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Fact Sheet 19-03

Finishing diets containing dry and modified corn distillers grains differently affect fatty acid profile of beef

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Summary

Flat iron (M. *Infraspinatus*) and Petite tender (M. *Teres major*) steaks were obtained from 24 crossbred steers finished with three dietary treatments: corn (CORN), corn plus Dry Distillers Grains plus Solubles (DDGS, 10 percent of moisture) and corn plus Modified Distillers Grains plus Solubles (MDGS, 50 percent of moisture) at 40 percent dry matter basis. Beef fed MDGS had higher levels of trans fatty acids and C18:3 ω3, whereas beef fed DDGS had higher Omega 6 to Omega 3 ratio. Fatty acid deposition also varied between muscles. Higher deposition of Polyunsaturated fatty acids (PUFA) and omega 6 was observed in petite tender steaks when compared to flat iron.

Introduction

Distillers grains are by-products resulting from the fermentation of cereal grains by yeast into alcohol. These grains may be pressed to decrease levels of moisture generating dry distillers grains (DDG) with 10 percent of moisture and modified (MDG) and wet distillers grains (WDG) with 50 and 70 percent of moisture, respectively. The liquid fraction remaining after fermentation is condensed, producing a type of syrup called solubles (S), and normally, solubles are added back to distillers grains.

When compared to corn, Distillers Grains plus Solubles (DGS) have greater concentrations of nutrients such as proteins, fat and fiber. Over the last decades, availability of DGS has increased due to increased ethanol production. Producers have been using DGS as an alternative to replace corn in feedlot diets due to lower production costs and sustainable practices (Cleveland et al., 2017. De Mello et al., 2018).

Fatty acid composition of beef is directly affected by the composition of diets provided to the cattle, whereas the fatty acid profile found in the lean is directly correlated to meat quality (Domenech-Pérez et al., 2017). In this study, we evaluated the effects of feeding corn-based finishing diets with or without DDGS or MDGS on fatty acids profile of value-added beef cuts.

Procedure

Twenty-four crossbred steers were randomly allocated to three different diets (Table 1): CORN (0 percent DGS), DDGS (40 percent DM of DGS with 8-12 percent of moisture), and MDGS (40 percent DM of DGS with 45-55 percent of moisture). Steers were fed for 190 days and harvested in an USDA inspected facility. After slaughter, shoulder clods (IMPS 114) were excised from carcasses, vacuum-packaged and transferred under refrigeration to the University of Nevada, Reno Meat Quality Laboratory.

After seven days of aging, the flat iron steak (INF, IMPS 114D PSO1) and the petite tender (TM, IMPS 114F) were fabricated from the clods, submerged in liquid nitrogen, and pulverized. For fatty acids analysis, total lipids were extracted by using a chloroform and methanol (2:1, v/v) mixture and were converted to Fatty Acids Methyl Esters (FAME). Fatty acid profile was analyzed by gas chromatography (Agilent Technologies, model 6890 series) and separated through a capillary column (Chrompack CP-Sil 88 - 0.25 mm x 100 m). Oven temperature was programmed from 140 to 220 C at 2 C/min and held at 220 C for 20 minutes. Injector and detector temperature were maintained at 270 and 300 C, respectively. The carrier gas was hydrogen at a flow rate of 30 mL/minutes.

Fatty acids were identified by comparison of retention times with known standards. Data were analyzed as a 3x2 factorial (diets x muscle) using PROC GLIMMIX of SAS, and when significance was detected at $P \leq 0.05$, means were separated using LSMEANS and DIFF functions.

Results

Effects of muscle on fatty acid profile is presented in Table 2, whereas Table 3 shows the effects of dietary treatment. Values of C14:1T ω5, C18:1Δ11 ω7, C18:2 ω6, C20:3 ω6, C20:4 ω6, total PUFA, and total Omega 6 were significantly higher in TM when compared to INF, whereas C18:1 ω9 levels were significant higher in INF than in TM. Feeding corn significantly increased levels of some saturated and monounsaturated fatty acids including C14:0, C16:0 and C18:1Δ11 ω7, when compared to DGS. Overall, finishing diets containing DGS significantly led to higher deposition of C18:0, C18:2 ω6, PUFA, and total Omega 6 FA. When comparing DDGS versus MDGS, feeding DDGS led to higher concentrations of C14:0, C14:1 ω5, C16:0, and C16:1 ω7 whereas MDGS led to higher C17:0 in the lean ($P \leq 0.05$). Feeding MDGS increased concentrations of C18:1T (ω9 and ω12), total trans, and C18:3 ω3 FA in the lean when compared to CORN, whereas beef from steers fed DDGS had higher Omega 6 to Omega 3 ratio when compared to CORN.

