# Evaluation of Drying Methods on Nitrogen and Energy Concentrations in Pig Feces and Urine, and on Poultry Excreta

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**Summary and Implications**

Drying method was evaluated based on the impact it had on gross energy and nitrogen concentration of swine feces and urine, and nitrogen in poultry excreta, Twelve individually penned growing pigs were fed one of three diets and 16 pens of 10 growing broilers were fed one of four diets that differed in NDF and CP. Feces, urine, and excreta were collected after diet adaptation and were assumed to vary widely in nutrient composition. Following collection, samples were dried using one of four methods: UD-undried, FD-freeze dried, OD55-oven dried at 55°C for 48 h, or OD100-oven dried at 100°C for 48 h, after which dry matter gross energy, nitrogen, carbon, and sulfur were determined. In swine feces, drying resulted in a loss of GE and S, but among the various drying methods, there was no difference for dry matter, gross energy, nitrogen, carbon and sulfur concentrations. There were no differences in urinary gross energy due to drying or among drying methods; however urinary dry matter was highest for FD compared to OD and higher for OD55 compared to OD100. In poultry excreta, gross energy, nitrogen, and S were reduced by drying, but there were no differences among the drying methods. Regardless of drying method, some loss of gross energy and nitrogen appears to be inevitable, but there is no apparent advantage between freeze drying and oven drying.

**Introduction**

Currently, there is no universally accepted method for drying feces, urine, or excreta for determination of energy or nitrogen concentration. Several studies have shown losses in nitrogen and energy, while others show no differences due to method of drying. For example, oven drying poultry excreta has been shown to have losses in both energy and nitrogen, compared to UD excreta. Likewise, *freeze drying feces has been shown to have the least* impact on energy. Oven drying can be nearly as efficient when drying at a higher temperature in a forced air oven for less time, compared to UD feces. Because there is no consensus on the best drying method, additional information is needed. The objective of this study were to determine how each of three drying methods (OD55, OD100, and FD) compared to UD on dry matter, gross energy, nitrogen, and carbon concentrations in swine feces and urine, and in poultry excreta.

**Materials and Methods**

Twelve individually penned growing pigs were fed one of three diets and 16 pens of 10 growing broilers were fed one of four diets that differed in neutral detergent fiber (NDF) and crude protein (CP) levels from which to obtain feces, urine, and excreta that varied widely in nutrient composition. Urine and feces were collected after a 7 d diet adaptation. All samples were dried by 1 of 4 methods: UD, FD, OD55, OD100, after which dry matter, gross energy, nitrogen, carbon, and sulfur were determined. Data were analyzed using PROC MIXED of SAS (SAS Inst. Inc., Cary, NC).

**Results and Discussion**

For swine feces, drying resulted in a loss of GE ($P < 0.10$) and S ($P < 0.05$) by 5% and 58%, respectively. There was no difference among drying methods on dry matter (DM), gross energy (GE), nitrogen (N), carbon (C), or sulfur (S) concentrations (Table 1). There were no differences in urinary GE due to drying or among drying methods; however urinary DM was highest by FD compared to OD ($P < 0.05$) and higher for OD55 compared to OD100 ($P < 0.01$). For poultry excreta, GE ($P < 0.05$), N ($P < 0.10$), and S ($P < 0.01$) were reduced by drying by 6%, 10%, and 66%, respectively Table 1. There was no difference among drying methods except FD excreta had a higher S concentration than OD ($P < 0.10$; Table 1). Regardless of drying method utilized, some loss of GE and N appears to be inevitable, but there is no apparent advantage between freeze drying and oven drying. The apparent high level of S losses warrants further investigation.

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**Table 1. The effect of drying method on the composition of pig feces and poultry excreta, as-is basis[1]**

| | Drying method[2] | | | | Model[3] | | Contrasts[4] | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyses | UD | FD | OD55 | OD100 | SEM | *P* value | UD vs dry | FD vs OD | OD55 vs OD100 |
| DM, % | -- | 31.04 | 31.17 | 32.46 | 3.01 | 0.93 | -- | 0.86 | 0.76 |
| GE, cal/g | 1,374 | 1,297 | 1,315 | 1,293 | 33 | 0.28 | 0.06 | 0.86 | 0.64 |
| N, % | 1.31 | 1.24 | 1.23 | 1.29 | 0.10 | 0.93 | 0.63 | 0.86 | 0.66 |
| C, % | 13.10 | 12.25 | 12.42 | 13.34 | 0.96 | 0.83 | 0.70 | 0.59 | 0.51 |
| S, % | 4.68 | 1.45 | 2.17 | 2.22 | 0.65 | 0.01 | 0.01 | 0.36 | 0.96 |
| *Poultry Excreta* | | | | | | | | | |
| DM, % | -- | 20.95 | 20.83 | 20.78 | 0.61 | 0.98 | -- | 0.87 | 0.96 |
| GE, cal/g | 854 | 809 | 796 | 812 | 20 | 0.22 | 0.05 | 0.86 | 0.59 |
| N, % | 1.16 | 1.07 | 1.05 | 1.01 | 0.05 | 0.25 | 0.07 | 0.50 | 0.58 |
| C, % | 8.45 | 8.33 | 8.37 | 8.24 | 0.36 | 0.98 | 0.74 | 0.95 | 0.81 |
| S, % | 2.94 | 1.53 | 0.55 | 0.88 | 0.38 | 0.09 | 0.01 | 0.09 | 0.54 |

[1] Fresh fecal matter collected from growing pigs with 12 observations per drying method and fresh excreta collected from growing broilers with 32 observations per drying method.

[2] Drying methods consisted of undried (UD), freeze drying (FD), and oven drying at 55°C (OD55) or 100°C (OD100).

[3] Model statistics.

[4] Preplanned contrast statements.