Performance and Pork Quality of Pigs Fed In-Shell Hazelnuts

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Introduction

Hazelnut (*Corylus spp)* is an extensively rooted perennial used in conservation plantings such as windbreaks and riparian buffers. Improved hazelnut germplasm adapted to the upper Midwest may be an alternative oilseed crop for farmers. Hazelnuts with a diameter less than 0.4 in. have been identified as unsuitable for human food due to challenges in separating the shell from the kernel. The objective of this project was to evaluate in-shell ground hazelnut as a feedstuff for pigs raised in bedded hoop barns.

Materials and Methods

Hazelnut kernels, shells, and undersized (diameter < 0.4 in.) in-shell hazelnuts were analyzed using standard wet-chemistry techniques for feed analysis. Two feeding trials also were conducted to evaluate the effect of diluting pig diets with 10 percent in-shell hazelnuts. In each trial, 36 barrows (128 ± 2 lb) were sorted into six pens inside of three mini-hoop barns (48 ft^2/pig). Pens of pigs were randomly assigned to receive a balanced corn-soybean meal diet (control) or the control diet diluted with in-shell hazelnuts (90:10 control:in-shell hazelnuts). Hazelnuts were pulverized using a roller mill before incorporation into the diet. Pigs were individually weighed every 28 days and feed disappearance was recorded. For each trial, all pigs were harvested on the same day after either 68 or 69 days of feeding. Two chops were collected from each pig to assess pork quality. One cube (1 $in.^2$) of fat was removed from half of the chops (1 sample/pig) and analyzed for fatty acid profile.

Results and Discussion

The nutrient profile of hazelnut products is summarized in Table 1 and compared with reference values for corn grain and soybean meal. Hazelnut kernels are rich in unsaturated fatty acids, particularly oleic (C18:1). In-shell hazelnuts have less crude fat and lower concentrations of specific fatty acids than hazelnut kernels, but more than corn grain or soybean meal. Due to the shells, all fiber measures of the in-shell hazelnuts were much greater than the hazelnut kernels, corn grain, or soybean meal.

Pig performance and carcass characteristics are shown in Table 2. Growth rate, carcass weight, and carcass fat were not different across dietary treatment. Pigs fed diets diluted with 10 percent in-shell hazelnuts grew less efficiently requiring 6 percent more feed/unit of gain.

Quality characteristics of loin chops and fatty acid profile of backfat is presented in Table 3. Pork quality attributes were not different across dietary treatments. The fat from pigs fed diets containing in-shell hazelnuts had less saturated fat and more unsaturated fat. Oleic

acid content was higher in the fat of pigs fed diets containing 10 percent in-shell hazelnuts compared with the control diet.

Feeding in-shell hazelnuts to pigs may be an effective way to add value to nuts ill-suited for processing into products for human consumption. A corn-finished pork is a high-value niche product in several parts of the world. The fatty acid profile of pork fat from acorn-fed pigs also has an elevated concentration of oleic and other monounsaturated fatty acids. Although fat from acorn-finished pigs is reported to have higher amounts of oleic acid than observed in this trial, feeding corn-soybean meal diets diluted with 10 percent in-shell hazelnuts effectively changed the fatty acid profile of pork fat. The optimal balance point among hazelnut feeding level, pig performance, pork quality, and shelf-life of pork remains to be determined.

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Table 1. Nutrient profile of hazelnut products and reference feedstuffs for pigs.

	Hazelnut[1]			Corn[2]	Soybean meal[3]
	Kernels	Shells	< 0.4 in.-shell nut		
Dry matter, %	100.0	100.0	100.0	100.0	100.0
Crude protein, %	18.4	1.3	7.6	9.3	53.0
Lysine, %	0.5	0.0	0.2	0.3	3.3
Crude fiber, %	4.8	75.4	49.5	2.2	4.3
NDF, %	12.2	96.8	68.7	10.3	9.1
ADF %	9.9	81.3	56.7	3.3	5.9
Crude fat, %	61.2	< 0.1	21.1	3.9	1.7
Fatty acids, % of total fat					
Palmitic (C16:0)	4.0	–	3.8	12.0	7.9
Oleic (C18:1)	77.1	–	74.9	26.3	16.3
Linoleic (C18:2)	16.0	–	18.0	44.2	39.8
Saturated	6.0	–	6.2	13.6	10.8
Unsaturated	93.5	–	93.6	72.0	61.4

[1]Hazelnut kernels, shells, and < 0.4 in. whole nuts were 3.88, 9.34, and 6.02% moisture as fed.
[2]Corn grain was 11% moisture as fed.
[3]Soybean meal was 10% moisture as fed.

Table 2. Growth performance and carcass characteristics of pigs fed 0 or 10% in-shell hazelnuts.[1]

	Dietary treatment			
	Control	Hazelnut	SEM	P-value
Start weight, lb	128.0	128.0	1.6	0.86
End body weight, lb	286.6	284.4	3.1	0.44
Average daily gain, lb/d	2.3	2.3	< 0.1	0.37
Average daily feed intake, lb/d	8.2	8.6	< 0.1	0.36
Feed-to-Gain	3.5	3.8	< 0.1	0.03
Hot carcass weight, lb	216.0	217.0	3.5	0.79
10^{th} rib back fat, in.	1.52	1.52	0.1	0.97
Last rib fat depth, in.	1.35	1.30	< 0.1	0.41

[1]Diets were a common corn-soybean meal diet diluted with either 0% (Control) or 10% (Hazelnut) rolled in-shell hazelnuts.

Table 3. Quality characteristics loin chops and fatty acid profile of backfat from pigs fed 0 or 10% in-shell hazelnuts.[1]

	Dietary treatment			
	Control	Hazelnut	SEM	P-value
Color	3.01	3.01	0.04	0.93
pH	5.75	5.78	0.02	0.17
Marbling, %	1.80	1.71	0.09	0.70
Warner-Bratzler Shear Force	3.51	3.51	0.11	0.99
Cook Loss, %	17.00	16.70	0.60	0.75
Fatty Acid Composition				
Myristic acid (C14:0)	1.43	1.37	0.08	0.58
Palmitic acid (C16:0)	25.60	24.60	0.25	0.01
Palmitoleic acid (C16:1)	1.92	1.72	0.08	0.07
Stearic acid (C18:0)	14.30	13.50	0.37	0.14
Oleic (C18:1)	41.00	43.30	0.47	< 0.01
Linoleic (C18:2)	8.46	8.89	0.28	0.25
Linolenic (C18:3)	0.35	0.33	0.01	0.16
Saturated fatty acids	42.00	39.80	0.55	< 0.01
Monounsaturated fatty acids	45.40	47.50	0.49	0.01
Polyunsaturated fatty acids	9.34	9.81	0.29	0.26

[1]Diets were a common corn-soybean meal diet diluted with either 0% (Control) or 10% (Hazelnut) rolled in-shell hazelnuts.