Moisture determination in pet food finished products: comparison of testing methods

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INTRODUCTION

Moisture assays are one of the most important analytical analyses performed on food products. Selection of the appropriate method depends on the type of product, its composition, form of water present, etc. In the food industry, the determination of moisture content is usually performed by the classical oven method, and various oven methods are approved by AOAC International. Depending on the product composition and sensitivity, the drying temperature typically ranges between 70 °C and 135 °C, and the drying time ranges between 2 and 24 h. The drying conditions are established in order to extract all moisture without loss of other volatiles presence in the matrix or produced by chemical reactions (e.g., Maillard reaction).

OBJECTIVES

The growing complexity of pet food products effects the selection of the appropriate analytical testing methods. This study was performed to compare three different moisture assays: LOD method at 135 °C for 2 h (AOAC 930.15), LOD method at 104 °C for 3 h (AOAC 935.29 and AOAC 945.15), and Karl Fischer titration method (modified AOAC 991.02) and their applicability for pet food testing. Results were statistically analyzed to evaluate biases (if any) between the LOD moisture methods and the Karl Fischer method.

METHODS

Commercially available (locally purchased at retail pet store) dry and wet pet food products, manufactured by three different companies, were tested in triplicate by three methods:
Method 1: Karl Fischer method (with overnight MeOH extraction) (**KF**);
Method 2: Loss-on-drying (LOD) oven method at 135 °C, 2 h (**M1**);
Method 3: Loss-on-drying (LOD) oven method at 104 °C, 3 h (**M2**).

All statistical analysis was performed using Minitab® 16 Statistical Software (Minitab, In., State College, Pa). For each sample, mean values were determined as the arithmetic average, and then recovery and bias was calculated for LOD methods relative to the Karl Fischer method. One-way analysis of variance (ANOVA) was used to determine if differences between moisture analysis methods were statistically significant within each pet food type and manufacturer combination. When a significant difference was detected among methods for a given sample, pair-wise comparisons were made using Tukey's method with probability level of 0.05.

RESULTS

A summary of the results is presented in Table 1.

Table 1. Comparison of loss-on-drying (LOD) oven methods with Karl Fischer method in pet foods

		Moisture, %						
		Karl Fischer	Oven Methods					
			135°C, 2 h			104°C, 3 h		
Pet food type	Vendor	Mean	Mean	% Recovery[c]	Bias[b]	Mean	% Recovery[c]	Bias[b]
Dry Dog Food	A	6.87[a]	7.08[a]	103.1	0.21	6.84[a]	99.6	-0.03
	B	8.47	8.99	106.2	0.52	8.84	104.4	0.37
	C	10.32[a]	10.43	101.1	0.11	10.30[a]	99.8	-0.02
Dry Cat Food	A	5.58	6.44	115.4	0.86	5.98	107.2	0.40
	B	7.06	7.36	104.2	0.30	7.21	102.1	0.15
	C	8.83[a]	9.06	102.6	0.23	8.77[a]	99.3	-0.06
Wet Dog Food	A	76.40	76.13	99.7	-0.27	76.17	99.7	-0.23
	B	81.10	80.47	99.2	-0.63	80.43	99.2	-0.67
	C	74.37[a]	74.33[a]	100.0	-0.03	74.27[a]	99.9	-0.10
Wet Cat Food	A	81.43[a]	81.33[a]	99.9	-0.10	81.30[a]	99.8	-0.13
	B	79.53[a]	79.47[a]	99.9	-0.06	79.23[a]	99.6	-0.30
	C	76.50[a]	76.37[a]	99.8	-0.13	76.30[a]	99.7	-0.20

[a] Means within a sample with the same superscript letter are not statistically different (P > 0.05) from the Karl Fischer mean

[b] Bias is each LOD moisture method minus Karl Fischer[c] Recovery as a percent of Karl Fischer Moisture

