

Circular 96

**NMSU
WITHDRAWN**

December, 1930

ROAST BEEF

Rare, Medium or Well Done

by

ESTHER LATZKE



Standing rib roast of beef

**AGRICULTURAL EXTENSION DIVISION
NORTH DAKOTA AGRICULTURAL COLLEGE,
Fargo, North Dakota**





ROAST BEEF—RARE, MEDIUM, OR WELL DONE

By ESTHER LATZKE, Research Worker in Home Economics.

It is the ambition of every housewife to prepare for her table food which is "done to a turn". Perhaps no one food is more difficult to prepare with accuracy and is more often of poor quality than the meat which forms the basis of at least one meal a day.

Roast beef—rare, medium or well done is first choice among meats in a large percentage of homes. How to be sure that the beef roast will be of the best quality possible and will be cooked to exactly the desired doneness has been the subject of considerable experimentation which revealed some interesting information concerning the processes of preparation.*

WHAT CUTS OF BEEF CAN BE USED FOR ROASTING?

Common cuts of beef for roasting are (1) the ribs, either as a standing roast with the bone left in, or as rolled roast in which the rib bones and chine bone are removed and the whole rolled and tied. (2) the loin, (3) the shoulder, (4) the rump. The rib roast which is most commonly used can be either large or small, one single rib up to seven ribs being cut for use. It is unwise to select a roast weighing less than $2\frac{1}{2}$ to 3 pounds, for it will become too dry on cooking.

WHAT IS AN IDEAL RARE, MEDIUM, AND WELL-DONE ROAST?

Personal taste plays such a large part in the choice of a rare or well done roast that what would be considered a medium done roast by many would be distinctly rare to others. Rare meat has a much more distinctive flavor and is tenderer and juicier than meat which is thoroly cooked thru, yet to many the color of the rare meat is so unattractive that it is unpalatable.

A rare roast will be characterized by three distinct layers of color in the meat—(1) the brown, and brownish gray layers on the

* Experimental work which formed the basis for this leaflet was done in connection with the national project "Factors which influence the quality and palatability of meats", cooperative between the U. S. D. A. and various state agricultural experiment stations. The processes were carried out by Miss Ethel Flaten.

outside, and (2) the pinkish layer, which gradually develops into a (3) bright red portion at the center. In a rare roast most of the meat shows at least a small amount of pink, but the deep red color of raw meat is not present.

A medium done roast is pink in the center, but has turned to the brownish gray color at least half way thru the meat and the juice which forms on cutting has only a slight pink color. More people desire a roast of this doneness than of any other. It is still very juicy and tender and the color is more attractive than in rare meat.

A well-done roast has the last bit of pink removed by extended cooking and is grayish brown all thru the meat. It is neither as juicy nor as tender as the less cooked meat for the proteins have coagulated and the fibers have shrunk, forcing out some of the juices.

If cooking is extended beyond the well done stage the meat continues to become drier and darker, until a crumbly texture is developed.

To determine exactly how much the meat should be cooked to secure these different degrees of doneness, experimental methods were developed using ovens with very definite heat control, a standard type of pan and thermometers which could be inserted into the center of the roast to tell the exact temperature of the roast during the cooking. Many roasts were cooked in ovens heated to the same temperature but removed when the meat thermometer stood at temperatures varying from 124°F (51°C) to 167°F (75°C).

If the meat was removed when the thermometer registered 124°F (51°C) the roast was ideal for a rare roast, when it registered 142°F (61°C) it was ideal for a medium done roast, and at 160°F (71°C) it was ideal for a well done roast. Altho the use of a meat thermometer gives the most accurate results in testing doneness, many housewives have not yet made such thermometers a part of the kitchen equipment. For this reason it is necessary to find another simpler measure of doneness. The time per pound which is required to bring the meat to the three different stages of doneness noted above is found to be a fairly accurate guide to doneness. The time required is approximately as follows for roasts cooked in a 250-260°F oven.

1. For a rare roast—14 to 15 minutes per pound.
2. For a medium done roast—17 to 18 minutes per pound.
3. For a well done roast—23 minutes per pound.

A ROAST CONTINUES TO COOK AFTER IT IS REMOVED FROM THE OVEN

Usually when a roast is removed from the oven it is placed on a hot pan or platter and allowed to stand uncut until the gravy is made and the rest of the dinner arranged for serving. Unless the meat is cut the cooking process will continue with an actual rise of

as much as 15 to 20°F in the temperature at the center of the meat, and will continue to rise as long as 30 to 45 minutes. The amount of cooking which takes place after the roast is removed is dependent upon two factors:

1. The degree of doneness of the meat.
2. The oven temperature at which the meat is cooked.

Roasts which are taken out when still rare show a greater rise in temperature after they are removed than the ones cooked to medium done and well done stages. If the cooking is continued past the 160°F for a well done roast there will be practically no further rise in temperature after removal.

If roasts are cooked in a very slow oven (230°F) they show much less tendency to continue cooking after they are removed than roasts cooked in an oven as high as 350°F.

Since a difference of several degrees in temperature makes a considerable difference in the quality of the roast it is necessary to make an allowance for this extra cooking outside the oven if the meat is to be cut at once. The following time for cooking should be used if the roasts are not to be allowed to stand after they are removed from the oven:

For a rare roast—allow 18 minutes per pound.

For a medium done roast—allow 20 to 22 minutes per pound.

For well done roast—allow 25 to 30 minutes per pound.

