The Effects of Extrusion Process Parameters and Physical Properties of Sorghum-based Dog Food Diets Designed for a Digestibility Study

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Introduction

- This experiment is to study the impact of raw particle size and thermal energy intensity in extrusion processing of sorghum-based dog food diets on the physical properties of the kibbles.
- This study is based on a future broiler model.

Objective

Evaluate the effects of extrusion processing parameters and physical properties of sorghum-based dog food diets for a future broiler digestibility study.

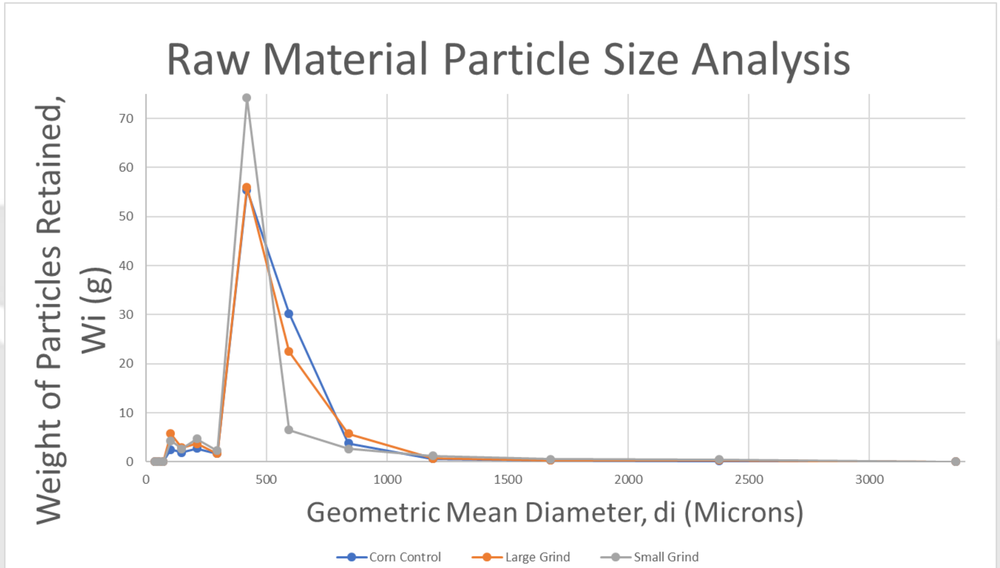
Extrusion Procedures

- The sorghum diets were ground to pass through either a 0.51 mm (0.02”) or a 1.65 mm (0.065”).
- Each grind was extruded with high and low extrusion process parameters.
- There was a corn control with a large grind and processed with high thermal energy.
- Extrusion in-barrel moisture ranged between 32-33% wet basis.
- 15 kibbles of each sample were randomly selected to calculate section expansion index.
- The STE was dependent upon the steam addition to the preconditioner.
- Bulk density was measured off the extruder and off the dryer.
- Hardness was determined with 30 kibbles from each sample tested with a texture analyzer.

Future Work/ Digestibility Trial

- A total of 288 Male chicks will be used for an 18 day study.
- Chicks will be housed in 2 Petersime batteries with 20 cages per battery and 6 chicks per cage.
- Dietary treatments will be randomly assigned to cages.
- Dietary treatments will be arranged in a 8 X 6 X 6 factorial with the main effects of particle size and extrusion parameters.
- Broilers and feeders will be weighed at day 0, 6, 12, and 18 to calculate body weight gain and feed conversion rate.

Experimental Results



	High Thermal/ Small Grind	Low Thermal/ Small Grind	High Thermal/ Large Grind	Low Thermal/ Large Grind	Corn Control
Expected Throughput (kg/hr)	128.8	130.2	135.7	132.3	121.5
In-Barrel Moisture (%)	32.60	32.56	32.08	33.11	31.6
Measured Throughput (kg/hr)	112.20	117.90	120.3	120.00	107.4
SME (kJ/kg)	195.17	200.28	131.72	173.60	142.77
STE (kJ/kg)	183.89	131.27	186.43	125.30	199.51
Expansion Ratio OD	3.35	3.03	3.85	3.68	4.61
Bulk Density OE (g/L)	273.75	291.50	287.75	302.25	289
Bulk Density OD (g/L)	276	283.50	304.25	320.75	293
Hardness (kg)	9.42	13.86	11.89	13.03	10.27

***SME = Specific Mechanical Energy (kJ/kg); STE – Specific Thermal Energy**

References

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Experimental Diets

Ingredients, %	Sorghum Diet	Ingredients, %	Corn Control Diet
Sorghum	56.64	Corn	51.95
Chicken By-Product Meal	15.00	Poultry By-Product Meal	18.93
Soybean Meal	10.00	Corn Gluten Meal	1900
Chicken Fat	5.50	Wheat	6.00
Corn Gluten Meal, 75%	5.00	Oats, Whole	3.04
Beet Pulp	4.00	Beet Pulp	3.00
Dicalcium Phosphate	4.00	Brewers Rice	3.00
Salt	0.40	Calcium Carbonate	1.00
Calcium Carbonate	0.20	Monocalcium Phosphate	0.89
Choline Chloride, 60% dry	0.20	Flaxseed	0.76
Potassium Chloride	0.20	Salt	0.76
Fish Oil	0.20	Brewers Yeast	0.76
DL Methionine	0.1528	Potassium Chloride	0.46
Vitamin Premix	0.1515	Vitamin Premix	0.45
Trace Mineral Premix	0.1452	**Total**	**100**
Lysine	0.1163		
Natural Antioxidant, Dry	0.035		
L-Threonine, 98%	0.249		
Natural Antioxidant, Liquid	0.0165		
Manganese Sulfate	0.0128		
Vitamin K	0.0001		
Total	**100**		

***The experimental sorghum diets and control corn diet were formulated to be iso-protein. (~ 25%)**

Conclusions

- STE intensity varied from 125-131 kJ/kg (low) to 185-200 kJ/kg (high) dependent on steam input into the preconditioner.
- SME ranged between 132-200 kJ/kg.
- Bulk density of kibbles increased from 280 g/L to 312 g/L with increase in particle size, because expansion decreased as surface area to volume ratio of particle decreased.
- Hardness of kibbles was impacted by both particle size and thermal energy.
- Dogs preferred the kibbles processed with high thermal intensity over low thermal intensity.