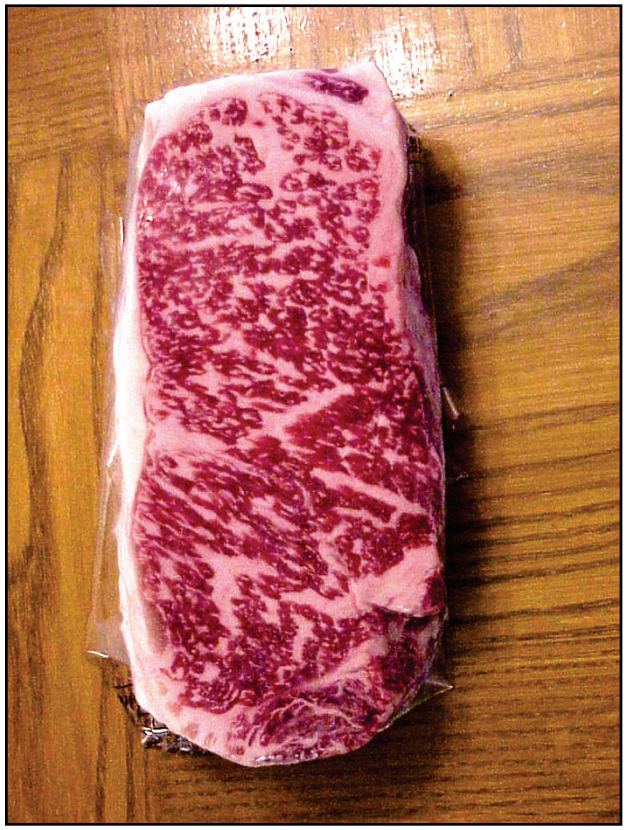
ANIMAL SCIENCE
TEXAS A&M UNIVERSITY

Long-Term Study of Fatty Acid Composition of Wagyu Beef



Texas Wagyu Association
Solado, Texas
April 21, 2017

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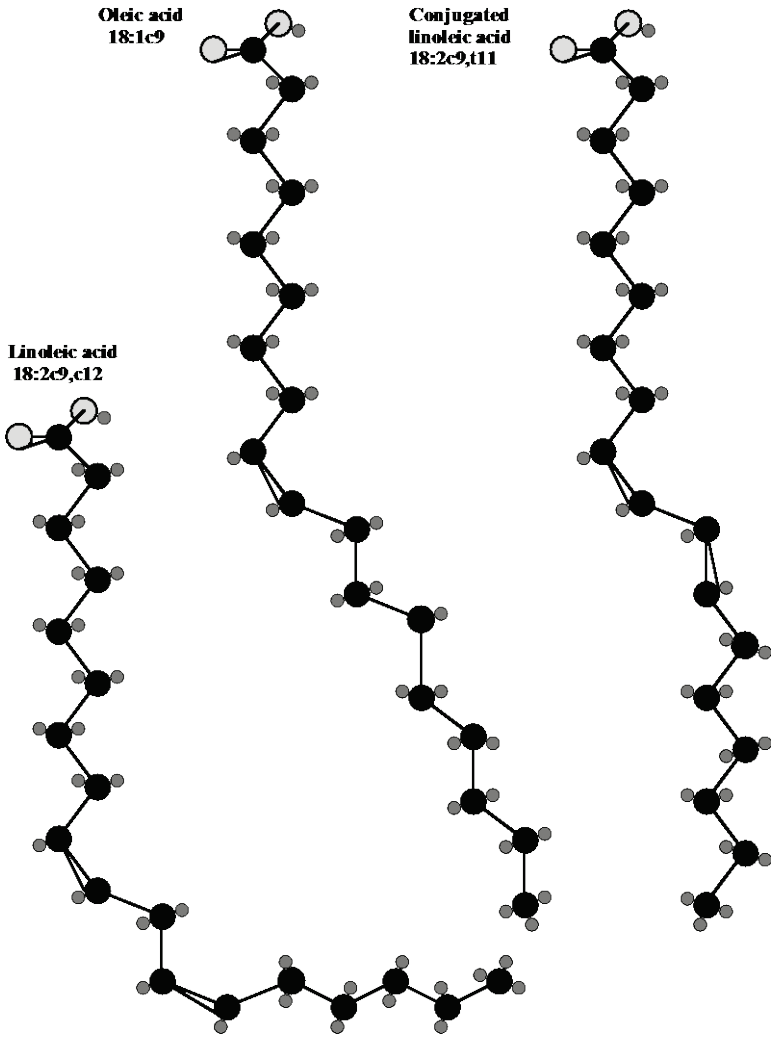
AgriLIFE RESEARCH & EXTENSION
Texas A&M System

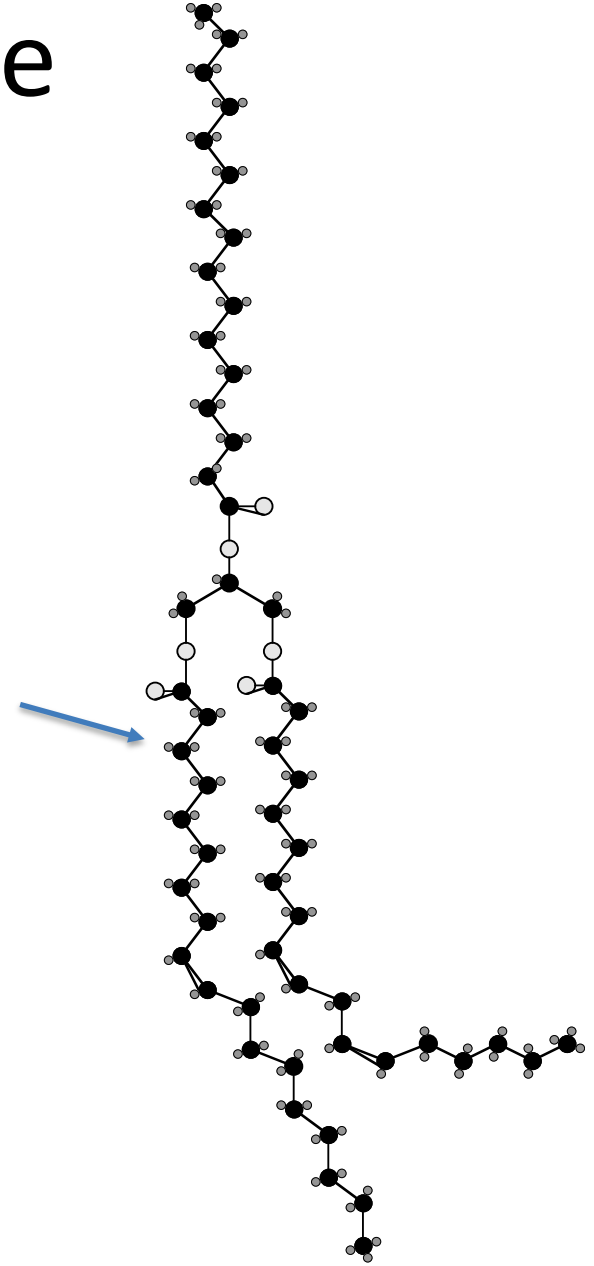
The healthful fatty acids in beef

- Oleic acid
  - The most abundant fatty acid in most beef
  - Very high in Wagyu beef (>45% total fatty acids)
- Linoleic acid
  - From plant oils
- Conjugated linoleic acid
  - Small amounts in beef



