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Effect of Varying Dietary Energy to Protein Ratio Level on Growth and Productivity of Indigenous Venda Chickens

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ABSTRACT
Two experiments were conducted to determine the effect of varying dietary energy to protein ratio on growth and productivity of indigenous Venda chickens raised in closed confinement from day-old up to 13 weeks old. In each experiment the diets had a similar energy value of 12.2 MJ ME kg^{-1} DM, but with five different levels of protein concentration of 220, 190, 180, 170 and 160 g kg^{-1} DM, thus ending up with different energy to protein ratios of 55, 64, 68, 72 and 76 MJ ME kg^{-1}protein. A complete randomized design was used in each experiment, the one to six weeks old growing period (unsexed Venda chickens) and the seven to 13 weeks old growing period (male Venda chickens) experiments. A quadratic type equation was used to determine the ratios for optimum production variable. A single E:P ratio of 62 MJ ME kg^{-1} protein supported optimum feed intake and growth rate while an E:P ratio of 63 MJ ME/kg protein supported optimum feed conversion ratio in Venda chickens aged between one and six weeks. In contrast, an E:P ratio of 60 MJ ME kg^{-1} protein supported optimum growth rate and feed conversion ratio in male Venda chickens aged between seven and 13 weeks. However, an E:P ratio of 62 MJ ME kg^{-1} protein supported optimum feed intake in male Venda chickens aged seven to 13 weeks. The results indicate that a single E:P ratio of 62 MJ ME kg^{-1} protein optimized feed intake in Venda chickens irrespective of differences in sex and age. These findings have implications on ration formulation for Venda chickens.

Key words: Venda chickens, intake, digestibility, fat deposition, growth

INTRODUCTION
The Venda chickens are multicoloured with white, black and red as the predominant colours. Rose coloured combs and five-toed feet are not uncommon. In contrast to other indigenous breeds, the Venda is fairly large and lays tinted eggs of a generous size. The hens are broody and are very good mothers. Little is known about this breed which is presently being collected and evaluated. As such, determination of the dietary energy to protein ratio level that will optimize growth and carcass characteristics of the indigenous Venda chickens is important. Tadelle and Ogle (2000) reported that the energy requirement of growing indigenous chickens as determined from the chemical analysis of their crop contents is 11.99 MJ ME kg^{-1} DM. However, NRC (1994) recommended that the required energy in growing indigenous chicken diets should be 12.14 MJ ME kg^{-1} DM. However, no studies on energy to protein ratio for optimal feed intake,

growth, feed conversion ratio, live weight, digestibility and carcass characteristics of indigenous Venda chickens aged between one and thirteen weeks and raised in closed confinement were found in the literature. Furthermore, extensive data on fat deposition in these chickens is also not available. Excessive fat in chickens is one of the problems faced by the poultry industry since it reduces carcass quality and feed efficiency (Oyedeji and Atteh, 2005). Energy to protein ratio value of a diet could be of importance in determining fat content in poultry meat. Summers and Leeson (1979) reported that chickens with widely differing amounts of carcass fat could be produced by manipulation of the dietary energy to protein ratio value. In addition, it seems that, as suggested by Leenstra (1984), the effect of diet on fat deposition have not being consistent and vary with chicken strains. Nawaz *et al.* (2006) reported no effect of dietary crude protein and/or metabolisable energy on abdominal fat weight in broiler chickens. On the other hand, Jianlin *et al.* (2004) reported a significant increase in abdominal fat pad in broiler chickens with a decrease in the dietary crude protein level. However, the effects of dietary energy to protein ratio value on fat deposition in indigenous Venda chickens are not known. The objective of this study was, therefore, to determine energy to protein ratios for optimal feed intake, digestibility, growth, feed conversion ratio, live weight and carcass characteristics of one to thirteen weeks old Venda chickens raised in closed confinement.

