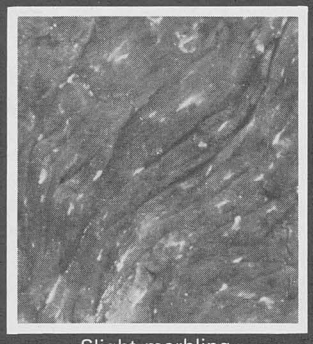
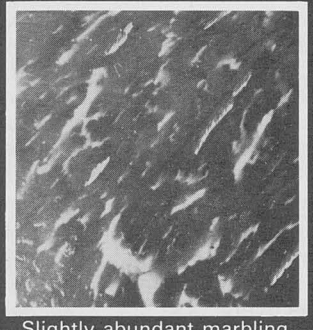
Extension Folder 382—Revised 1983

Amount of Fat and Cholesterol in Meat

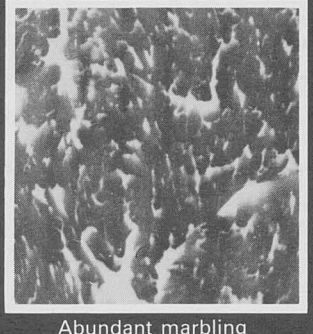


Slight marbling

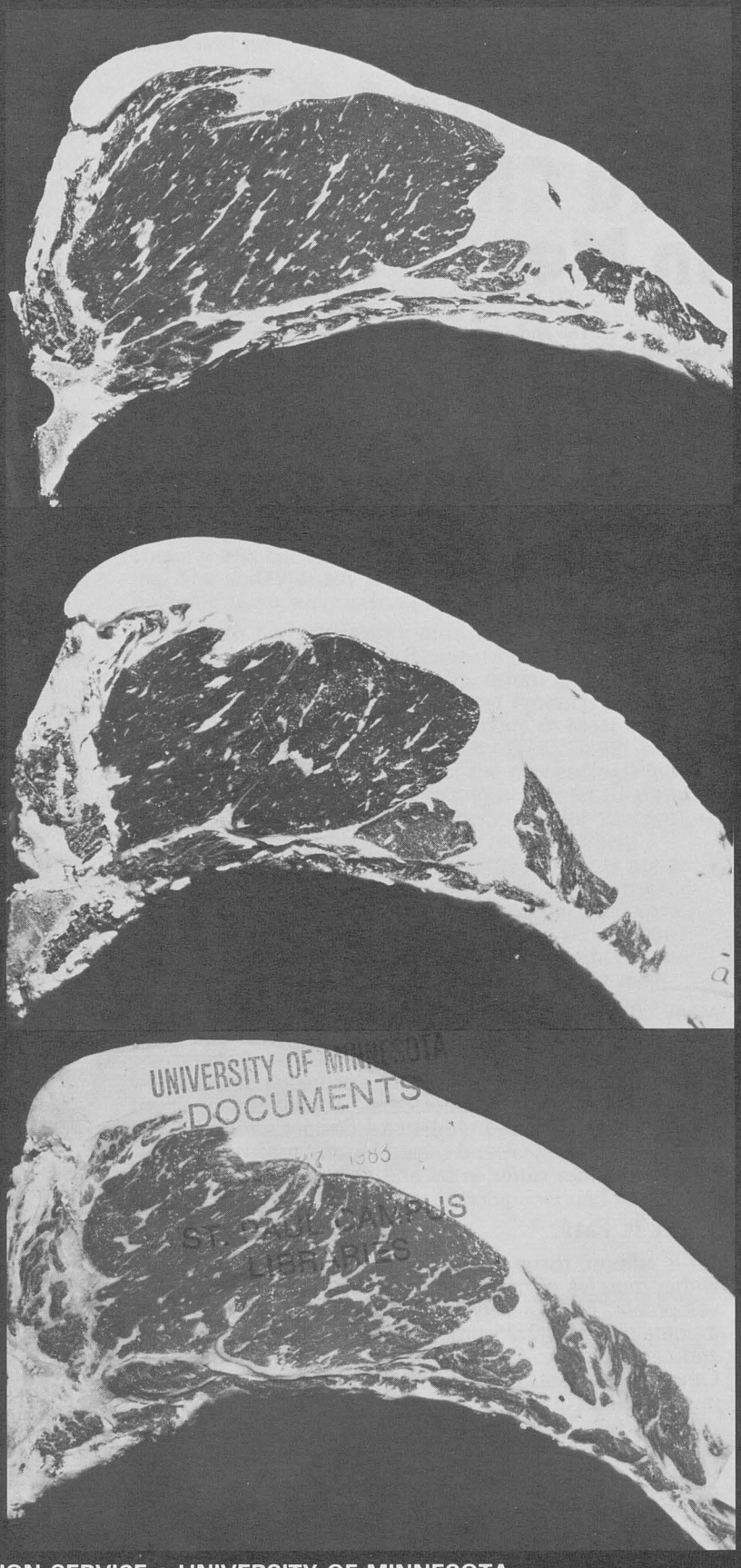
Modest marbling



Slightly abundant marbling



Abundant marbling



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Amount of Fat and Cholesterol in Meat

On the cover: The photographs on the left are examples of four degrees of marbling in beef. They illustrate variations in fat content of a specific muscle because of quality grade. The photographs on the right are examples of three beef carcass yield grades. They illustrate how fat to lean ratios can vary in a specific cut prior to trimming.

Many consumers of meat and meat products are concerned about fat and cholesterol content. This folder does not list the fat and cholesterol content of every available meat and meat product since such detailed information is available from other sources. Rather, it points out how fat and cholesterol content varies among types of meat and meat products and how to select meat that varies in fat and caloric content.

What Is Fat?

Fat is adipose tissue deposited around, between, and within muscles of meat animals during growth and development. Fat is a very concentrated form of energy; it contains about 2.25 times more energy than protein and carbohydrate. Fat is a major component of meat. Other components include water, protein, vitamins, and minerals.

Fat Type

All fat is not alike. Fat is made up of connective tissue and lipids, such as various fatty acids, that consist of carbon, hydrogen, and oxygen atoms. If all carbon atoms are joined by single chemical bonds, the acids are called saturated acids. If one or more double bonds occur on the chain of carbon atoms, the acid is unsaturated, has a lower melting point, and is more oily. Thus, unsaturated acids with double bonds become "saturated" with hydrogen into single bonds when hydrogen atoms are added to them in the normal metabolism of the animal.

