

AGE-TARGETED INTUBATION RATIOS FOR ACCURATE TRUE METABOLISABLE ENERGY ASSAYS IN TURKEYS

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ABSTRACT

This study was carried out to establish optimal ratios for intubating cereal grains (maize, sorghum, wheat, and acha) mixed with water in eight-week-old (n=40), sixteen-week-old (n=40), and twenty-four-week-old (n=50) turkeys. Various ratios were tested at each age, ranging from 15, 20, 25 and 30g feed /50, 60, 70 and 80mL of water respectively for 8 weeks old turkeys; 20, 25, 30 and 35g feed / 60, 70, 80 and 90mL water respectively for 16 weeks old turkeys; 35, 40, 45, 50 and 55g feed/ 90, 100, 110, 120 and 130mL water respectively for 24 weeks old turkeys. Each feed-to-water mixture was intubated into the crop of turkeys using a 150ml syringe fitted with a Tygon tube. Crop filling, regurgitation, and overall discomfort were immediately monitored. At eight weeks, 20g/60mL proved optimal, ensuring adequate crop filling without discomfort. Sixteen weeks old turkeys required 30g/80mL for proper filling, while twenty-four weeks old turkeys needed 50g/120mL. This study provides age-specific feed-to-water ratios for accurate intubation in true metabolisable energy assays for turkeys.

Keywords: Metabolisable energy assays, Intubation, Feed-to-water ratio, Age, Turkeys

INTRODUCTION

Precision diet formulation necessitates the use of accurate nutrient availability estimates to minimise the negative impacts on the environment from excessive nutrient excretion by livestock (Parsons *et al.*, 2023). Metabolisable energy assays play a vital role in poultry research, enabling the evaluation of nutrient utilisation and bioavailability (Leeson and Summers, 2005). True metabolisable energy (TME) is a critical parameter in poultry nutrition, reflecting the energy available for bird growth and production after accounting for metabolic losses. Accurate TME determination is crucial for formulating balanced diets, predicting bird performance, and optimising feed utilisation in poultry production systems. Traditional methods for TME assessment involve collecting excreta following controlled feed intake with a test diet (Sibbald, 1976). The gross energy (GE) of the diet and excreta is determined using bomb calorimetry, and TME is calculated as the difference between GE intake and the sum of excreted energy and fasting heat production.

Accurate assessments in TME assays rely on consistent feed intake, with intubation offering a controlled method for achieving this. However, determining the optimal feed-to-water ratio for intubation mixtures in turkeys at different ages remains a challenge. According to Sibbald (1976) and McNab and Blair (1988) an intubation mixture of 25g of feed and 60 mL of water for adult cockerels was established. Previous studies on broiler chickens suggest age-dependent variations in acceptable feed volumes (Abed *et al.*, 2011), but there is paucity of information on turkeys. Therefore, this study aimed to determine the optimal feed-to-water ratios for intubating cereal grains (maize, sorghum, wheat, and acha) in turkeys at eight, sixteen, and twenty-four weeks of age.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Poultry unit, Teaching and Research farm, University of Ibadan, Ibadan, Nigeria.

Procurement of the test ingredients

Maize, sorghum, and wheat were sourced at Bodija market in Ibadan, Oyo state, Nigeria while acha was sourced from the National Cereal Research Institute (NCRI), Ibadan. They were sorted to remove stones and dirt and were stored pending the time to be used for the experiment.

Animals and housing

Nicholas turkeys at 8 (n=40), 16 (n=40), and 24 weeks (n=50) of age were used in this experiment. The turkeys were weighed individually at each age, and the weight ranges were recorded as follows: 695.5-701.3g at 8 weeks, 2.27-2.58kg at 16 weeks, and 4.79-4.89kg at 24 weeks. Feed was withdrawn for 24 hours before the birds were intubated with the test ingredients.

Feed preparation and intubation

Four cereal grains (maize, sorghum, wheat, and acha) were ground using a 0.5-mm screen to guarantee fine particle size. A series of feed-to-water ratios were tested for each age group. Each mixture was prepared in 125mL plastic beakers and transferred to 150mL syringes equipped with 8mm Tygon tubes. Birds were appropriately restrained, and the tube was carefully inserted into their oesophagus. The mash was then administered into the crop using the syringe plunger.

Assessment and data collection

After intubation, each bird was observed for five minutes to assess crop fill, regurgitation, and any signs of discomfort (e.g. head shaking, wing flapping). Crop fullness was evaluated visually and through touch. Regurgitation was recorded.

