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**AGE AND CEREAL EFFECTS ON THE
PERFORMANCE, GUT PARAMETERS AND
NUTRIENT UTILISATION IN THE NEWLY
HATCHED BROILER CHICK**

**A Thesis Presented in Partial Fulfilment of the Requirements for the
Degree of Master of Applied Science at Massey University**

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ABSTRACT

This study was intended to provide a platform for enhanced nutritional management of modern broilers through better understanding of changes in nutritional utilisation in the newly hatched chick. Differences in performance, nutrient utilisation and the development of the gastrointestinal tract in the young broiler chicken fed diets based on different cereals were examined.

Diets based on wheat, sorghum and maize and formulated to contain iso-energy and iso-lysine levels were fed to broiler chicks between days 1 and 14 post hatch. Birds fed the maize based diet grew faster ($P < 0.05$) than those fed the sorghum based diet. Weight gains of birds fed the wheat based diet did not differ ($P > 0.05$) from those fed either maize or sorghum based diets. There were numerical differences in feed:gain with the sorghum based diet having the highest feed per gain, but the differences were not significant ($P > 0.05$). The relative weights of digestive organs and digestive tract showed no significant cereal treatment differences ($P > 0.05$). The treatments had no effect ($P > 0.05$) on the relative length of the digestive tract or gut histology measurements. The wheat based diet contained a commercial xylanase which may have ameliorated the digesta viscosity of this diet and reduced the NSP effect on gut structure and morphology. Furthermore, gut morphology samples showed a high degree of variation, suggesting that a large sample size would be necessary for significant differences to be determined.

Two experiments were conducted to investigate cereal and age effects on nutrient utilisation in the young broiler chicken. Experiment 1 determined the nitrogen-corrected apparent metabolisable energy (AME_n) of diets based on wheat, sorghum and maize during 14 days post-hatch. Changes in the total tract digestibility of starch and fat were also measured. The second experiment was conducted to confirm the results of Experiment 1 using wheat and maize based diets and was of 21 days duration. In both experiments, changes to AME_n with age were similar for all diets, declining from day 3 to days 5-9 and increasing again. In experiment 1, cereal effects were significant ($P < 0.05$) with maize and sorghum based diets having higher AME_n values than the wheat based diet. In experiment 2, cereal effects were

significant ($P < 0.05$) with the maize based diet having a higher AME_n than the wheat based diet.

In experiment 1, total tract starch digestibility determined for days 5, 7 and 14 showed no cereal differences ($P > 0.05$). Age effects were significant ($P < 0.05$) with starch digestibility declining from day 5 to day 7, and then increasing again. Total tract fat digestibility on day 7 was significantly lower for the wheat and sorghum based diets than for the maize based diet, but no cereal differences ($P > 0.05$) were observed on days 5 or 14. Age effect was highly significant with fat digestibility declining from day 5 to day 7 and increasing again. These results showed that nutrient utilisation is compromised during the first week of life of the broiler chick.

Samples of diets and excreta from Experiment 1 were analysed for minerals to determine changes in the apparent total tract mineral retention of the broiler chick during the first two weeks post-hatch. The diet and excreta samples were analysed for calcium, phosphorus, potassium, sodium, magnesium, iron, manganese, zinc and copper, and their retention was determined. The retention coefficients of individual minerals differed widely and the retentions of major minerals were much greater than those of minor minerals. The cereal effects were significant ($P < 0.05$) for several minerals, with a general tendency for the sorghum diet to have greater retention than maize or wheat diets. Age effects were significant ($P < 0.05$) for all minerals. In general mineral retention coefficients were higher at day 3, declined to day 7 and remained unchanged to day 14. Decline in mineral retention with age was similar in all three diets.

The studies reported in this thesis investigated the performance and nutrient utilisation of broiler chicks fed diets based on wheat, sorghum or maize. A significant reduction in nutrient utilisation over the period 5 – 9 days of age was observed suggesting that nutrient digestion and absorption is compromised during the first week of life of the broiler chick. Further work is required to identify the specific causes of the decline in digestibility during the early stages of chick development.

