Long-Term Study of Fatty Acid Composition of Wagyu Beef

Stephen B. Smith
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Texas Wagyu Association
Solado, Texas
April 22, 2016

The healthful fatty acids in beef

- Oleic acid
  - The most abundant fatty acid in most beef
- Linoleic acid
  - Most comes from plant oils
- Conjugated linoleic acid
  - Small amounts in beef
- \( \alpha \)-Linolenic acid
  - (omega-3 fatty acid, not shown)
  - Small amounts in beef (even grass-fed)

A leading authority in the U.S. concluded that oleic acid is good for you.

- In beef products, we should increase oleic acid and decrease saturated and trans fatty acids.

Kris-Etherton and Yu, 1997

Pasture feeding decreases oleic acid and increases trans-fats in ground beef.

- Grain-fed beef has twice as much oleic acid as beef from grass-fed cattle.
- Grass feeding increases saturated and trans-fatty acids.
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Linoleic acid
18:2c9,c12
Oleic acid
18:1c9
Conjugated linoleic acid
18:2c9,t11

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• Grain-fed beef has twice as much oleic acid as beef from grass-fed cattle.
• Grass feeding increases saturated and trans-fatty acids.
Pasture feeding increases saturated and trans-fats in beef steaks.

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Typical composition of the ground beef used in our four human trials

- Ground beef from grass-fed is high in saturated and trans-fatty acids.
- Ground beef from corn-fed cattle is high in oleic acid.
- Omega-3 fatty acids were very low in all ground beef types.

Overall results for four human trials: Lipids and glucose

- All types of ground beef increase HDL cholesterol.
- Grain-fed ground beef increases HDL cholesterol twice as much.

Ground beef and serum risk factors for metabolic syndrome

- Ground beef increases LDL size and decreases serum insulin.
- High MUFA ground beef decreases LP(a) and LDLIII-C.
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Eating ground beef decreases carbohydrate intake and increases fat intake.

- Men and women changed their eating patterns.
- They reduced carbohydrate intake when they ate more ground beef.

Carbohydrate intake versus fat intake

- As we consume more fat we consume much less carbohydrates.
- I consider this to be a healthy approach.

<table>
<thead>
<tr>
<th>G. Hanwoo</th>
<th>G. Imported beef</th>
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<tbody>
<tr>
<td>LDL</td>
<td>28.3</td>
</tr>
<tr>
<td>HDL</td>
<td>34.8</td>
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<tr>
<td>VLDL</td>
<td>18.5</td>
</tr>
<tr>
<td>TG</td>
<td>14.9</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>15.7</td>
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</tbody>
</table>

Change from baseline in serum LDL, HDL, VLDL, TG and Total Cholesterol concentration of women who consumed Korean style g. g. Hanwoo and imported beef that lower or high in MUFA with 300g twice/week for 4 weeks each (unpublished data from Chang Weon Choi, Daegu University, Korea, 2016).

2012 Kris-Etherton publication

- What are the effects of lean beef?
  - Decreased total cholesterol
  - Decreased LDL cholesterol
  - Decreased HDL cholesterol
  - We must include fat in the diet.

Roussell et al. (2012) Am J Clin Nutr
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We compared Angus and Wagyu steers fed corn-based or hay-based diets. Cattle were fed to 1,100 lb or 1,400 lb.

How do we change the fatty acid composition of beef?

- Corn-based diet
  - 89.1% dry matter
  - 11.2% crude protein
  - NE\(_{\text{m}}\) = 1.81 Mcal/kg
  - NE\(_{\text{g}}\) = 1.19 Mcal/kg
  - Target = 3 lb/d ADG.

- Hay-based diet
  - Steers had free access to hay and pasture.
  - Corn diet was added to provide 2 lb/d ADG.

Marbling scores were highest in corn-fed Wagyu steers at the Japanese endpoint.

Another way to look at marbling scores: as a function of carcass weight.

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The MUFA:SFA ratio is the ratio of monounsaturated fatty acids (mostly oleic acid) to saturated fatty acids.

High-quality beef has a high MUFA:SFA ratio (greater than 1.2).

Cattle with Asian genetics have MUFA:SFA ratios (more oleic acid) than our domestic breed types.

- A5 Japanese Black cattle have MUFA:SFA ratios > 2.0.
- American Wagyu cattle have MUFA:SFA ratios of 1.4.
- Commercial cattle have MUFA:SFA ratios ≤ 1.0.

However, SCD enzyme activity did not increase with time in hay-fed Angus steers.

The MUFA:SFA ratio increased in adipose tissue with age.

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However, SCD enzyme activity did not increase with time in hay-fed Angus steers.

それけれどSCD活性はhay給与のアンガス牛では上昇しませんでした。
• The longer cattle are on feed, the lower the lipid melting points.
• Corn-fed cattle produce fat with lower lipid melting points than hay-fed cattle.
• Hay-fed Wagyu steers had the lowest lipid melting points.

In beef, lipid melting points are determined by the amount of stearic acid.
• Fat depots differ widely in their amounts of stearic acid and melting points.
• Wagyu beef and domestic brisket have very low amounts of stearic acid and low melting points.

When marbling increases, oleic acid increases (and stearic acid decreases).
• Cattle fed high concentrate diets for long periods of time are very high in oleic acid and other MUFA.
• Short-fed cattle and grass-fed cattle have less marbling and less oleic acid.

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

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

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.

Where do we go from here?

- Wagyu beef represents a potential gold mine.
  - Marbling provides the flavor and juiciness beef eaters crave.
  - Oleic acid provides proven health benefits.
- Wagyu beef may be the true answer to grass-fed beef.
  - Grass feeding will increase omega-3 fatty acids (great for perception).
  - Grass-fed Wagyu beef may contain more oleic acid than grass-fed beef from conventional cattle.

Proposed Big Study

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

10 of each breed type will be grain-fed
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