Fatty acid analysis of specific adipose locations when steers were fed corn by-products

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Introducton

- Fatty acid composition of meat can greatly affect the many different attributes related to meat quality

- Diet can have an influence over the fatty acid composition for different adipose sites

Ground Beef in the US

- Today the use of subcutaneous fat trimmings are the major fat source that is used in ground beef production

- Over 50% of beef purchased by consumers at the retail level is ground beef

- About 73% of beef purchased by the food service industry is of the ground beef variety
  - NCBA 2013

Why is this of concern?

- Fat contains fatty acids
- Fatty acids are of a large importance to human health
- They provide a major source of energy
- They provide essential components of the cell membranes, of plasma phospholipids, and are precursors of prostaglandins and related regulators
  - J. Baggott and S. Dennis. 1995

Altering Fatty Acid Profiles

- Being able to alter the nutrition of cattle to produce the desired fatty acid composition of consumer products is becoming of interest

- The addition of subcutaneous fat trimmings that is higher in beneficial fatty acids can increase the nutritional health benefits to the consumer

Objective

- The purpose of this study was to determine the effects of corn by-products on fatty acid analysis within specific adipose locations as compared to a traditional soybean meal and ground ear corn diet

Animals

- Thirty-six Angus cross bred steers were used and randomly assigned to receive 1 of the 3 diets
- Cattle were randomly assigned to pens and were individually fed using Calan Gates for feed performance and carcass traits

Protein sources fed to 36 Angus Crossbred steers

- The three diets were:
  - Corn gluten feed (CGF)
  - Dried distillers grains plus solubles (DDGS)
  - Soybean meal and ground ear corn (SBM)

Diet Composition for Stocker Phase

	Protein Supplement		
	CGF	DDGS	SBM
Ingredient, %			
Corn Silage	75	75	75
Ground corn	0	0	15
Soybean meal	0	0	10
Dried distillers grains	0	25	0
Corn gluten feed	25	0	0
Chemical Composition,%			
DM	47	48	47
CP	16	18	16
NDF	51	52	53
ADF	18	19	17
Ash	3	3	3

Diet Composition for Finishing Phase

	Protein Supplement		
	CGF	DDGS	SBM
Ingredient, %			
SBM	0	0	10
CGF	25	0	0
DDGS	0	25	0
Ground Corn	48	48	63
Soy Hulls	8	8	8
Cottonseed Hulls	8	8	8
Citrus Pulp	8	8	8
Vitamin Premix	3	3	3
Chemical Composition,%			
DM	90	90	90
CP	13	15	14
NDF	28	25	19
ADF	11	11	9
Ash	5	4	5

Diets

- Cattle were stockered for 84 days on 1 of 3 diets consisting of 75% corn silage and on a 25% DM basis of CGF, DDGS, or SBM
- Steers were than finished on a 25% DM basis of 1 of the 3 diets and were formulated to be isonitrogenous and mixed daily using a Calan Data Ranger for 100 days
- Steer received the same supplement through out the project to mimic long term feeding of each protein source.
- Reference: J. R. Segers et al. (2012 & 2013)

Cattle Harvest

- Backfat was determined by ultrasound, once backfat was 1.27cm the steers were sent to the University of Georgia Meat Science Technology Center for slaughter under federal inspection

- Carcasses were chilled at -2˚C for 24 hours prior to sample collection

Beef adipose locations for determining fatty acid content

- Longissimus lumborum intramuscular fat (LL)
- Subcutaneous fat from the LL (SQ)
- Subcutaneous fat from the brisket region (BR)

Sample Collection

- Twenty four hours postmortem, the right side of the carcass was split at the 12^{th} – 13^{th} rib junction
- Before the LL was removed from the right side of the carcass, approximately 50 grams of subcutaneous fat was removed from the LL section, adjacent to the split between the 12^{th} and 13^{th} rib
- The first anterior steak off the LL was used for fatty acid analysis using the intramuscular fat of the LL

Sample Collection Conti.

- Also approximately 50 grams of subcutaneous fat was removed from the medial anterior region of the brisket
- Once samples were taken they were immediately vacuum packaged and frozen at -20˚C for determining fatty acid composition

Lipid Extraction

- The chloroform methanol method of Folch et al. (1957), was used for the wet tissue lipid extraction and further fatty acid analysis of all three adipose locations selected

