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Effect of garlic meal on growth performance and carcass characteristics of indigenous Venda chickens

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ABSTRACT

A study was conducted to determine the growth performance and carcass characteristics of indigenous Venda chickens fed a grower's diet supplemented with varying levels of garlic meal. The study was based on four diets containing similar energy but different garlic meal supplementation levels of 0, 10, 15 and 25 g/kg DM. At 50 to 91 days, all the growth and carcass parameters measured were improved (P<0.05) by garlic meal supplementation. Feed intake, growth rate, feed conversion ratio, live weight, carcass weight, dressing percent, breast meat, thigh, drumstick, gizzard and fat pad weights of Venda chickens were optimized at different garlic meal supplementation levels of 14.7, 15.8, 8.0, 16.4, 14.2, 12.7, 11.2, 12.7, 8.2, 10.5 and 15.1, respectively. These findings have implications on ration formulation for indigenous Venda chickens. Thus, it was concluded that garlic meal supplementation improved feed intake, growth rate, live weight and carcass weight of Venda chickens.

Key words: Carcass, Garlic meal, Growth, Grower's diet.

INTRODUCTION

Indigenous chickens are economically, nutritionally and culturally very important in most rural areas (Swatson *et al.,* 2001). Most of the chickens found in the rural areas are the indigenous breeds. To date, indigenous Venda chickens remain an important source of good quality meat and additional income for many rural households of South Africa (Hadjula, 2006). There is, therefore, a need to improve their productivity without compromising the meat attributes. The results of the studies carried out by Faruga and Jankowski (2000) indicated that garlic (*Allium sativum)* supplementation stimulate the immune reactions, thus reducing death and improves the performance of broiler chickens. *Allium sativum* used as single plant extracts or as mixed preparations has been reported to support both performance and health status of the chicken (Manzanilla *et al*., 2001). These can be attributed to bioactive components (allicin) present in garlic (Amagase *et al.,* 2001). The extracts of this plants are used as feed supplements to improve growth performance in broiler chickens (Abdullah *et al.,* 2010). Other studies did not find any improvement in broiler chicken productivity with garlic meal supplementation (Janvendel *et al*., 2008; Rahmatnejad *et al*., 2009; Ghasemi *et al*., 2010). There is, also, no agreement on supplementation levels of garlic meal for optimal productivity of broiler or on the indigenous chickens. Additionally, no studies were found on garlic meal supplementation effects on productivity of South African indigenous chickens. Thus, one possible nutritional strategy of improving productivity and reducing mortality in indigenous chickens may be supplementation with garlic meal. Therefore, the objective of this study was to determine the effect of garlic meal supplementation on feed intake, digestibility, and growth rate, feed conversion ratio, live weight, mortality and carcass characteristics of Venda chickens aged one to 13 weeks.

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MATERIALS AND METHODS

This study was conducted at the University of Limpopo Experimental Farm at Syferkuil, South Africa. The farm is located at about 10 km northwest of the Turfloop campus. The mean temperatures in winter (April to July) range between 10.1 and 28.4°C and in summer (August to March) between 18 and 36°C. The study was conducted between December, 2013 and March, 2014. The study commenced with 800-day-old chicks with an average weight of 30.25 ± 2 g and was carried out for a period of 13 weeks. A completely randomized design was used to randomly allocate the chicks to four garlic supplemented treatments with each treatment replicated ten times, thus, 40 floor pens were used in total. The chicks were fed a grower diet supplemented with

Table 1: Garlic supplementation levels.

Code	Supplementation levels
CGT_0	Chicks fed a grower diet without garlic meal supplementation
CGT_{10}	Chicks fed a grower diet supplemented with 10 g of garlic meal per kg DM feed
CGT_{15}	Chicks fed a grower diet supplemented with 15 g of garlic meal per kg DM feed
CGT_{25}	Chicks fed a grower diet supplemented with 25 g of garlic meal per kg DM feed

Table 2: Ingredients and nutrient composition of the experimental diets (%).