MATERIALS AND METHODS

This study was conducted at the University of Limpopo in South Africa in 2009. Two trials were performed to determine the effect of dietary energy to protein ratio on performance of unsexed indigenous Venda chickens between one and six weeks old (first trial) and male indigenous Venda chickens between seven and 13 weeks of age. At day old, 160 unsexed indigenous Venda chicks with an initial mean weight of 25±2 g per bird 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. A complete randomized design (SAS, 2008) was used. The experimental diets were isocaloric, having a similar energy value of 12.2 MJ ME kg^{-1}, but with five different levels of protein concentration of 220, 190, 180, 170 and 160 g kg^{-1} DM, thus ending up with different energy to protein ratios (Table 1). The birds were offered feed and fresh water *ad libitum*. The daily lighting program was 24 h. The experiment was terminated when birds were six weeks of age. The second experiment was used to determine the effect of dietary energy to protein ratio on performance of male indigenous Venda chickens between seven and 13 weeks of age. The treatments, design and layouts for the second experiment were similar to those in the first experiment, except that 100 seven weeks old male indigenous Venda chickens with an initial live mean weight of 320±2 g per bird were randomly

Table 1: Nutrient composition of experimental diets used in experiments one and two

	Diets				
Nutrients	EP55	EP64	EP68	EP72	EP76
Dry matter (g kg^{-1} feed)	931.4	932.0	928.6	931.4	931.8
Energy (MJ ME kg^{-1} feed)	12.2	12.2	12.2	12.2	12.2
Crude protein (g kg^{-1} DM)	220.0	190.0	185.0	170.0	160.0
E:P ratio (MJ ME kg^{-1} protein)	55.0	64.0	68.0	72.0	76.0
Lysine (g kg^{-1} DM)	11.0	10.9	10.8	11.1	11.2
Calcium (g kg^{-1} DM	12.3	12.1	12.0	11.9	11.8
Phosphorus (g kg^{-1} DM)	6.2	6.1	5.8	5.6	5.7

assigned to five treatments with four replications, each having five birds. Prior to this experiment, the chicks were fed a 22% CP practical diet that would satisfy their nutritional requirements according to NRC (1994). The two experiments were carried out around the same time. The ambient temperature during the experimentation period ranged between 20 and 30°C.

Data collection: The initial live weights of the birds were taken at the start of each experiment. Average live weight per bird was measured at weekly intervals by weighing the chickens in each pen and the total live weight was divided by the total number of birds in the pen to get the average live weight of the chickens. These live weights were used to calculate growth rate. Feed conversion ratio per pen was calculated as total feed consumed divided by the weight of live birds plus the weight of birds that died or were culled minus weight of all birds in the pen at the start of the experiment. Digestibility was measured when the chickens were between 36 and 42 days old for the first experiment and between 85 and 91 days old in the second experiment. Digestibility was conducted in specially designed metabolic cages having separated watering and feeding troughs. Two birds were randomly selected from each replicate of each experiment and transferred to metabolic cages for measurement of apparent digestibility. A three-day acclimatization period was allowed prior to a three-day collection period. Droppings voided by each bird were collected on a daily basis at 09.00 h. Care was taken to avoid contamination from feathers, scales, debris and feeds. At 91 days of age all remaining male Venda chickens per pen in the second experiment were slaughtered by cervical dislocation to determine carcass characteristics. Carcass parts and abdominal fat were weighed. Fat surrounding the gizzard and intestines extending to the bursa were considered as abdominal fat (Mendonca and Jenesen, 1989). At the end of each slaughtering, meat samples from each breast part of the slaughtered bird were taken and stored in the refrigerator at - 20°C until analyzed for dry matter and nitrogen content.

Chemical analysis: Dry matter and nitrogen contents of the diets, faeces, feed refusals and meat samples were determined as described by AOAC (2002). Gross energy values for feeds and faeces were determined using an adiabatic bomb calorimeter (Gallenkamp, University of Limpopo laboratory, South Africa). The apparent metabolisable energy contents of the diets from each experiment were calculated (AOAC, 2002). Apparent metabolisable energy was equal to energy in the feed consumed minus energy excreted in the faeces (AOAC, 2002). Nitrogen retention was calculated as intake nitrogen multiplied by digestibility nitrogen.

Data analysis: Data on feed intake, growth rate, feed conversion ratio, live weight, digestibility and carcass characteristics were analyzed by one-way analysis of variance (SAS, 2008). Where there was a significant F-test ($p<0.05$), the Duncan test for multiple comparisons was used to test the significance of differences between treatment means (SAS, 2008). The dose-related optimal responses to dietary energy to protein ratio levels were modeled using the following quadratic regression equation (SAS, 2008):

$$Y = a+b_1x + b_2x^2$$

where, y is feed intake, growth rate, feed conversion ratio, live weight, digestibility or carcass characteristics; a is intercept; b_1 and b_2 is coefficients of the quadratic equations, x is dietary energy to protein ratio level and $-b_1/2b_2$ is x value for optimum response. The quadratic model was fitted to the experimental data by means of the NLIN procedure of SAS (2008). The quadratic model was used because it gave the best fit.

