Wayamba Journal of Animal Science – ISSN: 2012-578X; P1636 - P1642, 2018
First Submitted January 28, 2018; Number 1518466943

EFFECTS OF PERIODIC ADMINISTRATION OF GARLIC EXTRACT ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF GRAZING LAMBS

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The effects of periodic administration of garlic extract on performance and carcass characteristics of grazing lambs was studied using West African Dwarf lambs in an experiment which lasted 12 weeks. Twelve (12) West African dwarf Lambs with an average weight of 12.00 ±0.77 kg were allotted to 3 treatment groups with 4 animals per group in a completely randomized design experiment which lasted for 12 weeks. Treatment 1 (T1) served as control group with no garlic extract, Treatment 2 (T2) were the group given 5ml garlic extract weekly and Treatment 3 (T3) received 5ml garlic extract every 2 weeks. The daily weight gain was influenced by the administration of garlic extract, with T3 having the highest gain of 89.29g/day followed by 50.60g for T2 while the control group (T1) recorded the lowest daily weight gain of 43.16g. The Hot carcass weight, Empty body weight, dressing percentage, kidney fat score, external fat score, meat proximate composition, meat pH, water holding capacity and weight of offals were not affected (P>0.05) by the administration of garlic extract. The dressing percentage on the basis of slaughter body weight are; 40.52, 41.08 and 42.80 for T1, T3 and T2 respectively. The kidney fat score were also similar (P>0.05) among treatment groups but a slight decrease from 3.33 in T1 to 2.00 in T2 was observed as the frequency of garlic administration increases. The weights of the heart, lungs, liver, kidney, spleen, abdominal fat, blood and gastrointestinal tract were not significantly (P>0.05) affected by the administration of garlic extract but has numerically decreased abdominal fat with T2 having the lowest value of 64.33g while the control group T1 recorded the highest value of 159.33g. The administration of garlic extract can be use to reduced the level of fat deposition in the gastrointestinal tract and the kidney of sheep thus improving the quality of mutton.

Keywords: Garlic Extract, West African Dwarf Sheep, Carcass.

Small ruminants such as sheep and goats play important role in the development of livestock subsector of the Nigerian agricultural economy (Lakpini *et al*., 2002). Sheep is an important livestock species in the socio-economic lives of people around the world including Nigerians (Yakubu and Ibrahim, 2011). The population of sheep in Nigeria is currently estimated at 33.9 million which is about 3.1% of the world's total (FAOSTAT, 2011). Sheep has the advantage of being able to survive on grasses without any supplement and do not compete for grains and concentrate protein feeds with human beings like monogastric animals (Johnston, 1983). The most common breed of Sheep found in the humid zone of Nigeria is the West African Dwarf (WAD) because of its resistance to trypanosomiasis which is prevalent in the zone. It is therefore an important source of animal protein to the people (Jahnke, 1982).

Even though sheep plays an important role in the supply of Animal protein, consumers generally reject sheep meat due to its high fat content (Nielson, 2001). The rejection of fatty meat is because consumers are increasingly becoming aware of the need to reduce fat intake due to health reasons

(Chilliard *et al*., 2001). Reducing fat intake could lower the risk for cardio-vascular heart disease by 10% (Latta, 1990).

There is rising interest in animal production practices which can reduce fat content of meat to make them more attractive to consumers while reducing risk of cardiovascular disease (Chilliard *et al*., 2001). Dietary supplementation has proved to be a simple and convenient strategy to introduce natural antioxidants into phospholipid membranes, where they may effectively inhibit oxidative reactions, improve quality and nutritional value of meat (Lauridsen *et al*. 1997).

Garlic is a natural antioxidant that has the capability to decrease plasma cholesterol, esterified cholesterol, high density lipoprotein cholesterol and low density lipoprotein as observed by of Kumar *et al*. (2000).