Ingredien	Composition
Maize	43.16
Wheat Bran	28.11
Full fat Soya	2.00
Hipro Soya	22.89
Limestone	2.64
Salt	0.44
Methionine	0.20
Lysine	0.15
Threonine	0.05
Choline	0.07
Vit/Min PMX	0.29
Total	100.00
Nutrient composition	
Dry matter	85.25
Crude protein	18.07
Ether extracts	2.41
Ash	2.54
Crude fibre	1.83
Nitrogen free extract	71.06

different levels of garlic meal. The grower diet contained 880 g of DM/kg, 12.2 MJ of metabolisable energy/kg DM and 180 g CP/kg DM. The four treatments were as presented in Table 1. Light was provided 24 hours daily while feed and water were provided *ad libitum* throughout the experiment. The experiment was terminated when the chickens were 91 days old. The ingredients, nutrient composition of the grower diets and proximate analysis of garlic meal are presented in Table 2. All statistical analyses were performed using (SAS, 2012). Data were investigated with analysis of variance (ANOVA). General Linear Model procedures for statistical Duncan test for multiple comparisons was used to test the significance of differences between treatment means ($P<0.05$). The responses in feed intake, feed conversion ratio, live weight, growth rate, carcass weight and other carcass characteristics to level of garlic meal supplementation were modelled using the following equation:

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

Where Y = optimum feed intake, feed conversion ratio, live weight, growth rate and carcass characteristics, a = intercept, b1 and b2 = coefficients of quadratic equation, x = garlic meal level of supplementation and $-b_1/2b_2$ = x value for optimal response. The quadratic model was fitted to the experimental data by means of NLIN procedures of SAS (SAS, 2012). The quadratic model was used because it gave the best-fit model.

RESULTS AND DISCUSSION

The results obtained from the effect of garlic meal supplementation on indigenous Venda chickens are presented on Tables 1, 3, 4, 5, 6 and 7, respectively. Results of this study indicate that garlic meal supplementation improved diet intake, growth rate, feed conversion ratio and live weight of unsexed Venda chickens aged one to 49 days. This is contrary to the results of Janvendel *et al.* (2008), Rahmatnejad *et al*. (2009) and Ghasemi *et al*. (2010) who did not find any effect of garlic meal supplementation on the performance of broiler chickens. However, Rahardja *et al*. (2010) reported that garlic meal supplementation at 1.2 and 4 % improved feed intake in pullets aged 4 weeks. Similarly, Kumar *et al*. (1991) reported that garlic meal supplementation increased weight gain, feed intake and feed conversion ratio of broiler chickens aged one to 21 days. However, these authors did not determine garlic meal level for optimal productivity of the chickens. The present results indicate that supplementation level of garlic meal 14.0 g/kg DM supported optimal feed intake of unsexed Venda chickens aged one to 49 days. This level is similar to 13.9 g/kg DM reported by Javandel *et al*. (2008) in broiler chickens aged one to 21 days. However, this value is contrary to the linear response observed by Rahardja *et al*. (2010) for pullets aged four weeks. Supplementation level of garlic meal 18.9 g/kg DM optimized growth rate of Venda chickens aged one to 49 days. This level however, is lower than the 43.9 g/kg DM reported by Javandel *et al.* (2008) in broiler chickens aged one to 21 days. Furthermore, Aji *et al*. (2011) reported a positive linear relationship between growth rate of broiler chickens and supplementation level of garlic meal, this might mean that the levels used by these authors were not high enough to optimize growth rate. Supplementation level of garlic meal 27.5 g/kg DM optimized feed conversion ratio of unsexed Venda chickens in the present study. This level is higher than 9.8 g/kg DM observed in the study conducted on broiler chickens aged one to 21 days by Javandel *et al*. (2008). This improvement might have been due to improvement in feed intake, feed conversion ratio and growth rate of chickens when supplemented with garlic meal. Live weight of unsexed Venda chickens was optimized at garlic meal supplementation level of 17.0 g/kg DM. Elagib *et al*.

