COMPARISON OF DIFFERENT DRYING TECHNIQUES FOR NITROGEN ANALYSIS OF POULTRY EXCRETA, FECES, AND TISSUE

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SUMMARY

The effects of drying (55 or 100 °C) on N content of feces, excreta, and tissue when compared with wet materials were studied. Drying of excreta but not feces or tissue, at 100 °C, resulted in significant N losses (p < 0.01). Addition of HCl prior to drying at 55 °C reduced N losses.

Key words: Nitrogen analysis, drying, excreta, tissue, feces

DESCRIPTION OF PROBLEM

Although freeze-drying is the preferred method for preparing samples for C-N balance studies, freeze-drying equipment is expensive and not always available. In such cases, oven-drying might be an option. However, errors may result from losses of N from the sample because of drying. Significant loss of N associated with the oven-drying procedure when excreta (feces + urine) was dried at 65 °C was observed [1].

Three assays are described in this report. The effects of oven-drying at 55 and 100 °C were compared with wet samples of tissue (broiler carcasses), excreta (feces + urine), and feces from colostomized birds. Within the excreta samples, HCl addition was compared against no acid addition to determine its effect on N losses.

Tissues were obtained from carcasses homogenized according to the method of McDonald [2].

MATERIAL AND METHODS

ASSAY 1

Autoclaved and ground tissues of 17 broiler carcasses were used. Each sample was divided in three parts. One part remained wet, and the others were oven-dried at 55 and 100 °C.

ASSAY 2

Excreta samples obtained from 14 broilers were used in this study to determine the possible loss of N caused by drying. The excreta of each bird were divided into five sets. One set was kept wet, two were oven-dried at 55 and 100 °C, and the two remaining sets were oven-dried...
TABLE 1. Effect of drying on N content of broiler tissue, excreta, and feces

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>WET</th>
<th>55 °C</th>
<th>100 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue</td>
<td>8.53a</td>
<td>8.67a</td>
<td>8.76a</td>
</tr>
<tr>
<td>Excreta</td>
<td>6.78a</td>
<td>6.18b</td>
<td>5.67c</td>
</tr>
<tr>
<td>Feces</td>
<td>2.83a</td>
<td>2.61a</td>
<td>2.55a</td>
</tr>
</tbody>
</table>

a,b,cValues within rows with common letters are not significantly ($p > 0.05$) different.

at 55 and 100 °C with previously added HCl-5N until the pH of the mix dropped to 4.5. All samples remained in the oven until a constant weight was observed.

ASSAY 3

Feces from 10 colostomized birds [3] were prepared in the same way as in Assay 1.

After drying, each sample was ground and homogeneously mixed. To determine protein, a sample of 0.4 to 0.5 and 2.0 g of dried and fresh sample, respectively, was dropped into a Kjeldahl flask, and N determination was carried out using the conventional AOAC method [4]. Moisture was determined by drying the samples in an oven at 101 °C overnight. Nitrogen values were calculated on a dry matter basis so that the results would be comparable.

All of the values were analyzed by ANOVA using the General Linear Models procedure of SAS [5].

RESULTS AND DISCUSSION

A comparison of the N content of tissue, excreta, and feces dried at different temperatures against the N content of wet samples is shown in Table 1. No significant differences ($p > 0.05$) were observed between wet samples and tissue or feces samples dried at 55 or 100 °C. Many laboratories do not autoclave carcasses because of N loss concerns. This procedure is important, however, because moisture losses produced by autoclaving promote homogeneity [2].

When the excreta results were examined, significant differences ($p < 0.05$) were observed among wet samples and samples dried at 55 and 100 °C. Any drying procedure resulted in a significant ($p < 0.05$) loss of N. When compared with wet samples, a decrease of 8.8 and 11.9% was observed at 55 and 100 °C, respectively. These N losses are greater than those previously reported [6].

Overestimation of N retention using the differences procedure (consumed N – excreted N vs. comparative slaughter method) has been observed [7]. It is suggested that part of the N in the excreta is lost during the oven-drying procedure at 60 °C and that this fact influences the calculated EMA$_{n}$ values.

Table 2 shows the effect of adding HCl to avoid N volatilization. No acidification × drying temperature interaction was found. There was a significant ($p < 0.01$) acid addition effect on N content. Dried samples had higher N content when acid was added before drying. A similar N value of 6.78% was found in wet samples and 55 °C oven-dried samples pretreated with acid.

The drying method had some influence on N concentration of feces without urine ($p > 0.07$), and the wet feces had a significantly higher N concentration when compared with feces dried to 100 °C. There was a reduction of 7 and 10% in the N content when comparing wet feces with feces dried in the oven at 55 and 100 °C, respectively (Table 1).

When comparing the percentage of N in feces with no urine to the complete excreta, a large difference in N content was observed, as expected (2.66 vs. 6.54%). This difference is due to the fact that urine is not present in feces, and urine is the greatest source of N; it contains 80% of total N as uric acid and 10% as ammonia [8]. It is speculated that the greatest N loss, which occurs during drying, is due to the volatilization of ammonia, which is present in low
concentrations in the feces of colostomized birds.

When N level comparisons are evaluated among treatments within a single experiment, the numeric differences found are not very important. However, when comparisons are made across several experiments, the described methodology may be essential to explain differences that are often mistakenly attributed to treatment effects.

**CONCLUSIONS AND APPLICATIONS**

1. Nitrogen level in the carcass and feces of broilers was not changed ($p > 0.05$) because of drying at 55 °C when compared with wet samples.
2. Nitrogen losses were noted when excreta was submitted to oven-drying at 55 or 100 °C. The addition of HCl prior to drying reduced ($p < 0.01$) these losses, regardless of the drying temperature, and maintained N values very close to the levels obtained in wet samples.

**REFERENCES AND NOTES**