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TABLE OF CONTENTS

Abstract	i
Acknowledgements	iii
Table of Contents	iv
List of Tables	ix
List of Figures	xi
List of Plates	xii

CHAPTER 1: GENERAL INTRODUCTION

1.1 OBJECTIVES OF THE STUDY.....	1
1.2 RELEVANCE OF THE RESEARCH.....	3
REFERENCES	3

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION.....	4
2.2 GROWTH RATE.....	5
2.3 FEED INTAKE AND PASSAGE RATE.....	5
2.4 VITELLINE RESIDUE	6
2.5 DIGESTIVE ORGAN DEVELOPMENT	6
2.6 RELATIVE DEVELOPMENT OF INTESTINE AND DIGESTIVE ORGANS	6
2.7 DEVELOPMENT OF GUT MUCOSA	7
2.8 MUCOSAL DNA.....	8
2.9 GASTROINTESTINAL TRACT pH.....	9

2.10	BILIARY SECRETIONS AND DIGESTIVE ENZYMES IN THE YOUNG BROILER CHICKEN.....	9
2.10.1	Biliary Secretions	9
2.10.2	Pancreatic Enzymes.....	9
2.10.3	Brush Border Enzymes.....	12
2.11	COMPARISON OF GROWTH, DIGESTIVE ORGAN DEVELOPMENT AND DIGESTIVE ENZYME LEVELS IN FAST AND SLOW GROWING LINES OF CHICKENS	13
2.11.1	Bodyweight	13
2.11.2	Feed Intake	13
2.11.3	Passage Rate	14
2.11.4	Vitelline Residue	14
2.11.5	Development of Digestive Organs	14
2.11.6	Gut Morphology	15
2.11.7	Digestive Enzyme Activity	16
2.11.7.1	Pancreatic Enzymes	16
2.11.7.2	Brush Border Enzymes.....	18
2.12	DIGESTION AND UTILISATION OF NUTRIENTS IN NEWLY HATCHED CHICKS	18
2.12.1	Nutrient Digestibility.....	18
2.12.2	Energy Utilisation.....	20
2.13	NUTRITIVE VALUE OF CEREALS FOR POULTRY	20
2.13.1	Cereal Energy Values	21
2.13.2	Digestive Tract Development	21
2.13.3	Gut Morphology	22
2.13.4	Anti-Nutritive Value of Cereal Non-Starch Polysaccharides	22
2.13.5	Physical and Chemical Properties of Soluble NSP Which May Contribute to Anti-Nutritive Properties.....	23
2.13.5.1	Viscosity	23
2.13.5.2	Surface Activity.....	24

2.13.5.3	Water Holding Capacity.....	24
2.13.5.4	Viscosity-Microflora Interaction.....	24
2.13.5.5	Increase in the Secretion of Endogenous Protein.....	25
2.14	SUMMARY.....	25
	REFERENCES.....	26

CHAPTER 3: PERFORMANCE, DIGESTIVE TRACT
DEVELOPMENT AND GUT MORPHOLOGY OF THE
NEWLY HATCHED BROILER CHICK FED DIETS
BASED ON WHEAT, SORGUM OR MAIZE

3.1	ABSTRACT	33
3.2	INTRODUCTION	34
3.3	MATERIALS AND METHODS	
3.3.1	Diets	35
3.3.2	Experimental Procedures	35
3.3.3	Collection and Processing of Samples	38
3.3.4	Morphological Measurement	38
3.3.5	Data Analysis	38
3.4	RESULTS	
3.4.1	Performance Data	40
3.4.2	Digestive Tract Measurements	40
3.4.3	Morphological Measurements	42
3.5	DISCUSSION	44
	REFERENCES	46

CHAPTER 4: NUTRIENT UTILISATION OF DIETS
BASED ON WHEAT, SORGHUM OR MAIZE BY THE
NEW HATCHED BROILER CHICK

4.1	ABSTRACT	48
4.2	INTRODUCTION	49
4.3	MATERIALS AND METHODS	49
4.3.1	Experimental Procedures	50
4.3.2	Collection and Processing of Samples	50
4.3.3	Chemical Analysis	50
4.3.4	Calculations	51
4.3.5	Data Analysis	52
4.4	RESULTS	52
4.4.1	EXPERIMENT 1	52
4.4.1.1	AME.....	52
4.4.1.2	Total Tract Starch Digestibility	54
4.4.1.3	Total Tract Fat Digestibility	55
4.4.1.4	Nitrogen Retention	56
4.4.1.5	Feed Intake	57
4.4.2	EXPERIMENT 2	58
4.4.2.1	AME.....	58
4.4.2.2	Nitrogen Retention	59
4.4.2.3	Feed Intake	60
4.4.2.4	Feed Intake Per Unit of Bodyweight	60
4.5	DISCUSSION.....	60
	REFERENCES.....	64