Triacylglycerol structure

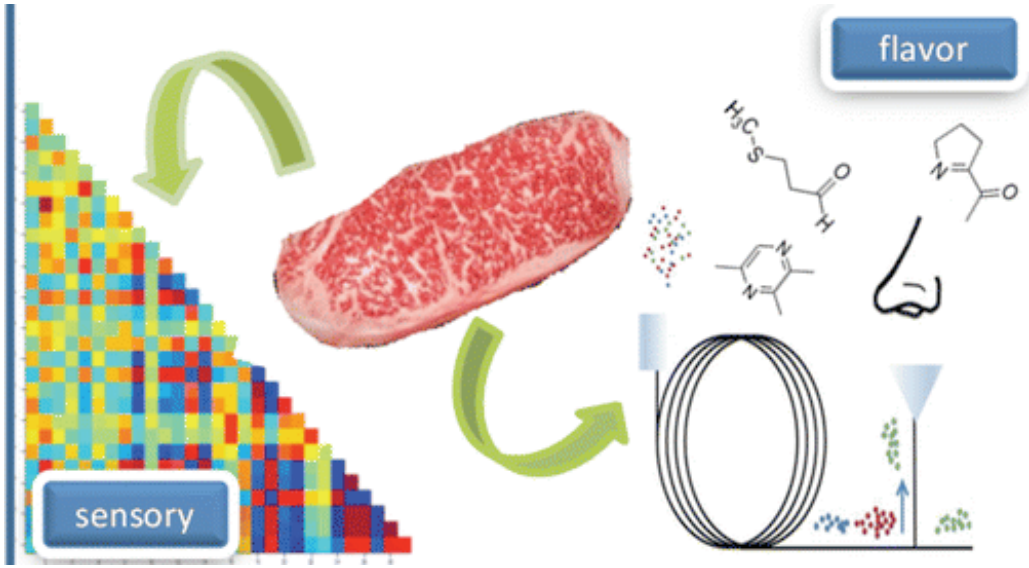
- Triacylglycerol molecules contain three fatty acids in an ester linkage with glycerol.
- Virtually all TAG are mixed.
  - This TAG contains oleic acid in the sn-1 position, palmitic acid in the sn-2 position, and linoleic acid in the sn-3 position.



My universe revolves around oleic acid.

Flavor research from the University of Melbourne, Australia

- Striploins from Angus grass-fed yearlings (5.2–9.9% intramuscular fat), Angus grain-finished steers (10.2–14.9% IM fat), and Wagyu grass-fed heifers (7.8–17.5% IM fat) were evaluated.



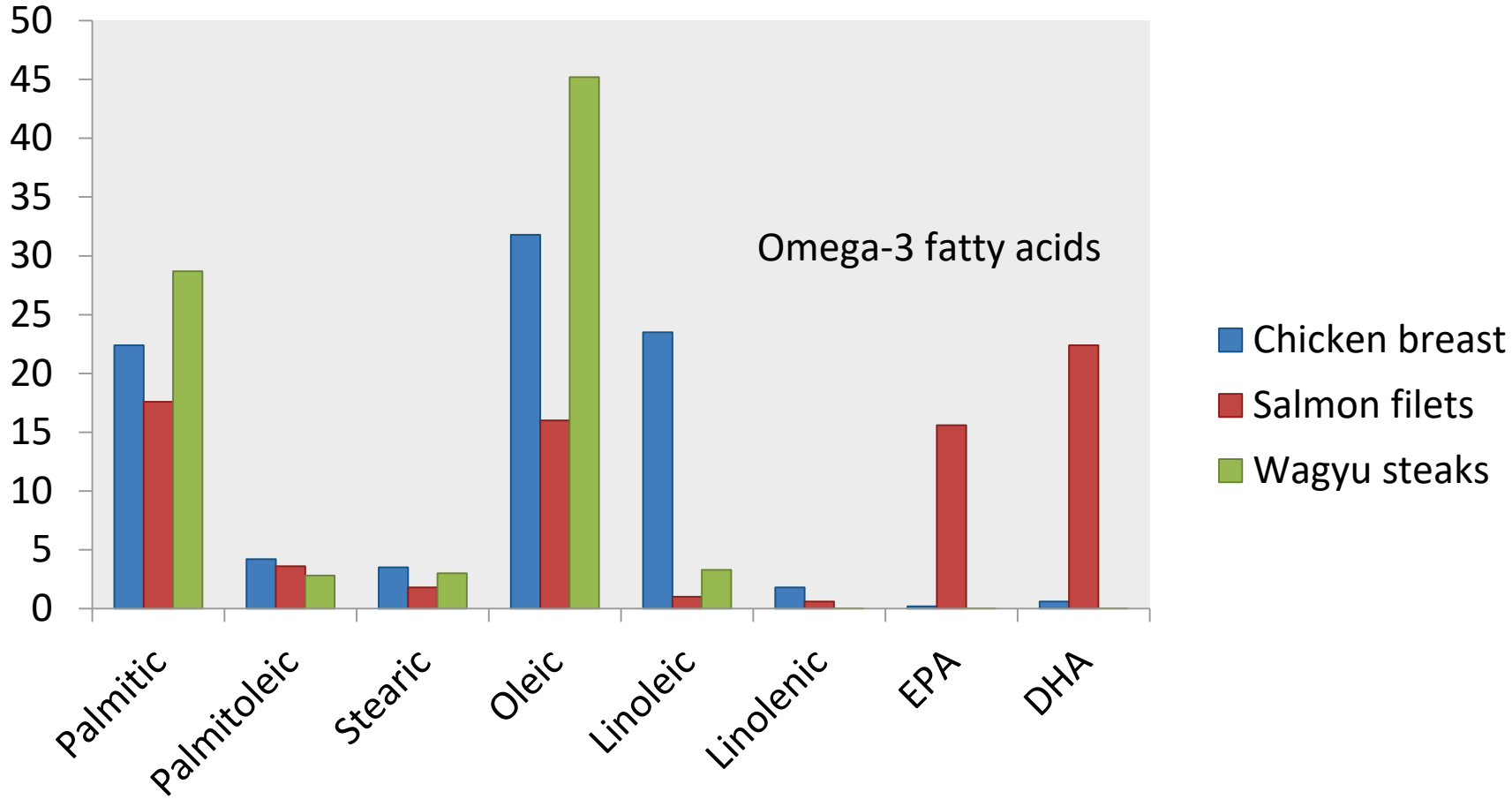
- Tenderness and juiciness increased with the marbling level.
- Unsaturated fatty acids with potential health benefits (vaccenic, oleic, and rumenic acids) increased with the level of marbling.

