams, with an average of 8.2 milligrams per 100 grams on the fresh basis. Cooking and commercial processing caused some loss of the vitamin.

7. McMEEKAN, C. P., STEVENS, P. G., and LAMBERT, R.

1942. THE EFFECT OF PLANE OF NUTRITION ON THE GROWTH OF HOGGETS.

New Zealand Jour. Sci. and Tech. 24(4A):215A-222A, 1942.
(B.A. 18:1485, 1944.)

The study was conducted with 77 lambs on the high plane of nutrition wintered on soft turnips, weeds, and grass, an average of

25 lambs on intermediate nutrition involving pasture supplemented with good quality alfalfa hay, and 25 on a low plane of nutrition consisting of poor quality pasture without supplements. The general nutritive status of lamb feeding during the first year is discussed. Attention is called to the live weight composition, and conformation of the lambs, with determinations of the general character and quality of the carcasses. The average weights were 28.4, 38.2, and 49.6 pounds on low, intermediate, and high nutritive rations. In the high plane of nutrition 98.3% of the carcasses graded first. The weights and internal measurements of the muscle and fat of the carcasses showed favorable influences for the higher plane of nutrition. When placed on a more favorable nutritive ration there was a prompt recovery from underfeeding.

8. McNAUGHT, K. J.

1939. DETERMINATION OF COBALT IN ANIMAL TISSUES.
Analyst 64:23-27, 1939.
(C.A. 33:2554, Apr. 1939.)

The importance that Co has assumed in the treatment of certain types of wasting disease in sheep and cattle in Western and South Australia, New Zealand and Florida has focused attention on the determination of the very small quantity of Co that is normally present in animal tissues. In this paper a suitable method for destroying the organic matter with HNO₃ is described and an improved procedure is given for determining the Co with Van Klooster's nitroso-R-salt reagent. Good recoveries of added Co were obtained with about 0.20 p.p.m.

9. MICKELSEN, O., WAISMAN, H. A., and ELVEHJEM, C. A. (Wis. A.E.S.)

1939. THE DISTRIBUTION OF VITAMIN B₁ (THIAMIN) IN MEAT AND MEAT PRODUCTS.
Jour. Nutr. 17(3):269-280, 1939.
(E.S.R. 81:741-742, Nov. 1939.)

The vitamin B₁ content of various meats and meat products was determined in the raw state and for a limited number of products after cooking by various household methods. The rat-growth method was used with the basal diet of Arnold and Elvehjem. The assays were made over a 6-week period, with weekly weighings. The increases in body weights of the test groups were compared with the standard group and the vitamin B₁ value calculated by a simple proportion. Among other results, the following were given: On the dry weight basis the highest values obtained were with pork muscle. Pork loin gave values of 13 and 20 I. U. per gram. Beef round contained 3 and leg of lamb 4 I. U. per gram. No record was given of cooking samples of lamb.

10. MICKELSEN, O., WAISMAN, H. A., and ELVEHJEM, C. A. (Wis. A.E.S.)

1939. THE DISTRIBUTION OF RIBOFLAVIN IN MEAT AND MEAT PRODUCTS.
Jour. Nutr. 18(5):517-526, 1939.
(E.S.R. 82:853-854, Jun. 1940.)

The microbiological method of Snell and Strong was used in determining the riboflavin content of various meat tissues, including the samples used in the previous study of the vitamin B₁ content of meat. Protein, fat, and moisture analyses of the additional samples and riboflavin values for all of the samples, calculated on the fresh and dry basis, are tabulated. Parallel tests by the bacteriological and rat-growth methods on a few samples gave practically the same values, and simultaneous assays of fresh and dried material at equivalent levels showed that no destruction of riboflavin took place during the drying process. The highest content of riboflavin was found in liver and kidney tissues. The liver values ranged from 105 to 125 micrograms per gram of dried material for beef, from 100 to 135 for veal, 90 for lamb, and from 80 to 90 micrograms per gram for pork. Muscle tissues contained approximately 10 micrograms per gram. The cooking method which appeared to have the least destructive effect was stewing. Frying resulted in losses ranging from 33 to 50% and roasting from 30 to 60%. The conclusion is drawn that meats and meat products are an important source of riboflavin.

11. MICKELSEN, O., WAISMAN, K. A., and ELVEHJEM, C. A. (Univ. Wis.)

1939. RECENT STUDIES ON THE VITAMIN CONTENT OF MEATS AND MEAT PRODUCTS.
Jour. Amer. Dietet. Assoc. 15(7):529-536, 1939.
(E.S.R. 83:276, Aug. 1940.)

This discussion is confined to the properties and distribution in meats and meat products of five members of the vitamin B complex, as studied in the authors' laboratory. Values are given for the content of vitamin B₁ in International Units in 1 gram of dried tissue, the chick antidermatitis factor and factor W in percentages of the ration required for definite rate of growth of the experimental rats over a 6-week period, and riboflavin and nicotinic acid in gamma in 1 gram of dried tissue. The materials listed for some or all of these constituents include beef brain, heart, kidney, liver, pancreas, round, and spleen; veal leg and liver; lamb leg and liver; pork ham (fresh and smoked), heart, kidney, liver, and loin; and light and dark meat of poultry. Vitamin B₁ was contained in highest concentration in the substances tested in the pork muscle; riboflavin, in beef kidney and liver and veal liver; and nicotinic acid, in lamb liver and in pork kidney and liver (not all of the materials listed were tested for nicotinic acid). Frying is considered to conserve the vitamin B₁ content better than other methods of cooking. Riboflavin

is stable to most cooking processes, but it is noted that when foods are boiled in water the vitamin is separated from the proteins in which it is normally in combination and consequently may be lost in the cooking water. Nicotinic acid is not destroyed by ordinary cooking processes, but may be leached away to some extent in the cooking water.

12. MILLER, J. C.

1941. ANGORA GOAT FEEDING AND CARCASS STUDY MADE BY A. & M. COLLEGE.
Southwestern Sheep and Goat Raiser 11(11):16-32, 1941.
(B.A. 15:2216, 1941.)

The performance of 1-, 2- and 3-year-old Angora wethers was compared in dry lot with feeder lambs when fed a fattening ration of yellow corn, cottonseed meal and alfalfa hay. Fifteen goats of each age group and 15 lambs were fed for 100 days. The goats required 180.7% more concentrate and 163.5% more hay per hundred pounds gain than the lambs. The goats dressed 45.7% and carcass analyses indicated almost the same percentage of edible lean and fat as the lamb carcasses. Palatability studies showed the goat meat to be desirable in the tenderness, juiciness and flavor when scored by 40 judges as chops, barbecue, or chili.

13. MILLER, J. C., JONES, J. M., and BURT, C. R.

1943. FEEDLOT AND CARCASS STUDIES OF ANGORA WETHERS.
Texas A.E.S. Bull. 631:1-14, Apr. 1943.

Forty-five Angora wethers ranging from yearlings to 4-year-olds were removed directly from the range to the feedlot and fed on a standard lamb fattening ration during a 100-day period. Fifteen Rambouillet lambs were fed at the same time as a check on the performance of the Angora goats. A physical analysis of the amounts of lean, fat and bone was made for comparative purposes. Determinations of tenderness, juiciness and palatability were made by two sets of judges. The chevon was prepared as broiled chops, leg roasts, barbecue, and chili. The wethers made an average gain of 0.16 pound per head daily as compared to an average daily gain of 0.31 pounds made by the lambs. The lamb ration appeared to be unsuited for fattening Angora goats economically. The wether carcasses contained 82.6% total edible portion as compared with 81.5% for the Rambouillet lambs. Chevon was scored favorably with respect to tenderness, juiciness, and flavor. The broiled chops were more juicy than the leg roasts, but there was little difference in their tenderness or flavor.

14. MILLER, R. F.

1935. CROSSBREEDING INVESTIGATION IN THE PRODUCTION OF CALIFORNIA SPRING LAMBS.
Univ. of Calif. A.E.S. Bull. 598:1-32, Dec. 1935.