Fatty Acid Methyl Esters

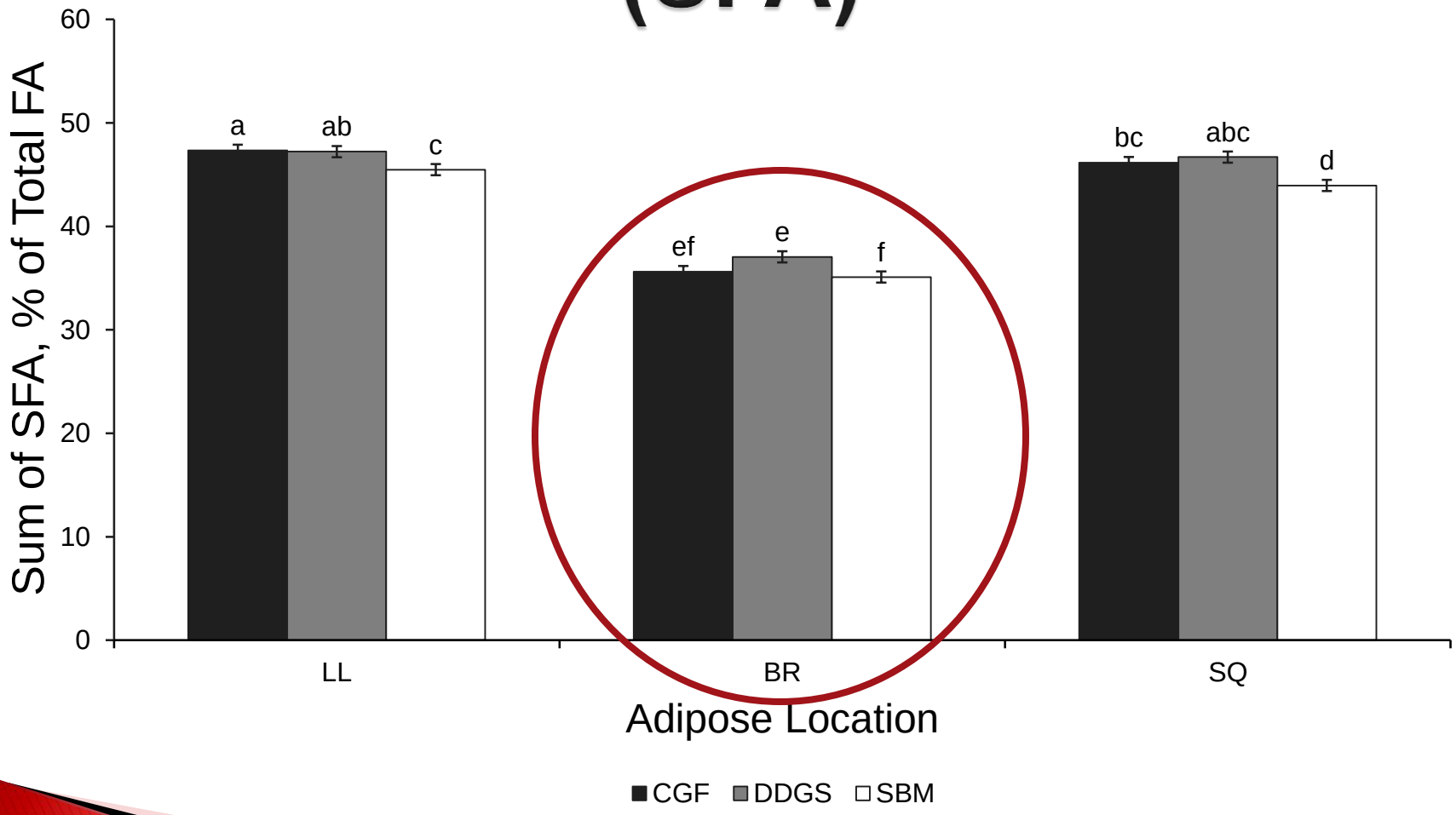
- Fatty acid methyl esters was determined using the Agilent 6850 gas chromatograph
- Separations were accomplished by using a 100-m Sp2560 capillary column (5 mm i.d. and 0.20-µm film thickness)
- The fatty acids values were determined by an internal standard, methyl heptacosanoic acid (C27:0), into each sample during methylation and expressed as a percentage of total fatty acids.

- Methods adopted from Duckett et al. (2002)

