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Shelf Life of Cooked Ground Beef Patties From Cattle Fed Wet Distillers Grains with Solubles

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Summary

Cattle were grazed without or with energy supplementation of wet distillers grains with solubles (WDGS) during backgrounding, and were finished on a corn-based diet with or without 35% WDGS. Ground beef patties were made from shoulder clods, cooked, and stored in a refrigerated or frozen state. Cattle supplemented with WDGS had greater lipid oxidation in cooked ground beef patties regardless of finishing diet or storage type.

Introduction

Animal fat is associated with each species' meat flavor. Within each species, the fat content of each animal varies depending on the diet each animal consumed during growth and development. Feeding WDGS to cattle causes increases in polyunsaturated fatty acids and oxidation rates in the meat (*2009 Nebraska Beef Cattle Report*, pp. 110-112; *2009 Nebraska Beef Cattle Report*, pp. 113-115), resulting in rancid flavors and aroma.

Oxidation in meat products is a major concern of meat processors and impacts the product quality and shelf life. Moreover, feeding WDGS during backgrounding and finishing has continued to increase along with growth in the ethanol industry. While much work has been conducted on the impact of feeding WDGS on raw steaks, little research has been conducted in the area of cooked, ready-to-eat meat products. This study investigated the impact of feeding WDGS during different stages of production on lipid oxidation in ready-to-eat beef products.

Procedure

Cattle (n = 64) were assigned to a diet in a 2 x 2 factorial design. During backgrounding (177 days), cattle either received energy supplementation in the form of WDGS (0.6% BW/day) or no supplementation. Cattle were then finished on a corn-based diet with or without 35% WDGS for 119 days. Cattle were harvested at the Greater Omaha Packing plant in Omaha, Neb.

The shoulder clod of four different carcasses from each of the four treatment groups were collected, totaling 16 clods. Day 7 post-mortem, the clods were coarse ground (fat content was not formulated,), mixed with ingredients (1.5% salt and 0.25% sodium phosphate), and fine ground. The same day, ¼ lb patties were formed, covered with plastic wrap, and stored overnight in the refrigerator. The next day each patty was cooked on a belt grill to an internal temperature 158°F. Half of the patties from each treatment were placed in a zip top bag and stored in a dark 38°F cooler for an assigned number of days. The remaining patties were placed on a plastic tray, overwrapped with PVC oxygen-permeable plastic film, and placed in a -4°F freezer. When the patties were crust frozen, they were placed in a zip top bag and stored in a dark -4°F freezer for an assigned number of days

Samples were collected on the day of cooking (day 8 postmortem) and every two days for the next 14 days for refrigerated samples and every 28 days for the next 252 days for frozen samples. Samples were ground, weighed, and stored at -112°F freezer until evaluation for lipid oxidation using the thiobarbituric acid reactive substances (TBARS) measure.

Proximate composition (fat, moisture, protein, and ash) of the cooked patties was also measured. Moisture and ash were measured using a LECO thermogravimetric analyzer, and fat was measured using ether extraction. Protein was calculated by difference.

Data were analyzed using the PROC GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.) for treatment, day and treatment*day effects.

Results

For both frozen and refrigerated patties, there were no significant three-way interactions between supplementation, finishing diet, and day ($P > 0.05$). For frozen patties there was a significant ($P < 0.01$) interaction between supplementation and finishing diet (Figure 1). When supplementation was provided, TBARS values were the greatest regardless of finishing diet. This suggests that cooked beef patties in frozen storage from animals that were supplemented with WDGS during backgrounding will have more oxidation and, therefore, will be more rancid than patties from animals that did not receive supplementation. Noticeable rancid flavors are associated with TBARS values greater than 1.0 mg/kg. All four treatment combinations from patties held under freezer conditions had TBARS values well over 1.0 mg/kg by the end of the study. However, patties from cattle that were not supplemented during grazing and were finished on WDGS did not have oxidation values over 1.0 mg/kg until day 140 of frozen storage while all other treatment

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Table 1. The effect of supplementation and finishing diet on meat quality characteristics of cooked beef patties.

	Supplementation[1]				Finishing Diet			
	No	Yes	SEM	*P*-value	Corn	WDGS[2]	SEM	*P*-value
Moisture, %	59.1	58.95	0.81	0.90	59.06	58.99	0.81	0.95
Fat, %	19.81	19.61	1.21	0.91	19.53	19.89	1.21	0.84
Ash, %	2.98	3.09	0.04	0.06	3.02	3.05	0.04	0.54
Protein, %	18.12	18.36	0.59	0.78	18.39	18.08	0.59	0.72

[1]Energy supplementation with WDGS during backgrounding phase.
[2]WDGS = Wet distillers grains with solubles.
[a,b]Means within the same row sharing a common superscript are similar ($P \geq 0.05$).

combinations exceeded 1.0 mg/kg by day 28.