RESULTS

Results of the first experiment indicate that Venda chickens offered a diet having 64 MJ ME kg^{-1} protein had a higher ($p<0.05$) feed intake than those offered diets having 55, 68, 72 and 76 MJ ME kg^{-1} protein ratios, respectively. However, those offered diets having 55 and 72 MJ ME kg^{-1} protein ratios had similar ($p>0.05$) feed intakes (Table 2).

Venda chickens offered a diet having 64 MJ ME/kg protein ratio had higher ($p<0.05$) growth rates than those offered diets having 55, 68, 72 and 76 MJ ME kg^{-1} protein ratios, respectively. However, Venda chickens offered diets having 55 and 68 MJ ME kg^{-1} protein ratios had similar ($p>0.05$) growth rates. Venda chickens on a diet having 68 MJ ME kg^{-1} protein ratio had a better ($p<0.05$) feed conversion ratio than those on diets having 55, 64, 72 and 76 MJ ME kg^{-1} protein ratios, respectively. Venda chickens offered diets having 55, 64, 68 and 72 MJ ME kg^{-1} protein ratios, respectively had similar ($p>0.05$) live weights. Birds offered diets having 72 and 76 MJ ME kg^{-1} protein ratios had similar ($p>0.05$) live weights. Dietary energy to protein ratio had no effect ($p>0.05$) on ME and nitrogen retention values of Venda chickens aged one to six weeks (Table 2).

The present result showed that in the second experiment, Male Venda chickens offered a diet having 64 MJ ME kg^{-1} protein ratio ate more ($p<0.05$) feed than those offered diets having 72 and 76 MJ ME kg^{-1} protein ratios, respectively). However, male Venda chickens offered diets having 55, 64 and 68 MJ ME kg^{-1} protein ratios had similar ($p>0.05$) feed intakes. Similarly, chickens offered diets having 55, 68, 72 and 76 MJ ME kg^{-1} protein ratios had same ($p>0.05$) feed intakes. (Table 3).

Male Venda chickens offered diets having 64 MJ ME kg^{-1} protein ratio had higher ($p<0.05$) growth rates than those offered diets having 72 and 76 MJ ME kg^{-1} protein ratios, respectively. However, chickens offered diets having 55, 64 and 68 MJ ME kg^{-1} protein ratios had similar ($p>0.05$) growth rates. Male Venda chickens on a diet having 64 MJ ME kg^{-1} protein ratio had a better ($p<0.05$) feed conversion ratio than those on diets having 55, 68, 72 and 76 MJ ME kg^{-1} protein ratios. Male Venda chickens offered a diet having 64 MJ ME kg^{-1} protein ratio had a higher ($p<0.05$) live weight than those offered diets having 72 and 76 MJ ME kg^{-1} protein ratios.

Table 2: Effect of energy to protein ratio level (MJ ME kg^{-1} protein) on feed intake (g/bird/day), growth rate (g/bird/day), feed conversion ratio (FCR) between one and six weeks of age, live weight at six weeks old (g $bird^{-1}$), apparent metabolisable energy (MJ ME kg^{-1} DM) and nitrogen retention (g/bird/day) of unsexed Venda chickens between 36 and 42 days of age

	Diets					
Parameters	EP55	EP64	EP68	EP72	EP76	SE
Feed intake	32.0^{b}	34.0^{a}	30.0^{c}	32.0^{b}	29.0^{d}	0.01
Growth	9.0^{b}	10.0^{a}	9.0^{b}	8.0^{c}	7.0^{d}	0.01
FCR	3.6^{c}	3.4^{d}	3.3^{e}	4.0^{b}	4.1^{a}	0.01
Live weight	400.0^{a}	425.0^{a}	405.0^{a}	380.0^{ab}	345.0^{b}	15.50
ME	11.1	12.4	12.6	12.9	12.8	1.56
N-retention	2.3	2.4	2.2	2.0	1.8	0.36

Means in the same row not sharing a common superscript are significantly different ($p<0.05$); ME: Apparent metabolisable energy; N-retention: Nitrogen retention; SE: Standard error