A six-year breeding test, in which 120 Rambouillet ewes were mated in lots of 20 with Hampshire, Suffolk, Shropshire, Southdown, Romney, and Rambouillet rams, was conducted to determine the merits of the various mutton sires for the production of crossbred lambs. The ewes and rams were carefully selected, fed, mated, and their lambs were marketed. Data was obtained as to lamb weight, grades, dressing yields, and price values. This test demonstrated that the early-breeding quality of the Rambouillet ewes was an important factor in spring lamb production; and also that the trade did not discriminate sufficiently in weight and quality of carcass to permit the choice Southdown lamb to compete favorably with the larger, coarser Hampshire or Suffolk lamb in terms of gross income.

15. MILLER, W. B.

1939. FAT LAMB PRODUCTION.
Jour. Dept. Agr. Victoria 37(10):453, 1939.
(E.S.R. 82:523, Apr. 1940.)

The relative feed-lot performance and carcass quality of lambs resulting from various crosses of mutton-type rams on half-breed (Romney Marsh X Merino) and Merino ewes as determined in several years' testing at the State Experiment Farm at Rutherglen, Australia, are presented.

16. MILLS, J. I.

1932. THE VITAMIN C CONTENT OF SHEEP LIVER, WITH OBSERVATIONS ON THE EFFECTS OF FREEZING AND STORAGE.
Biochem. Jour. 26(3):704-711, 1932.
(E.S.R. 68:566, Apr. 1933.)

Determinations by the Hojer method and a curative method similar to the one described by Harris, et al., are reported for sheep liver in the fresh state and after freezing by a slow or quick process, storing for various periods of time, and slow thawing. It was found necessary to feed the liver as a water extract, as digestive disturbances resulted when the liver was fed directly. The minimum protective dose of the fresh liver in the Hojer test was between 5 and 10 cc. of the extract, equivalent to from 2.88 to 5.77 grams of the liver. In the curative test 5 cc. compared closely with 1 gram of cabbage, a fully curative dose. Freezing either by a quick or slow process followed by thawing brought about a considerable decrease in the vitamin C content of the liver, and a still further loss occurred during storage at -19°C. for six months. Attention is called to observations in the literature suggesting that the rat, chicken, and calf have the power of synthesizing vitamin C. It is thought possible that this is also the case with sheep. Of practical significance is the fact that in England large quantities of liver are imported in the frozen state.

17. MOORE, T. and PAYNE, J. E. (England)
1942. THE VITAMIN A CONTENT OF THE LIVERS OF SHEEP, CATTLE, AND PIGS.
Biochem. Jour. 36(1-2):34-36, 1942.
(E.S.R. 89:770, Dec. 1943.)

Various samples of beef, sheep, calf, and pig liver obtained from English retail markets were analyzed for vitamin A by the $SbCl_3$ method after extraction of the liver fat by digestion with alkali. Blue units were converted into International Units by the use of the factor 0.6. Carotene was found to be virtually absent in sheep and pig livers, but small amounts occurred in bovine liver. Vitamin A in I. U. per gram averaged 459, 144, 39, and 45, respectively for samples of sheep, beef, calf, and pig liver obtained in summer and winter. The livers of cattle and pigs were usually richer in vitamin A in summer than in winter, but no difference was found with sheep.

18. MORTON, G. E. and FAIRBANKS, B. W. (Colo. A.E.S.)

1932. FEEDLOT FATTENING RATIONS FOR LAMBS.

Colorado Sta. Press Bull. 79:1-16, 1932.
(E.S.R. 68:514, Apr. 1933.)

Eighteen lots of 24 lambs each, averaging approximately 64 pounds per head, were fed for 114 days. Alfalfa hay and salt were fed in all lots. In addition the respective lots received rations consisting of shelled corn, barley, cottonseed meal, ground flax-seed, wet beet pulp, linseed meal, and wheat mixed feed and screenings. The average daily gains in the respective lots were calculated. In every case the addition of cottonseed meal increased the rate of gain and improved the finish, and with every ration except barley and wet beet pulp decreased the cost of gains and improved the dressing percentage. A ration made up of barley, wheat mixed feeds and screenings, wet beet pulp, and alfalfa hay produced the largest and most economical gains, the highest dressing percentage and the greatest profit per lamb, and every carcass from this lot graded Choice. There was no difference in the carcasses of lambs fed wheat and those fed corn.

19. MOWREY, R. (Texas Tech. Coll., Lubbock, Tex.)

1941. UNLIMITED LAMB FEEDING POSSIBILITIES ON TEXAS PLAINS.

Sheep and Goat Raiser 22(1):18-19, 1941.
(B.A. 16:129, 1942.)

Hampshire rams crossed on grade fine wool ewes proved more profitable than using Corriedale, Rambouillet or Southdown rams on similar ewes for the production of early milk lambs. The Hampshire crosses were 17 pounds heavier than the Rambouillets, 18.2 pounds heavier than the Corriedales and 22.5 pounds heavier than the Southdowns at time of sale on May 8. The Hampshire lambs dressed 0.5% less and had slightly inferior carcass grades to the Southdown cross and sold for \$0.50 less per hundred pounds. The lambs averaged 147 days of age.

N

1. No author given.

1929. NEBRASKA STA. RPT., pp. 27-28, 1929.
(E.S.R. 63:660, Nov. 1930.)

A lot of 118 65-pound lambs was full fed shelled corn and alfalfa hay for 84 days. At the end of this period 20 of the lambs were retained and the rest marketed. One-half of the lambs retained were continued on a full feed and the others on a maintenance ration for 56 days. Another lot of 118 lambs was fed alfalfa hay only for 56 days, and then was full-fed for 84 days on corn and hay. Three lambs were slaughtered from each lot at the beginning of the test and three others at 28-day intervals thereafter. The cost of 100 pounds of gain was 7 cents less in lot 2 than in lot 1 for the whole feeding period. No material difference in texture, tenderness, or juiciness of meat was found in the lambs fed as above.

2. No author given.

1930. NEBRASKA STA. RPT., pp. 26-29, 1930.
(E.S.R. 65:858-859, Dec. 1931.)

Factors affecting the quality and palatability of meat is one of two studies noted in this report. A lot of lambs was full-fed shelled corn and alfalfa hay for 140 days, a second lot was full-fed the same ration for 140 days, and a third lot received a maintenance ration of alfalfa hay for 56 days and was then full-fed corn and alfalfa for 84 days. At 28-day intervals, three average lambs from each lot were slaughtered for carcass studies and palatability tests. In lot 1 the lambs improved from Medium to Choice during the feeding period, increasing in weight from 64 to 105 pounds per head and in dressing percentage from 27.5 to 52. In lot 2 the lambs made equal progress during the first 84 days, but while on a maintenance ration the dressing yield decreased about 3%. There were no significant changes in dressing percentage or yield of internal fat for the lambs in lot 3 during the maintenance period, but later their behavior was similar to the other lots. As the feeding period progressed the percentage of fat in the tissues increased with a corresponding decrease in percentages of water, protein, and ash. Palatability studies showed that the aroma of fat roasts was more pronounced and more desirable, the flavor of the fat more desirable, and the flavor of the lean less marked and more desirable. Fat roasts were more tender and juicy than leaner roasts.

3. No author given.

1932. NEBRASKA STA. RPT., pp. 21-43, 1932.
(E.S.R. 69:562, Oct. 1933.)

Information is given of studies with beef, swine, sheep, and poultry. The tests with sheep include data on the factors affecting the quality and palatability of lamb.

4. NOBLE, I., SPEAR, J., and TURNBULL, F. (Minn. A.E.S.)

1944. THE EFFECT OF ROASTING TO DIFFERENT INTERIOR TEMPERATURES UPON THE THIAMINE CONTENT OF LEG OF LAMB.

N.C.P. Progress Notes, Minn. Sta. Prog. Notes, pp. 1-3, 1944.

