

Marbling: Good for You

Texas meat scientist explains health advantage of high-quality Angus beef.

Story & photo by **Steve Suther**

Marbling has become one of the least understood concepts in the beef-consuming world. No wonder, with all the competing and contradictory messages from “experts.”

If your blood test shows low-density lipoprotein (LDL) cholesterol levels have jumped, most doctors and nutritionists react like a hammer to the knee. They say cut back on red meat — especially highly marbled beef.

News media editors know that, and they use a simplistic filter for diet and health news: fat and cholesterol are bad. They also may rely on the supporting opinions of individual reporters, chefs, dietary consultants or lean niche promoters within the beef industry, thus building the Babel Tower of perceptions for consumers.

Facts are beginning to dispel the clouds. “Intramuscular fat (IMF), or marbling, largely determines beef carcass value; USDA established that decades ago,” says Texas A&M University (TAMU) meat biologist Stephen Smith. “Beef with more marbling tastes better to most people. The lower melting point of marbling fat strongly increases palatability and distinguishes the flavor of U.S. beef.” The Angus breed excels in its ability to hit this high-quality beef target.

But many health-conscious consumers have denied the call of their taste buds, fearing the guilty pleasure will catch up to them one day. Nobody wants heart disease.

Relax, Smith would tell them: “No human studies have ever shown that supplementing the diet with beef increases LDL cholesterol. However, studies have shown that oleic acid supplements can decrease LDL.”



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When doctors warn you away from beef that is not lean, they are probably thinking about external fat, which is typically trimmed off to a constant level for all grades of beef.

“There’s a health benefit to eating well-marbled beef, compared to the lower-grading kind,” Smith says. More marbling means more oleic acid, which means less of the potentially harmful saturated and trans-fatty acids that have given beef a black eye.

Research challenges popular advice

Research conducted by Smith calls into question the most popular nutritional advice. Dietitians say to choose USDA Select over higher-marbling beef to cut back on fat. However, Smith showed Select ground beef had the worst ratio of healthy monounsaturated-to-saturated fatty acids, at 0.75. Thanks to marbling, Prime beef had a ratio of 1.33.

As consumers have been wary, producers also have been warned that marbling is an elusive or impractical target.

Twenty years ago, research by Smith’s TAMU colleagues Jeff Savell and Russell Cross established the relationships between total fat (lipids) and marbling score. They developed a “window of acceptability” for beef that included USDA Select and low Choice based on taste panel studies and assumptions about local cattle, Smith says.

The window assumed external fat growth would overtake marbling deposition once cattle reached low Choice, so there was no point in aiming higher.

“That conclusion needs to be revisited,” Smith says. “It’s certainly a valid concept that relates to cost of production, but it was based on industry averages. If you include superior marbling genetics and focused management, the results could be quite different.”

Smith has conducted research on marbling and fatty acid profiles of Angus and Wagyu cattle, and he participated as a subject in a human medical study of men and LDL cholesterol.

“Some cattle, such as the Japanese blacks derived from Wagyu, can put on marbling indefinitely; others hit a ceiling,

Confusion in the press

Excerpts from the *New York Times* published July 2006 to May 2008:

- The chef said that some farmers are supplementing corn feed with cheaper wheat and soy, giving the beef less flavor and less marbling.
- “In the past, about 2% of all beef graded out as Prime — the top variety, the most well-marbled, with flavorful, tenderizing fat. Some wholesalers think that may have dropped to as low as 0.5%. The supply of top levels of Choice beef, the next grade, has also shrunk.”
- “Even if a restaurant says it is serving Prime meat, it may not be. If your steak lacks a deep beefiness and is too chewy to be pleasurable, it is probably Choice grade. And if no grade is given on the menu, you can be sure it is Choice.”

- More consumers today are making responsible choices like grass-fed beef ... better for the environment and healthier for the body.
- The grass-fed beef hot dog [made of beef imported from Uruguay] is leaner and has a healthier dose of omega-3 fatty acids.