Animal fat contains a higher proportion of saturated fatty acids than does most fat from plant sources. As illustrated in table 1, however, animal fats are not all saturated and the proportion of saturated fat to unsaturated fat varies with the animal. Of the red meats, lamb fat is the most saturated and pork fat is the least saturated. This is why lamb fat is hardest at room temperature, pork fat is softest, and beef fat is in between. It also is the reason why pork cannot be stored in the freezer as long as beef or lamb.

Fat in the Diet

Fat in the U.S. food supply rose 31 percent between 1909 and 1980. About half of this increase occurred after 1949. Although nearly half of the fat in the food supply comes from animal fat, most of the total increase can be attributed to vegetable fat, mainly salad and cooking oil (see table 2).

Fat Amount

Many factors influence the total fat content of meat, including the definition of meat, meat grade, cut-to-cut variation, muscle-to-muscle variation, level of visible intramuscular fat within the lean (marbling), method of cooking, and degree of doneness.

Some published values of composition of meat are not realistic for consumer purposes. For example, values of 35, 28, and 21 percent fat, respectively, in the entire beef carcass of Choice, Good, and Standard grades are almost meaningless for consumer purposes. These values are derived from all fat present in the carcass, yet some of this fat is trimmed before it goes to the meat counter, and many individuals do not eat much of the fat remaining on the meat after cooking.