However, there is lack of convincing information on quantity and interval of supplementing garlic on the quality of mutton. It is against this background that this study was conducted to evaluate the effect of periodic administration of garlic extract on body weight gain and carcass characteristics of grazing lambs.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Teaching and Research farm, Animal Production Department, Faculty of Agriculture, University of Ilorin, Kwara State of Nigeria. It is located on latitude 82^0 9' N, and longitude 43^0 5' E, with a relief of about 305m above sea level. The average annual rainfall is about 1234.4mm and the mean annual temperature is 27^0c (Olofintoye and Salami, 2011).

Preparation of garlic extract

About 200g of dried garlic cloves are soaked overnight in 200ml of distilled water to allow easy removal of cuticles and extraction of the juice. The cloves still immersed in water are pounded until they are completely mushy. The crushed material is left to stand for 2 hours and later filtered. The garlic juice is used as soon as possible because the active compound Allicin is prone to rapid decomposition. The garlic juice is then diluted in water at the ratio of 8:2 making a concentration of 80% according to Masamha *et al*. 2010.

Experimental animal management and design

Twelve (12) West Africa dwarf lambs with an average body weight of 12.00 ±0.77 were randomly divided into Three (3) groups of four (4) animals per group in a Completely Randomized Design (CRD). Group 1 (T1) is the control group with no garlic extract drench, group 2 (T2) were given 5ml garlic extract weekly and group 3 (T3) received 5ml garlic extract every 2 weeks. The lambs were allowed to graze naturally every day with no supplementation and given access to fresh drinking water ad-libitum. Animals were treated against ecto and endo-parasites before the commencement of the experiment. Lambs were tagged, weighed weekly with a hanging scale and a sack before going out for grazing. The experiment lasted for 12 weeks.

Carcass and physiochemical characteristics

At the end of the experiment, 3 animals were selected from each group and slaughtered. The live weight at slaughter and slaughter weight were measured using a hanging scale. The hot Carcass Weight (HCW) was determined after removing the skin, head, forefeet, hind feet and all the viscera and fat depots (kidney and gut fat). Dressing Percentage (DP) is calculated as percentage of hot carcass weight (HCW) to slaughter weight or Empty body weight. The empty body weight (EBW) obtained by subtraction of gastro-intestinal tract and contents from the slaughter weight. Offals like skin, head, legs, heart, liver, kidney, spleen, gut fat and lungs were also weighed using a digital scale of 1g accuracy. The relative weight of the visceral organs, head, skin and legs was calculated as a percentage of live weight at slaughter. Blood weight is determined as the difference between lives weight at slaughter and slaughter weight. External fat finishing score (5=extremely abundant, 4=abundant, 3=medium, 2=slight, 1=scarce), and kidney fat (1=no fat, 2=little fat coverage, 3=2/3 of kidney covered, 4=kidney completely

covered, 5=kidney covered with very thick fat) were determined according to Mamani-Linares and Gallo (2013). Meat sample collected from *longissimus dorsi* muscle was analysed for proximate composition on dried meat sample following A.O.A.C (1990) and meat pH was obtained within 24hours after slaughter using a portable Digital pH meter as described by Davilla *et al*. (2013).

Statistical analysis

Data obtained were subjected to one way analysis of variance (ANOVA) using SPSS (2007) and Significant difference between treatments means were separated using Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Body weight changes and growth rates

Mean daily weight gain was found to be significantly (P<0.05) different between treatment group and the control, with T3 having the highest gain of 89.29g/day followed by 50.60g and 43.16g for T2 and T1 respectively. The mean weekly weight gain also differ significantly (P<0.05) with T3 having the highest gain of 0.625kg while T1 has the lowest value of 0.301kg/week as shown in table 1. The relative growth-promoting effects of garlic in this study buttress earlier reports of Demir *et al*. (2003). Lewis *et al*. (2003) observed that body weight gain was significantly higher (P<0.05) in broiler chickens fed low

Table 1: Growth Performance

Parameter	T1	T2	T3	S.E.M
Initial weight (kg)	12.25	12.00	12.50	0.770
Final Weight (kg)	16.88	16.25	20.25	1.212
Mean Daily weight gain (g)	43.16^{a}	50.60^{b}	89.29^{b}	8.229*
Mean Weekly weight gain (kg)	0.301^{a}	0.353^{a}	0.625^{b}	0.057*

Means without letters are not significantly different (P>0.05) while those with different letters (a, b, c) are significantly different (P<0.05).

