DECLARATION

I declare that the thesis hereby submitted to the University of Limpopo for the degree of Doctor of Philosophy (Animal Nutrition) has not previously been submitted by me for a degree at this or any other university, that it is my own work in design and execution, and that all material contained therein has been duly acknowledged.

Signature……. Date……..

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Above all, I am most sincerely thankful to the Almighty God, for His strength, comfort and wisdom. Glory be to the Father, the Son and the Holy Spirit, Amen.

DEDICATION

This thesis is dedicated to my lovely mother Elizabeth Mbajiorgu and late father Charles Mbajiorgu for their support in educating me.

ABSTRACT

Ten experiments were conducted to determine the effect of dietary energy to protein ratio level on growth and productivity of indigenous Venda chickens raised in closed confinement from day-old up to thirteen weeks of age. The ten experiments were based on five different energy levels of 12.2, 13, 13.2, 13.4 and 14 MJ ME/kg DM. Each dietary energy level had five different levels of protein concentrations of 220, 190, 180, 170 and 160 g/kg DM, thus ending up with twenty five different dietary energy to protein ratio levels. Experiments 1 to 5 examined the effect of dietary energy to protein ratio on productivity of unsexed Venda chickens aged one to six weeks. Experiments 1 to 5 each commenced with 160 unsexed day-old indigenous Venda chicks with an initial weight of 25 ± 2 g per bird and each lasted for a period of six weeks. In each experiment, the chicks were randomly assigned to five treatments with four replications, each having eight birds. Thus, 20 floor pens (1.5 m^2 /pen) were used in total for each experiment. All the five experiments were carried out around the same time. A complete randomized design was used for each experiment. A quadratic regression model was used to determine the ratios for optimum feed intake, growth rate, feed conversion ratio, live weight, metabolisable energy and nitrogen retention in each experiment while a linear model was used to determine the relationship between optimal responses in the above variables and dietary energy to protein ratio levels. Dietary energy to protein ratio level for optimal response for any variable was relative and depended on the energy to protein ratio values of the diet. Energy to protein ratios of 63, 67, 70, 74 and 78 MJ ME/kg protein promoted optimal live weights of 415, 408, 370, 365 and 344 g at six weeks of age for diet energy levels of 12.2, 13, 13.2, 13.4 and 14 MJ ME/kg DM, respectively. However, optimal response trends for different variables were also influenced by the dietary energy to crude protein ratio. Optimal feed intake increased linearly with increasing dietary energy to protein ratio levels. Similarly, optimal metabolisable energy level increased linearly with increasing dietary energy to protein ratio levels without any increase in live weight. On the other hand, increasing dietary energy to protein ratio level decreased growth rate with a linear deteriorating feed conversion ratio,

thus, negatively affecting live weight of the chickens at six weeks of age. However, increasing dietary energy to protein ratio levels improved efficiency of protein utilization with a linear deteriorating metabolisable energy utilization. In experiments 1 to 5, correlation analysis indicated that optimal feed intake, feed conversion ratio and metabolisable energy level were positively and strongly correlated with dietary energy to protein ratio levels while optimal live weight, growth rate and nitrogen retention were negatively and strongly correlated with dietary energy to protein ratio levels. The study indicated that a diet containing a crude protein content level of 178 g/kg DM and an energy level of 14 MJ ME/kg DM allowed for optimal utilization of absorbed protein and energy for growth in unsexed indigenous Venda chickens aged between one and six weeks.

Experiments 6 to 10 examined the effect of dietary energy to protein ratio level on productivity of male Indigenous Venda chickens raised in closed confinement from seven up to 13 weeks of age. Each experiment commenced with 100 seven-week old male Venda chickens with an initial weight of 320 ± 2 g per bird. In each experiment, the chickens were randomly assigned to five treatments with four replications, each having five birds. Thus, 20 floor pens (1.5 m^2/pen) were used in total for each experiment. All the five experiments were carried out around the same time and for a period of seven weeks. A complete randomized design was used for each experiment. A quadratic regression model was used to determine energy to protein ratios for optimum feed intake, growth rate, feed conversion ratio, live weight, metabolisable energy, nitrogen retention, carcass yield, breast meat yield and fat pad deposition in each experiment while a linear model was used to determine the relationship between optimal responses of the above variables and dietary energy to protein ratio levels. Energy to protein ratios of 60, 71, 66, 72 and 71 MJ ME/kg protein promoted optimal live weights of 1167, 950, 983, 1235 and 1172 g at thirteen weeks of age for diet energy levels of 12.2, 13, 13.2, 13.4 and 14 MJ ME/kg DM, respectively. Optimal response trends in feed intake, growth rate, feed conversion ratio, nitrogen retention, and metabolisable energy intakes in male Venda chickens tended to increase with increase in dietary energy to protein

ratio level. In contrast, optimal carcass and breast meat yield tended to decrease with increasing dietary energy to protein ratio level. However, optimal live weight and fat pad remained unchanged with increase in dietary energy to protein ratio value. Additionally, increasing dietary energy to protein ratio level improved efficiency of protein utilization with deteriorating metabolisable energy utilization. On the other hand, experiments 6 to 10 showed that optimal feed intake, growth rate, feed conversion ratio, live weight, metabolisable energy level, nitrogen retention and fat pad were positively and poorly correlated with dietary energy to protein ratio levels while optimal carcass weight and breast meat yield were negatively and poorly correlated with dietary energy to protein ratio levels This study indicated that a diet containing 193 g CP/kg DM and an energy level of 14 MJ ME/kg DM allowed for optimal utilization of absorbed protein and energy for growth in male indigenous Venda chickens aged between seven and thirteen weeks.

It is, therefore, concluded that optimal response trends for different variables in growing unsexed Venda chickens offered diets differing in optimal dietary energy to protein ratio levels are influenced by the diet crude protein content rather than the feed energy level per se. Diets containing decreased dietary energy to protein ratio levels may promote improved growth rate and efficient feed conversion ratio while naturally restricting feed intake. Diets containing increased dietary energy to protein ratio levels favoured efficient utilization of consumed dietary protein. However, with such diets, protein became limiting and birds increased their feed intake attempting thereby to obtain more of the limiting protein in order to meet their protein requirement regardless of the energy value of the diet.

It is, also, concluded that growing male Venda chickens increased their feed intake with increase in dietary energy to protein ratio. This is contrary to what has been observed in broiler chickens which decrease their intake with increase in diet energy value. It is suggested that this might reflect the differences between

indigenous and broiler chickens in terms of their genetic and physiological abilities to regulate their feed intakes according to dietary energy levels.

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