The retention of thiamine during the roasting of four pairs of choice legs of lamb to an interior temperature of 79 and 82°C. at an oven temperature of 149°C. was determined by the Conner & Straub (1941) method. The thiamine content of the lamb varied from 1.3 to 1.8 micrograms per gram moist raw meat, 2.8 to 4.2 micrograms per gram dry meat, and 7.4 to 11.5 micrograms per gram dry, fat-free meat. The thiamine content of lamb roasted to 79°C. was not significantly different from that roasted to 82°C. The average percentage of thiamine retained in the whole roast during cooking was 70.

5. NOVIKOVA, E. I.

1941. CHANGES IN MUTTON SUET AND GOOSE FAT DURING STORAGE.

Kholodil'naya Prom. 19(1):2102, 1941; *Chem. Zentr.* I:3269, 1942.
(C.A. 37:3519, Jun. 1943.)

The sheep and goose carcasses were stored at -10° to 25° for 15 months with and without cellophane covering, and the condition of the fat at the surface of the meat was examined from time to time. No important changes were observed during the first 3 months in the mutton suet stored at -10°, but after that they became more and more noticeable. After 6 months they were considerable, and after 15 months the suet was unfit for food. At -18°, the color, odor, and taste remained practically unchanged for 15 months. The peroxide no. increased in 15 months from 0.35 to 0.96 at -10°, and to 0.58 at -18°. The amount of hydroxy acids increased correspondingly 33- and 15-fold, and the acid no. from 1.65 to 12.2. Covering with cellophane slows up fat oxidation and permits longer storage. Results were also given as to the experiment with goose fat.

O

1. No author given.

1929. OREGON STA. BIEN. RPT., pp. 74-75, 1929-30.
(E.S.R. 64:368, Mar. 1931.)

Reports are made of the several experiments with sheep and goats at the Oregon Agricultural Experiment Station, including one of chevon. Chevon has been found equal in quality and palatability to lamb or mutton of similar age and condition. Since Angora goats mature slowly and do not fatten readily, there are few young goats carrying the same condition as choice lambs.

P

1. PALSSON, H.

1939. MEAT QUALITIES IN THE SHEEP, WITH SPECIAL REFERENCE TO SCOTTISH BREEDS AND CROSSES, I.

Jour. Agr. Sci. (England) 29(4):544-626, 1939.
(E.S.R. 82:523, Apr. 1940.)

This contribution from the University of Cambridge presents the results of an extensive statistical analysis of data on carcass quality measurements and weights of lambs and yearlings of various Scottish breeds and crosses, of the Suffolk breed, and of the Iceland breed and its cross with the Border-Leicester. The relative merits of the different breeds and crosses for lamb and mutton production are discussed in relation to practice.

2. PALSSON, H. (England)

1940. MEAT QUALITIES IN THE SHEEP, WITH SPECIAL REFERENCE TO SCOTTISH BREEDS AND CROSSES, II.

Jour. Agr. Sci. (England) 30(1):1-82, 1940.
(E.S.R. 84:91, Jan. 1941.)

Data are presented on a comparative study of the anatomical composition and characters of the different breeds and crosses previously described in the first report (E.S.R. 82:523). The material for this study was provided by the complete anatomical dissection of 11 wether lambs and 5 yearling wethers selected as representative. Breed differences in the relative development of the different regions of the body and of the major tissues in different joints and in total carcasses and also the concept of early and late development as a fundamental factor in meat production are emphasized. The comparison of lambs and yearlings showed that in the total carcass bone had increased least, muscle only slightly more, and fat most

during the increase in age from 4.5 to 13 months. Other anatomical differences are described and illustrated. The relationship of the many factors and principles involved in this study to practical problems in lamb and mutton production are discussed in length.

3. PARSHIN, A. N.

1938. EXTRACTIVE NITROGEN BASES OF MUSCULAR TISSUE AND THEIR BIOLOGICAL SIGNIFICANCE. VII. THE PRESENCE OF ANSERINE IN THE MUSCLE OF SHEEP.

(In Russian) *Biochem* 3(2):169-174, 1938.
(B.A. 12:734, 1938.)

Both carnosine and anserine were isolated from sheep muscle tissue. Carnosine was identified microscopically, anserine chemically. Their simultaneous presence in the muscles of vertebrates suggested there was a genetic connection in the interformation of carnosine, anserine, creatin, and purine bases.

4. PIERSON, EDITH

1934. VITAMIN B AND B₆(G) CONTENT OF SOUTH DAKOTA TAILLESS LAMB (MUSCLE, LIVER, PANCREAS, THYMUS) AND VITAMIN C CONTENT OF LIVER.

South Dak. Agr. Expt. Sta., Ann. Rpt., pp. 34-35, 1934.
(C.A. 30:1886, Mar. 1936.)

The amount of lean lamb muscle required to give a gain of 25 grams in 8 weeks (Sherman-Chase unit of vitamin B) was less than 1 gram; liver, less than 0.5 gram; tongue, 1 gram; brain, less than 1 gram; kidney, less than 1 gram; heart, 0.5 gram; pancreas, 1 gram. The lamb was richer in vitamin B than beef.

5. PRESS, R. and FEARON, W. R.

1939. STUDIES ON THE ULTIMATE COMPOSITION OF BIOLOGICAL MATERIAL. III. GLANDULAR TISSUE. *Sci. Proc. Roy. Dublin Soc.* 22(13):157-159, 1939.
(B.A. 13:1332, 1939.)

Spectrographic analysis by means of C or Ag arc revealed the elements Na, K, Ca, Mg, Fe, Cu, and Mn in the pituitary, testis, adrenal, pineal and liver, obtained from horse, sheep, pig, and ox. Zn was only detected in sheep pituitary. Pb, Al and Rb occurred sporadically.

R

1. RASMUSSEN, K. and WEIR, J. A.

1940. THE EFFECT OF BREEDING ON FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS OF LAMBS AS DETERMINED BY FEEDING TRIALS AND CARCASS TESTS: A COMPARISON OF RYELAND x RAMBOUILLET, ROMNEY x RAMBOUILLET, CANADIAN x CORRIEDALE, AND RAMBOUILLET FEEDER LAMBS.

Sci. Agr. 21(4):153-166, 1940.
(E.S.R. 84:800, Jun. 1941.)

Comparisons were made of the rate and economy of gain in 1937-38 and 1938-39 of four groups of 40 lambs each of Ryeland x Rambouillet, Romney x Rambouillet, grade Rambouillet, and Corriedale breeding. In the first trial an attempt was made to keep all lambs on about the same amount of grain mixture of barley and oats with alfalfa hay. In the second trial the amount of barley was increased to 3 parts. The lambs were slaughtered, and the carcasses were cut, measured, and graded. The average initial weights of the lambs in the groups ranged about 70 pounds with the Corriedales averaging 65 pounds, the lightest in weight. The first year's average daily gains were about 0.3 pound with the largest average gains being made by the Ryeland-cross lambs. In the second year this group made the poorest gains, averaging 0.23 pound per day as compared with 0.27, 0.28, and 0.27 pound for the other groups. A statistical analysis by the methods of variance revealed differences, but in most cases such differences were not statistically significant.

2. Report of the Chief of the Bureau of Animal Industry.

1937. U. S. Department of Agriculture, p. 9.

A study was made of the carcasses of 38 hothouse lambs, including both purebred and cross-bred lambs. With an average chilled weight of 28.4 pounds, these carcasses yielded, on the average, 25.6% of separable fat, 55.0% of lean, and 80.6% of total edible portion. Previous unpublished work has indicated that with lambs produced under the usual, less intensive conditions such high percentages are found only in carcasses weighing approximately 40 pounds or more. Thus hothouse lamb carcasses possess a given degree of fatness, proportion of lean meat, and ratio of meat to bone at a much lighter weight than do the carcasses of lambs produced under less intensive conditions. Leg roasts of the hothouse lambs were judged as tender although lacking somewhat in juiciness. The lean and fat were rated as "moderately pronounced" in flavor, and in quality of juice the roasted meat was "slightly rich."