Conclusion

Inclusion of distillers grains with different moisture levels differently affected fatty acids profile of beef. When compared to corn-fed, beef fed MDGS had higher levels of trans fatty acid and C18:3 ω3, whereas beef fed DDGS had higher Omega 6:Omega3.

Implications

Feeding DGS may lead to different fatty acid profile of beef when compared to corn. Increasing polyunsaturated fatty acids such as C18:3 ω3 improve nutritional values of beef.

However possible detrimental effects on lipid stability and color may occur since polyunsaturated fatty acids such as ω3s are more prone to oxidation than saturated fatty acids (De Mello et al., 2018). Supplementation with vitamin E must be considered when feeding DGS.

References

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Table 1. Ingredients of finishing diets on dry matter basis (% DM).

Ingredients	CORN	DDGS	MDGS
High-moisture corn	39.25	20.5	20.5
Dry-rolled corn	39.25	20.5	20.5
DDGS[1]	-	40.0	-
MDGS[2]	-	-	40.0
Corn silage	15.0	15.0	15.0
Supplement	6.5*	4.0**	4.0**

[1]Dried distillers grains plus solubles (DDGS).
[2] Modified distillers grains plus solubles (MDGS).
*Limestone; tallow; urea (1.285 %); SoyPass®; salt; minerals; vitamins A, D and E; Rumensin®90; and Tylan®40.
**Fine-ground corn; limestone; tallow; salt; minerals; vitamins A, D and E; Rumensin®90; and Tylan®40.

Table 2. Fatty acid profile (mg/100mg) of value-added cuts (INF, flat iron) and (TM, petite tender) from beef steers.

	Muscle			
Fatty acids	**INF**	**TM**	**SEM**	***P*-Value**
C6:0	0.0179[a]	0.0058[b]	0.0044	0.0096
C14:1t	0.0845[b]	0.1313[a]	0.0226	0.0456
C18:1 ω9	36.3850[a]	34.2854[b]	0.7978	0.0118
C18:1d11 ω7	1.5796[b]	1.7446[a]	0.0618	0.0108
C18:2 ω6	3.9046[b]	4.4483[a]	0.2652	0.0466
C20:3 ω6	0.2000[b]	0.2917[a]	0.0274	0.0018
C20:4 ω6	0.5063[b]	0.7492[a]	0.0605	0.0002
PUFA	5.7125[b]	6.7325[a]	0.3422	0.0048
ω6	4.7746[b]	5.7129[a]	0.3160	0.0049
Total	95.5537[a]	94.5942[b]	0.3233	0.0049
Others	4.4462[b]	5.4058[a]	0.3233	0.0049

[a,b] Means having different superscripts within row are significantly different.

Table 3. Fatty acid profile (mg/100mg) of beef from steers fed CORN, DDGS and MDGS.

	Treatment				
Fatty acids	**CORN**	**DDGS**	**WDGS**	**SEM**	***P*-Value**
C8:0	0.0162[b]	0.0518[a]	0.0137[b]	0.0110	0.0331
C14:0	3.4169[a]	2.9825[b]	2.5062[c]	0.1106	<.0001
C14:1	0.8781[a]	0.6294[b]	0.4538[c]	0.0611	<.0001
C16:0	25.7756[a]	24.6900[b]	22.8175[c]	0.2750	<.0001
C16:1	3.4019[a]	2.5869[b]	2.1106[c]	0.1440	<.0001
C17:0	1.4688[b]	1.2363[c]	1.6469[a]	0.0513	<.0001
C17:1	1.1006[a]	0.8581[b]	0.9750[ab]	0.0453	0.0021

C18:0	12.2313[b]	14.1600[a]	14.9144[a]	0.4818	0.0010
C18:1t	3.2362[b]	3.8012[ab]	4.6219[a]	0.3109	0.0111
C18:1d11n7	1.8925[a]	1.4819[b]	1.6119[b]	0.0535	<.0001
C18:2n6	3.2506[b]	4.9088[a]	4.3700[a]	0.2297	<.0001
Total trans	3.8475[b]	4.4050[ab]	5.1619[a]	0.3160	0.0190
PUFA	5.4269[b]	6.9488[a]	6.2919[a]	0.2963	0.0031
ω6	4.4244[b]	6.0138[b]	5.2931[a]	0.2736	0.0008
ω6:ω3	7.3900[b]	9.9019[a]	8.3244[ab]	0.5946	0.0162

[a,b] Means having different superscripts within row are significantly different.