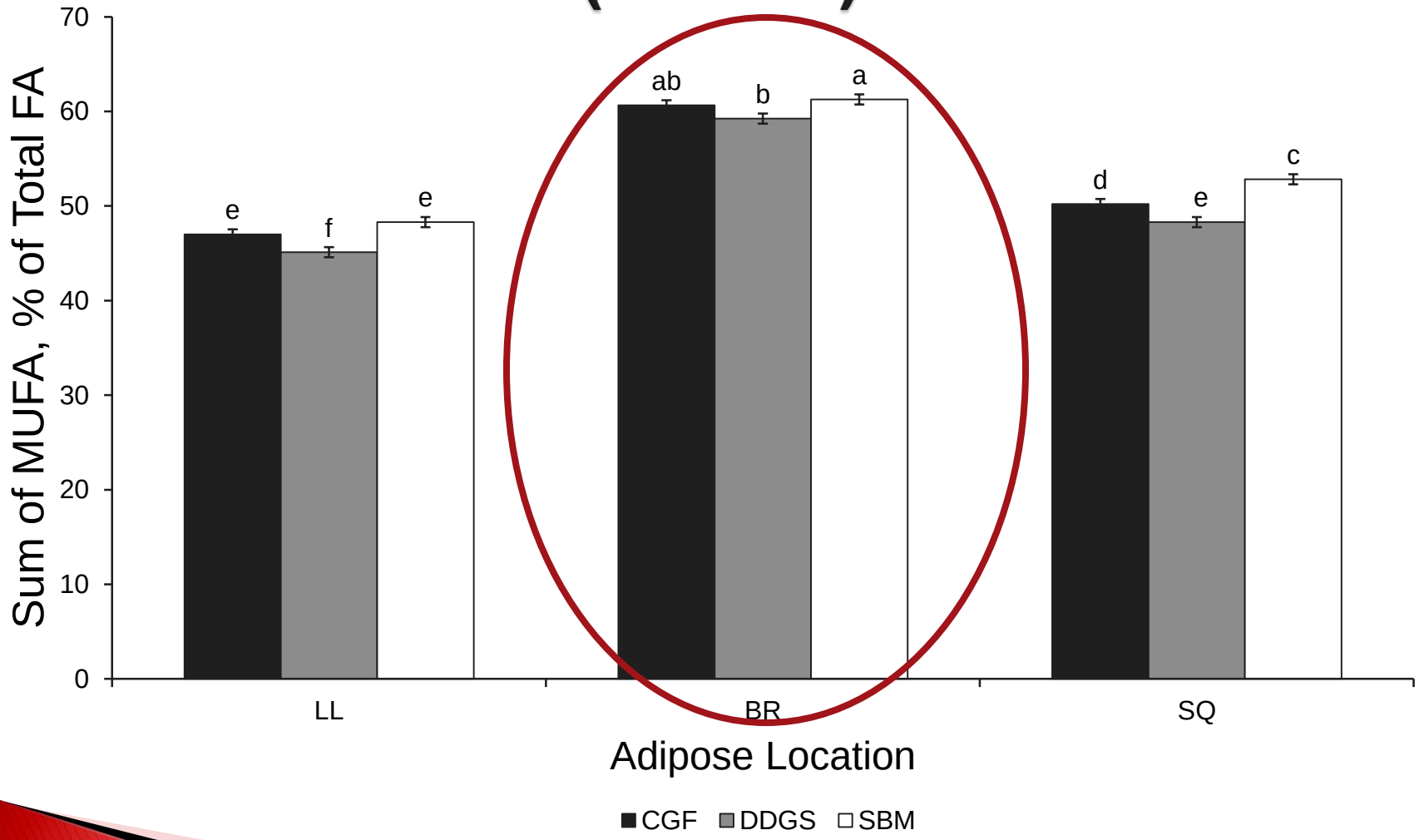
Analysis of Data

- Using the MIXED procedure; the main effects of protein source, adipose location, and subsequent interactions were evaluated at a significance level of $\alpha = 0.05$
- Fatty acid data was analyzed as a completely random design with carcass as the experimental unit
- Carcass within treatment was considered the random variable