3. Report of the Chief of the Bureau of Animal Industry.

1937. U. S. Dept. of Agriculture Publication, p. 9.

Paired legs weighing approximately 4 to 6 pounds, from Choice and Good grade lambs, were cured in sweet pickle (6 pounds of salt, 3 pounds of sugar, and 3 ounces of saltpeter) with a salinometer reading of 70°, for periods ranging from 10 to 30 days at a tempera-

ture of approximately 38°. The cured legs were then smoked at about 110° for 18 to 20 hours, after which one leg of each pair was analyzed for salt content, portions of individual muscles being used for samples. The other leg was roasted and judged for palatability. Legs with the muscles or lean meat averaging between 4 and 5% of salt content, on a wet basis, were most desirable to the judges. This concentration was generally attained when the legs had been in cure approximately 4 days for each pound of weight. Salt appeared rather evenly distributed throughout the leg muscles except in the 10-day cure when it failed to penetrate completely portions of the muscles nearest the femur bone.

4. Report of the Chief of the Bureau of Animal Industry.

1938. U. S. Dept. of Agriculture Publication, p. 10.

Through analysis of accumulated data, a classification of lamb carcasses on the basis of fatness was developed. Dressed carcasses containing more than 35% of fat (ether extract) in the edible portion were classified as fat; those containing 20 to 34%, as intermediate; and those of less than 20%, as thin. The approximate average physical composition, including separable fat, lean, total edible meat, and bone, was determined for the leg, rib, shoulder, loin, neck, and breast cuts from carcasses of each class and chemical composition for the leg, rib, and shoulder cuts. Leg cuts, for example, contained 18.5, 14.4, and 7.6% of separable fat and shoulder cuts, 27.1, 18.0, and 11.5% for the fat, intermediate, and thin classes, respectively. The results should be useful as a guide to housewives, chefs, dietitians, and others in the purchase and utilization of lamb.

5. Report of the Chief of the Bureau of Animal Industry.

1938. U. S. Dept. of Agriculture Publication, p. 10.

In cooperation with the West Virginia Agricultural Experiment Station, a study was made of lambs produced at Hillsboro, W. Va., by crossing Corriedale rams on native West Virginia ewes of Hampshire type. When weaned, second-cross Corriedale lambs were heavier, had a higher dressing percentage, and produced higher grading carcasses than third-cross lambs containing 87.5% of Corriedale blood. The meat of the former group was also more tender, as shown by results from roasted leg cuts.

6. Report of the Chief of the Bureau of Animal Industry.

1938. U. S. Dept. of Agriculture Publication, p. 10.

Suffolk-sired range lambs from Corriedale and Rambouillet ewes produced at the U.S. Sheep Exp. Sta., Dubois, Idaho, weighed more at weaning time than Hampshire-sired lambs from the same breeds of ewes. However, the Suffolk-sired lambs produced less tender leg roasts. In another cross-breeding study, carried on in cooperation with the Wyoming Agricultural Experiment Station, Lincoln x Rambouillet range lambs produced definitely less tender meat than comparable lambs sired by Corriedale, Columbia, and Romney rams and from Rambouillet ewes. Although the results of these experiments and the West Virginia experiment do not necessarily indicate that such results would be obtained from any breed or cross between breeds, they do show that tenderness of meat may be associated with the breeding of the animals.

7. Report of the Chief of the Bureau of Animal Industry.

1938. U. S. Dept. of Agriculture Publication, p. 10.

Further research on the carcasses and meat of hothouse lambs, produced at the U.S. Morgan Horse Farm, Middlebury, Vt., showed that on the average Southdown-sired lambs from Dorset x Delaine Merino ewes were less fat and had a lower proportion of edible meat than Southdown-sired lambs from Dorset ewes or from Dorset x Tasmanian Merino ewes. The first-mentioned lambs also graded lower as dressed carcasses and were less plump in the leg than the lambs of the other two crosses. No appreciable difference in tenderness of the roasted legs was observed. All three crosses produced meat highly satisfactory in this respect.

8. Report of the Chief of the Bureau of Animal Industry.

1938. U.S. Dept. of Agriculture Publication, pp. 10-11.

Lamb rib cuts, consisting of the fourth to twelfth ribs, inclusive, were frozen at 0°F. at the Agricultural Research Center and then stored at 0° and 18°, some being protected by wrapping and some unprotected from air. During 252 days of storage the unprotected cuts at 0° and 18° lost 14.0 and 18.3% in weight, respectively, whereas those protected from air remained practically constant in weight. Data for the first 168 days of the storage period indicate that with increase in storage time there was some increase in free-fat acid content of the lean tissue of the meat stored at both temperatures. However, the increase was less for the lean of the meat stored at 0°. There is no definite evidence that the free-fat acid content of the fat tissue increased with time up to 168 days under any of the four sets of storage conditions. However, with 168 days of storage at 18°, the flavor of fat of both the protected and unprotected samples had a rather definite decrease in desirability.

9. Report of the Chief of the Bureau of Animal Industry.

1938. U. S. Dept. of Agriculture Publication, p. 11.

Lamb legs were cured at 38°F. for 5 to 6 days per pound in sweet pickle containing 12.5% of salt and then smoked 18 to 20 hours at

approximately 110°. They withstood a storage period of 28 days at 68° better than similar lamb legs cured for shorter periods. After storage the meat of the lamb legs cured for 5 to 6 days per pound contained approximately 4.5% of salt, which was 15 to 16% more than was contained by their pair mates, which were not stored. This increase is largely accounted for by their shrinkage during the aging process. While the legs were curing, salt was found in greatest quantities in the muscles adjacent to the fell. The inside muscles, the adductor and vastus intermedius, were the last to absorb the salt. The aging process, however, was accompanied by a shifting of salt and moisture between muscles, which procedure tended to equalize the salt distribution. As a result, the previously mentioned inside muscles consistently gained in salt, whereas outside muscles, notably the gracilis, decreased in salt content. Palatability data were obtained on other lamb legs weighing 5, 6, and 7 pounds that were cured 5 to 6 days per pound. These data indicated that subsequent storage for 31 days at 68° increased the intensity and decreased the desirability of the aroma, flavor of fat, and flavor of lean. The decrease in desirability was least for the 7-pound legs.

10. Report of the Chief of the Bureau of Home Economics.

1932. U.S. Dept. of Agriculture Publication, p. 3.

Data on the edible quality of 1,984 legs of lamb were correlated with facts on breed, age, sex, ration, grade of animal and carcass, cutting yields of meat, color of meat, and tenderness by mechanical test. Carcass grade and degree of finish of a leg of lamb influence shrinkage and cooking time. Cooking time and shrinkage are increased when the fell is removed, but palatability does not appear to be definitely affected. Analysis of data on ripening of lamb showed a definite and fairly rapid increase in tenderness up to 10 days after slaughtering. From 10 to 24 days there was some, but much less, increase. Some lamb was tender immediately after killing, while ripening failed to tender other samples.

11. RICHARDSON, J. E. and DICKSON, W. F. (Montana A.E.S.)

1936. THE EFFECT OF FEEDS ON THE QUALITY AND PALATABILITY OF LAMB.

Montana Sta. Bull. 320:19, 1936.
(E.S.R. 75:823, Dec. 1936.)

