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Feeding garlic powder on growth performance, nutrient digestibility and carcass characteristics of rabbit

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ABSTRACT

The objectives of the present study were to investigate the feeding effect of garlic powder supplementation on growth performance, digestibility of nutrients and carcass characteristics of growing rabbit. For this purpose, 12 male New Zealand White growing rabbits were distributed randomly in three treatment groups, *i.e*. control (T_0), adding 0.25% garlic powder (T_1) and adding 0.50% garlic powder (T_2). All diets were around iso-energic and iso-nitrogenous. Body weight at 35 days of age was higher (376.75kg) in T_1 group. There was no significant effect among treatment groups with respect to feed intake, growth and feed conversion ratio but these values were numerically higher in T_1 group. The digestibility of crude protein, crude fiber and digestible crude fiber values were higher in T_1 diet than the others. Carcass protein content was higher and fat content was lower in T_1 diet. Therefore, it may be concluded that adding 0.25% garlic powder may be practiced for economic rabbit production.

Keywords: Garlic powder, growth, digestibility, rabbit.

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INTRODUCTION

In Bangladesh, meat produced by different conventional sources like, poultry, cattle, sheep and goat to meet-up the growing demand of trimming millions but it is insufficient. So the use of small herbivorous and unconventional species of livestock like, Rabbit will be the most acceptable sources to mitigate protein shortage of trimming millions. Rabbit which has recognized as micro livestock (Vietmeyer, 1985) may be a promising source of protein in Bangladesh.

The domestic rabbit (*Oryctolagus cuniculus*) is emerging as viable livestock species (Cheeke, 1989b). Vietmeyer, (1985) aptly states, livestock for use in developing countries should, like computer, be getting smaller and more personal. Mainframe, such as cattle, cannot solve the widespread shortage of meat due too much space and expense for the landless and poor. Mainframes, such as sheep and goats, could play an increasing role. But tiny, user-friendly species rabbit for home use show the most potential and they are being overlooked.

FAO (1987) stated that rearing of rabbit has an economic importance in developing countries mainly for meat production. Therefore, farmers who are interested to an alternative livestock enterprise with low capital and labour investment may consider rabbit farming in our country.

Rabbit have a numerous characteristics that would make them particularly suitable as meat producing small livestock in Bangladesh. These are small body size, short generation interval (gestation period 28-32 days), high reproductive potential (5 or 6 litter per year), rapid growth rate, potential for genetic improvement, resistance to heat stress, , utilize forage and by-products as major diet components (Cheeke, 1986b). It is raised for several purposes and as pets (Cheeke, 1986a). Rabbit meat is acknowledged as of high quality meat, being high in protein but low in fat and cholesterol (Jones, 1990; Handa et al., 1995). As

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mentioned by Cheeke (1986a), rabbits are primarily herbivores and can be successfully raised on diets that are low in grains and high in roughage. The ability of rabbit to convert roughage into meat efficiently will be of great help for Bangladesh where animal feed shortage is serious.

Furthermore, rabbits are easy to handle and can be raised under primitive condition. It involves little financial investment and women & children can easily accomplish its husbandry at home every time.

There is no such notable work on rabbit under the environmental condition of Bangladesh. A very few works on energy and protein requirements of rabbit have been completed in the Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh. Several publications on growth, reproductive performance, carcass qualities of rabbit in different developed and developing countries are found. However, very little information is available on feeding garlic powder to rabbit. Thus, the present study was undertaken to investigate the feeding effects of garlic powder on the growth performance, nutrient digestibility and carcass characteristics of rabbit.

MATERIALS AND METHODS

The experiment was conducted to study the effect of garlic powder as a supplement on growth performance, digestibility of nutrients and carcass characteristics of growing cross-bred New Zealand White (NZW) rabbits. The experiment was conducted from 9th September, 2014 to 1st October, 2014 in the Shahjalal Animal Nutrition Field Laboratory, Bangladesh Agricultural University, Mymensingh. The chemical analyses of feed stuff were performed in the laboratory of the Department of Animal Nutrition, Bangladesh Agricultural University, Mymensingh. Twelve New Zealand White (NZW) rabbits were used in the experiment for a period of 35 days. The initial live weight of experimental rabbits ranged from 513g to 1258g. All of the experimental animals were housed individually in steel cage. Every day morning and afternoon feed and water were provided in each cage. Before commencement of the study, the animals were kept for 7 days to adopt with the experimental feeds.