When the carcass is trimmed of excess fat for retail sale, all the cuts from Choice, Good, and Standard grade beef carcasses have a total fat content of 25, 20, and 16 percent, respectively.

Table 1. Percentage of saturated fatty acids and unsaturated fatty acids in the fat of meat*

Species	Total saturated fatty acids	Total unsaturated fatty acids	Ratio of unsaturated/ saturated fatty acids
Lamb, cooked, separable lean	56	44	.78
Veal, cooked, separable lean	48	52	1.08
Beef, cooked, separable lean	48	52	1.08
Pork carcass, cooked, separable lean	37	63	1.70
Chicken fryers, cooked flesh, skin, and giblets	30	70	2.33
Turkey, all classes, total edible, raw	29	71	2.45

*_Nutritive Value of American Foods in Common Units_. Agriculture Handbook 456. Catherine F. Adams, 1975. Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C.

Table 2. Sources of fat in the U.S. food supply*

Year	Meat, poultry and fish	Dairy products	Other foods	Fats and oils	Total
	grams per capita per day				
1909-13	46	18	14	46	124
1947-49	47	25	17	53	142
1967-69	58	19	16	63	156
1980	59	18	15	70	162

Handbook of Agriculture Charts, Agriculture Handbook 609, 1982. U.S. Department of Agriculture, Washington, D.C.

Fat content varies considerably from cut to cut. For example, a Choice beef round has a total edible tissue (fat and lean) fat content on a raw basis of 12.3 percent, whereas a rib from the same carcass has a fat content of 37.4 percent (as listed in *Composition of Foods*, Agriculture Handbook 8, by Watt and Merrill). These values for fat content of wholesale cuts are misleading to consumers who do not eat all the fat present in a wholesale cut.

Specific muscles within the same carcass vary in fat content. The muscle-to-muscle variation in fat content is apparent from reading across in table 3. The top loin with a modest (Choice) amount of marbling has 6.6 percent fat, whereas the corresponding top round has 3.7 percent fat. The amount of marbling or visible intramuscular fat within a muscle (see cover photos) also influences the fat content (table 3, reading down). The variation in marbling also influences caloric content (table 3, reading down).

Table 4 shows the influence of marbling on fat and caloric content of pork. The data in tables 3 and 4 substantiate that consumers can purchase meat with widely varying fat and caloric content by selecting various cuts or meat with various levels of marbling (see cover photos). For example, top round with slight marbling has 2.8 percent fat in the muscle, whereas top loin with abundant marbling has 14.6 percent fat in the muscle. Selection of meat according to content of trimmable fat further varies the amount of fat in retail meat purchased (see cover photos).

The values in table 3 are most meaningful to consumers concerned about fat intake and calories. These values demonstrate how visual selection of cuts from the meat counter with different levels of marbling can markedly influence fat content and calories of the cut. Consumers concerned about these aspects should learn to evaluate cuts of meat for marbling content even though the meat already has been graded.

Cooking procedure also can affect fat content, as illustrated in table 5. Cooking effectively removes 8 to 18 percentage units of fat present in raw ground beef.

Although moisture is the major component lost during cooking, fat content also is influenced by degree of doneness. Well done meat has a lower fat content than rare meat because some fat drips out during cooking if the meat is broiled, roasted on a rack, or fried on a grill. These methods allow the fat to be lost as drip from the meat. Although pan frying removes some fat from meat, the meat still cooks in its own fat drip. The addition of soy protein to ground beef results in less cooking loss because soy retains moisture during cooking. The ability of soy protein to retain fat from ground beef during cooking is somewhat controversial.