For refrigerated patties, providing supplementation caused significantly higher ($P < 0.01$) TBARS values than not supplementing, and finishing on corn without WDGS had a tendency ($P = 0.07$) to also cause higher TBARS values (Figure 2). Numerically, patties from the non-supplemented cattle that were finished on WDGS had the lowest scores for both refrigerated and frozen storage. For all proximate composition measures (% moisture, fat, ash, and protein) neither the main effects of supplementation or finishing diet nor their interactions had any significant effects ($P > 0.05$, Table 1).

In conclusion, feeding WDGS as an energy supplementation during backgrounding caused higher amounts of oxidation in both refrigerated and frozen cooked beef patties regardless of finishing diet. The levels of oxidation were greater in frozen patties. These data suggest that the time WDGS is fed during production impacts lipid oxidation in cooked beef products.

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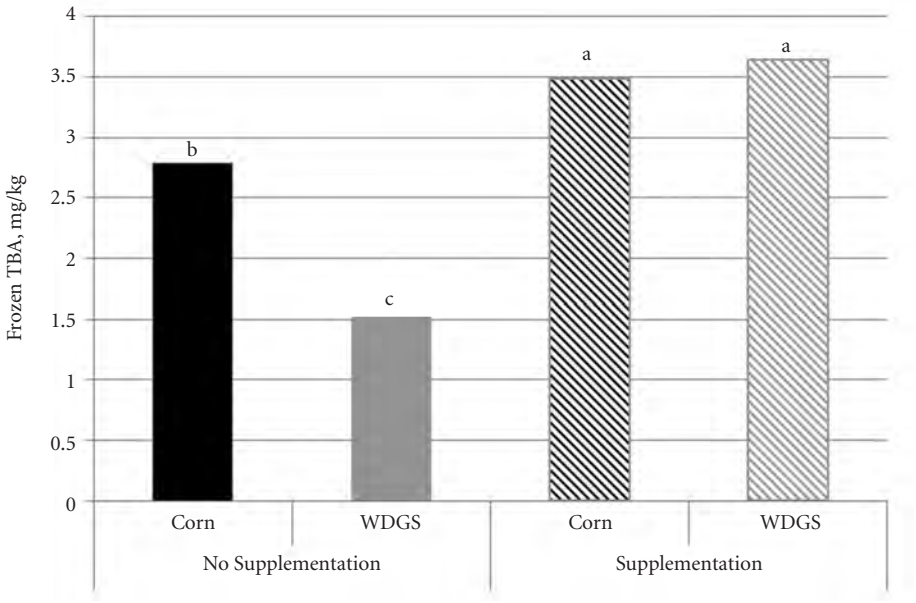
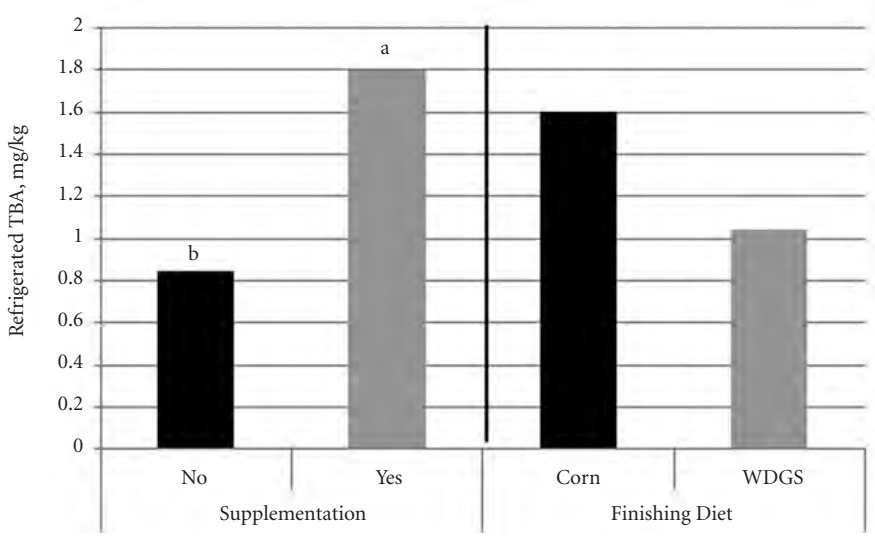


[a,b,c]Means within the same treatment sharing a common superscript are similar ($P \geq 0.05$)

Figure 1. The effect of the interaction between supplementation and finishing diet on cooked beef patties under frozen storage ($P < 0.01$)



[a,b]Means within the same treatment sharing a common superscript are similar ($P \geq 0.05$)

Figure 2. The effect of supplementation ($P < 0.01$) and finishing diet ($P = 0.07$) on cooked beef patties under refrigerated storage