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Research Article ***Open Access***

Performance of growing rabbit bucks and does fed diets supplemented with brewers' dried grains

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SUMMARY

The study was conducted at the Rabbit Unit of the National Animal Production Research Institute, Ahmadu Bello University, Shika-Zaria, to evaluate the performance of growing rabbit bucks and does fed diets supplemented with brewers' dried grains (BDG). Forty growing rabbits aged from 6 to 7 weeks, with an initial average weight of 0.75 kg, were randomly assigned to four dietary treatments (0%, 20%, 30%, and 40% BDG) in a completely randomized design (CRD) with five rabbits in each treatment. The experimental diet and clean drinking water were supplied *ad libitum* during the experiment, which lasted for 8 weeks. Growth parameters were measured, i.e. daily feed intake and weight changes: initial weight, final weight, total weight gain, average daily gain, and feed conversion ratio. Data were subjected to statistical analysis using SAS software. In growing rabbit bucks, initial weight, average daily feed intake, final weight and average daily gain showed no significant differences between treatments ($P > 0.05$). The feed conversion ratio was significantly varied ($P < 0.05$), with the best feed efficiency noted in the control and the poorest in the group receiving the diet with 20% BDG inclusion. For the does, there were no significant differences ($P > 0.05$) in initial weight or average daily feed intake. There were significant differences ($P < 0.05$) in final weight, average daily gain, and feed conversion ratio. Final weight and average daily gain had a similar pattern, with the highest and lowest values recorded for the control (0%) and treatment 2 (20%), respectively. The feed conversion ratio showed a different pattern; it was significantly higher in treatments 2 (20%), 3 (30%) and 4 (40%) than in the control. It can be concluded that the inclusion of BDG in the diet of growing rabbits has no effect on growth performance, but is efficiently utilized.

KEY WORDS: rabbits bucks, rabbit does, brewers' dried grains, supplementation.

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INTRODUCTION

In tropical, subtropical and arid regions, temperature, humidity, solar radiation, and air movement are the overriding environmental factors affecting the physiological functions and reproductive performance of domestic animals (Marai et al., 2007, Ondruska et al., 2011). High ambient temperature coupled with pro-oxidants (reactive oxygen species) can lead to heat stress and oxidative stress (Heise et al., 2006). Heat stress (HS) is defined as a stress inflicted by a wide range of environmental temperature conditions that induce a state of physiological strain within an animal's body. This means that the animals cannot passively regulate their heat through homeostasis. It mainly occurs when animals are exposed to high ambient temperatures, high humidity, low wind speed, and high direct or indirect solar radiation (Willmer et al., 2000).

As homoeothermic animals, rabbits can regulate their bodies' heat input and output using physical, morphological, biochemical, and behavioural processes to maintain a constant body temperature (Marai and Habeeb, 1994) within a thermo-neutral zone (TNZ) temperature of about 18–21°C (Habeeb et al., 1998). However, when rabbits are exposed to elevated ambient temperatures (Ta), imbalances in their body temperature are induced (Habeeb et al., 1999), which adversely affect their growth and reproductive traits (Okab et al., 2008). Furthermore, disturbances in feed intake, feed utilization, water metabolism, blood parameters, enzymatic reactions, and hormonal secretions have been reported in heat-stressed rabbits, in addition to protein, energy and mineral imbalances (Okab et al., 2008).

Dietary application of fibre is considered an appropriate practical strategy to reduce the deleterious consequences of heat stress in rabbits, as available data show that fibre is not only necessary in rabbit diets for functioning of the digestive tract, but also contains antioxidants which ameliorate heat stress (Adejinmi et al., 2013:).

Agro-industrial by-products are waste products arising from the processing of crops or animal products, usually by an agro-industrial firm. Fibrous agro-industrial by-products, which can be of tremendous use in livestock feeding, include brewers' dried grains, cassava peel, orange pulp, rice bran, maize bran, and palm kernel cake (Oke et al., 2016; Adejinmi *et al*., 2013). These agro-industrial wastes are by-products of sorghum, cassava, pineapple, maize and palm oil processing.

Brewers' dry grains (BDG) are solid waste from brewery industries. They are available and cheap but difficult to dry due to their high moisture content, especially during the wet season. There is wide variation in the proximate composition of BDG depending on the brewery producing it (Adejinmi et al., 2013). Brewers' dried grains contain about 19–25% crude protein, 10–22% crude fibre, ME of 7.38 MJ/kg, and gross energy of 3030–3170 Kcal/kg (Olupona et al., 2002).