Experimental design and dietary treatment

The rabbits were divided into three treatment groups with four replications in a completely randomized design. The treatments are categorized as T_0= (Concentrate mixture containing 0% garlic powder), T_1= (Concentrate mixture containing 0.25% garlic powder) and T_2= (Concentrate mixture containing 0.5% garlic powder).

Preparation of dietary treatments

The garlic was collected from local market of Bangladesh Agricultural University, Mymensingh. The garlic was dried in the sun and ground to make it powder form. The garlic powder was kept in polythene bags and stored for experimental uses. The ration was composed of locally available feed ingredients. Concentrate feed ingredients were thoroughly ground to sufficient fineness for easy consumption of rabbits. Three almost iso-nitrogenous (19% CP) and iso energetic (2500 kcal ME/kg DM) concentrate diets (NRC, 1977) were used throughout the experimental period. The diets T_0, T_1 and T_2 were prepared by 0%, 0.25% and 0.5% garlic powder addition respectively. The ingredients and nutrient composition of the three diets are shown in Table 1.

Feeding and management

Concentrate mixture of each diet and green grass were offered *ad libitum* in each group twice in a day. Clean, fresh water was made available for rabbits at all time. The rabbits of all treatment groups were provided with identical care and management throughout the experimental period. The polythene was kept clean and dry.

Growth performance

Live weight, average daily gain and feed conversion ratio were calculated. Feed sample were analyzed following the method of AOAC (2004).

Table 1
Ingredients and nutrient composition of experimental diets.

Parameter	Treatments #		
	T_0	T_1	T_2
Feed Ingredients			
a. Green grass	*Adlibitum*	*Adlibitum*	*Adlibitum*
b. Concentrate(g/100g)			
Maize	18.3	18.3	18.3
Wheat	37	37	37
Wheat bran	13.8	13.8	13.8
Garlic powder	0	0.25	0.50
Mustard oil cake	19.15	19.15	19.15
Soybean meal	9.5	9.5	9.5
DCP	1.5	1.5	1.5
Vitamin, mineral pre-mix	0.25	0.25	0.25
Salt	0.5	0.5	0.5
Nutrient composition of conc.mix. (g/100g)**			
Crude protein	15.95	15.99	16.03
Crude fiber	5.05	5.11	5.16
Ether Extract	3.23	3.24	3.24
Ash	6.18	6.19	6.20
NFE	58.62	58.73	58.86
ME (MJ/kg DM), (Calculated value)	13.55	13.46	13.09

****** According to NRC (1977)

Digestibility Trial

At the end of the experimental period a conventional digestibility trial was conducted for 7 days. The leftover feed were recorded and deducted from the feed supplied to determine feed intake of the experimental animals. Collected feces were weighed and total quantity of feces voided per day was recorded against each animal. A polythene sheet was spread on the floor of each individual rabbit for rabbit for rapid passage of urine in order to avoid contamination with feces. About 10% was collected from the total quantity of feces voided daily, dried in the sun and stored in polythene bags. At the same time, 50g of fresh feces sample was collected and stored in the deep fridge for DM and N analysis. At the end of collection period the sun-dried feces were mixed together and then ground for chemical analysis.

Carcass characteristics

At the end of the experimental period, all of the rabbit from each treatment were selected for slaughter. They were weighed and slaughtered for the measurement of carcass yield, dressing percentage, protein and fat percentage of meat.

Statistical analysis

Data collected for different parameters were analyzed by using "SPSS" statistical program to compute analysis of variance (ANOVA) in a completely randomized design at 5% level of probability.