Table 3: Effect of energy to protein ratio level (MJ ME kg^{-1} protein) on feed intake (g/bird/day), growth rate (g/bird/day) and Feed Conversion Ratio (FCR) between seven and thirteen weeks of age, live weight at thirteen weeks old (g bird^{-1}), apparent metabolisable energy (MJ ME kg^{-1} DM) and nitrogen retention (g/bird/day) of male Venda chickens between 85 and 91 days of age

	Diets					
Parameters	$E_{12.2}P_{22}$	$E_{12.2}P_{19}$	$E_{12.2}P_{18}$	$E_{12.2}P_{17}$	$E_{12.2}P_{16}$	SE
Feed intake	84.0^{ab}	93.0^{a}	83.0^{ab}	78.0^{b}	73.0^{b}	3.59
Growth rate	16.0^{ab}	19.0^{a}	14.0^{ab}	10.0^{b}	10.0^{b}	2.28
FCR	5.3^{d}	4.8^{e}	5.9^{c}	7.8^{a}	7.3^{b}	1.62
Live weight	1115.0^{ab}	1240.0^{a}	1006.0^{ab}	830.0^{b}	813.0^{b}	124.80
ME	12.7^{bc}	14.2^{a}	13.7^{ab}	13.7^{ab}	12.3^{c}	0.32
N-retention	2.1^{a}	2.3^{a}	2.7^{a}	1.5^{b}	2.2^{a}	0.17

Means in the same row not sharing a common superscript are significantly different (p<0.05). ME: Apparent metabolisable energy N-retention :Nitrogen retention; SE: Standard error

Table 4: Effect of energy to protein ratio level (MJ ME kg^{-1} protein) on carcass weight (g bird^{-1}), breast meat yield (g bird^{-1}) and fat pad weight (g bird^{-1}) of male Venda chickens at 13 weeks of age

	Diets					
	$E_{12.2}P_{22}$	$E_{12.2}P_{19}$	$E_{12.2}P_{18}$	$E_{12.2}P_{17}$	$E_{12.2}P_{16}$	SE
Carcass weight	893.0^{ab}	992.0^{a}	713.0^{ab}	695.0^{ab}	676.0^{b}	63.53
Breast meat yield	158.0^{ab}	168.0^{a}	121.0^{b}	132.0^{ab}	107.0^{b}	10.21
Fat pad weight	1.3	0.6	0.4	0.3	0.5	0.65

Means in the same row not sharing a common superscript are significantly different (p<0.05). SE: Standard error

However, chickens offered diets having 72 and 76 MJ ME kg^{-1} protein ratios had similar (p>0.05) live weights. Similarly, chickens offered diets having 55, 64 and 68 MJ ME kg^{-1} protein ratios, respectively had similar (p>0.05) live weights. Male Venda chickens offered diets having 64, 68 and 72 MJ ME kg^{-1} protein ratios, respectively had similar (p>0.05) apparent ME values and those offered diets having 55 and 76 MJ ME kg^{-1} protein ratios, respectively also had the same (p>0.05) apparent ME values. Male Venda chickens offered diets having 55, 64, 68 and 76 MJ ME kg^{-1} protein ratios, respectively had higher (p<0.05) nitrogen retentions than those offered diets having a 72 MJ ME kg^{-1} protein ratio. However, those offered diets having 55, 64, 68 and 76 MJ ME kg^{-1} protein ratios, respectively had similar (p>0.05) nitrogen retentions (Table 3).

Results of the effect of dietary energy to protein ratio level on carcass weight, breast meat yield and fat pad weight of male Venda chickens at 13 weeks of age are presented in Table 4. Male Venda chickens offered a diet having 76 MJ ME kg^{-1} protein ratio had lower (p<0.05) carcass weight than those offered a diet having 64 MJ ME kg^{-1} protein ratio. However, chickens offered diets having 55, 64, 68 and 72 MJ ME kg^{-1} protein ratios, respectively had similar (p>0.05) carcass weights. Similarly, chickens offered diets having 55, 68, 72 and 76 MJ ME kg^{-1} protein ratios had similar (p>0.05) carcass weights. Male Venda chickens offered diets having 68 and 76 MJ ME kg^{-1} protein ratios, respectively) had lower (p<0.05) breast meat yield than those offered a diet having 64 MJ ME kg^{-1} protein ratio. However, chickens offered diets having 55, 64 and 72 MJ ME kg^{-1} protein ratios, respectively had similar (p>0.05) breast meat yields. Similarly, chickens offered diets having 55, 68, 72 and 76 MJ ME kg^{-1} protein ratios, respectively had similar (p>0.05) breast meat yields. There were no differences (p>0.05) in fat pad weights between male Venda chickens offered diets having 55, 64, 68, 72 and 76 MJ ME kg^{-1} protein ratios.