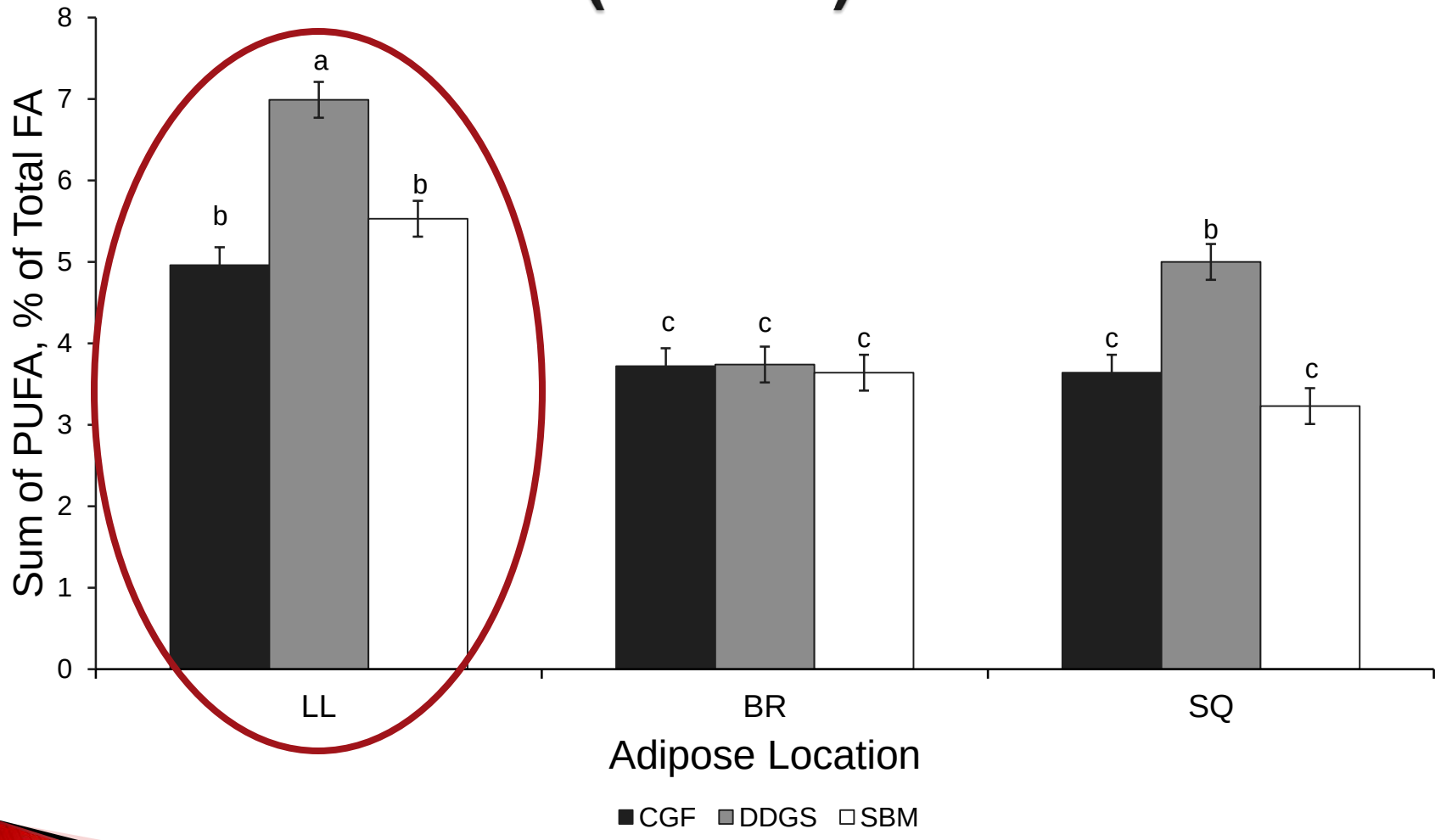
Total Saturated Fatty Acid (SFA)



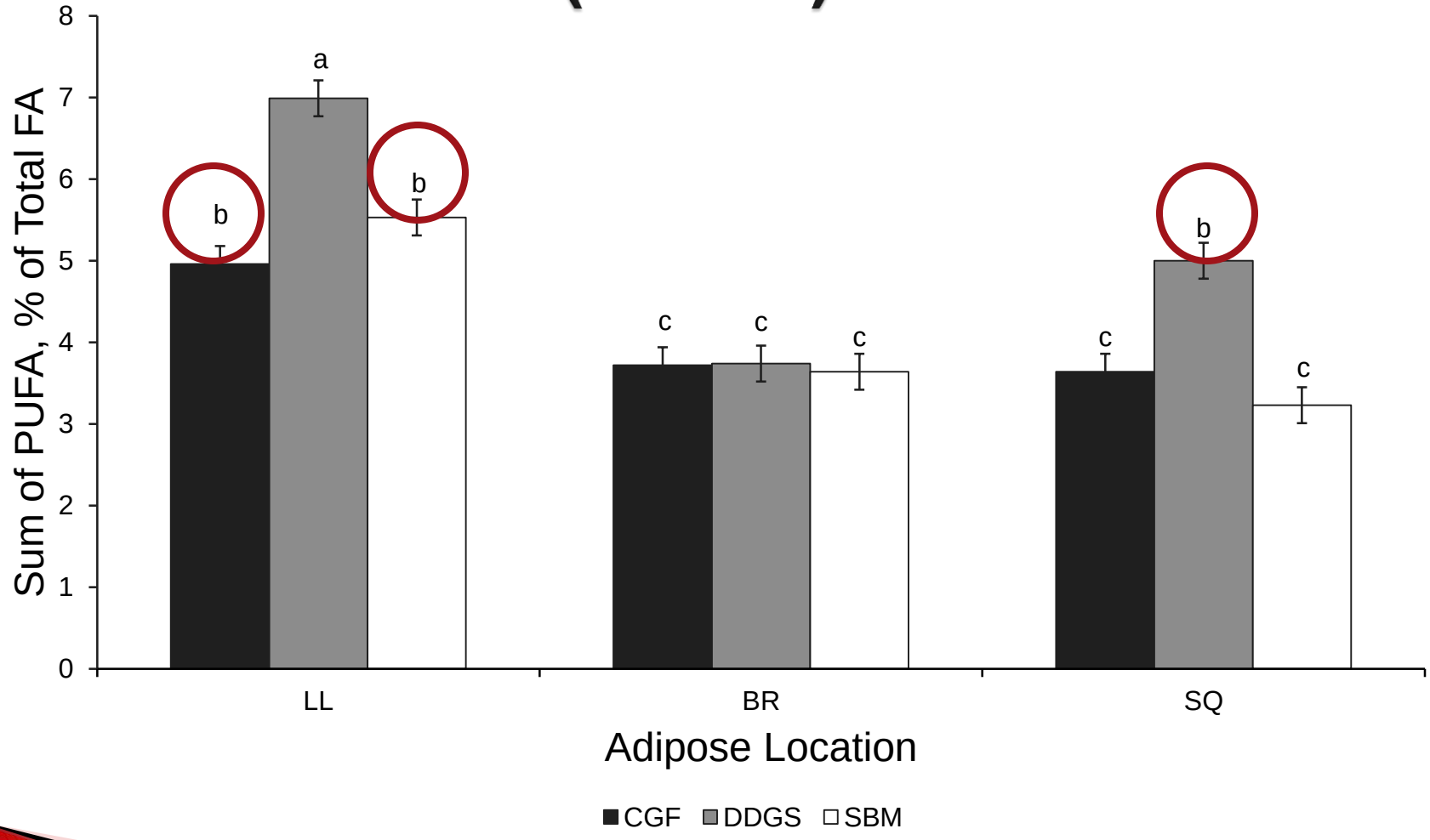
Total Monounsaturated Fatty Acid (MUFA)