Table 2: Carcass and physiochemical properties

Parameter	T1	T2	T3	S.E.M
Carcass component				
Live weight at Slaughter (kg)	19.83	17.00	19.33	1.635
Slaughter weight (kg)	19.00	16.17	17.83	1.696
Hot carcass weight (kg)	7.67	7.00	7.33	0.707
Dressing % (on Slaughter weight)	40.52	42.80	41.08	0.859
Dressing %(on Empty body weight)	67.18	64.53	69.56	2.96
Carcass length (Inches)	22.00	20.67	21.33	0.623
Kidney Fat Score	3.33	2.00	2.67	0.373
External Fat Score	3.00	2.33	3.33	0.261
Empty Body weight	11.63	8.00	10.23	0.946
Offals				
Head (kg)	1.37	1.23	1.27	0.098
Skin (kg)	1.63	1.43	1.43	0.128
Legs (kg)	0.62	0.50	0.53	0.035
Physiochemical Properties				
Meat pH	4.6	4.1	4.3	0.140
Water Holding Capacity (%)	58.17	65.76	57.52	3.174
Chemical Composition (on dry matter basis)				
Crude Protein (%)	55.96	57.79	56.62	1.04
Crude Fat (%)	10.16	9.74	15.02	1.389
Crude Fibre (%)	2.70	2.76	2.49	0.187
Ash (%)	3.92	4.01	4.78	0.391

Means without letters are not significantly different (P>0.05) while those with different letters (a, b, c) are significantly different (P<0.05).

concentrations of commercial garlic products than the control group. The mean initial weight and the mean final weight were not significantly (P>0.05) different among treatment groups. The final weight of the lambs ranges from 16.25kg in T2, 16.88 in T1 to 20.25kg in T3 (Table 1)

Carcass and Meat Physiochemical characteristics

The carcass characteristics of lambs given garlic extract drench are shown in Table 2. The Hot carcass weight, Empty body weight, dressing percentage, kidney aft score, external fat score, meat proximate composition, meat pH, water holding capacity and weight of offals were not influenced (P>0.05) by the administration of garlic extract (Table 2). The dressing percentage on the basis of slaughter body weight are; 40.52, 41.08 and 42.80 for T1, T3 and T2 respectively. The dressing percentage on the basis of Slaughter weight are comparable to the results obtained by Fitwi and Tadesse (2013) who reported a range of 35-45% for growing lambs. The dressing percentage on basis of Empty Body weight for T1, T2 and T3 are 67.18, 64.53 and 69.56 respectively as shown in Table 2. This is slightly higher than those obtained by Fitwi and Tadesse (2013) who reported 44-55%. Dressing percentage describes the carcass merit condition as a proportion of carcass weight to body weight which helps to assess the meat proportion of the animal (Getahun, 2006). Dressing percentage of sheep are generally between 40 -50%, although affected by different factors. It increases with age, low in young sheep and higher in older sheep (Gatenby, 1991).

Dressing percentage values on the empty body weight basis were higher than on the slaughter weight basis, implying the influence of digesta (gut fill) on dressing percentage. Ingesta constitute a large portion of the body weight even when the animals are fasted for long hours. It is more meaningful to express dressing percentage as the proportion of empty body weight than slaughter weight because the gut contents contribute 4 - 14% of fasted live weight in sheep fasted for about 24 hours before slaughter (Gibbs and Ivings 1993; El-khidir *et al*., (1998). Hot carcass weight was found to be similar (P>0.05) among different groups with a range of 7.00kg in T2 to 7.67kg in T1. Slaughter weight and Empty

