

Total Fecal Collection and Acid-Insoluble Ash as Measures of Dry Matter Digestibility by Kowari (*Dasyuriodes brynei*)

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Comparisons were made between the total fecal collection and acid-insoluble ash (AIA) natural marker methods for determining dry matter digestibility (DMD) coefficients of rations for Kowari (*Dasyuriodes brynei*) at the Metro Toronto Zoo (MTZ). Two rations were evaluated separately in trials of 5 to 7 days duration; a ground mice diet (2 trials) and a plain carnivore mix diet (4 trials). Dry matter intakes were determined and feces were collected daily, for each of 4 animals. Diet and fecal samples were analysed for AIA using a modification of the 2N HCL procedure of Van Keulen and Young (1977). Due to the limited sample available, the daily feces were combined within a trial for each animal. Digestibility, calculated for AIA fecal analysis versus total fecal collection were 0.8983 and 0.8440 respectively, and for the ground mice diet versus the plain carnivore diet, 0.8281 and 0.9142 respectively. Both diet and method were significant factors in determining DM digestibility ($P < 0.01$).

Key words: acid-insoluble ash, total fecal collection, dry matter digestibility, carnivorous diet, monogastric

INTRODUCTION

Dry matter digestibility of a diet is traditionally evaluated by total collection of the feces from animals housed in metabolic crates or use of external markers (chromium oxide or chromium mordanted fibre). Naturally occurring dietary markers have advantages over external markers and total collection, particularly in field conditions where traditional methods are often expensive, labour intensive and impractical. The difficulty associated with the total collection method in small animal species led to the present study. Acid-insoluble ash (AIA) is a naturally occurring marker that has been used to assess digestibility of diets fed to monogastrics and ruminants (McCarthy et al., 1974, pigs; Moughan et al., 1991, pigs; Vogtmann et al., 1975, poultry; Atkinson et al., 1984, rainbow trout, Van Keulen and Young, 1977, sheep; Sunvold and Cochran, 1991, steers). The objective was to compare the total fecal collection and acid-insoluble ash (AIA) natural marker methods for determining dry matter digestibility in two animal based diets fed to Kowari (*Dasyuriodes brynei*) at the MTZ.

METHOD

A ground mice diet (2 trials) and the Metro Toronto Zoo (MTZ) plain carnivore mixture diet (4 trials) were evaluated separately in trials of 5 to 7 days duration each. Feces were collected daily for each of four animals and dry matter feed intakes and feed digestibility by total fecal collection calculated. Digestibility by AIA was calculated as the ratio of acid-insoluble ash in feed and feces (Van Soest, 1994). Due to the limited sample available, daily feces were pooled within a trial for each animal. Duplicate samples were analysed for each animal in each trial. Diet and fecal

samples were analysed for AIA using a modification of the 2N HCl procedure by Van Keulen and Young (1977). Feed and feces were dried in a forced air oven (65 C for 24 hr). All samples were ground in a small coffee grinder and/or with a mortar and pestle. Duplicate 1 to 2 gm samples were used to determine analytical dry matter and then ashed at 450 C overnight. The ash was transferred to a Berzelius beaker with 100 ml 2N HCl and allowed to boil for 5 minutes on a crude fiber digestion apparatus. The hot hydrolysate was filtered through ash less paper and washed free of acid with boiling distilled water. The filter paper was ashed at 450 C overnight and the remaining residue weighed to determine AIA. Filtering and weighing were the most critical steps due to the extremely small amount of residue left after boiling and subsequent ashing. The best duplication was obtained by carefully scraping each crucible and weighing the AIA alone. Data was statistically evaluated according to SAS (1990) using the General Linear Models Procedure. The experimental design was a 2 X 2 factorial arrangement in which the main effects of diet (mice or carnivore) and method (AIA or total collection) and their interaction were examined for the response variable digestibility. Main effect means were further examined using Duncan's Multiple Range Test.

RESULTS

Table 1 shows that both the diets and the method of digestibility determination were found to be significantly different factors ($P < 0.01$), however there was no interaction between diet and method ($P > 0.05$). Naturally occurring levels of AIA were very low in the diets in this study (0.033 and 0.024% for mice and carnivore diets respectively) though fecal concentrations were several fold higher (0.270 and 0.404% for the two diets respectively).

DISCUSSION

Thonney et al. (1984) found that in all diets studied except those containing very small amounts of naturally occurring AIA there was no significant difference between mean digestibilities determined by total collection or AIA. High grain diets which contain only small amounts of naturally occurring AIA showed more variability between the two methods (Thonney et al. 1984). This was also apparent in the diets fed in this study.

Diet differences exist between the two measures of digestibility in the current study ($P < 0.01$). Total fecal collection gave significantly lower digestibility than AIA ($P < 0.01$).

Although there are problems associated with the detection of AIA in carnivore diets, even at these low natural levels the amount of AIA increased several fold in the feces. Atkinson et al. (1984) experienced similar problems with low endogenous AIA levels in fish-meal diets for rainbow trout, but addition of celite (a diatomaceous earth) as a source of AIA in the diet reduced variability. Similarly, human diets typically contain low levels of AIA and in digestibility studies involving fecal collection, celite was a useful marker compound (Rowan et al. 1991). If celite were added to diets naturally low in AIA this gravimetric method may prove useful as a more reliable means of determining digestibility of feeds in animal species where total fecal collection methods are not practical or efficient.

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TABLE 1. The mean DM digestibility determined by AIA fecal analysis versus total fecal collection and mice versus carnivore diet for kowari

Main Experimental Effects	Digestibility
Method	
AIA	0.8983 a
Total Collection	0.8440 b
SIG.	**
Diet	
Mice	0.8281 b
Carnivore	0.9142 a
SIG.	**
Method X Diet	NS
Model S.D.	0.03
** P<0.01, ab, means are significantly different	