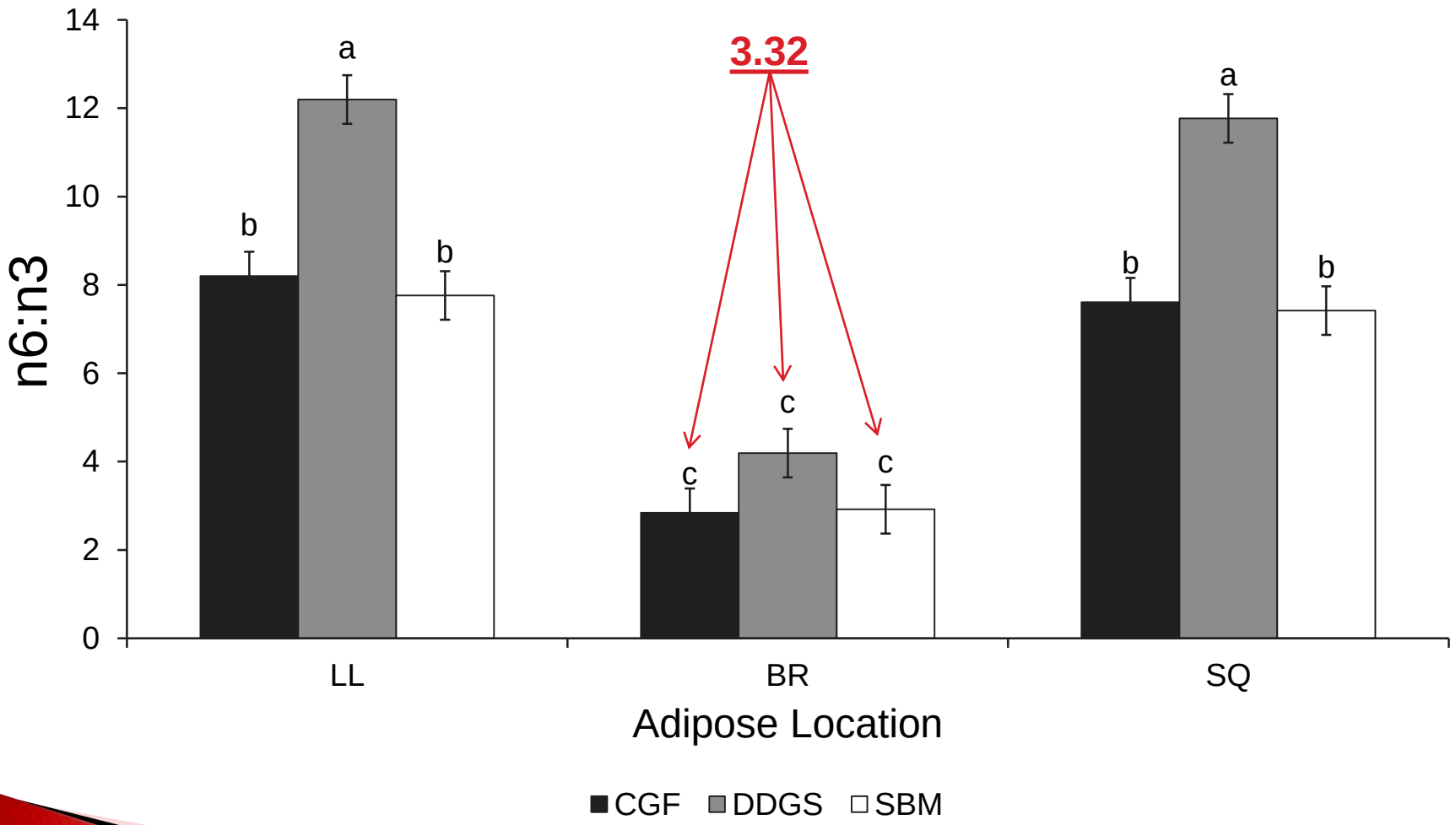
Total Polyunsaturated Fatty Acid (PUFA)