Frank et al. J. Agric. Food Chem. (2016)

Preliminary study: Comparison of the lipid composition of chicken breast, salmon, and Wagyu strip steaks

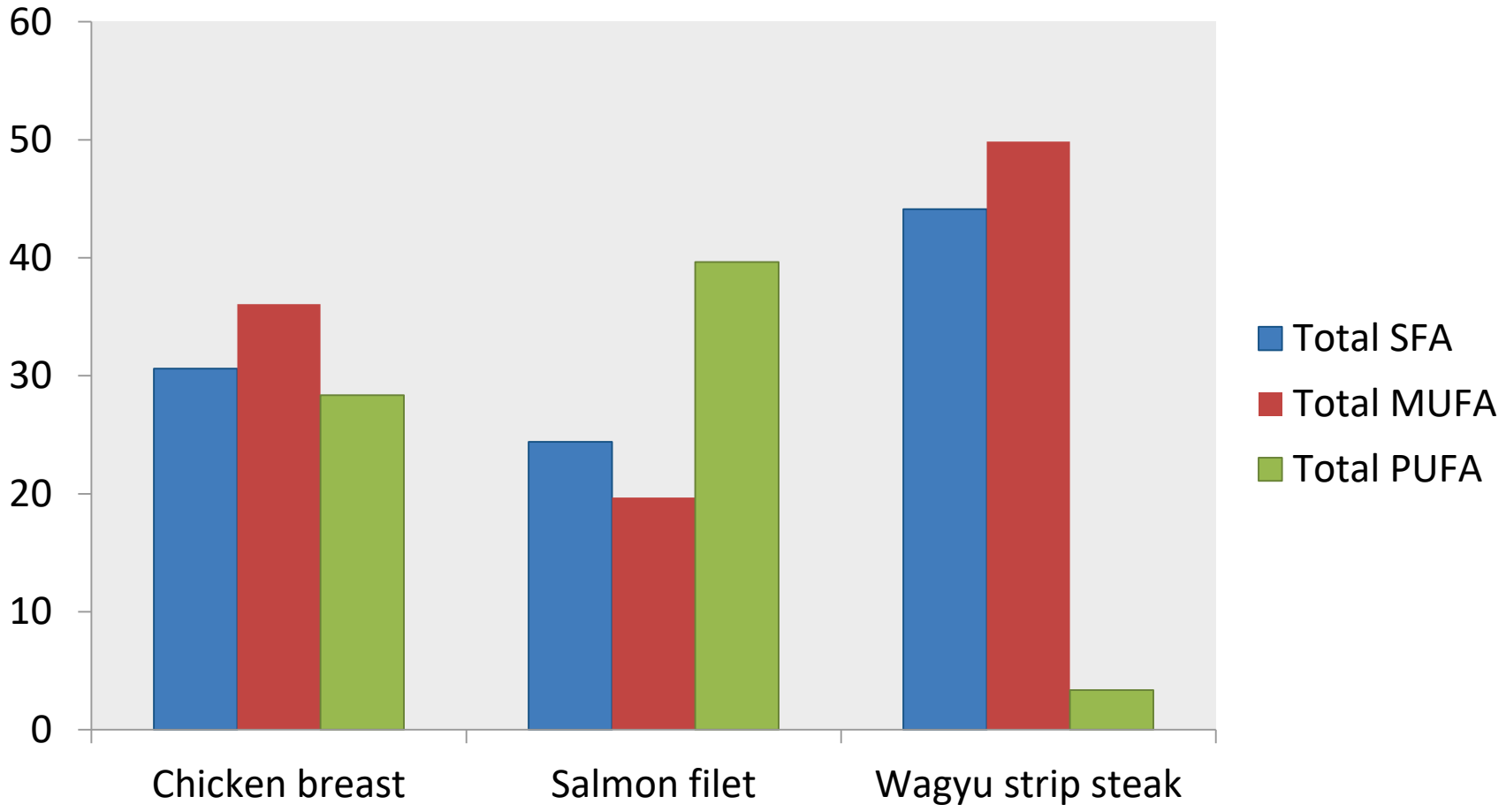
- Total fat, fatty acids, and lipid melting points were measured in:
  - Breast meat, free range chickens (n = 10)
  - Salmon, fresh caught (n = 10)
  - Wagyu rib steaks (n = 10)

Overall Fatty Acid Composition

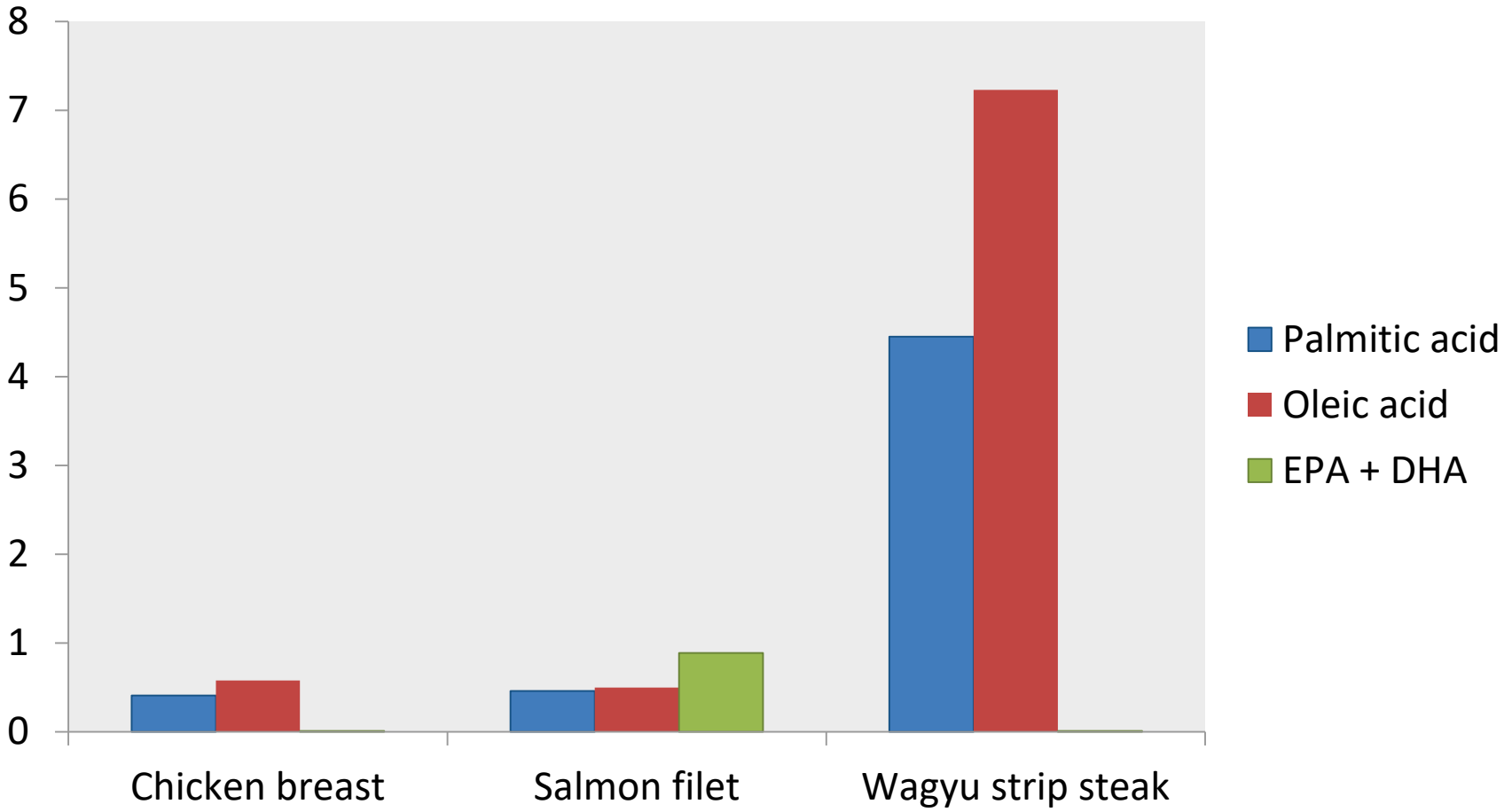


All samples containing saturated and monounsaturated fatty acids. Wagyu beef contains the highest percentage of oleic acid. Fish are high in EPA and DHA.