Table 3: Absolute and Relative Weight of Visceral Organs

Parameter	T1	T2	T3	S.E.M
Absolute weight				
Heart (g)	103.33	98.67	111.33	1.989
Lungs and Trachea (g)	357.00	296.67	292.67	24.435
Liver (g)	447.33	447.33	434.67	35.833
Kidney (g)	69.00	84.67	74.00	6.323
Spleen (g)	122.67	92.33	93.67	11.674
Abdominal Fat (g)	159.33	64.33	105.00	35.00
Blood (g)	0.83	0.83	1.53	0.155
Full G.I.T (kg)	7.37	5.77	7.27	0.489
Relative weight (% of Live Weight at Slaughter)				
Heart (%)	0.53	0.59	0.61	0.031
Lungs and Trachea (%)	1.84	1.76	1.54	0.091
Liver (%)	2.27	2.64	2.27	0.100
Kidney (%)	0.35	0.51	0.42	0.041
Spleen (%)	0.62	0.52	0.42	0.043
Abdominal Fat (%)	0.75	0.39	0.45	0.136
Blood (%)	4.22	5.50	9.34	1.471
Full G.I.T (%)	37.09	33.61	34.30	1.862

Means without letters are not significantly different (P>0.05) while those with different letters (a, b, c) are significantly different (P<0.05).

body weight were also not significantly different (P>0.05) among different groups as shown in Table 2.

The kidney fat score were similar among treatment groups but a slight decrease from 3.33 in T1 to 2.00 in T2 was observed as the frequency of treatment administration increases. Onibi *et al*. (2009) reported numerically lower relative weights of the abdominal fat for broilers fed supplementary garlic compared with those fed the control diet. This suggests that garlic supplementation could reduce fat deposition (Lydia, 2001). External fat score also show a non significant (P>0.05) difference among treatment groups with 3.00, 2.33 and 3.33 recorded for T1, T2 and T3 respectively (Table 2).

The results obtained in the study for head, skin, legs were found to be similar among different groups with the range of 1.23-1.37, 1.43-1.63 and 0.50-0.62 for head, skin and legs respectively. The values obtained in the study were in line with those reported by Shija *et al*. (2013) for head (1.59), skin (1.66) and legs (0.52).

The chemical composition of *Longissimus dorsi* muscle is collected from the carcasses of ram lambs fed different experimental rations revealed that the crude protein, crude fat, crude fibre and ash content of muscle were ranged from 55.96-57.79, 9.74-15.02, 2.49-2.76 and 3.92-4.78% respectively (table 2). The results were in agreement with those obtained by Vidya *et al*. (2012) who reported no variation in chemical composition of mutton with increasing concentrate supplementation. The crude protein observed in the experiment is higher than a range of 21.64-21.71% (on fresh basis) reported by Vidya *et al*. (2012). This increase observed in the study is due to the absence of moisture during analysis which was done on dry matter basis. The crude fat is also higher (table 2) than the one (1.94-2.13%) reported by Vidya *et al*. (2012). This may be due to breed differences.

The meat pH and water holding capacity of the meat are also similar among treatment groups with a range of 4.1-4.6 and 57.52-65.76% respectively.

Weight of Visceral Organs

The weights of the heart, lungs, liver, kidney, spleen, abdominal fat, blood and gastrointestinal tract were not significantly (P>0.05) affected by the administration of garlic extract as shown in Table 3. The results of the present study were in accordance with the findings of Dien *et al*. (1990) who observed non significant (P>0.05) difference in weight of viscerals. Vidya *et al*. (2012) also reported a non significant (P>0.05) difference in the weight of pluck, liver, heart, testes, GIT, spleen, lungs with trachea of Sheep. The relative weight of heart, liver and full GIT as observed by Vidya *et al*. (2012) are 0.47-0.48%, 1.58-1.81%, 27.86-31.62% respectively which are in agreement with results obtained in the present study (Table 3). The administration of garlic has numerically decreased abdominal fat with T2 having the lowest value of 64.33g while the control group T1 recorded the highest value of 159.33g as shown in Table 3.

CONCLUSION

The administration of garlic extract has numerically reduced fat deposition in the gastrointestinal tract and the kidney. It has also numerically reduced the kidney fat score. This will improve the quality of mutton and hence its acceptability to the people.

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