CHAPTER 5: TOTAL TRACT RETENTION OF
MINERALS IN DIETS BASED ON WHEAT,
SORGHUM OR MAIZE WHEN FED TO THE
NEWLY HATCHED BROILER CHICK

5.1	ABSTRACT.....	67
5.2	INTRODUCTION.....	68
5.3	MATERIALS AND METHODS.....	68
5.3.1	Experimental Procedures and Processing of Samples.....	68
5.3.2	Chemical Analysis.....	68
5.3.3	Calculations.....	69
5.3.4	Data Analysis.....	69
5.4	RESULTS.....	69
5.4.1	Major Minerals.....	70
5.4.2	Minor Minerals.....	71
5.5	DISCUSSION.....	72
	REFERENCES.....	74

CHAPTER 6 SUMMARY AND CONCLUSIONS

6.1	SUMMARY.....	75
6.2	CONCLUSIONS.....	77
	REFERENCES.....	79

LIST OF TABLES

Chapter 3

Table 1: Composition and calculated analysis (g/100g) of diets based on wheat, sorghum and maize

Table 2: Weight gain, feed intake and feed per gain ratio of male broiler chicks fed diets based on wheat, sorghum or maize

Table 3: Relative digestive organ and tract weights (g/100g body weight) of male broiler chicks fed diets based on wheat, sorghum or maize

Table 4: Relative lengths of digestive tract segments (mm/100g BW) of male broiler chicks fed diets based on wheat, sorghum or maize

Table 5: Intestinal morphological measurements of male broiler chicks fed diets based on wheat, sorghum and maize

Chapter 4

Table 1: Least square means for AME_n (MJ/ kg DM) of wheat, sorghum and maize-based diets for broiler chickens during the first 14 days post hatch – calculated by the total collection method

Table 2: Least square means for AME (MJ/ kg DM) of wheat, sorghum and maize-based diets during the first 14 days post hatch – calculated by the titanium marker method

Table 3: Total tract starch digestibility coefficients for broilers fed wheat, sorghum and maize based diets at 5, 7 and 14 days of age

Table 4: Total tract fat digestibility coefficients for broilers fed wheat, sorghum and maize based diets at 5, 7 and 14 days of age

Table 5: Nitrogen retention (g/ kg DM intake) for broilers fed wheat, sorghum and maize based diets at 5, 7 and 14 days of age

Table 6: Changes in daily feed intake (g DM/day)

Table 7: Least square means for AME (MJ/ kg DM) of wheat and maize-based diets for the first 21 days post hatch

Table 8: Nitrogen retention (g/kg DM intake) of wheat and maize-based diets for the first 21 days post hatch

Table 9: Daily feed intake (g DM/ bird), 1-21 days post-hatching

Table 10: Feed intake per unit of bodyweight (g/kg body weight)

Chapter 5

Table 1: Determined mineral contents of diets based on wheat, sorghum and maize

Table 2. Least square means for total tract retention of major minerals in broilers fed wheat, sorghum and maize-based diets during the first 14 days post-hatch

Table 3. Least square means for total tract retention of minor minerals in broilers fed wheat, sorghum and maize-based diets during the first 14 days post-hatch

LIST OF FIGURES

Chapter 4

Figure 1. AME_n values for wheat, sorghum and maize based diets for broiler chickens - calculated by the total collection method

Figure 2. AME_n for wheat, sorghum and maize based diets – calculated by the titanium marker method

Figure 3. Starch digestibility coefficients for broilers fed wheat, sorghum and maize based diets at 5, 7 and 14 days of age

Figure 4. Fat digestibility coefficients for broilers fed wheat, sorghum and maize based diets at 5, 7 and 14 days of age

Figure 5. Nitrogen retention (g/kg DM intake) for broilers fed wheat, sorghum and maize based diets at 5, 7 and 14 days of age

Figure 6. Changes in AME_n values for wheat and maize based diets during 1-21 days post hatch

Figure 7. Nitrogen retention (g/kg DM intake) of wheat and maize-based diets for the first 21 days post hatch

LIST OF PLATES

Chapter 3

Plate 1. Battery brooder unit.

Plate 2. Gastro-intestinal tract measurements.

Plate 3. Sample sites for gut morphology measurements.

Plate 4. Cross section of the gut (100 X magnification) at the four sampling sites in birds fed the wheat based diet