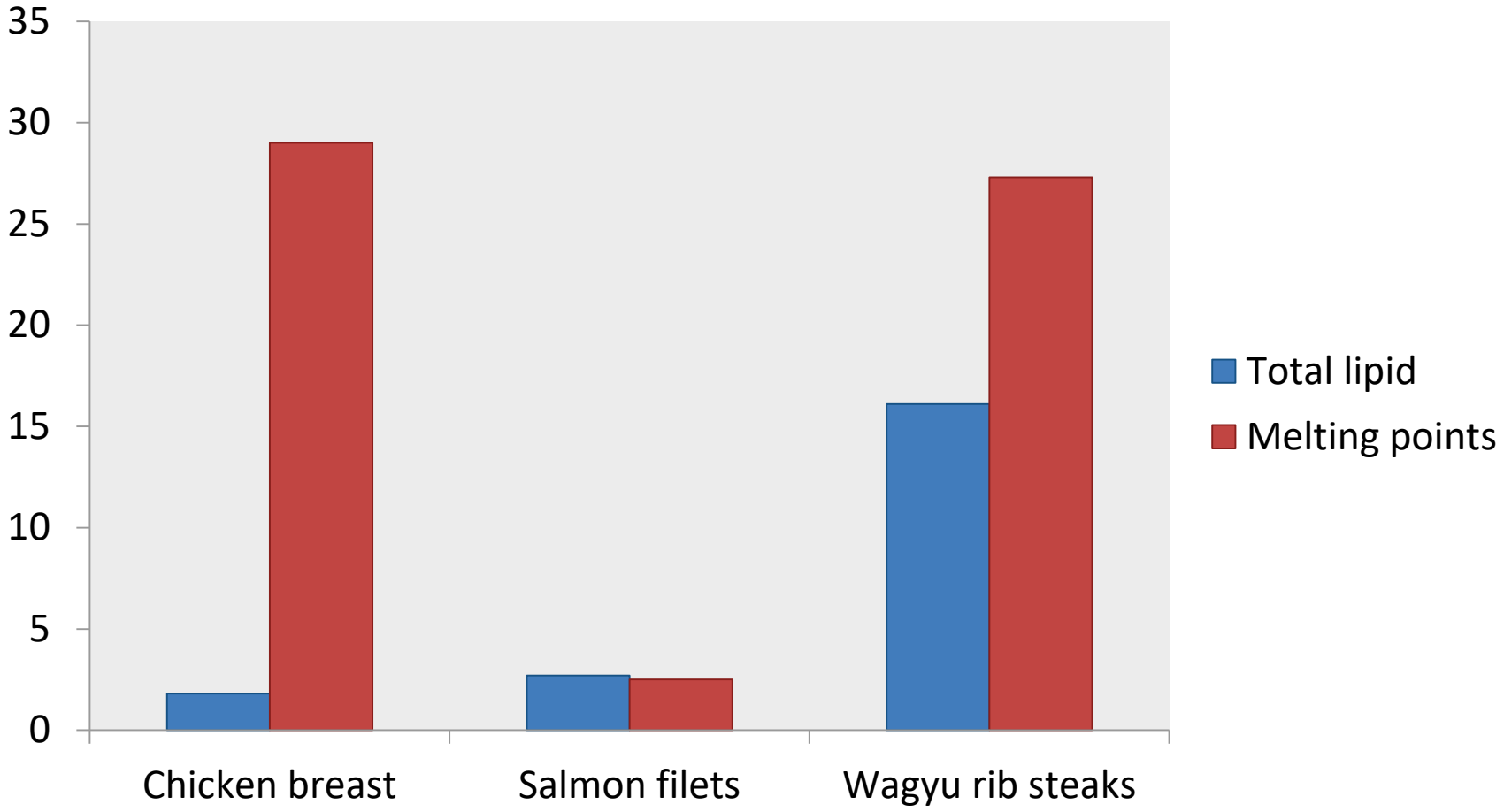
Total saturated, monounsaturated, and polyunsaturated fatty acids (percent of total lipid)



Total saturated, monounsaturated, and polyunsaturated fatty acids (grams per 4 ounce serving)