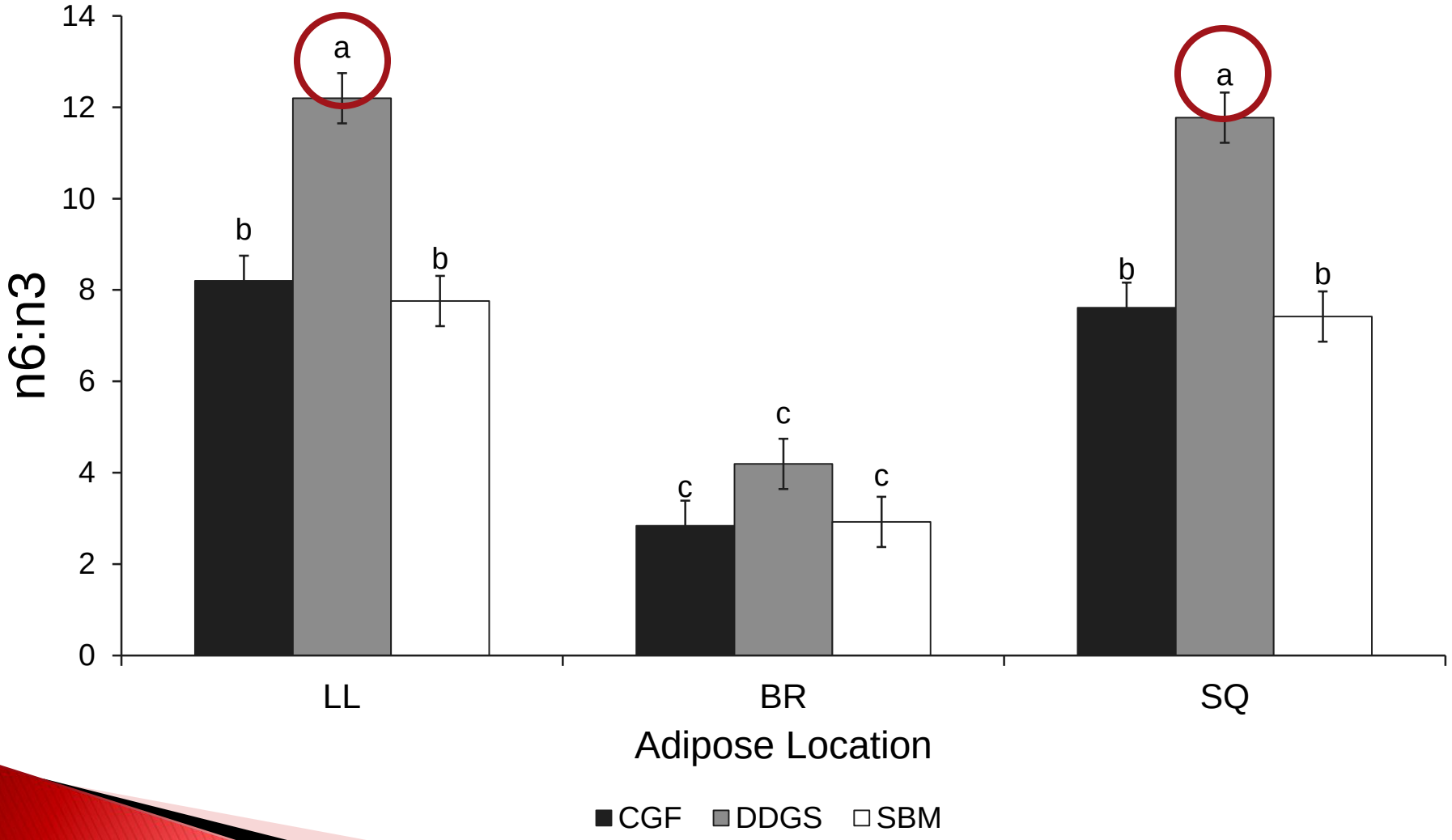
Total Polyunsaturated Fatty Acid (PUFA)