Figure 1. Mean % recovery for oven methods based on Karl Fischer

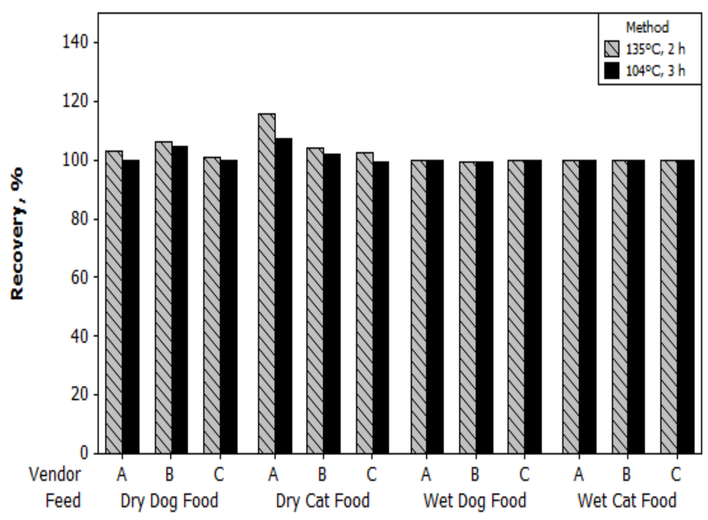
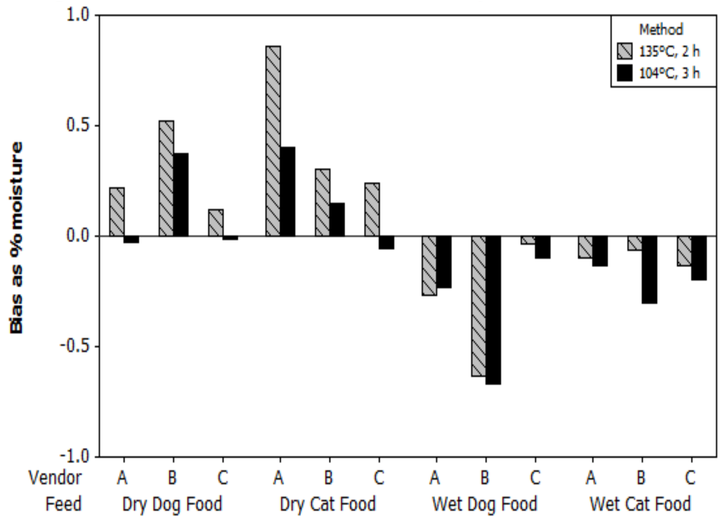


Figure 2. Moisture bias for oven methods compared to Karl Fischer



DISCUSSION

Across all dry pet food samples, results for M2 (104°C, 3 h) were more similar to the results of the KF method than the LOD method M1 (135 °C, 2h). The mean values obtained using the M2 method were determined to be statistically different than the KF method for three of the six samples analyzed. By contrast, the mean values generated by M1 were determined to be statistically different than the KF method for five of the six samples analyzed. In each case, the absolute bias for the M2 method was less than the absolute bias observed for M1 method when compared to the KF. Additionally, the biases for the M2 method are apparently somewhat random compared to the KF method, with both negative and positive values. On the contrary, results for the M1 method were always systematically biased high when compared to the KF method.

For wet cat food and wet dog food, the results for both oven methods (M1 and M2) were very similar. There was no difference detected between the oven methods (M1 and M2) and the KF method for wet cat food samples, while results for two of three wet dog food samples were statistically different for the oven method compared to the KF method.

CONCLUSIONS

- Results generated by the oven method M2 (104 °C, 3 h) are more similar to the results generated by the Karl Fischer method than the results obtained by the M1 method (135 °C, 2 h).
- There is a good agreement between the two oven method for wet pet food.
- There are slight differences detected between the oven methods and Karl Fischer method for two of the six wet pet foods analyzed.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge NPAL sample receiving and preparation teams, PTC St. Louis and R&D Amiens teams assistance in the project.