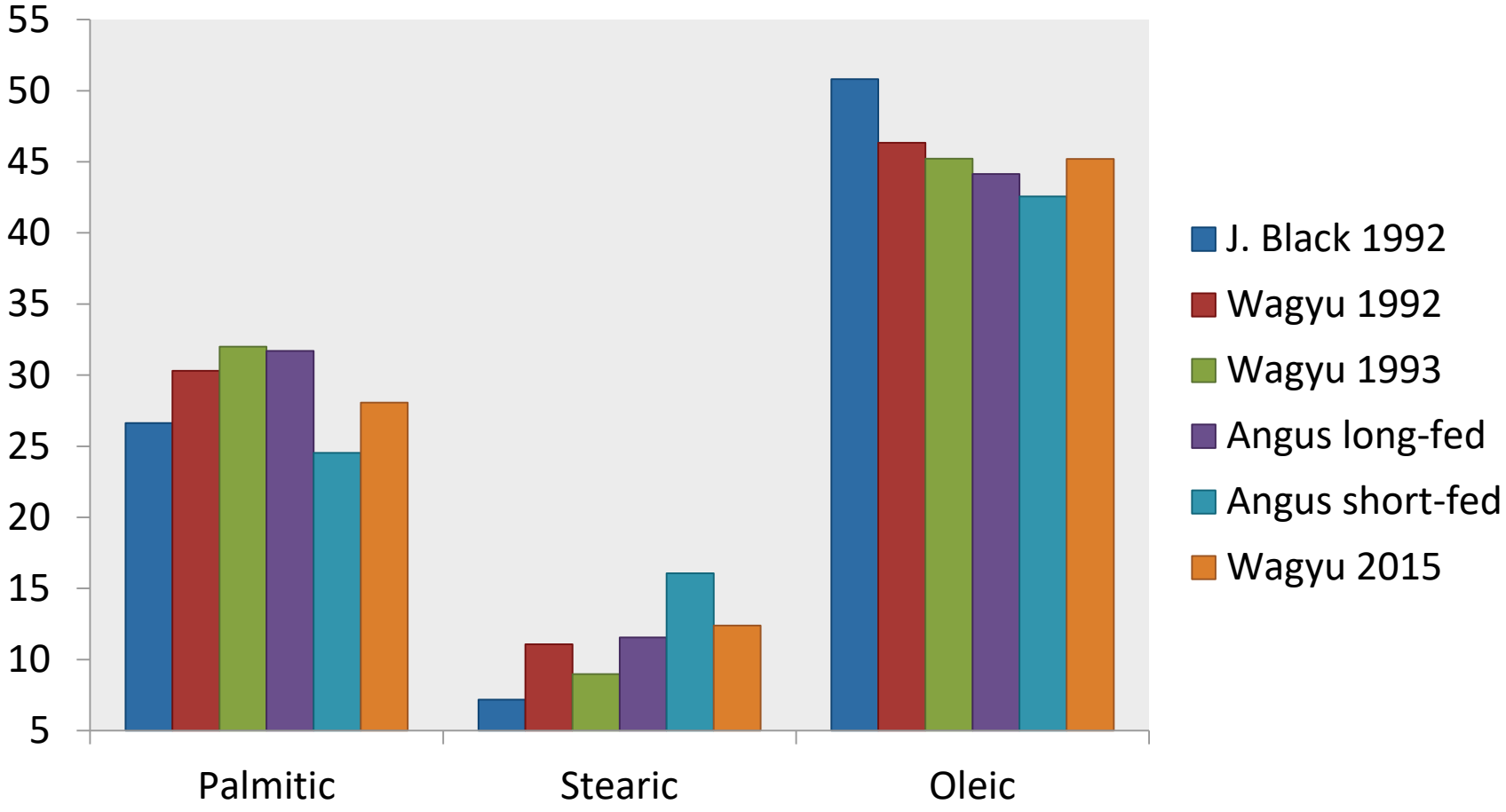


Total lipid and lipid melting points



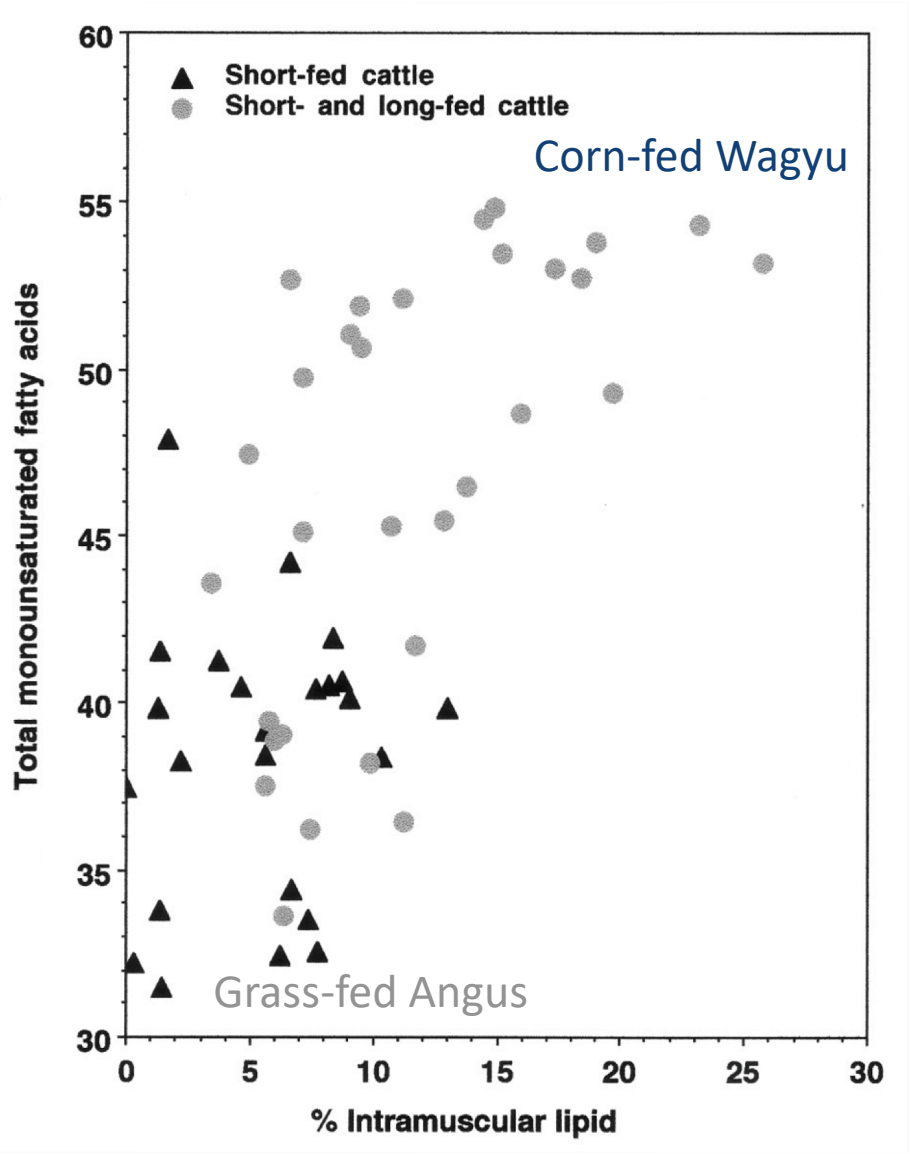
In fish, the low lipid melting points are caused by EPA and DHA (fish oil fatty acids).

How do the current samples stack up?



Samples from Japanese Black A5 had the highest oleic acid (> 50%), but beef from Wagyu cattle raised in the U.S. consistently contains approximately 45% oleic acid.

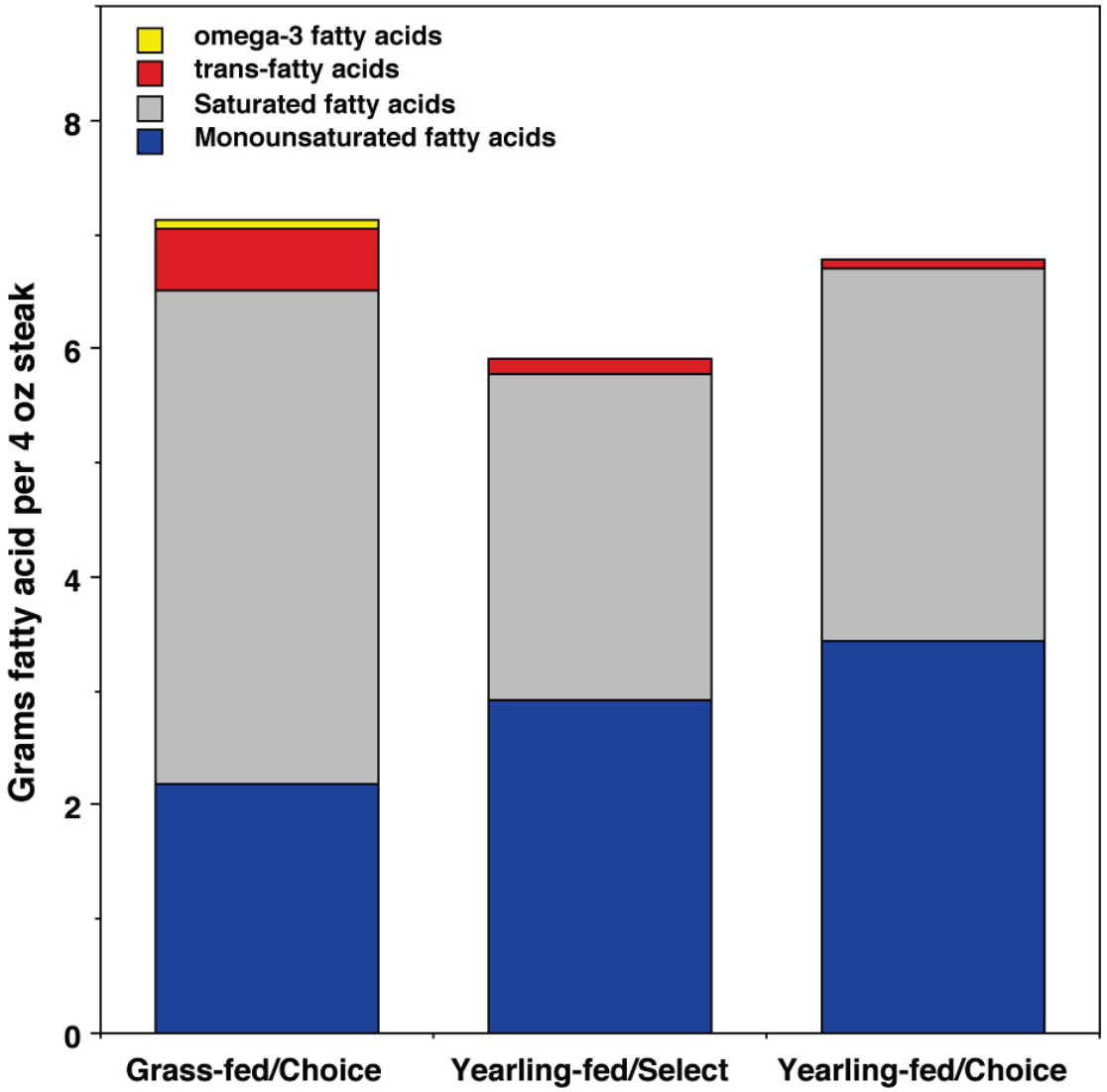
Why is there variation across studies?