Table 5: Dietary energy to protein ratio level for optimal feed intake, growth rate, feed conversion ratio, carcass weight and breast meat yield in Venda chickens

Trait	Formula	Optimal E:P ratio	R^2	p-value
1-6 weeks old unsexed Venda chickens				
Intake	$Y= -16.8613+1.590076x + -0.0128x^2$	62	0.441	0.559
Growth	$Y = -33.6343+1.384424x+-0.0111x^2$	62	0.904	0.096
FCR	$Y = 17.430+-0.44595x + 0.003543x^2$	63	0.813	0.187
7-13 weeks old male Venda chickens				
Intake	$Y = -260.74 + 11.297x + -0.091x^2$	62	0.850	0.150
Growth	$Y = -98.780 + 3.858x + -0.032x^2$	60	0.767	0.233
FCR	$Y = 32.679 + -0.957x + 0.008x^2$	60	0.735	0.265

Table 5 showed that during the one to six weeks growing period, a single dietary energy to protein ratio of 62 MJ ME kg^{-1} protein optimized both feed intake and growth rate while feed conversion ratio was optimized at energy to protein ratio of 63 MJ ME kg^{-1} protein. Similarly, during the seven to thirteen weeks growing period, a single dietary energy to protein ratio of 60 MJ ME kg^{-1} protein optimized both growth rate and feed conversion ratio in male Venda chickens, while feed intake was optimized at dietary energy to protein ratio of 62 MJ ME kg^{-1} protein.

DISCUSSION

The results of the present study showed that during the one to six weeks growing period, a single dietary energy to protein ratio of 62 MJ ME/kg protein optimized both feed intake and growth rate in unsexed Venda chickens. Data on ideal dietary energy to protein ratio levels for optimal variable responses in growing unsexed Venda chickens are scarce. A single dietary energy to protein ratio of 53.27 MJ ME kg^{-1} protein calculated from the data of Nawaz *et al.* (2006) also optimized both feed intake and growth rate in broiler chickens during the starter period. However, the ratio of 62 MJ ME kg^{-1} protein for optimum feed intake and growth rate obtained in the present study is higher than the ratio of 53.27 estimated from the data of Nawaz *et al.* (2006) for optimum feed intake and growth rate in broiler chickens during the starter period. This may indicate differences in energy and protein requirements for optimum feed intake and growth rate between the indigenous Venda chickens and broiler chickens. Thus, there are higher protein requirements for broiler chickens than Venda chickens. This was not unexpected as the early growth phase of the broiler chickens are characterized by a high and increasing growth rate; the self-accelerating phase described by Brody (1945). There is, therefore, a high demand for protein in the early growth phase and hence such discrepant variations in requirements may be due to genetic differences.

On the other hand, optimum dietary energy to protein ratio of 63 MJ ME kg^{-1} protein optimized feed conversion ratio. The ratio of 63 MJ ME kg^{-1} protein is higher than the 55.22, 57.30 and 58.17 MJ ME kg^{-1} protein values of Kamran *et al.* (2008), Nascimento *et al.* (2004) and NRC (1994), respectively, for optimal productivity of all production variables in broiler chickens during the entire starter period. However, the ratio of 63 MJ ME kg^{-1} protein for optimizing feed conversion ratio in Venda chickens is slightly higher than the ratio for optimum feed intake and growth rate. This may imply that an alteration of tissues takes place, particularly muscle and fat deposits, which may differ in nutrient contents (Moran and Bilgili, 1990).