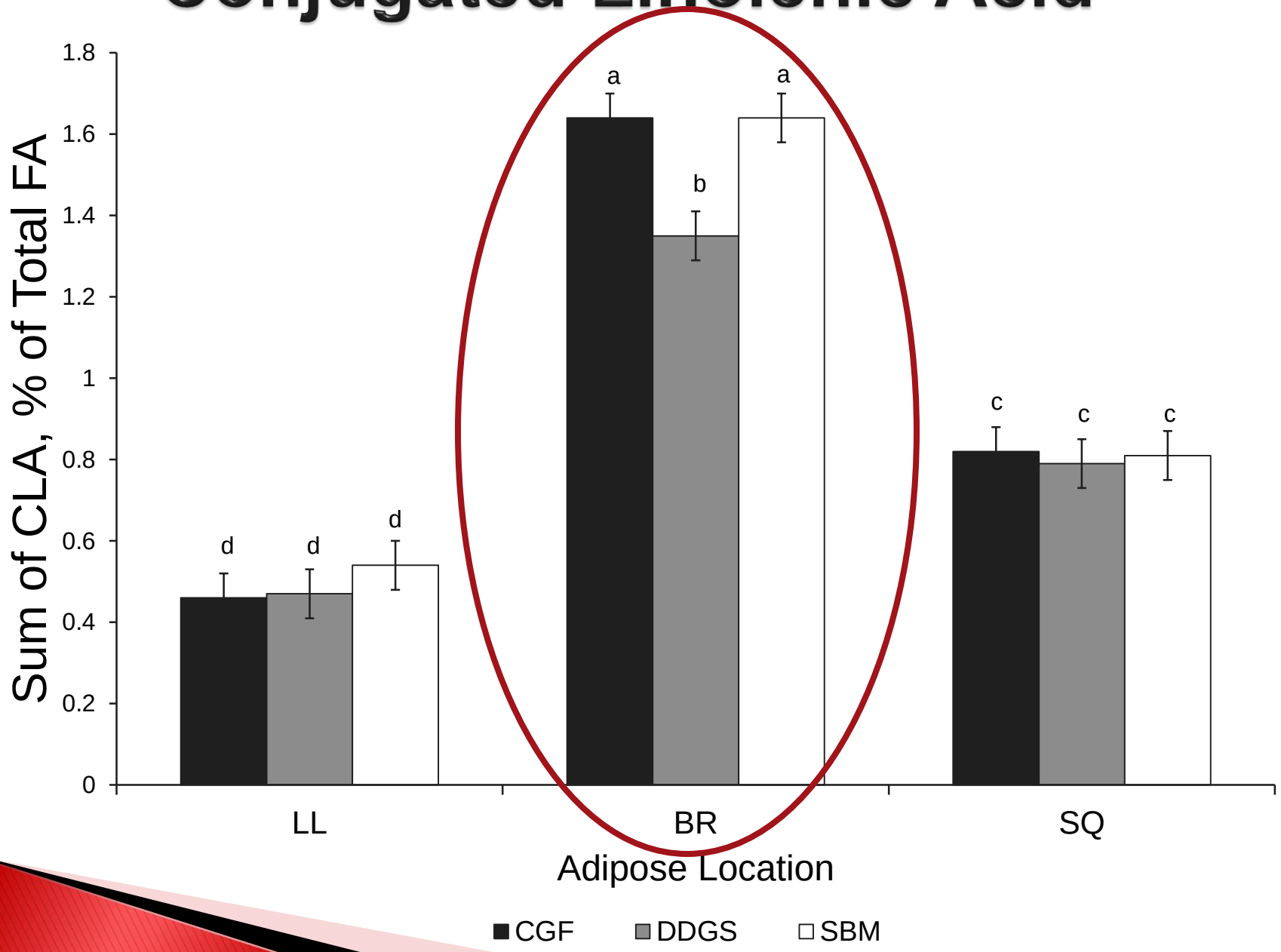
Total n6:n3


n6:n3
14
12
10
8
6
4
2
0
3.32
a
b
b
c
c
c
a
b
b
LL
BR
SQ
Adipose Location
CGF
DDGS
SBM