High temperatures in tropical and developing countries such as Nigeria can lead to a significant reduction in daily weight gain; ambient temperature greater than 25°C affects growth performance due to decreased feed intake and nutrient utilization in rabbits (Liu et al., 2011). This is because high temperature stimulates thermal receptors to transmit suppressive nerve impulses to the appetite centre of the hypothalamus and to the thyroid. This reduces feed intake, leading to a decrease in the metabolic rate (Abdulrashid, 2016). It can also lead to dehydration, tissue catabolism and low metabolizable energy for growth, as more energy is consumed by the increased respiratory rate (Min et al., 2015).

Ondruska et al (2011) reported that high environmental temperature generates behavioural, physiological and immune responses, which could decrease feed intake and negatively affect the feed conversion ratio, body weight, and productivity. Therefore, the objective of the study was to evaluate the performance of growing bucks and does fed diets supplemented with brewers' dried grains.

MATERIALS AND METHODS

Location of experimental site

The study was conducted at the Rabbit Unit of the National Animal Production Research Institute (NAPRI), Shika, Zaria. Shika is situated at 11°12'42"′N, 7°33'14" E, 691 m above sea level (Ovimaps, 2020). The area falls within the Northern Guinea Savannah zone of Nigeria, with average annual rainfall of 1100 mm, from April to September. The mean maximum temperature varies from 19°C to 38°, depending on the season, and the mean relative humidity during the dry and wet season is 21% and 72%, respectively (IAR, 2020).

Experimental animals and management

Forty 6–7-week old New Zealand White weaner rabbit kits (20 females and 20 males), with an average initial weight of 0.75 kg, as well as 40 12–18-week old grower rabbits (20 males and 20 females) were sourced from the National Animal Production Research Institute, Ahmadu Bello University (NAPRI/ABU), Shika-Zaria for the study.

The rabbits were weighed and assigned to one of four groups constituting treatments defined by the level of BDG (0%, 20%, 30% and 40%), in a completely randomized design. Each rabbit within a group was a replicate. The rabbits were fed 100 g of concentrate daily supplemented with 100 g of hay three times weekly.

The diet was formulated to meet nutrient requirement for rabbits. They were fed every morning with the experimental diet (concentrate) containing 18–22% crude protein and 2500–2600 Kcal ME/Kg feed. Drinking water was provided daily *ad libitum*. The animals were allowed to adjust to the experimental diet for one week. They were kept in individual metal wire cages measuring 120 × 50 × 60 cm and placed 75 cm above the ground level. The light day in the rabbit house was 12 hours, the average relative humidity was 25%, and the average temperature was 32°C. Earthen pots were used as feeders and waterers in each cage. For the pregnant does (20 does), kindling nest boxes were provided in each cage from the 20–25 days of gestation. Coccidiostats and anti-stress drugs consisting of vitamins and electrolytes were administered to the animals at the start of the experiment. Routine management operations such as regular cleaning and disinfection of pens, cages, feeders and waterers were carried out regularly throughout the study period.

Parameters measured included daily feed intake and weight changes: initial weight, final weight, total weight gain, average daily gain, and feed conversion ratio.

Proximate analysis of BDG

Samples of BDG were analysed according to AOAC (1995) methods at the Biochemical Laboratory, Department of Animal Science, Ahmadu Bello University, Zaria.

Measurement of growth parameters

The initial weight, subsequent weekly weights, and final weight were measured with a weighing balance scale (Camry Emperors table scale with 20 kg capacity) to determine weight changes in the rabbits. Feed intake was determined by subtracting the leftover feed from the feed offered on the previous day. Feed efficiency ratio was calculated by dividing weight gain by feed intake.

Statistical analysis and modelling

Data for growth parameters were analysed using analysis of variance (ANOVA) in SAS software (2002), and the significant differences in means were separated by Duncan's Multiple Range Test (SAS, 2002).

Model for the experiment

$$Y_{ij} = \mu + A_i + \varepsilon_{ij}$$

where:

Y_{ij} – observation

μ – overall mean

A_i – fixed effect of BDG levels, i = 1, 2, 3, 4 (T1, T2, T3, T4)

ε_{ij} – random error

Table 1

Proximate analysis of BDG

Nutrient (%)	Percentage (%)
Dry matter	97.33
Crude Protein	23.38
Crude fibre	16.56
Ether extract	18.71
Ash	17.08

Source: Biochemistry Laboratory, Department of Animal Science, A.B.U., Zaria

Table 2
Ingredient composition and proximate composition of experimental diet supplemented with different levels of BDG