Statistical Analysis

Data were analysed using descriptive statistics.

Results**Table 1: Optimal feed-to-water ratios for turkeys at 8 weeks (n=10 per Ratio)**

Tested Ratios (g Feed/mL Water)	Birds with Full Crop	Birds with Discomfort	Birds with Regurgitation	Observed Outcomes
15/50	0	0	0	Insufficient
20/60	10	0	0	Sufficient
25/70	10	9	7	Discomfort and regurgitation
30/80	10	10	10	Discomfort and regurgitation

At 8 weeks, 15g of feed per 50 ml of water did not sufficiently fill the crop of the birds. Mixtures exceeding 20g of feed per 60 ml of water resulted in discomfort and regurgitation in young turkeys. Therefore, a 20/60 ratio proved optimal for adequate crop filling without discomfort.

Table 2: Optimal feed-to-water ratios for turkeys at 16 weeks (n=10 per Ratio)

Tested Ratios (g Feed/mL Water)	Birds with Full Crop	Birds with Discomfort	Birds with Regurgitation	Observed Outcomes
20/60	0	0	0	Insufficient
25/70	1	0	0	Insufficient
30/80	10	0	1	Sufficient
35/90	10	10	9	Discomfort and regurgitation

Initial ratios (20g/60mL and 25g/70mL) proved inadequate for complete crop filling in most 16-week-old turkeys. The optimal ratio emerged at 30g/80mL, ensuring full crops with minimal discomfort (one regurgitation). Increasing to 35g/90mL triggered widespread discomfort and regurgitation, presumably due to excessive feed volume.

Table 3: Optimal feed-to-water ratios for turkeys at 24 weeks (n=10 per Ratio)

Tested Ratios (g Feed/mL Water)	Birds with Full Crop	Birds with Discomfort	Birds with Regurgitation	Observed Outcomes
35/90	0	0	0	Insufficient
40/100	0	0	0	Insufficient
45/110	0	0	0	Insufficient
50/120	10	0	0	Sufficient
55/130	10	8	7	Discomfort and regurgitation

Mirroring 16-week-old findings, ratios below 50g/120mL failed to fill crops in all 24-week turkeys. The optimal ratio emerged at 50g/120mL, ensuring complete fill without discomfort or regurgitation. Pushing to 55g/130mL crossed a tolerance threshold, triggering widespread discomfort and regurgitation.

DISCUSSION

This study successfully established age-specific optimal feed-to-water ratios for intubating turkeys, addressing a gap in the existing literature. The findings highlight the importance of considering age-related differences in crop capacity and feed tolerance when administering bioavailable assay mixtures.

The observed variations in optimal ratios across age groups aligned with previous research on age-dependent feed intake in poultry. Abed *et al.* (2011) reported that broiler chickens at 3 weeks required significantly less feed than those at 6 weeks for intubation without regurgitation. Similarly, findings in the present study showed that younger turkeys (8 weeks) tolerated lower feed quantities compared to older birds (16 and 24 weeks). This likely reflects the gradual increase in crop size and digestive capacity with age (Leeson and Summers, 2005).

The higher viscosity of wheat compared to other cereal grains in this study necessitated increased water volumes to prevent clogging of the Tygon tube. This finding emphasized the importance of considering feed composition and physical properties when determining optimal intubation ratios. Similarly, studies on broiler chickens highlighted the influence of feed texture and particle size on crop emptying rates (Sands *et al.*, 1997).

Accurate feed intake is crucial for reliable data in bioavailable assays (Leeson and Summers, 2005). The established age-specific ratios offer a practical and standardized approach for intubating feed mixtures in turkeys, minimizing potential sources of variation and improving assay accuracy. By establishing age-specific optimal feed-to-water ratios for intubating turkeys, this study contributes valuable knowledge to poultry research methodology. The findings from this study underscore the importance of considering age and feed composition when administering bioavailable assay mixtures, paving the way for more accurate and reliable data in future studies.

CONCLUSION and Recommendation

This study successfully established optimal feed-to-water ratios for intubating turkeys at 8, 16 and 24 weeks, thereby contributing valuable knowledge to poultry research methodology. These findings underscore the importance of considering both the age and composition of feed in administering intubation mixtures during bioavailable assays. Future research should also explore optimal ratios against the influence of different feed types and textures as well as alternative delivery methods or physiological factors that can refine intubation procedures thereby enhancing the accuracy of bioavailable assay in turkeys.

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