These are the time-weight relations usually recommended for the housewife who carves her roast in the kitchen as soon as it is removed from the oven.

WHAT OVEN TEMPERATURE SHALL BE USED FOR ROASTING?

The roasting process is divided into two parts, the first short period of high temperature in which the outer brown crust is formed which gives flavor to the meat, and the longer period at a reduced temperature for slow cooking. It is found best to have the oven at 527°F for the 20 minutes of searing, but the question of how low to turn the oven after searing is less easily decided.

A high oven temperature of 350°F (175°C) requires a shorter total time for cooking a roast than a lower oven temperature of 257°F (125°C), or lower still, 230°F (110°C), but the amount of fuel consumed is greater and the roast is much less evenly cooked. The lowest temperature which can be secured in the baking oven will yield the most evenly cooked product, but the total time of cooking will be increased.

The greatest factor of difference between the roasts cooked at low oven temperatures and those at higher temperatures comes in the

amount of loss in the meat. The higher the loss the drier and the more shrunken the meat, and consequently the fewer servings can be made from a pound of meat. This factor of loss is one to be carefully considered by the housewife.

Loss of weight in roasts cooked at 350°F is 70 percent greater than in roasts cooked at 230°F. The actual percentage of loss in weight of several roasts cooked at temperatures of 230°F, 257°F, and 350°F is shown below:

4 roasts cooked at 230°F oven temperature average total loss—13.5 percent.

4 roasts cooked at 257°F oven temperature average total loss—18.1 percent.

4 roasts cooked at 350°F oven temperature average total loss—22.5 percent.

Losses in meat are of two kinds, (1) evaporation of moisture and other volatile material, and (2) drippings which are made into gravy and are not an actual loss. The amount of loss to drippings is always large when the meat is well mottled with fat. Fat meat on the other hand is juicier than very lean meat and a liberal amount of fat is therefore desirable.

The temperature of the oven makes considerable difference in the quality of the drippings from a roast. A high oven temperature yields rich brown drippings making gravy of excellent color and flavor, while a low oven temperature yields drippings much lighter in color and less attractive. Since losses in the meat are so much greater at the higher temperatures it seems inadvisable to sacrifice the quality of juiciness of the meat to the color of the gravy. An oven temperature of 257°F is found to yield a roast having a fairly minimum loss with a good brown color of drippings.

A SUCCESSFUL METHOD OF ROASTING BEEF

To produce a beef roast which is sure to be the highest standard of quality the following directions are given:

Choose a rib roast of beef weighing not less than 3 pounds. A 5 to 6 pound roast is preferable. Ask the butcher for the exact weight. Wipe the meat with a damp cloth, but do not wash it or remove any of the fat. Place the roast, fat side up, bone side down, in a shallow open roasting pan or dripping pan.

Heat the oven with the regulator set at 525-550°F for at least 20 to 30 minutes. If a portable oven thermometer is used, set it in the front of the oven to the right. A 550°F oven is extremely hot, hotter than is used for any baking process.

Place the pan and roast in the middle of the oven and allow the meat to sear for 20 minutes. After the searing process is completed open the oven door for 4 to 5 minutes to quickly reduce the temperature. Reset the regulator to 255-260°F, or if a portable thermometer is used, the oven flame should be adjusted to maintain this same low temperature; 255-260°F. is a very low oven temperature

such as would be used for baking angel food cake. While the oven is open season the meat with any seasoning desired. Use one-fourth teaspoonful of salt to each pound of meat.

The roast may be left without further attention at this low temperature until it has cooked for the time periods noted below:

1. For a rare roast—18 minutes per pound of raw meat.
2. For a medium done roast—20 to 22 minutes per pound.
3. For well done roast—25 to 30 minutes per pound.

Prepare the gravy by adding 2 tablespoonfuls of flour to each 2 tablespoonfuls of fat and drippings in the roaster. Stir until blended into a smooth mixture, then add slowly $1\frac{1}{2}$ cups of liquid for each 2 tablespoonfuls of flour and stir until it boils for about 3 minutes. Liquid for the gravy may be water, milk, or vegetable or meat stock. If the drippings from the roast are too light to make a gravy of good color the flour and fat mixture can be browned before adding the liquid.

It is a wise plan to calculate the cooking time of a roast before putting it into the oven so that the time at which it will be ready to serve can be accurately determined. For a well done roast allow:

For a 10 pound roast—4 hours 10 minutes of cooking.

For a 6 pound roast—2 hours 30 minutes of cooking.

For a 4 pound roast—1 hour 40 minutes of cooking.

For a 3 pound roast—1 hour 15 minutes of cooking.

If such methods are followed it will be unnecessary to wonder if the meat will be done in time, or to continually test the meat with fork or skewer allowing juices to escape. The roast can be served with the assurance that it has been done to a turn.

Even more accuracy can be assured by using a meat thermometer such as described above and removing the meat when the thermometer registers 61°C (142°F) for a rare roast, 68°C (154°F) for a medium done roast, and 75°C (167°F) for a well done roast. Meat thermometers are not yet commonly marketed but the portable oven thermometers can be purchased at any hardware store for a small price.

ROASTING OTHER CUTS OF BEEF

No definite time relations are quoted for rump roasts or rolled roasts. There will be some variation from the method described above. A rolled roast is more compact and will require a longer time per pound than a roast with the bone retained. Fat roasts require a slightly longer time than lean roasts due to the slower penetration of heat thru fat.