- The amount of oleic acid in beef is very sensitive to breed type/sire and time on feed.
- Oleic acid is highest in beef from Asian cattle (Wagyu, Korean Hanwoo, Chinese Yanbian Yellow Cattle)
- Oleic acid in beef increases with time on a grain-based diet.

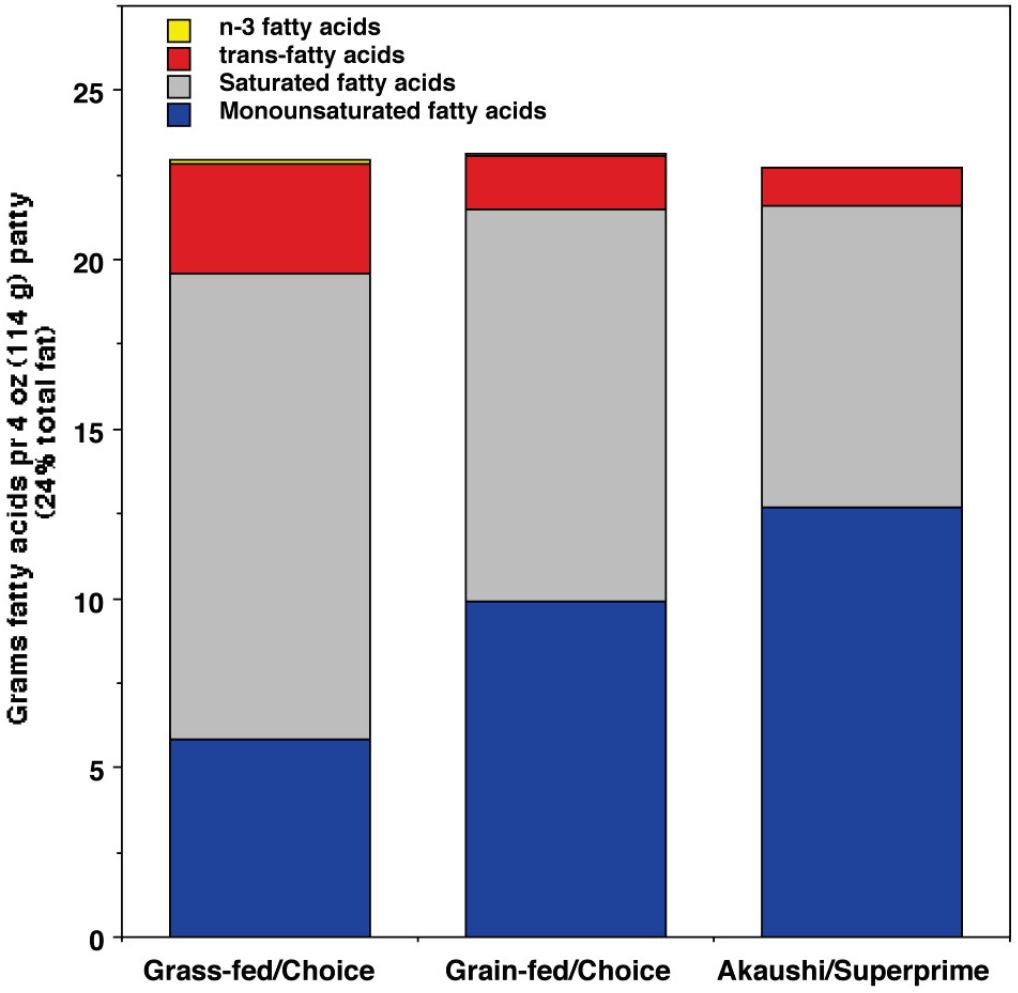
Grass feeding increases saturated and *trans*-fats in beef steaks in Angus steers.

- Grain feeding increases oleic acid in beef from Angus steers.
- Grass feeding increases saturated and *trans*-fatty acids.
- Grass feeding provides very little omega-3 fatty acids in beef.

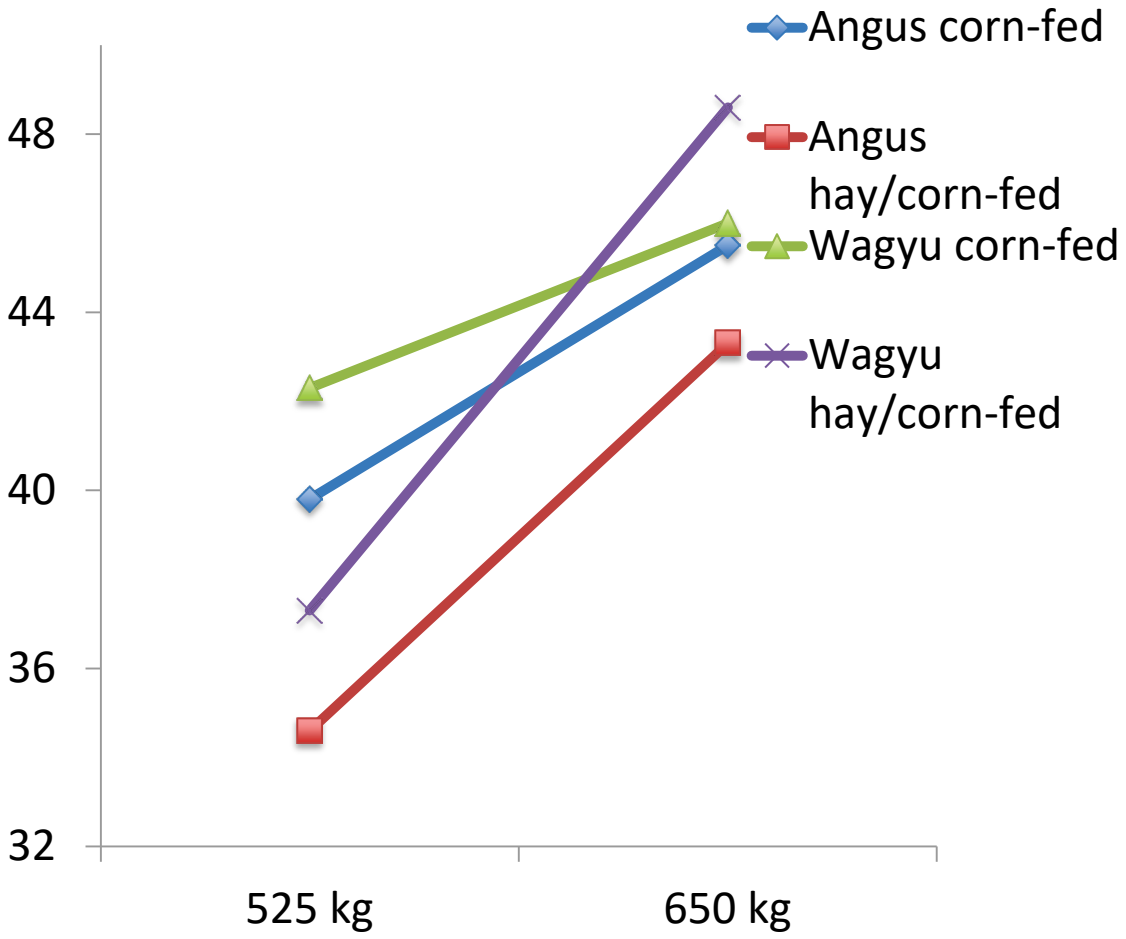


Grass feeding increases saturated and *trans*-fats in ground beef from Angus steers.