Table 3: Effect of garlic meal supplementation on DM feed intake (g/bird/day), growth rate (g/bird/day), feed conversion ratio (g DM feed/ g live weight gain) and live weight (g/bird) of Venda chickens aged one to 49 and 50 to 91 days.

Variable	Diet				
	CGT_0	CGT_{10}	CGT_{15}	CGT_{25}	SE
Venda chicks aged one to 49 day					
Feed intake	33.39^{b}	34.41^{ab}	35.57^{a}	33.91^{b}	0.291
Growth rate	7.08^{c}	8.15^{ab}	8.36^{a}	8.11^{b}	0.154
Feed conversion ratio	4.71^{a}	4.22^{b}	4.25^{b}	4.18^{b}	0.073
Live weight	382.03^{c}	432.61^{ab}	443.26^{a}	429.97^{b}	7.399
Mortality	0.48	0.44	0.40	0.42	0.002
Venda chickens aged 50 to 91 day					
Feed intake	78.49^{c}	89.05^{a}	89.34^{a}	84.18^{b}	1.358
Growth rate	20.33^{c}	24.46^{a}	22.76^{b}	20.09^{d}	0.544
FCR	3.91^{b}	3.64^{c}	3.92^{b}	4.19^{a}	0.059
Live weight	1235.97^{b}	1459.93^{a}	1399.53^{a}	1399.97^{a}	31.286
Morality	0.00	0.00	0.00	0.00	0.000

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

Table 4: Garlic meal supplementation levels (g/kg DM feed) for optimal feed conversion ratio (FCR) (g DM feed/g live weight gain), growth rate (g/bird/day) and live weight (g/bird) of Venda chickens aged one to 49 and 50 to 91 day.

Variable	Formula	r^2	Garlic meal level*	Optimum level
Optimization at one to 49 days				
Feed intake	$Y = 33.29 + 0.252X - 0.009X^2$	0.794	14.0	35.08
Growth rate	$Y = 7.08 + 0.151X - 0.004X^2$	1.000	18.9	8.45
FCR	$Y = 4.70 - 0.055X + 0.001X^2$	0.952	27.5	4.15
Live weight	$Y = 381.92 + 7.248X - 0.213X^2$	1.000	17.0	443.00
Optimization at 50 to 91 days				
Feed intake	$Y = 78.572 + 1.531X - 0.052X^2$	0.841	14.72	89.84
Growth rate	$Y = 20.547 + 0.410X - 0.013X^2$	0.899	15.77	23.78
FCR	$Y= 3.888 - 0.0321X + 0.002X^2$	0.850	8.03	3.76
Live weight	$Y = 1244.93 + 24.47X - 0.745X^2$	0.996	16.41	1445.76

Garlic supplementation levels for optimal production of the variable.

Table 5: Effect of garlic meal supplementation on diet dry matter digestibility (%), metabolisable energy intake (ME) (MJ/kg DM) and nitrogen retention (g feed/g live weight gain) of Venda chickens aged seven and thirteen weeks.

Variable	Diet				
	CGT_0	CGT_{10}	CGT_{15}	CGT_{25}	SE
Digestibility at seventh week					
Dry matter digestibility	66.1	70.5	70.1	70.8	0.60
Metabolisable energy	11.1	12.6	11.8	11.1	0.21
Nitrogen retention	1.0	1.2	1.3	1.1	0.04
Digestibility at thirteenth week					
Dry matter digestibility	66.49	70.51	67.36	69.35	0.608
Metabolisable energy	11.43	11.89	12.27	12.18	0.134
Nitrogen retention	1.68	2.33	2.27	2.35	0.085

SE: Standard error

Table 6: Effect of garlic meal supplementation on carcass weight (g/bird), dressing percentage (%) and weight of carcass parts (g) of Venda chickens aged 91 days.