Excerpts from the American Heart Association web site:

- “Saturated fat is found mostly in foods from animals and some plants. Foods from animals include beef, beef fat, veal, lamb, pork, lard, poultry fat, butter, cream, milk, cheeses and other dairy products made from whole and 2% milk.”
- Polyunsaturated and monounsaturated fats are found mainly in many fish, nuts, seeds and oils from plants.

and it appears to vary with breed type,” Smith says.

In procuring research cattle, he knew that no individuals could represent a breed. “But we did try to find the best, with well-documented genetics for producing high-quality beef.”

The initial study, published in 1993, compared Angus and Wagyu steers fed for the Japanese standard of more than two years. It was the first systematic comparison of Wagyu and U.S. domestic cattle, Smith says.

“Our approach was to use breed types that deposit more marbling and softer fat, containing more oleic acid,” he explains. “We were looking at the permanent effects of diet and age on fatty acid composition in the beef.” TAMU animal scientist Dave Lunt fed the cattle hay supplemented with enough corn to provide a growth rate of 1 pound (lb.) per day; the cattle were fed for 550 days (see Fig. 1).

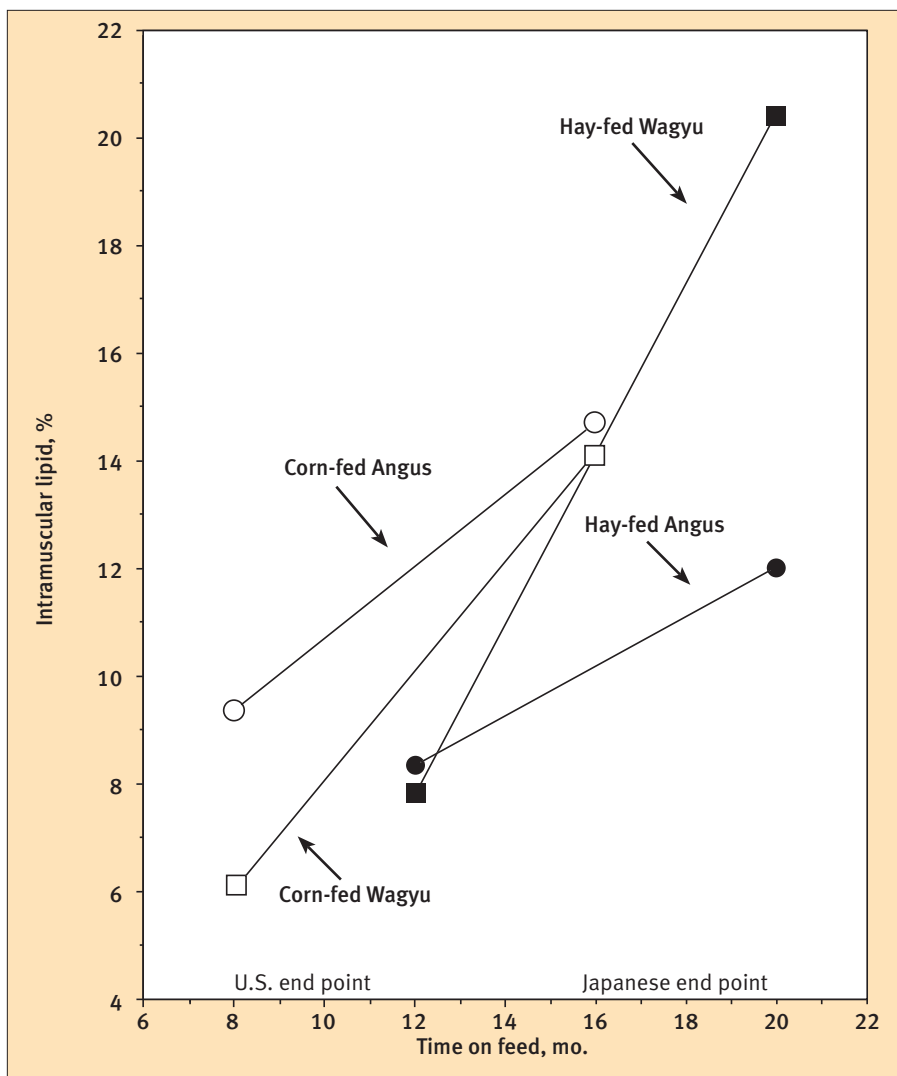
“It was clear that Angus love corn, but they do not do as well on hay,” Smith says. “The Wagyu were less efficient in daily gain on corn, but they marbled better, whether they were fed hay or corn. On the hay-based diet, Wagyu steers out-performed the Angus steers. The Angus accumulated 15% lipid in their rib steaks, but the Wagyu steers accumulated 20%.”