RESULTS AND DISCUSSION

Effects of feeding garlic powder on growth performance and feed intake of rabbits

The effect of different levels (0%, 0.25% and 0.5%) of garlic powder with concentrated mixture on growth performance of rabbits is shown in Table 2. The initial average live weights of the rabbits were 926.50, 940.25 and 1043.50g for the diet of T_0, T_1 and T_2 respectively (Figure 1). The average final live weights of rabbits of different

treatments were 1248g, 1317g and 1287g for the diet of T_0, T_1 and T_2 respectively and the results did not significantly differ (P>0.05) between the diets. The average total body weight gain was 321.50, 376.75g and 243.50g for animals fed diets T_0, T_1 and T_2 respectively. The daily live weight gain was 9.18g (T_0), 10.76g (T_1) and 6.98g (T_2) respectively among the treatment groups. The daily live weight gain of rabbit did not significantly (P>0.05) differ among the groups due to addition of garlic powder. But numerically the highest daily live weight gain was recorded for treatment T_1 (10.76g) and lowest for T_2 treatment (6.98g). So the results of this study indicated that, an addition of garlic powder at 0.25% level with concentrated mixture had beneficial effect on growth performance of rabbits. This might be due to increased amounts of protein available at the cellular level for deposition in the body tissues. This result agrees with reports of Ortsergu et al. (2008) and Ademola et al. (2005), who reported an increased weight gain of rabbits and broilers, fed garlic supplemented diets respectively.

Pourali et al. (2010), showed that allicin in garlic promotes the performance of the intestinal flora thereby improving digestion and enhancing the utilization of energy, leading to improved growth. El Nawawy, GH (1991), reported that body weight gain of broiler chickens were improved when adding 1% fresh onion or garlic to their rations and El Nahla, AMM (1983), also reported that adding 2% dry onion or garlic into broiler diet improved their live body weight gain.

The average total dry matter (DM) intake was 2452.26g, 2418.97g and 2386.06g for treatment T_0, T_1 and T_2 respectively (Table 2). The dietary treatment did not differ significantly (P>0.05) among the dietary groups. The average daily dry matter intake was 70.06g, 69.11g, and 68.17g for treatment T_0, T_1 and T_2 respectively (Table 2) and it was observed that the DM intake did not differ significantly among the groups.

The average FCR on diet T_0, T_1 and T_2 were 7.62, 6.63 and 9.91 respectively (Table 2) and it was expressed that adding of garlic powder increased feed efficiency in diet. This result agrees with the result of El-Sayiad et al. (2003) on rabbits who reported that the best results of feed conversion were recorded with 1% garlic. They observed that the improvement in feed conversion by garlic may be due to better efficiency of feed utilization, reducing animal pain and improve organs function. Javendel et al., (2008) who also fed herbal plants (ginger and garlic) as growth promoters in broiler diets and observed a pronounced improvement in their body weight gain and feed conversion ratio.

The average total crude protein (CP) intake of different dietary treatment was 113.05 g, 111.47g and 109.11g for diet T_0, T_1 and T_2 respectively (Table 2, Figure 2). There was no significant (P>0.05) difference among the treatment groups. The average daily CP intake was 3.23g, 3.18g and 3.12g for diet T_0, T_1 and T_2 respectively and there was no significant (P>0.05) difference among the various treatment groups.

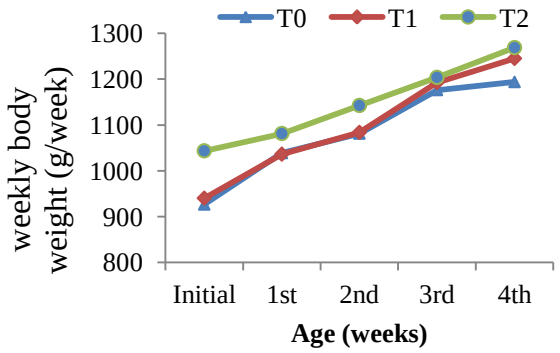

Figure 1
Weekly body weights (g) of rabbit of different groups.