The results of the present study indicate that dietary energy to protein ratio of 62 MJ ME kg^{-1} protein optimized feed intake in male Venda chickens aged between seven and 13 weeks. This value is lower than the ratio of 69.77 MJ ME kg^{-1} protein calculated from the data of Nawaz *et al.* (2006) for optimum feed intake in broiler chickens during the grower phase. This may indicate higher energy requirements for broiler chickens than Venda chickens during the grower phase since broiler chickens have a bigger body to maintain and as such variations in requirements are expected due to genetic differences. However, a single dietary energy to protein ratio of 60 MJ ME kg^{-1} protein optimized growth rate and feed conversion ratio. The ratio of 60 MJ ME kg^{-1} protein is different from the ratio of 62 MJ ME kg^{-1} protein estimated for optimum feed intake. This may suggest that the dietary energy to protein ratio level for optimal responses in male Venda chickens offered isocaloric diet with varying protein levels may depend on the production variable in question. Contrary to the present findings, NRC (1994) and Kamran *et al.* (2008) estimated single ratios of 66.9 and 59.83 MJ ME kg^{-1} protein for all production variables in broiler chickens during the entire grower phase.

The results of the present study indicate that at each phase, a single dietary energy to protein ratio of 62 MJ ME kg^{-1} protein optimized feed intake in Venda chickens irrespective of the differences in sex and age. The physiological explanation for this effect is not known, however, this is contrary to the findings of Nawaz *et al.* (2006) with broiler chickens which indicated that dietary energy to protein ratio level for optimizing feed intake is generally lower during the starter phase than for the grower phase. No previous study on this issue in Venda chickens was found.

In an isocaloric diet with varying crude protein levels, increasing dietary energy to protein ratio had no effect on ME intake and nitrogen retention in unsexed Venda chickens between one and six weeks of age. The present findings is similar to the findings of Han *et al.* (1992) who found no differences in performance variables of broiler chickens when dietary energy to protein ratio of the feed was changed by decreasing the diet crude protein content from 23 to 20%. It is possible that the dietary energy to protein ratio required for optimum ME intake and nitrogen retention in unsexed Venda chickens were lower than or equal to ratios used in the present study. Contrary to these observations, increasing dietary energy to protein ratio had effect on ME intake and nitrogen retention in male Venda chickens between seven and 13 weeks of age. The physiological explanation for these differences is not clear and merits further observation. However, it is known that feeds of different dietary energy to protein ratio levels will give different performance responses (Buyse *et al.*, 1992; Jones and Smith, 1986; Lin *et al.*, 1980).

In the present study, dietary energy to protein ratio level had no effect on fat pad weight values of male Venda chickens. Similarly, Nawaz *et al.* (2006) reported no effect of dietary crude protein and/or metabolisable energy on abdominal fat weight in broiler chickens. Similar results were also reported by Jackson *et al.* (1982) who showed that the effect of dietary energy to protein ratio levels on fat deposition was similar in broiler chickens at any given dietary energy to protein ratio value. Contrary to the present findings, Bartov and Plavnik (1998) found that the relative abdominal fat pad weight increased significantly in chickens by increasing energy to protein ratio of the diet. Similarly, Cheng *et al.* (1997) reported a significant decrease in abdominal fat in broiler chickens when dietary energy to protein ratio level of the feed was changed by increasing the diet crude protein content. On the other hand, Jianlin *et al.* (2004) reported a significant increase in abdominal fat pad in broiler chickens with a decrease in the dietary crude protein level. Thus, it seems that, as suggested by Leenstra (1984), the effect of diet on fat deposition vary with chicken strains. In addition, Marks (1990) showed that there is a significant genotype x diet interactions for abdominal fat deposition in chickens. Thus, one possible consequence of the intrinsic genetic limitations of indigenous chickens might be the inability to change their body fat composition according to alteration in dietary energy to protein ratio level. This might reflect the differences between indigenous and broiler chickens in terms of their genetic and physiological abilities to change their body fat composition according to changes in dietary energy to protein ratio value of the diet.

CONCLUSION

Dietary energy to protein ratio level for optimal response in indigenous Venda chickens was relative and depended on the energy and protein values of the diet. This may imply that the nutrient requirements of indigenous Venda chickens are dynamic and dependent on which production variable is taken into consideration when formulating the rations. Thus, the feeding program for optimal production in indigenous Venda chickens must take into consideration the primary variable in question at each phase. Fat pad deposition remained unchanged regardless of increase in dietary energy to protein ratio value. More research is suggested to fully understand the effects of dietary energy to protein ratio level on productivity and carcass characteristics of indigenous Venda chickens raised in closed confinement from day-old up to 13 weeks of age. For example, the effect of dietary energy to protein ratio level on meat composition and sensory attributes.

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