Variable	Diet				
	CGT_0	CGT_{10}	CGT_{15}	CGT_{25}	SE
Carcass weight	1054.7[b]	1160.1[a]	1154.6[a]	1103.5[ab]	15.95
Dressing %	79.1[b]	82.9[ab]	85.9[a]	78.9[b]	1.50
Breast meat	130.6[b]	143.3[a]	143.8[a]	122.5[c]	2.93
Thigh	222.9[b]	255.1[a]	255.9[a]	224.5[b]	5.10
Drum sticks	135.1[a]	140.7[a]	138.4[a]	111.3[b]	3.62
Gizzard	35.3[b]	45.2[a]	46.3[a]	23.7[c]	2.78
Fat pad	37.0[a]	31.0[b]	20.6[c]	31.4[b]	1.89

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

Table 7: Garlic meal supplementation levels (g/kg DM feed) for optimal carcass weight (g), dressing percentage (%), breast meat (g), thigh (g), drumstick (g), gizzard (g) and fat pad (g) weights of Venda chickens aged 91 days.

Variable	Formula	r^2	Garlic meal level*	Optimum level
Carcass weight	$Y = 1056.167 + 14.87X - 0.52X^2$	0.985	14.24	1162.0
Dressing %	$Y = 78.808 + 0.915X - 0.036X^2$	0.868	12.71	84.62
Breast meat	$Y = 130.396 + 2.526X - 0.113X^2$	0.993	11.18	144.51
Thigh	$Y = 222.854 + 5.368X - 0.212X^2$	1.000	12.66	256.83
Drum sticks	$Y = 134.863 + 1.792X - 0.109X^2$	0.995	8.22	142.23
Gizzard	$Y = 34.971 + 2.271X - 0.108X^2$	0.983	10.51	46.91
Fat pad	$Y = 37.892 - 1.695x + 0.056X^2$	0.705	15.13	25.07

*: Garlic meal supplementation level for optimal production of the variable.

(2013) reported a higher supplementation level of 24.5 g/kg DM for live weights of broiler chickens aged 42 days.

Garlic meal supplementation improved feed intake, growth rate, feed conversion ratio and live weight of Venda chickens aged 50 to 91 days. These results differ from those of Ashayerizadeh *et al*. (2009) who reported that garlic meal supplementation did not have any effect on body weight gain and feed conversion ratio of broiler chickens aged 22 to 42 days. Similarly, Ghasemi *et al*. (2010) reported that inclusion of 0.1 and 0.2 % garlic meal to the diets of laying chickens aged three to eight weeks did not significantly affect their body weight gain and feed conversion ratio. A garlic meal supplementation level of 14.24 g/kg DM optimized carcass weight of Venda chickens aged 91 days. This level is higher than the 10.2 g/kg DM observed by Javandel *et al.* (2008) in broiler chickens aged 42 days; however, it is lower than the 21.4 g/kg DM recorded by Elagib *et al*. (2013) in broiler chickens aged 42 days. The dressing percent and thigh weights were optimized at a garlic meal supplementation level of 12.7 g/kg DM. The 12.7 g/kg DM level for dressing percent is lower than 18.25, 26.4 and 53.1 g of garlic meal/ kg DM reported for broiler chickens by Elagib *et al*. (2013), Fadlalla *et al*. (2010) and Fayed *et al*. (2011), respectively. The difference could be attributed to the breeds used. The breast meat weight of Venda chickens, in the present study, was optimized at a garlic meal supplementation level of 11.2 g/kg DM. This is lower than the 21.4 g/kg DM observed in broiler chickens by Elagib *et al*. (2013).

REFERENCES

Aji SB, Ignatius K, Ado AY, Nuhu JB, Abdulkarim A, Aliyu U, Gambo MB, Ibrahim MA, Abubakar H, Bukar MM, Imam HM and Numan PT. (2011). Effects of feeding onion (*Allium cepa*) and garlic (*Allium sativum*) on some performance characteristics of broiler chickens. Research Journal of Poultry Sciences. 4(2):22-27.