“More recently we have compared U.S. and Japanese end points,” Smith says. Completed in 2006, the research harvested some corn-fed Angus and Wagyu cattle at 16 and 24 months (after eight or 16 months on a corn ration) and hay-fed Angus and Wagyu steers at 20 and 28 months (after 12 or 20 months on hay). Those on a hay diet were fed even longer to reach the same end weight.

“The Angus cattle did better than Wagyu steers at the U.S. end point in every area except Yield Grade,” Smith reports. “Wagyu don’t put on much outside fat, and they do put on fat that is high in oleic acid, but they don’t really fit our system.” At the Japanese (heavy weight) end point, Wagyu did better than Angus steers in every respect, especially in the hay-fed pens.

Oleic acid is a simple (monounsaturated) fat prevalent in olive oil. “It’s good for you,”

Fig. 1: Fatty acid profiles of Wagyu and Angus beef fed hay or corn



Smith says. “Oleic acid comes from both endogenous synthesis and dietary fats, and the level can be manipulated. The scientific literature suggests that you can’t eat too much oleic acid, and corn feeding increases it in beef.”

While steam-flaking corn or processing it for ethanol and its byproducts may fit some models of efficiency, producers should keep it simple for greater beef quality, Smith says.

“Minimally processed corn delivers more starch to the small intestine,” he says. “That means more glucose, a powerful substrate for the lipogenesis of marbling.”

Subcutaneous fat does not come from glucose, Smith notes. It comes from the forage-derived acetate, and can form four to six times faster than marbling.

One study showed that while feeding steam-flaked corn resulted in 6% premium Choice, cattle fed high-moisture and whole-shell corn achieved 28% and 25% premium Choice. Research on feeding corn-based distillers’ grain continues, but Smith notes the early work suggests, “It’s not an excellent feed for realizing full marbling potential.”

That’s why he and Lunt fed whole-shell, high-moisture corn in their research.

When Lunt and Smith fed a minimally processed corn ration for 550 days — for scientific, not practical reasons — the amount of oleic acid in the fat trim reached 58% in Wagyu and 53% in Angus. Fat from cattle fed for the U.S. market typically contains around 35% oleic acid. “That tells us there are both breed and production effects on fatty acid composition,” Smith says.

Getting the skinny on fat

Data on the fat content of premium Choice is relatively sparse,” says Certified Angus Beef LLC (CAB) research and development manager Mark Gwin. “That’s why we are designing a study to quantify the percentage of total fat, saturated fat and cholesterol for raw (uncooked) Certified Angus Beef® brand cuts.”

Working with the U.S. Department of Agriculture (USDA) and the National Cattlemen’s Beef Association (NCBA), Gwin plans to first secure all data that can be separated from previous studies that did not publish a breakout of Small, Modest and Moderate marbling.

“The limited data we have now indicates the fat difference between low Choice and the upper two-thirds of Choice is 2.5 to 3 percentage points,” he says.

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“An Australian study found some Japanese cattle with no trans fat, and that was because they had an incredibly high amount of oleic acid,” Smith notes. Other research in that country found that grass-fed beef had much lower oleic acid content, a higher ratio of saturated-to-unsaturated fat, and relatively high trans fat.