How much fat is necessary to insure adequate flavor, juiciness, and tenderness? Results from various consumer studies presented at a symposium called *Fat Content and Composition of Animal Products* in Washington, D.C., in 1974 ("Eating Quality of Meat Animal Products and Their Fat Content" by G. C. Smith and Z. L. Carpenter, pp. 147-182 of the proceedings) indicate that 3.5 to 4.5 percent intramuscular fat (slight to a small amount of marbling) is necessary for "acceptable" palatability of intact muscle meats, namely steaks, chops, and roasts. Marbling definitely is not a major factor in tenderness. Conclusions of effects of higher levels of marbling on flavor and juiciness vary. The influence of marbling on palatability varies with such things as individual tastes, cooking methods, degree of doneness, and use of flavorings. Select meat with various fat levels until you find a level of palatability that suits you.

Minnesota rules and regulations require that ground beef contain no more than 30 percent fat, lean ground beef no more than 22 percent fat, and extra lean ground beef no more than 15 percent fat. Most consumers purchase ground beef according to intended use. For broiled patties, 30 percent fat content may be acceptable; 16 to 20 percent is recommended for me-

Table 3. Muscle-to-muscle and marbling influence on fat and caloric content of raw beef*

Marbling level†	Longissimus muscle (large muscle in top loin) Percent fat	Calories per 100 grams‡	Semimembranosus (top round) Percent fat	Calories per 100 grams
Slight (found in Good)	4.1	125	2.8	114
Modest (found in Choice)	6.6	145	3.7	121
Slightly abundant (found in Low Prime)	11.4	184	4.6	128
Abundant (found in High Prime)	14.6	210	7.2	149

*"Influence of Marbling and Maturity on Palatability of Beef Muscle. I. Chemical and Organoleptic Considerations." B. B. Breidenstein, C. C. Cooper, R. G. Cassens, G. Evans, and R. W. Bray. *Journal of Animal Science*, 27:1532, 1968.
†The marbling levels in beef are devoid, practically devoid, traces, slight, small, modest, moderate, slightly abundant, moderately abundant, and abundant (see cover photos).
‡100 grams is the same as 3½ ounces.

Table 4. Influence of marbling on fat and caloric content of raw pork*

Marbling level	Longissimus muscle (Large muscle in pork loin chops) Percent fat	Calories per 100 grams
Devoid	3.1	116
Slight	3.7	121
Modest	5.0	131
Slightly abundant	6.9	147
Abundant	10.4	175

*Biochemical Properties of Pork and their Relationship to Quality. II. Intramuscular Fat." R. G. Kauffman, Z. L. Carpenter, R. W. Bray, and W. G. Hoekstra. *Journal of Food Science*, 29:70, 1964.

Table 5. Effect of commercial cooking method on composition of ground beef patties*

Cooking method	Grams of fat per 100 grams of product (Same as % of raw product)	Calories resulting from 100 grams of raw product and then cooked
Raw	18.1	237
Broiled	10.0	164
Grill fried	10.5	169
Microwaved	8.0	146

*"Effect of Broiling, Grill Frying and Microwave Cooking on Moisture, Some Lipid Components and Total Fatty Acids of Ground Beef." L. J. Janicki and H. Appledorf. *Journal of Food Science*, 39:715, 1974.

dium to well done patties. At lower fat levels, the cooked product will lack juiciness. If the ground beef product is to go in a casserole or meat loaf, where most of the fat that is cooked out still remains in the cooking container, extra lean ground beef (no more than 15 percent fat) should be selected. Most sausage items, such as frankfurters, have a 30 percent allowable fat maximum. Fresh pork sausage, however, can contain up to 50 percent fat. Low fat sausage products are available; ask your meat market manager to stock them if you prefer them.

What Is Cholesterol?

Cholesterol is a compound in bile, gallstones, cell membranes, and especially nerve tissue. It is an essential constituent of body cells in animals and is synthesized in the human body. Because it is a component of all animal cell membranes, it is present at different levels in animal foods. Plant foods do not contain cholesterol.