Effects of garlic powder on nutrient digestibility and nutritive values

The digestibility of nutrient components of different diets is presented in Table 3. The results indicated that addition of garlic powder did not affect digestibility of DM, OM, EE and NFE. But garlic powder affected the digestibility of CP and CF in T_1 diet due to increased amounts of protein available at the cellular level for deposition in the body tissues.

Table 2
Effects of garlic powder on growth performance and feed intake of rabbits.

Parameters	Treatments			*P* value	Comments
	T_0	T_1	T_2		
Initial body weight (g)	926.50	940.25	1043.50	0.798	NS
Final body weight (g)	1248	1317	1287	0.901	NS
Total body weight gain (g)	321.50	376.75	243.50	0.290	NS
Daily live weight gain (g/d)	9.18	10.76	6.98	0.290	NS
DM intake					
a. Green grass	365.62	348.10	252.31		
b. Concentrate	2086.64	2070.87	2133.75		
Total dry matter intake(g)	2452.26	2418.97	2386.06	0.960	NS
Average dry matter intake(g/d)	70.06	69.11	68.17	0.960	NS
FCR (Total DM basis)	7.62	6.63	9.91	0.132	NS
Total CP intake (g)	113.05	111.47	109.11	0.514	NS
CP intake (g/d)	3.23	3.18	3.12	0.514	NS

NS= Non-significant; *= 5% level of significance

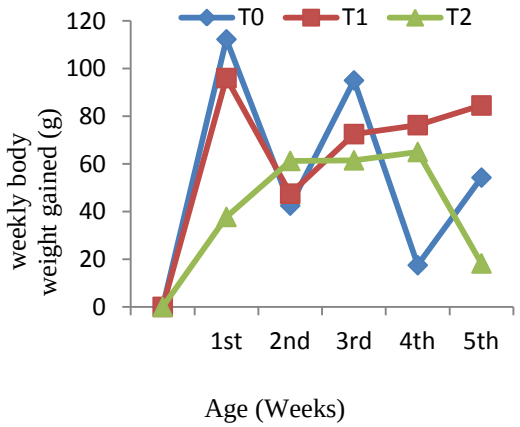

Figure 2
Comparison among the treatments on average weekly weight gain (g) of rabbit up to five weeks.

The results of CP and CF digestibility agrees with Patra et al. (2001) and Shehata et al. (2003), who stated that addition of garlic with different levels improved CP and CF digestibility significantly (P<0.05).

Hernandez et al. (2004) also showed that garlic extract supplementation improved apparent whole tract digestibility of the nutrients specially CP. The improvement of digestibility in T_1 was probably due to herbal effects of garlic powder in increasing the microbial population especially the number of bacteria such as *E. coli*, *Clostridium* spp. and Enterococci which improved digestibility.

Nutritive values

The nutritive values of nutrient components of different treatment are shown in Table 3. The results stated that addition of garlic powder did not affect on digestible ether extract, digestible nitrogen free extract and digestible organic matter. But the garlic powder affected digestible crude protein, digestible crude fiber and total digestible nutrient in T_1 diet.

This result agrees the result of Patra et al. (2001) and Shehata et al. (2003) who reported that addition of garlic with different levels improved DCP and TDN significantly (P<0.05). These results might be due to restore of important protein which increase glutathione enzymes in the liver which protects the cells from oxidative damage and play vital role in detoxification, inhibit lipid per oxidation, improve organs function and immunity.

Table 3
Effects of garlic powder on nutrient digestibility and nutritive values.