“There is no scientific evidence that the trans fat in beef is bad for you,” Smith cautions. “But certainly, perception is reality to consumers, who see all trans fat as bad.”

While promoters of grass-fed beef often mention that it has “more” conjugated linoleic acid (CLA) and omega-3 fatty acid than other beef, there are other ways to look at it.

Trans-vaccenic acid (TVA) is the precursor to CLA, and it comes from the rumen breakdown of forages as well as from the oil in grains. Feeding flaxseed can also boost TVA. However, research shows that just 20% of TVA goes to CLA in the human diet. “The other 80% is still floating around, and it may be acting as saturated fat,” Smith says. “We don’t yet know what TVA does to cholesterol levels. We do know that the more marbling in beef, the less TVA.”

Whether the topic is CLA or omega-3, Smith says science has not yet identified cattle or management strategies that can accumulate enough to make a significant difference. “Beef is simply not a reasonable source of these,” he says. “It just doesn’t work.”

Benefits of brisket

The latest research from Smith’s team showed that, independent of breed type or feeding method, the brisket excels in its lipid profile, with more oleic acid than other cuts. The plate and flank, sometimes considered among the leanest cuts, contained the most saturated fat in the study.

The marbling levels achieved in the Angus cattle used in Smith’s research were equivalent to those in the *Certified Angus Beef*® (CAB®) brand and CAB Prime. He notes untrained consumer panels have been able to distinguish beef by breed type when

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— *Stephen Smith*

the ratio of saturated fat is lower, as it is in highly marbled beef.

“We have found that the marbling in premium-quality Angus beef has improved functionality, lower melting point and better mouth feel than

commodity beef fat,” Smith says. “It also has more oleic acid and less trans fat than beef from any of the crossbred animals studied. It appears that CAB brisket would be especially high in oleic acid, perhaps as high as Wagyu beef. This is something we’d certainly like to investigate.”



Fig 2: Medical definition of lean beef

Mayo Clinic nutrition labeling	Definition	Cuts included
Lean beef	A 3.5-oz. serving that contains less than: 10 g total fat 4.5 g saturated fat 95 mg cholesterol	Round steak 95% lean ground beef Chuck shoulder roast Arm pot roast Shoulder steak Strip steak Tenderloin steak T-bone steak

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Fig. 3: Leanest cuts of beef

Comparison of USDA Select, Choice and CAB Retail Cuts	Calories, kcal per 100 g			Fat, fatty acids, g			Saturated mg			Cholesterol		
	Select	Choice	CAB®	Select	Choice	CAB	Select	Choice	CAB	Select	Choice	CAB
Eye of round, roasted	132	149	160	3.0	4.8	6.1	1.1	1.8	2.2	59	59	59
Top round, broiled	142	156	171	2.9	4.6	6.2	1.6	1.6	2.0	71	71	71
Round tip (sirloin tip), roasted	145	153	169	4.5	5.4	7.2	1.6	1.9	2.4	69	69	69
Bottom round, braised	163	181	197	5.4	7.4	9.2	1.8	2.5	2.7	81	81	81
Top sirloin, broiled	153	170	187	4.8	6.6	8.5	1.9	2.6	3.1	76	76	76
Chuck, arm pot roast, braised	168	187	207	5.4	7.4	9.6	1.9	2.7	3.3	86	86	86
Top loin (strip loin), broiled	156	177	187	5.9	8.2	9.2	2.2	3.1	3.2	65	65	65
Tenderloin (filet mignon), broiled	170	180	183	7.5	8.6	8.9	2.8	3.2	3.2	71	71	71

Based on 3-ounce cooked serving (lean only), trimmed to 0-inch fat.
Information derived from USDA Handbook 8-13, 1990, and *Journal of Muscle Foods*, Vol. 3, p. 57, Jones et. al., 1992.