In this cooperative study, conducted between the departments of animal husbandry and home economics over a period of 9 years, the effect of different feeding rations on the quality of lamb was studied. Tests on cooking losses and length of cooking were also made. It was found that the use of wheat screenings or dockage containing many hard-weed seeds resulted in flabby meat covered with a scant layer of greasy fat and having a peculiar flavor. Of the various weed seeds fed the fanweed seed imparted the most objectionable flavor. When fed with alfalfa hay oats were slightly superior to wheat and barley in producing roasts of quality, juiciness, and general desirability. Barley appeared to produce consistently a rather greasy fat and a pronounced flavor in the lean. Adding wet beet pulp to a ration of wheat, barley, or oats and alfalfa hay improved the rate of gain and reduced the differences in palatability scores. Adding either dry or wet beet pulp to a ration of oats and alfalfa hay resulted in roasts that were similar and desirable in quality and palatability. During the roasting process the total shrinkage averaged about 25% when roasts were cooked to 182°F. by an oven temperature of 257° after being seared 20 minutes at 527°. Approximately one-half of the total shrinkage was by evaporation and the other half by drippings. These shrinkages were not appreciably altered by the ration fed or by the kind of cut roasted. It required about 40 minutes per pound to roast loins to the well-done stage and about 37 minutes per pound for leg roasts.

S

1. SAFFRY, O. B., COX, H. S., KUNERTH, B. L., and KRAMER, M. M. (Kans. Sta.)

1940. A BIOLOGICAL ASSAY OF RIBOFLAVIN IN THE LIVER OF THE COW, CALF, SHEEP, LAMB, AND HOG.

Jour. Nutr. 20(2):169-174, 1940.
(E.S.R. 84:564, Apr. 1941.)

Livers of beef, calf, lamb, and pork were purchased in the early fall and again in the winter and of mutton in the winter at local retail markets supplied from Kansas City packing plants. Each of the samples represented from two to six animals. The edible portions of the raw livers were run twice through a meat chopper (fine blade), and stored in glass containers at a temperature below 0°C. until used for riboflavin determinations by the Bourquin-Sherman method. The livers were fed in 200 milligram portions twice a week and riboflavin for comparison at levels of 2 and 2.5 milligrams daily. A control from each litter received no supplement. From 8 to 15 rats were used for each sample of liver tested. The riboflavin values, as estimated from the growth records, were lamb liver 4,950 and 5,400 micrograms per 100 grams, mutton (winter sample) 4,350, calf 3,450 and 4,350, beef 2,850 and 3,450, and pork 2,700 and 2,700 micrograms per 100 grams. At the end of the experiment the positive controls and the test animals fed the livers with the higher riboflavin content were in excellent condition, with glossy fur and a normal appetite. Those fed pork liver were restless and in poor condition, with shaggy fur, and the negative controls were in extremely poor condition, with rough fur and poor muscular tone.

2. SAIR, L. and COOK, W. H.

1938. RELATION OF pH TO DRIP FORMATION IN MEAT.

Can. J. Research 16(D):225-267, 1938.
(C.A. 33:250-251, Jan. 1939.)

The quantity of drip obtained from meat frozen at a constant rate is affected by the period between slaughter and freezing, and the pH of the tissue. These 2 factors appear to act independently and only the latter was studied extensively. In precooled meats the maximum amount of drip was obtained at about pH 5.2, and as the pH increased the net drip decreased to zero at about pH 6.4. Pork, beef and mutton behave similarly both with respect to the form of the drip-pH relation and the quantity of drip exuded at a given acidity. Beef is normally more acid than the other meats tested, and this can account for its greater tendency to drip in common practice. Microscopic studies showed that large crystals were always produced by slow-freezing, regardless of the pH of the material. The absence of drip from slowly frozen tissue at pH 6.4 is therefore not due to crystal size, but must be attributed to the greater reabsorbing power of the proteins in this region. Protein denaturation does not affect the quantity of drip obtained when meat is slowly frozen or stored for periods up to 3 days in the freezing zone. The weak reabsorptive power of the proteins at pH 5.2 must be attributed to their isoelectric condition in this region rather than to their denaturation. It is only in this isoelectric region that the production of small crystals by quick-freezing will reduce the quantity of drip.

3. SASAKI, RINZIRO, KANDATU, MAKOTO, and MINATO, SYOHEI

1939. SMOKED MUTTON.

J. Agr. Chem. Soc. Japan 15:337-347, 1939.
(C.A. 34:4476, Jul. 1940.)

The changes of N compounds during smoking were investigated. The change of muscle protein was greatest.

4. SATER, LENORE E. (Iowa A.E.S.)

1935. PASSING AN ALTERNATING ELECTRIC CURRENT THROUGH FOOD AND FRUIT JUICES.

Iowa A.E.S. Research Bull. 181:275-312, 1935.

A piece of cooking apparatus was designed and constructed for cooking of food with heat generated by the resistance of the food to the passage of an alternating electric current. Fruits, vegetables and meats (pork, beef, mutton and chicken) were cooked by this process and judged for texture, color and flavor. Fruits and fruit juices were heated to different temperatures, canned and tested for keeping qualities. Among other results it was found that while lean meat cooked readily by this process and the time and cost of cooking were decreased, the product was usually tough and rarely palatable owing to the scorched flavor. The meat juices were extracted to a greater degree than by ordinary cooking methods, resulting in increased shrinkage and a very dry product. Lean meats were found to have a very low resistance to the current, while fat meats had an extremely high resistance. Cooking the meat in water, eliminated the scorched flavor, but took a longer period of time and the product was often tasteless. Little or no current would pass through mutton tallow.

5. SCHWEIGERT, B. S., NIELSEN, E., McINTIRE, J. M., and ELVEHJEM, C. A.

1943. BIOTIN CONTENT OF MEAT AND MEAT PRODUCTS.

J. Nutr. 26:65-71, 1943.

The biotin content of beef, pork, lamb, veal and chicken before and after roasting, braising, broiling and frying was determined by the Lactobacillus casei method described by Shull, Hutchings and Peterson ('42) and modified by Shull, Miller and Peterson ('43). Kidney and liver were the best sources of biotin, pork and beef kidney, for example, containing, respectively 6,230 and 4,050 micrograms of biotin per gram of dry tissue, and lamb, beef, veal, and pork livers containing respectively 4,375, 3,530, 2,820, and 2,840 micrograms per gram dry tissue. Heart, pancreas, and light and dark chicken meat with values from 358 to 815 micrograms per gram (dry basis) were good sources. Beef spleen, lung, brain, and tongue contained about the same amount of biotin as pork, beef, veal, and lamb muscle meats, the latter group containing 95 to 288 micrograms per gram on the dry basis and 21 to 77 micrograms per gram on the fresh basis.

6. SCHWEIGERT, B. S., McINTIRE, J. M., ELVEHJEM, C. A., and STRONG, F. M.

1944. DIRECT DETERMINATION OF VALINE AND LEUCINE IN FRESH ANIMAL TISSUES.

J. Biol. Chem. 155:183-191, 1944.
(C.A. 38:6317-6318, Nov. 1944.)

The method is microbiological and depends on the growth response of Lactobacillus arabinosus. Satisfactory hydrolysis of animal tissues can be obtained by autoclaving with 2 N HCl for 5 to 10 hrs. Fresh muscle tissues can be hydrolyzed directly for leucine and valine analysis without preliminary removal of fat, moisture and water-soluble constituents. Fresh muscle tissues contain an average of 0.93% valine and 1.4% leucine. Muscle and organ tissue proteins contain an average of 5.3% valine and 7.7% leucine.

7. SCHWEIGERT, B. S., TATMAN, I. E., and ELVEHJEM, C. A. (Wis. A.E.S.)

1945. THE LEUCINE, VALINE, AND ISOLEUCINE CONTENT OF MEATS.

Arch. Biochem. 6(2):177-184, 1945.
(E.S.R. 93:364, Sept. 1945.)

A suitable microbiological assay for isoleucine was developed. Various cuts of meat were assayed, and a tabulation of the valine, leucine, and isoleucine values of the tissues on a raw (or cooked) basis as well as a protein basis was made. Leg, sirloin and stew cuts of veal and lamb; raw and cured ham; and beef rib, round, liver, tongue, heart, kidney, and brain, as well as veal liver were tested. The amounts of the 3 amino acids were relatively constant in the meat protein, irrespective of the kind or cut of meat, the leucine averaging 7.7% (6.1-9.0%), the valine 5.2% (4.4-6.4%) and the isoleucine averaging 5.7% (4.6-6.3%). The amount of these three amino acids extracted by boiling water ranged from 1.1 to 3.6%, while a retention of 86-106% (97% average) was observed during the cooking or curing processes used. Less than 2% of any of the 3 amino acids was recovered in the drippings.