Ingredient (%)	**T1**	**T2**	**T3**	**T4**
Maize	27.60	27.00	27.80	30.00
Maize offal	40.00	34.00	29.20	15.00
BDG	**0.00**	**20.00**	**30.00**	**40.00**
Groundnut cake	27.00	14.00	8.00	10.00
Limestone	0.50	0.50	0.50	0.50
Bone meal	2.55	2.55	2.55	2.55
Common salt	0.25	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25	0.25
L-Lysine	0.77	0.77	0.77	0.77
DL-Methionine	0.68	0.68	0.68	0.68
Total	100	100	100	100
Calculated analysis				
Crude protein (%)	20.09	18.07	17.27	18.99
ME (kcal/kg diet)	2.49	2651	2651	2659
Crude fibre (%)	6.45	7.40	7.76	7.64
Ether extract (%)	4.29	4.65	4.83	5.18
Calcium (%)	0.92	0.95	0.97	1.00
Phosphorus (%)	0.48	0.49	0.49	0.50
Lysine (%)	1.36	1.30	1.27	1.35
Meth + cysteine (%)	1.14	1.17	1.19	1.28
Feed cost/25 kg (N)	1575.05	1476.30	1436.40	1440.60

ME = Metabolizable Energy, kcal/kg = kilocalories per kilogram, Meth = Methionine

RESULTS AND DISCUSSION

Performance of growing rabbit bucks fed diets supplemented with brewers' dried grains

Table 3 shows the feed intake and growth performance of growing rabbit bucks fed diets with varying levels of BDG. Initial weight, average daily feed intake, final weight and average daily gain showed no significant differences between treatments ($P > 0.05$). The feed conversion ratio was significantly varied ($P < 0.05$), with the best feed efficiency noted in the control and the poorest in the group receiving a diet with 20% BDG inclusion.

The initial weight, average daily feed intake (ADFI), final weight, and average daily gain of growing rabbit bucks fed diets supplemented with brewers' dried grains showed no significant differences, but ADFI was highest at 20% inclusion. Feed conversion ratio (FCR) was lowest (most

favourable) in the control, but did not translate to the final weight. The improved FCR may have been due to individual differences in feed utilization.

Table 3
Performance of growing rabbit bucks fed diets supplemented with brewers' dried grains (BDG)

Parameters	Level of BDG inclusion					
	0%	20%	30%	40%	SEM	P-Value
Initial weight (g)	1730.00	1530.00	1560.00	1560.00	81.01	0.3199
ADFI (g)	118.64	151.17	140.06	147.52	12.24	0.2748
Final weight (g)	2550.00	2390.00	2580.00	2720.00	85.00	0.0933
Average daily gain (g)	22.77	21.34	23.03	24.29	0.76	0.0933
FCR	5.22	6.99	6.08	6.08	0.41	0.0583

ADFI = average daily feed intake; ADG = average daily weight gain; FCR = feed conversion ratio; BDG = brewers' dried grains

Performance of growing rabbit does fed diets supplemented with brewers' dried grains

The performance of growing rabbit does receiving diets supplemented with varying levels of inclusion of brewers' dried grains is presented in Table 4. There were no significant differences ($P > 0.05$) in initial weight or average daily feed intake. There were significant differences ($P < 0.05$) in final weight, average daily gain, and feed conversion ratio. Final weight and average daily gain had a similar pattern, with the highest and lowest values recorded in the control and treatment 2, respectively. Feed conversion ratio showed a different pattern, as it was significantly higher in treatments 2, 3 and 4 than the control.

The final weight, average daily gain, and feed conversion ratio of growing rabbits fed diets supplemented with BDG were all significantly different between the control and the other treatments. The improved feed conversion ratio directly relates to average daily gain and final weight. This might be attributed to the feed having been easily utilized by the body of the rabbit. According to Etuk et al. (2003), protein nutrition is essentially amino-acid nutrition. Protein is very important for tissue growth and development (Asaniyan et al., 2009). If non-structural protein (NSP) is broken down into small molecules, it can be digested and utilized, leading to increased nutrient and protein accretion. Protein accretion results in growth and explains variations observed in the weight of laying hens (Madubuike and Obidimma, 2009).

Table 4
Performance of growing rabbit does fed diets supplemented with brewers' dried grains (BDG)

	Level of BDG inclusion					
Parameters	**0%**	**20%**	**30%**	**40%**	**SEM**	**P-Value**
Initial weight (g)	1520.00	1470.00	1462.00	1460.00	74.66	0.9320
ADFI (g)	116.56	120.24	128.93	131.53	6.16	0.3162
Final weight (g)	3080.00^{a}	2560.00^{b}	2770.00^{ab}	2650.00^{b}	131.49	0.0427
Average daily gain (g)	27.50^{a}	22.86^{b}	24.73^{ab}	23.66^{b}	1.10	0.0426
FCR	4.24^{a}	5.26^{b}	5.22^{b}	5.63^{b}	0.23	0.0038

ADFI = average daily feed intake;FCR = feed conversion ratio; SEM = standard error of mean; brewers' dried grains (BDG)

CONCLUSION

It was concluded from the findings of the study that brewers' dried grain in the diet of growing rabbit does did not affect their final weight or average daily gain, but they were better in the control group. The feed conversion ratio of both bucks and does was better in the control treatment than in the treatments with BDG.

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