- Ground beef from grass-fed Angus beef has twice as much *trans*-fatty acids as beef from grain-fed Angus steers.
- Grass feeding also increases saturated fatty acids.
- Ground beef from Red Wagyu (HeartBrand) steers contains the most oleic acid and least saturated and *trans*-fatty acids.

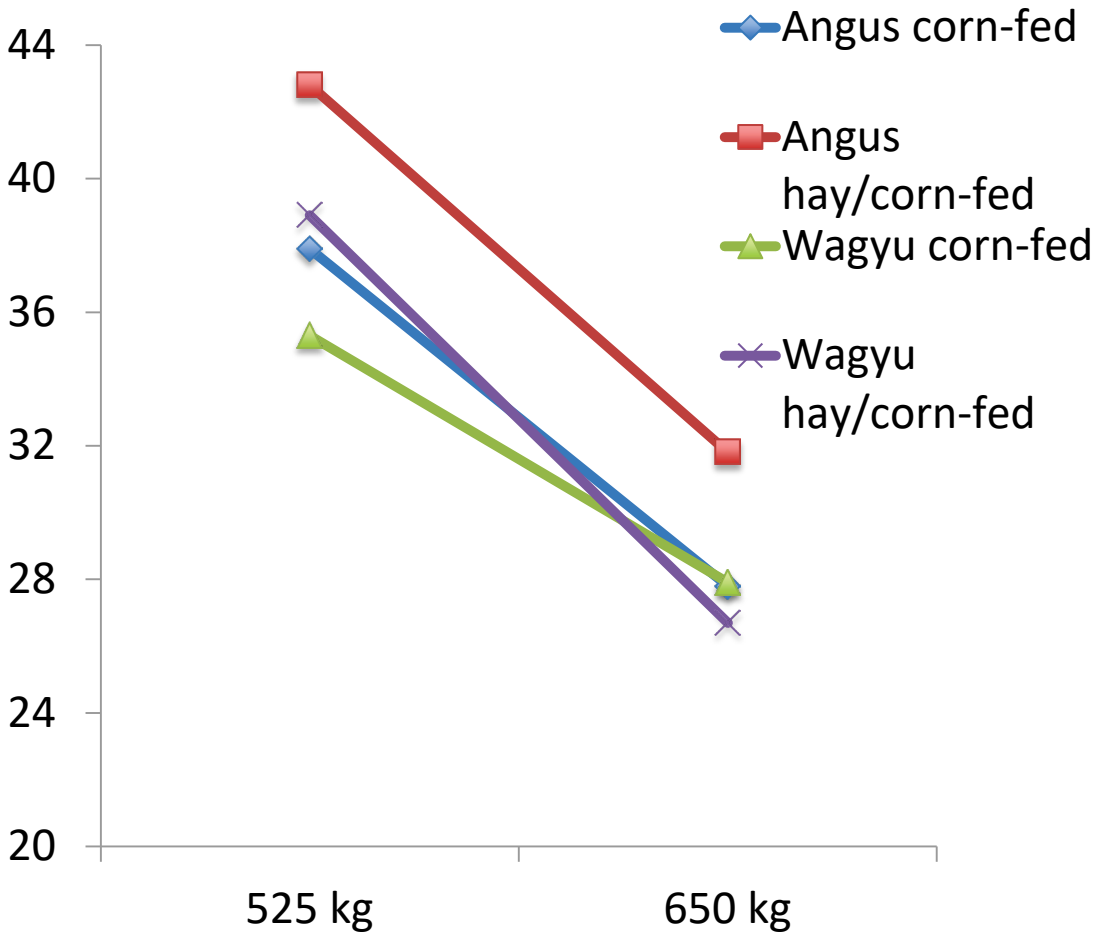


Oleic acid in Angus and Wagyu subcutaneous adipose tissue



- Oleic acid always increases with time on feed in some grain is provided.
- Oleic acid actually was highest in fat from Wagyu hay/corn-steers.

Lipid melting points in Angus and Wagyu rib steaks



- Lipid melting points always decrease with time on feed ifsome grain is provided.
- Wagyu lipid melting points are the same whether they are corn-fed or hay/corn-fed.

Where do we go from here?

- Wagyu beef *may* be the true answer to grass-fed beef.
  - Grass feeding will increase omega-3 fatty acids (great for perception).
  - Grass-fed full blood Wagyu beef should contain more oleic acid than beef from grass-fed, full blood black Angus steers.

Study design – Establishing nutritional composition of beef from full blood and F1 Wagyu steers and Angus steers

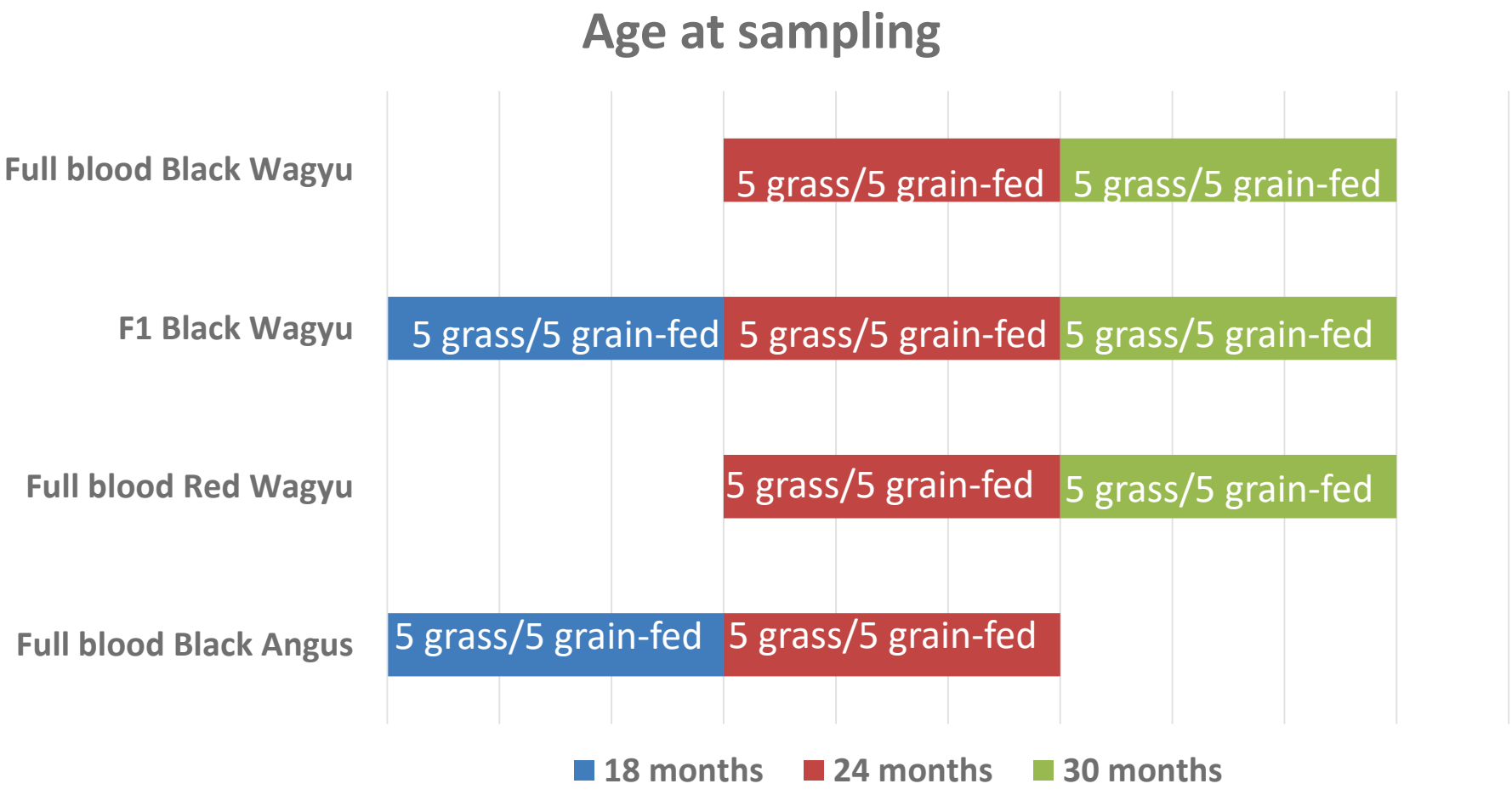
- Full Blood Black Wagyu (20)
- F1 Black Wagyu (30)
- Full Blood Red Wagyu (20)
- Full Blood Angus (20)