Parameters digestibility (%)	Treatments			*P* value	Comments
	T_0	T_1	T_2		
DM	85.23	84.16	81.34	0.238	NS
OM	87.28	85.48	82.95	0.322	NS
CP	79.37	85.86	79.63	0.078	NS
CF	66.06	83.82	61.43	0.021	*
EE	86.58	83.95	80.79	0.068	NS
NFE	89.82	88.17	86.62	0.476	NS
Nutritive value					
DCP	15.85	17.19	15.97	0.069	NS
DCF	5.98	7.65	5.64	0.017	*
DEE	3.18	3.10	2.98	0.089	NS
DNFE	58.80	57.83	56.92	0.545	NS
DOM	84.73	84.13	81.83	0.394	NS
TDN	87.80	89.64	85.33	0.190	NS

*= 5% level of significance; NS= Non-significant

Carcass characteristics

The carcass weight was 665g, 728.75g and 686.25g for dietary treatment T_0, T_1 and T_2 respectively, which corresponded to 53.38%, 55.63% and 52.95% dressing yield respectively (Table 4). There was no significant (P>0.05) difference among the groups. Among the treatments, diet T_1 showed the highest carcass weight and dressing percentage.

The findings of Dieumou et al. (2009) and Fadlalla et al. (2010), in the diet of broilers reported a non-significant effect on broiler dressing percentage values (but numerically higher) due to the inclusion of garlic powder.

The CP content of meat was 17.70%, 18.60% and 18.49% for dietary treatment T_0, T_1 and T_2 respectively and there was no significant difference (P>0.05) among the treatment groups. But CP% was highest numerically in T_1 diet due to an increase in protein efficiency in T_1 diet.

The EE or crude fat was 3.67%, 2.36% and 2.03% for dietary treatments T_0, T_1 and T_2 respectively and it was found that garlic powder significantly decreased the fat content of meat. The result agrees with the reports of O'Brien and Reiser (1979) and Fuhrman et al. (2000), reported that plant component had cholesterol-suppressive capacity. The hypocholesterolemic effects of ginger and garlic reduced fat content in rabbit meat for safe human consumption. Vidica et al. (2011), also reported that incorporation of 0.75% garlic in the diet of broilers reduced drastically the level of cholesterol in the meat. Silagy and Neil, (1994), Neil et al. (1996) and Chowdhury et al. (2002) showed that garlic has cholesterol lowering effect in layer chicken only due to the presence of sulphur containing bioactive compounds in its homogenates.

Mirhadi et al. (1992), reported allicin that present in garlic, significantly inhibited hypercholesterolemia, reduced tissue cholesterol, lowered low density lipoprotein concentration (LDL) and raised high density lipoprotein concentration (HDL). Allicin also inhibits the action of hydroxymethly gutaryl - CoA reductase, which is the most important enzyme that participates in the synthesis of cholesterol and lipids. Lydia (2001), also suggested that garlic supplementation could reduce fat deposition than control diet.

Table 4
Effects of garlic powder on carcass characteristics of rabbits.

Parameters	Treatments			*P* value	Comments
	T_0	T_1	T_2		
Carcass weight(g)	665	728.75	686.25	0.757	NS
Dressing yield (%)	53.38	55.63	52.95	0.354	NS
CP (%)	17.70	18.60	18.49	0.380	NS
EE (%)	3.67	2.36	2.03	0.001	*

*= 5% level of significance; NS= Non-significant

Table 5
Cost of concentrate of different treatments.

Ingredients	Price of ingredients (Tk/ kg)	Price of ingredients		
		Treatments		
		T_0	T_1	T_2
Maize	20	366	366	366
Wheat	32	1184	1184	1184
Wheat bran	35	483	483	483
Garlic powder	60	0	15	30
Mustard oil cake	40	766	766	766
Soybean meal	52	494	494	494
DCP	60	90	90	90
Vitamin, mineral pre-mix	150	37.5	37.5	37.5
Salt	12	6	6	6
Price of ingredients (Tk/kg)		34.26	34.41	34.56

* Price in 2014

Cost of dietary treatments

The costs of these three dietary treatments were 34.26, 34.41 and 34.56 TK/kg for diet T_0, T_1 and T_2 respectively (Table 5). The results showed that there was no significant difference for price among the groups.

The result of carcass analysis indicated that addition of garlic powder at 0.25% level numerically increased the carcass weight (g), dressing yield (%) and crude protein (CP) content and decreased fat content of meat in T_1 diet. In addition the cost involve for this T_1diet is similar with other treatments. So it can be concluded that adding 0.25% garlic powder may be practiced for economic rabbit production.

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