8. SHACKLETON, L. and McCANCE, R. A.

1936. THE IONIZABLE IRON IN FOODS.

Bio-Chem. J. 30(4):582-591, 1936.
(B.A. 11(3):604, Mar. 1937.)

The "ionizable" iron content of a large number of British food-stuffs was determined by means of dipyrldyl. Expressed as percentage of their total Fe content, some of the results given are as follows: green-leaf vegetables, 50-80%; legumes and cereals, 80-100%; roast beef and mutton, 10-25%; pork, 15-47%; glandular organs 60-100%. Although the "total" Fe content of various samples of a particular foodstuff may be widely different, the "ionizable" Fe, expressed as a percentage of the "total" Fe, is relatively constant.

9. SMALCELJ, I.

1937. BEITRAG ZUR KENNTNISS DER BOSNISCHEN ZACKELSCHAFEN.

Zucht. Reihe B. Tierzucht. u. Zuchtungsbiol. 39(3):
363-385, 1937.
(B.A. 12:973, 1938.)

The Privor sheep, which are kept in a mountainous region in Central Bosnia, are described. This breed is one of the largest varieties of the Zackel sheep. The fleece is heavy, coarse and long, locks of wool from the back often being more than 12 inches long. The sheep are kept upon mountain pastures all summer. During the winter on the farms they are fed only hay. About 50% of the income from these sheep is milk, but wool and meat are also important. The dressed carcasses from unfattened animals are about 50% of their live weight.

10. SMITH, E. C. B., LEA, C. H., and SHARP, J. G.

1943. DRIED MEAT.

J. Soc. Chem. Ind. 62:100-104, 1943.
(C.A. 37:6360, Nov. 1943.)

Laboratory and pilot plant experiments with beef, pork and mutton have been made to determine optimum conditions for drying, and the results are tabulated. In the procedure recommended, the bones are removed and the fat is reduced to an estimated 30-40% on a dry-weight basis. The meat is cut into pieces of 0.25-0.50 pound, cooked with addition of a minimum amount of water in a steam-jacketed pan, or without added water in a canning retort until brown throughout, and then coarsely minced. The meat is spread, 2 pounds per square foot, on wire trays 1/4-inch mesh, and the cooking liquor, concentrated to 1/4 of its original volume, added uniformly. The meat is dried to 7% moisture content (12% on fat-free basis) in a current of air at not over 70°. The dried meat is compressed to a density of 1 in molds slightly smaller than the ultimate container, which is hermetically sealed after filling. The product can be stored at ordinary temperatures. After further cooking it is undistinguishable from cooked fresh minced meat. Raw meat dries very slowly and forms a hard crust on the surface; at this stage it must be minced again; the quality of dried raw meat is as good as that of cooked.

11. SMITH, H. H. (Utah)

1929. LAMB SLAUGHTERING, CUTTING, AND CURING.

Utah Sta. Circ. 81:1-16, 1929.
(E.S.R. 62:549, Apr. 1930.)

The slaughtering and cutting of lamb on the farm is discussed in this popular publication.

12. SPOTTEL, W.

1942. THE PHYSIOLOGICAL PROCESS OF DEHYDRATION IN THE MUSCULATURE OF GOATS AND EWES.

Biedermanns Zentr. Abt. B. Tierernahr 14:463-480, 1942.
(C.A. 37:5772-5773, Oct. 1943.)

Both the fat and lean musculatures of a fat sheep contain less water than those of a thin animal. In the course of development of rabbits, dogs, bulls and goats, the dry substance increases gradually; upon reaching its maximum it decreases again. The fatty muscula-

ture of the goat shows a greater decrease in water content during growth than that of the ewe. Increase in the fat content of fully grown animals results in decrease of metabolic intensity and water content. Normal nutrition in the growing individual increases the fat content and fat deposit, and decreases the absorption and relative amount of water in the various muscles. Work enhances the capacity of the muscle to absorb water.

13. SPOTTEL, WALTER

1943. FAT, PROTEIN AND ASH CONTENTS OF MUSCULAR TISSUES OF GROWING GOATS AND SHEEP, AND AN INTERPRETATION OF THE ANALYTICAL FINDINGS.

Biedermanns Zentr., B. Tierernahr 15:127-174, 1943.
(C.A. 38:4668, Sept. 1944.)

At the same age and under identical conditions of feeding, the muscular tissues of goats contain more fat, but less protein and ash than those of sheep. Goat muscles reach a maximum fat content at 20-30 kilograms body weight, thereafter the muscular tissues slowly lose some of their fat. In both species the following muscles rank in fat and protein content in the order given: hind legs, front legs, back and stomach. The neck muscles of sheep have considerably more fat than those of goats; both are poor in proteins whose concentration is comparable with that of the muscles of the hind legs. In both species the ash content of all muscles decreases with increasing age. Economical aspects of the results are discussed.

14. STARKE, J. S. (Losperfontein Exp. Sta., Union So. Africa)

1944. GRADE SOUTHDOWN SIREs FOR SUCKER-LAMB PRODUCTION.

Farming in S. Africa 19(222):533-564, 1944.
(B.A. 19:712, 1945.)

Where purebred Southdown sires are not available, 3/4 grade and 7/8 grade Southdown Persian rams can be used on crossbred ewes in the production of sucker-lambs; use of a half-breed sire is undesirable. There was no reduction in growth of lambs or in carcass grade where 7/8 grade and 3/4 grade sires were used, but the carcasses of lambs from 1/2 grade sires were of lower grade due to poorer conformation and poorer distribution of fat over the body.

T

1. TANNOR, B., CLARK, N. G., and HANKINS, O. G. (Bur. of A.I.)

1943. MECHANICAL DETERMINATION OF THE JUICINESS OF MEAT.

J. of Agri. Research 66:403, 1943.

A specially adapted hydraulic laboratory press for determination of expressible juice content of samples of cooked meat weighing approximately 25 to 35 grams was developed. Pressure on the sample, maintained at 50°C., was increased gradually to a total of 9,800 pounds and held there for 5 minutes. The difference in weight of the sample before and after pressing represented the quantity of expressible juices. An encouraging relationship was found between the expressible juice content of samples of beef that varied narrowly in juiciness and committee scores. The proposed method was recommended for use with beef, lamb, and pork, when the variation in juiciness is due to animal production factors, or to the internal temperature to which the meat is heated.

2. TOSCANI, V. A., RUPP, V. R., and McCLELLAN, W. S.

1934. ANALYSES OF MEATS.

Jour. Nutr. 7(4):473-480, 1934.
(E.S.R. 73:268, Aug. 1935.)

This paper contains the values for protein, fat, carbohydrate, calcium, and phosphorus, for meats used in the investigation of the metabolism of two men subsisting on an exclusive meat diet for a year. In addition the total ash and water content are given. The samples included beef muscle (well trimmed and not trimmed), tongue, liver, kidney, and brain, lamb muscle, and veal muscle. Attention is called to the fact that in meat analyses carbohydrates are usually neglected. In the present study total carbohydrates were taken as the sum of hydrolyzable carbohydrate and lactic acid. From the data obtained it is estimated that the exclusive meat diet consumed by the men taking part in the investigation furnished as much as from 8 to 12 grams of carbohydrate a day. Attention is also called to the low content of calcium in the meat and the higher values for phosphorus in liver and kidney as compared with other cuts.

3. TROWBRIDGE, P. F. and SEVERSON, A.

1933. MEAT ON THE FARM, PART 3. LAMB: SLAUGHTERING, CUTTING, AND CURING.

North Dakota Sta. Circ. 49:1-19, 1933.
(E.S.R. 70:816, Jun. 1934.)

This circular considers methods that may be practiced on the farm for the selection of animals for killing, and for slaughtering, cleaning, cutting, and curing lamb.