- *10 of each breed type will be grain-fed*
- *10 of each breed type will be grass-fed*

Proposed study design

- Weaning: 4-5 months of age
- Feeding: Steers will be fed at the Texas A&M University Research Center, McGregor, TX
- Slaughter
  - Full blood Black and Red Wagyu steers processed at 24and 30 months of age
  - F1 Black Wagyu steers processed at 18, 24, and 30 months of age
  - Full blood Black Angus steers processed 18 months of age

Proposed study design

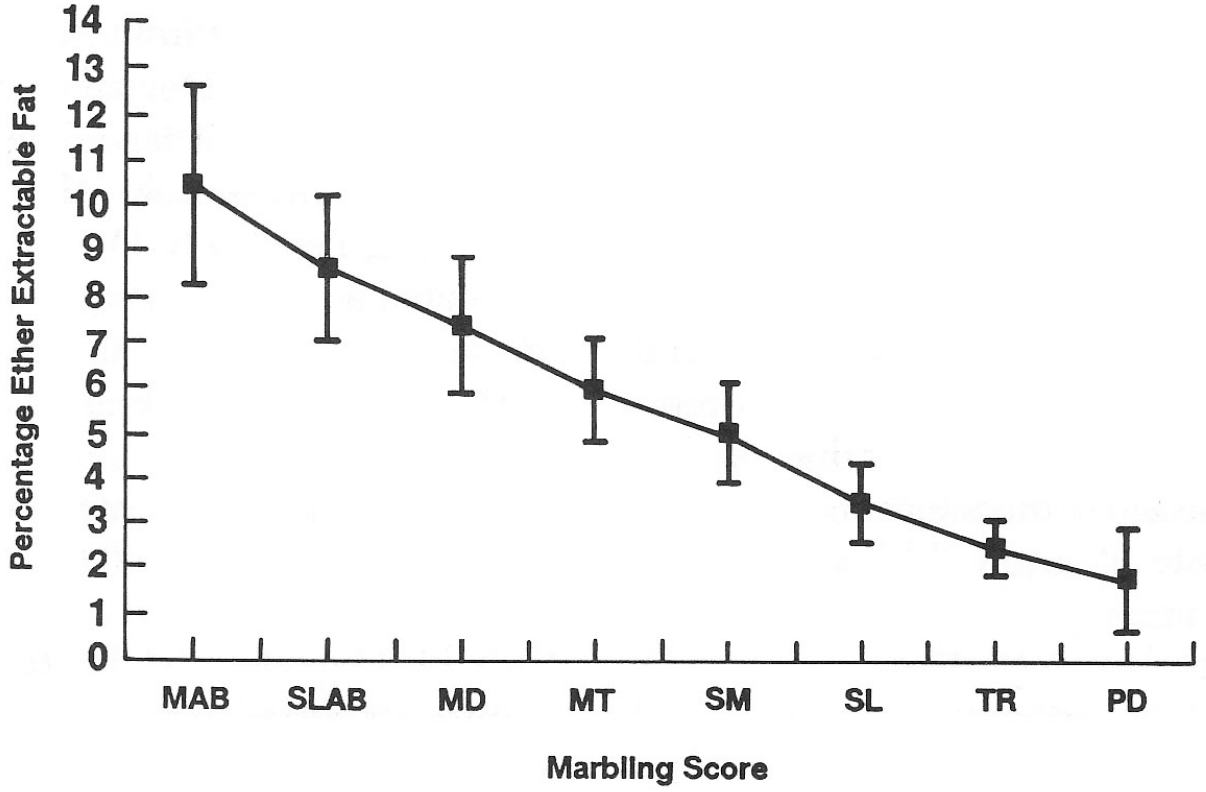


Proposed measurements

- Carcass quality and yield grades
- Total fat and moisture of the rib steaks
- Total fatty acid analyses
  - Percentage of each fatty acid
  - Actual amounts of each fatty acid per 100 grams steak (approximately 4 ounces)
- Lipid melting points
- Cholesterol content of the rib steaks

Chemical lipid and marbling scores

- We can predict marbling scores from chemical lipid content of the rib steaks.
- We probably will have to create terms for marbling scores above 12% total extractable lipid.



Additional measurements

- Body weights at regular intervals
- Ultrasound measurement of ribeye area, overlying fat thickness, and marbling scores
  - This will allow a real-time measurement of fat and marbling development.
  - This will be compared to called marbling scores and the chemical analysis of total lipid in the rib steaks.
- Additional data
  - Instrument grading (camera)
  - DNA samples

Modifications to the study design

- There is huge variation in entry weights for the full blood Black Wagyu steers.
  - This probably means that there is considerable variation in the age of steers at delivery to McGregor, even from the same producer.
- We will block the steers by body weight to the sampling periods
  - The largest Black Wagyu steers will be assigned to the 24 month sampling group.
  - The smallest Black Wagyu steers will be assigned to the 30 month sampling group

Current problems

- We only have 69 steers from the full blood and F1 Black Wagyu group.
  - We need information from each of the producers about the steer ages, tag numbers – all of the information you have available.

Points to consider

- It would be best to process the steers at the same plant.
  - Variation in graders across plants will make it difficult to compare breed types and production groups (grain-fed vs grass-fed).
- If we processed the steers at Texas A&M University:
  - The cattle would be USDA inspected.
  - We can collect samples for many additional analyses.
  - There would be consistent carcass grading.
  - *But*, the carcasses would not have a federal carcass grade.

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Thank you!

- Please contact me at sbsmith@tamu.edu

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