The concern (or lack of it) over cholesterol in food is controversial, to say the least. An enormous number of studies on the health effect of lowering or raising dietary cholesterol have been published in the scientific literature. The debate centers around three issues: (1) What changes in diet, if any, result in lowering serum cholesterol in humans? (2) If serum cholesterol can be lowered by dietary means, does this reduction result in lowering the incidence of coronary heart disease? (3) Are there other factors such as genetics, stress, weight reduction, smoking, and exercise that are more important in lowering the incidence of coronary heart disease?

Cholesterol Amount

The cholesterol content of meat often is misunderstood. For example, data in table 6 indicate that veal and lamb have a higher cholesterol content than beef and pork.

It has been established that marbling is low in cholesterol and that most of the cholesterol within muscle (lean) actually originates from muscle cell membranes and intracellular structures (Stromer et al., *Journal of Animal Science,* 25:1145, 1966). It also has been established that in cooked steaks with eight different degrees of marbling (the range included U.S. Standard, Good, Choice, and Prime), there were no significant differences in cholesterol content of the cooked lean among any of the marbling groups (Rhee et al., *Journal of Food Science,* 47:716, 1982). Thus, selecting meat with less marbling does not decrease the amount of cholesterol in the lean consumed (according to Barbara Kraus, *The Dictionary of Sodium, Fats, and Cholesterol).* It also has been established that trimmable fat (subcutaneous and seam fat, or fat outside the steak and fat depots between muscles, respectively) also contains significant amounts of cholesterol (Rhee et al., *Journal of Food Science,* 47:1638, 1982).

It also should be emphasized that selecting meat with less marbling and not eating the trimmable fat on a steak or chop reduces the number of calories. Making these choices may be the most important aspect of the presence of fat in meat and is more widely accepted as important to human health because of the relationship between caloric intake and obesity.

Table 6. Milligrams of cholesterol in 100 grams of edible portion*

Beef, raw, without bone	68
Pork, raw, without bone	62
Lamb, raw, without bone	71
Veal, raw, without bone	71
Chicken, raw, flesh and skin	81
Turkey, raw, flesh and skin	74
Shrimp, raw, flesh only	150
Brains, raw	2,000

*"Cholesterol Content of Foods." Ruth M. Feeley, Patricia E. Criner, and Bernice K. Watt. *Journal of American Dietetic Association,* 61:134, 1972.

Summary

Fat content in meat varies because of the definition of meat (whole carcass vs. trimmed carcass vs. trimmed cuts vs. separable lean). Fat content also varies from cut-to-cut, from muscle-to-muscle, with level of marbling, and with cooking method. Highly marbled meat does not contribute any more to cholesterol intake than does meat with little marbling, but the number of calories increases as marbling increases (see tables 3 and 4).

Suggested Readings

"Saturated Fat in the Diet and Serum Cholesterol Concentration: A Critical Examination of the Literature." Raymond Reiser. *American Journal of Clinical Nutrition,* 26:254, 1973. In this paper the author reviews the effects of saturated fat in the diet and serum cholesterol concentration. He concludes that saturated fats do not produce hypercholesteremia by any criterion, nor do they elevate it to high risk levels, if indeed they raise it all.

"Bias and Misrepresentation Revisited: Perspective on Saturated Fat." Ancel Keys, Francisco Grande, and Joseph T. Anderson. *American Journal of Clinical Nutrition,* 27:188, 1974. This article presents opposite views (rebuttals) of most of the points brought out in the article above.

"Saturated Fat: A Rebuttal." Raymond Reiser. *American Journal of Clinical Nutrition,* 27:228, 1974. This short article refutes the rebuttals in the above listed article and suggests that the readers draw their own conclusions by reading both articles.

The Cholesterol Controversy. Edward R. Pinckney and Cathey Pinckney. Sherbourne Press, Los Angeles. 1973. 162 pages. This text examines some of the scientific and commercial claims that dietary changes may or may not influence human health.

"Dietary Fat and Cancer Trends— A Critique." Mary G. Enig, Robert J. Munn, and Mark Keeney. *Federation Proceedings,* 37:2215, 1978. This article examines correlations between dietary fat and cancer mortality.

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