U

1. Author not given.

1936. U.S. Dept. Agr., Bur. Anim. Indus. Rpt., pp. 7-20, 1936.
(E.S.R. 76:667, May 1937.)

Results are reported from studies on factors affecting the quality of pork, beef, and lamb.

2. Author not given.

1942. U.S. Dept. Agr., Bur. Anim. Indus. Rpt., pp. 7-18, 1942.
(E.S.R. 88:665, May 1942.)

In this report on experiments in livestock production by the Bureau of Animal Industry in cooperation with the state experiment stations, progress is briefly reported on storage temperature and tenderness of lamb and the relation of separable fat from lamb carcasses to grade.

3. Author not given.

1935. FOODS AND NUTRITION, U.S. DEPT. AGR. BUR. HOME ECON. RPT., pp. 2-6, 1935.
(E.S.R. 74:720, May 1936.)

This annual report contains data on the cooking qualities and palatability of lamb and mutton cured and stored for varying lengths of time along with studies of other foods.

4. Author not given.

1936. U.S. GRADED AND STAMPED MEAT.
U.S.D.A. Leaflet 122:1-7, 1936.
(E.S.R. 77:81, Jul. 1937.)

This is a brief description of the methods employed in grading and stamping meats under the Government meat inspection service, with a list of official grades for beef, lamb and mutton, and veal.

5. Author not given.

1934. U.S. Dept. Agr., Sec. Agr. Rpt., pp. 88-96, 1934.
(E.S.R. 72:671, May 1935.)

Along with other reports, information is given on the progress of investigations on the quality and palatability of lamb and pork.

V

1. VAUGHAN, H. W., JOSEPH, W. E., and VINKE, L.

1927. Montana Sta. Rpt. 1927, pp. 49-61.
(E.S.R. 60:761, Jun. 1929.)

One of the several studies noted was "Wheat screenings may cause objectionable flavor in lamb." A brief summary is as follows: Lambs fed wheat screenings containing 28.1% of wheat, 16.1% of fanweed, 20.7% of hare's-ear mustard, and lesser amounts of other weed seeds developed a weed-seed flavor in the meat after 60 days on feed. Feeding on screenings for 68 days and then on wheat for 60 days almost eliminated the objectionable flavor. When the lambs were fed wheat for 82 days after 128 days on screenings, the flavor was reduced to an almost negligible point.

2. VILLEGAS, VALENTE, YNALVES, L. A., and GATAN, A. M.

1938. A COMPARATIVE STUDY OF THE NUTRITIVE VALUE OF THE CARCASSES OF SHEEP AND GOATS.
Philippine Agr. 27:52-58, 1938.
(C.A. 33:4651, 1939.)

Moisture, ash, protein, N-free extract, fat and calorific value were determined in the edible portions of each of the commercial cuts and in each of the internal organs and in the blood of 5 wethers (Indian) and of 5 wether goats (Anglo-Nubian), similarly fed and killed at 18 months of age.

W

1. WAISMAN, H. A. and ELVEHJEM, C. A. (Minnesota)

1941. THE VITAMIN CONTENT OF MEAT.
Minneapolis, Minn. Burgess Pub. Co., 1941.
(E.S.R. 86:560, Apr. 1942.)

This book, summarizing available information on the nutritive value of meat and meat products, is based on data assembled from the literature and on analyses and assays made in the authors' laboratory. Individual chapters are devoted to the more important nutrients, vitamins A, D, E, K, and C, thiamin, riboflavin, nicotinic acid, pyridoxin, and pantothenic acid. Where available, information is given on the influence of cooking on the vitamin content of meat. Current assay methods, including biological, microbiological, and chemical techniques are discussed briefly, and the procedure used in the author's laboratory for preparation of the samples is described. A summary chapter gives general values for the vitamin content of the most important forms of meat products.

2. WAISMAN, H. A., HENDERSON, L. M., MCINTIRE, J. M., and ELVEHJEM, C. A.

1942. THE EFFECT OF ENZYMATIC DIGESTION ON THE PANTOTHENIC ACID CONTENT OF MEATS DETERMINED BY THE MICROBIOLOGICAL METHOD.
Jour. Nutr. 23(3):239-248, 1942.
(E.S.R. 88:153, Feb. 1943.)

The pantothenic acid content is reported for more than 80 samples of animal tissues, many of which were samples analyzed earlier by the chick-assay method. The pantothenic acid was extracted from dried pulverized or fresh homogenized samples subjected to pancreatic digestion for from 24 to 72 hours at 38°C. in a phosphate buffered solution at pH 7.0-7.5. The medium, culture, inoculation, and titration procedures used were essentially those reported by Strong, et al. Liver (39-88 micrograms pantothenic acid per gram, fresh basis) and kidney (27-49 micrograms) of the various species were the richest of any of the tissues, while striated muscle (4-21 micrograms), heart (12-25 micrograms), lung, pancreas, brain, and spleen contained appreciable quantities. The pantothenic acid in the animal tissues occurred chiefly in combined form, since it was liberated most completely by digestion with pancreatin. There was a decrease of approximately 30-40% of the vitamin in the cooked or commercially processed samples tested.

3. WAISMAN, H. A., MICKELSEN, O., ELVEHJEM, C. A. (Wis. A.E.S.)

1939. THE DISTRIBUTION OF THE CHICK ANTIDERMATITIS FACTOR (PANTOTHENIC ACID) IN MEATS AND MEAT PRODUCTS.
Jour. Nutr. 18(3):247-256, 1939.
(E.S.R. 82:231, Feb. 1940.)

Based on the minimum protective level of feeding which gave complete protection against chick dermatitis, the potency of pantothenic acid in various tissues of cattle, hogs, and lambs is indicated. The liver and kidneys of the various species were found to be the richest sources of this factor, followed by the heart, spleen, brain, pancreas, tongue, and lungs. Muscular tissues of beef, lamb, pork, and veal were relatively low in potency. Ordinary stewing reduced the potency of kidney, heart, and spleen tissues by approximately one-third. However, frying appeared to increase rather than decrease the potency in beef liver.

4. WARNER, K. F.

1931. BONING LAMB CUTS.
U.S.D.A. Leaflet 74:1-8, 1931.
(E.S.R. 65:689, Nov. 1931.)

Simple directions, with photographic illustrations, are given for boning the shoulder, leg, loin, and breast cuts of lamb, together with suggestions for cooking the various boned cuts. Boning is recommended because the boned cuts are easier to carve, have a more attractive appearance, and, if stuffed, go farther than unboned cuts.

5. WARNER, K. F. and ALEXANDER, L. M.

1932. LAMB BECOMES MORE TENDER WHEN RIPENED BY PERIOD OF STORAGE.
U.S. Yearbook of Agriculture, 1932, pp. 260-263.

A total of 1,222 legs from lambs were compared as to palatability and tenderness by a palatability committee and also by the use of a shearing device to study the effect of periods of storage varying from 2 to 25 days. The meat was seared for 20 minutes at 265°C. and finished very slowly at 125°C. until an interior temperature of 70°C. was reached. The results of these tests showed that, on the average, lamb legs become more tender if held in cold storage for from 7 to 10 days after slaughter. Tenderness changes but slightly during the next 10 days, and the mechanical tests showed a small decrease in tenderness beyond 20 days of ripening.

6. WATSON, J. C. and FENN, F. U. (S. D. A.E.S.)

1941. FATTENING WESTERN LAMBS AND GUMMER EWES.
South Dak. Sta. Bull. 354:1-11, 1941.
(E.S.R. 86:228-229, Feb. 1942.)

Three-years' comparisons of rations containing ground and whole corn and barley with alfalfa hay for ewes and lambs were made. Results showed that lambs required smaller amounts of feed per unit of gain than the ewes. Mortality of the ewes was greater than that of the lambs. Average daily gains per head were 0.30, 0.28, 0.35, and 0.34 pound in the ewes on the whole barley, ground barley, whole corn, and ground corn rations, respectively. The whole grains produced average daily gains of 0.32 and 0.34 pound in the lambs. Corn as a fattening feed was more efficient than barley, and the animals receiving corn were more uniform at finishing. Quality and vigor determined the death losses occurring in the ewes. The roasted mutton from five representative fat ewes from each lot compared favorably with that from lambs. Grinding did not prove profitable, even for gummer ewes, because of the reduction in palatability.