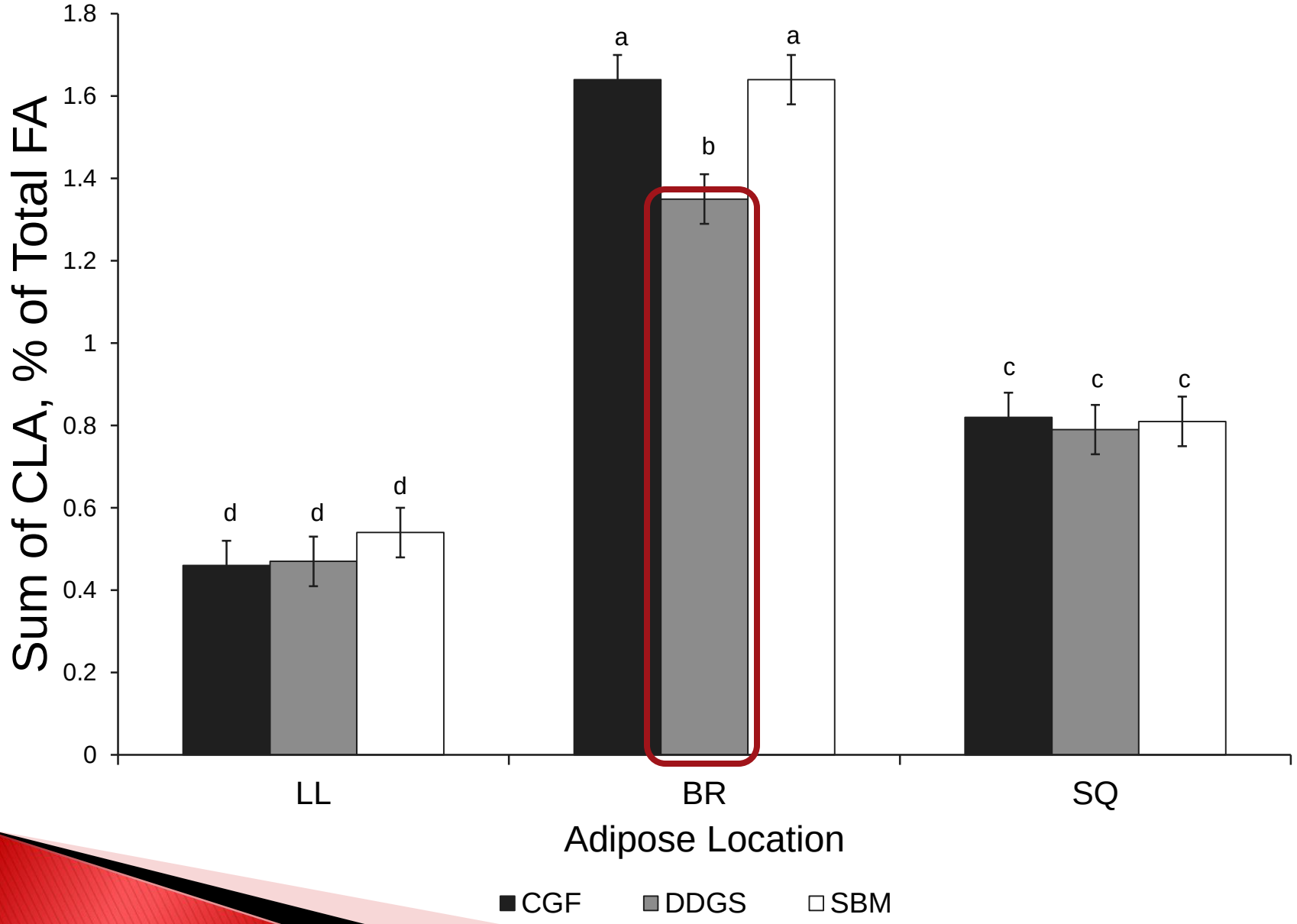
Total n6:n3


14
12
10
8
6
4
2
0
n6:n3
a
b
b
c
c
c
a
b
b
LL
BR
SQ
Adipose Location
CGF
DDGS
SBM

Conjugated Linolenic Acid



Conjugated Linolenic Acid



Conclusion

- Of the adipose locations evaluated BR had the more favorable n6:n3 ratio and CLA proportion as compared to LL and SQ regardless of diet

- The mechanism that is causing different fatty acid profiles needs to be further evaluated between adipose sites

Conclusion

- This research has shown that feeding corn gluten feed or dried distillers grains plus solubles can differently alter the fatty acid composition depending on adipose location compared to a traditional soybean meal with ground ear corn diet.

- The fat source for consumer beef products can be greatly altered in a nutrition stand point by the type of diet fed to cattle.

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Questions?