Abdullah YA, Kamel ZM, Basheer MN and Rasha IQ (2010). Small intestinal histology, production parameters and meat quality as influenced by dietary supplementation of garlic (*Allium sativum*) in broiler chicks. Italian Journal of Animal Science. 9:e80.

Amagase H, Petesch BL, Matsuura H, Kasuga S. and Itakura Y. (2001). Intake and its bioactive components. Journal of Nutrition. 131:955S-962S.

Ashayerizadeh A, Dastar B, Rahmatnejad E, Shargh MS, Ashayerizadeh O. and Hossaini SMR. (2009). Use of garlic (*Allium sativum*), black cumin (*Nigella sativa* L) and wild mint (*Mentha lonifolia*) in broiler chickens diets. Journal of Animal and Veterinary Advances. 8: 1860-1863.

Elagib HAA, El-Amin WIA, Elamin KM and Malik HEE. (2013). Effect of dietary garlic (*Allium sativum*) supplementation as feed additive on broiler performance and blood profile. Journal of Animal Science Advances. 3:58-64.

Fadlalla IMT, Mohammed BHM and Bakhiet AO. (2010) Effect of feeding garlic on the performance and immunity of broilers. Asian Journal of Poultry Science. 4:182-189.

Faruga, A. and Jankowski, J. (2000). Turkey-Breeding and Maintenance. (PWRiL) Państwowe Wydawnictwo Rolnicze i Lecene, Warszawa.

Fayed RH, Razek AHA and Jehan M. (2011). Effect of dietary garlic supplementation on performance, carcass traits and meat quality in broiler chickens. In: 4th Conference of International Congress on Animal Hygiene: Vienna, Austria. p. 243-249.

Ghasemi R, Zarei M and Torki M. (2010). Adding medical herbs including garlic (*Allium Sativum*) and thyme (*Thymus Vulgaris*) to diet of laying hens and evaluating productive performances and egg quality characteristics. American Journal of Animal and Veterinary Sciences. 5:151-154.

Hadjula MM (2006). The Anthelmintic Effect of Makahiya (*Mimosa pudica*) leaves Extract in Native Chicken (*Gallus domesticus*) Naturally Infected with Gastro-Intestinal Parasites. A Thesis Presented to the Faculty of the College of Arts and Sciences Natural Science Department, Zamboanaga City: Ateneo de Zamboanga University.

Javandel F, Navidshad B, Seifdavati J, Pourrahimi GH and Baniyaghoub S. (2008). The favorite dosage of garlic meal as a feed additive in broiler chicken rations. Pakistan Journal of Biological Sciences. 11:1746-1749.

Kumar OM. (1991). Effect of Liv-52 syrup on broiler performance in North Eastern Region. Indian Journal of Poultry Science. 31:37-38.

Manzanilla EG, Baucells F, Kamel C, Morales J, Perez JF and Gasa J. (2001). Effects of Plant Extracts on the Performance and Lower Gut Microflora of Early Weaned Piglets. Journal of Animal Science Supplement. 1:473.

Rahardja DP, Hakim MR, Pakiding W and Lestar VS. (2010). Hypocholesterolemic effect of garlic powder in laying hen: low cholesterol egg? Journal of Indonesian Tropical Animal Agriculture. 35(1):251-259.

Rahmatnejad E, Roshanfekr H, Ashayerizadeh O, Mamooee M and Ashayerizadeh A. (2009). Evaluation the effect of several non- antibiotic additives. Journal of Animal and Veterinary Advances. 8:1670-1673.

SAS (2012). Statistical Analysis Systems. SAS User's Guide: Version 9.2, 2nd edition. Raleigh North Caroline; USA / SAS Institute Inc.

Swatson, H. K., Nsahlai, I. V. and Byebwa, B. K. (2001). The status of small holder poultry production in the Alfred District of KZN (South Africa) Priorities for Intervention. The proceedings of the institutions for Tropical Veterinary Medicine10th International Conference on "Livestock, Community and Environment" 20-23rd August 2001, 143-149. Copenhagen, Denmark.