7. WEBER, A. D. and LOEFFEL, W. J. (Nebraska)

1931. WHEAT FOR FATTENING LAMBS.
Nebraska Sta. Bul. 257:1-16, 1931.
(E.S.R. 65:660-661, Nov. 1931.)

This study was undertaken to compare shelled corn and whole wheat, to determine whether or not wheat should be ground for lambs, and to ascertain the advisability of feeding a mixture of wheat and corn. Two tests of 84 days each were conducted, using

black-faced Idaho lambs averaging 67 pounds initial weight in the first test and white-faced Wyoming lambs averaging 62 pounds in the second test. In both tests, the different lots of lambs were fed varying ratios of alfalfa hay, shelled corn, ground corn, whole wheat, and ground wheat. The average daily gains in the respective lots were obtained, and the differences were measured as to dressing yields, carcass quality, and palatability of representatives of the different groups of lambs. Whole wheat was found to be practically as palatable for fattening lambs as shelled corn, but in test I it was only 85%, and in test II, 88% as efficient as shelled corn for producing gains. When ground wheat was fed alone it was distinctly less palatable than whole wheat or shelled corn, but was more efficient for producing gains than whole wheat. The grain mixture made up of 3 parts of ground wheat and 1 part of ground corn produced as rapid and as economical gains as shelled corn. A study of three average corn-fed and three average whole-wheat-fed lambs showed little difference in dressing yields, carcass quality, or palatability.

8. WEBER, A. D. and LOEFFEL, W. J. (Nebraska)

1932. FEEDING TESTS AND CARCASS STUDIES WITH EARLY SPRING LAMBS AND AGED WESTERN EWES. Nebraska Sta. Bull. 276:1-31, 1932. (E.S.R. 69:91-92, Jul. 1933.)

In an effort to determine the minimum amount of grain that may be fed to aged western ewes to produce choice early lambs, three lots of 50 ewes each were fed as follows: (1) A heavy grain ration (ground ear corn) before and after lambing, (2) no grain before and liberal grain after lambing, and (3) no grain before or after lambing. The experiment also included a study of the quality and palatability of the carcasses of the ewes fed grain before and after lambing and to determine the effect of weaning on the quality and palatability of lamb carcasses. The results of the latter part of the experiment are as follows: Creep-fed lambs weaned at 3 months of age made good gains when continued on full feed for 28 days. The carcasses of such lambs at weaning time weighed 34 pounds and after an additional 28 days' feeding weighed 41 pounds. There was little difference in the two groups in dressing yield or carcass grade, and no noticeable difference in cutting yields. Full feeding for 28 days after weaning slightly increased the yield of internal fat and reduced somewhat the kidney fat, but chemical analyses showed no loss of fat for the entire carcass. The roasts from weaning lambs were a little less pronounced in aroma and flavor of fat and lean but more tender and juicy than roasts from lambs fed for 28 days. The ewes in lot 1 dressed 50% when slaughtered at the time the lambs were weaned. The carcasses of these ewes were graded Good and were thickly but rather unevenly covered. The flesh from the racks contained 48% fat. Roasts from such carcasses had a pronounced but not necessarily an undesirable aroma. When compared with lamb the roasts had a more pronounced and less desirable flavor of both fat and lean, were slightly dry, and not particularly tender.

9. WEBER, A. D., LOEFFEL, W. J., and PETERS, M.

1931. LENGTH OF FEEDING PERIOD AND PLANE OF NUTRITION AS FACTORS IN LAMB FEEDING. Univ. of Nebraska A.E.S. Bull. 262:1-39, Oct. 1931.

The object of this experiment was to study the length of feeding period and the plane of nutrition as related to the problem of fattening Western lambs for the February, March, and April markets. Two trials were conducted in which the following conditions were imposed upon western lambs: (1) A maintenance period of 56 days followed by 84 days of full feeding; (2) 84 days of full feeding followed by 56 days of maintenance, and (3) continuous full feeding for 140 days. The effects of each of these conditions upon the carcasses, total gains produced, and total feed required for 100 pounds of gain was measured. The carcasses were graded, and slaughter data, cutting data, boning yields were collected. Chemical studies, cooking tests, and palatability studies were also conducted. Eighty-four days of full feeding on corn and alfalfa produced carcasses which reached the peak so far as grade was concerned. Continued full feeding brought about a lowering of grade due to increasing wastiness. From the standpoint of weight, finish, and attractiveness as gauged by market standards for live lambs, maintenance followed by full feeding was the most efficient method of prolonging the feeding period. As fattening progressed, the flavor of the lean became noticeably less pronounced. Comparatively little difference was noted in the tenderness of the samples for the various lots.

10. WILKE, A.

1940. THE FEEDING OF GLYCINE TO GROWING SHEEP. THE PROTEIN-SPARING ACTION AND HARM TO THE ORGANISM. Z. Tierernahr. Futtermittelk. 4:263-283, 1940. (C.A. 36:585, Jan. 1942.)

The total substitution by glycine of the peanut cake meal, amounting to 58% of the total N in the daily feed ration of sheep, did not affect to any extent their gain in weight. The protein-sparing action of the glycine was further evidenced by the loss in weight of other sheep that were given a deficient N supply corresponding to the amount of nonglycine N of the substitute feed. Slaughter experiments showed that the quality of flesh of the glycine-fed sheep was less firm than that of the animals given the normal feed, owing in part to a higher H₂O content. The glycine feeding also caused an increase in the acidity of the rennet bag and changes

in the color of the filtrate from the protein determination on the feces. No significant differences in the N or fat contents of the flesh, blood or wool of the differently fed sheep were found.

11. WINKLER, C. A.

1939. COLOR OF MEAT. I. APPARATUS FOR ITS MEASUREMENT, AND RELATION BETWEEN pH AND COLOR.

Can. J. Res. 17(D):1-7, 1939. (C.A. 33:3474, May 1939.)

A photoelectric color comparator, similar to that designed by Bolton and Williams, has been constructed and used to compare the colors of meat samples at different pH values. Light falls at an angle of 45° on the surface of the sample, and the amount scattered at right angles from the surface in the red, green and blue regions of the spectrum, defined by standard color filters in the path of the scattered light, is measured photoelectrically as a percentage of the amount similarly scattered in the same spectral regions from a standard white surface under the same light intensity. The precision of the measurements on meats was ±0.25% scatter with any one of the three filters. When samples of pork, beef and mutton were used, after adjustment of the pH by injections of lactic acid or ammonia, the relation between pH and color was found to be similar for the three meats with maximum scatter of red, green and blue at pH about 5.0-5.5.

12. WINTER, L. B.

1940. A NOTE ON THE CARDIAC INOSITOL OF THE SHEEP, PIG AND OX.

Biochem. J. 34:249-250, 1940. (C.A. 34:4445, Jul. 1940.)

It was not possible to detect combined inositol in the heart muscle of the sheep, pig or ox although it has been previously obtained from dog hearts. Inositol was destroyed to a considerable extent when it was boiled with 5% of aqueous KOH.

Y

1. YOUNG, DUNLOP

1937. THE PRESENCE OF COPPER IN LAMB LIVERS.

Vet. J. 93:51-55, 1937. (C.A. 31:6717, Sept. 1937.)

Copper determinations were made on imported lamb livers by a modification of the method of Sylvester and Lampitt. The livers were found to contain 21.6 to 510 p.p.m. of Cu. The average of 3 livers of Scotch origin, 2 Welsh and 2 Devon was 132 p.p.m. The Cu content of 9 human livers varied from 19.0 to 126.0 p.p.m. with an average of 36.3.

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