THERMOREGULATORY PARAMETERS OF ADULT RABBIT BUCKS FED DIETS SUPPLEMENTED WITH BREWERS DRIED GRAIN (BDG)

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ABSTRACT
A study was conducted using twenty (20) adult rabbit bucks to evaluate the effect of feeding brewers dried grain (BDG) on thermoregulatory parameters. The rabbits were randomly allotted into the experimental treatments of four treatment groups with five (5) rabbits per treatment in a completely randomized design (CRD). In the first study, treatments were diets with 0, 20, 30 and 40% level of inclusion of brewers dried grain (BDG), respectively. Feed and water were served *ad libitum*. Thermoregulatory parameters such as respiratory rate (RR), heart rate (HR), rectal temperature (RT), ear temperature (ET) and scrotal temperature were measured weekly. Data generated were subjected to analysis of variance of SAS. There was no significant ($P > 0.05$) difference in pulse rate, rectal, ear, skin and scrotal temperatures across treatments. However, respiratory rates was significantly ($P < 0.001$) higher in rabbits fed diets supplemented with 30 and 40% BDG than in those fed 0 and 20% BDG diets. It was concluded that supplementing BDG in the diets of had little or no effect on thermoregulatory parameters measured although it didn't seem to have any deleterious effect.
Keywords: Rabbit, Bucks, Thermoregulation, BDG, Heat stress

INTRODUCTION
Livestock reared in developing countries found within the tropical region are highly vulnerable to the impact of climate variability and extremity (Thornton *et al*., 2007; IFAD, 2010). Rabbits, as homoeothermic animals can regulate the heat input and output of their bodies using physical, morphological, biochemical, physiological and behavioural processes to maintain a constant body temperature (Marai and Habeeb, 1994). The thermo-neutral zone (TNZ) for rabbits is 18–21°C (Habeeb *et al*., 1998). However, when rabbits are exposed to elevated ambient temperatures imbalances are induced in their body temperature (Habeeb *et al*., 1999), which adversely affect their growth and reproductive traits (Okab *et al*., 2008). The 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 necessary in rabbit diets for normal functioning of the digestive tract (Adejimi *et al*., 2013). Amongst factors that affect digestibility of feedstuffs, the most important factor is the amount of fibre. Agro-industrial by-products are waste products arising from the processing of crops or animal products usually by an agro-industrial firm. Agro-industrial by-products that are fibrous can be of tremendous use in livestock feeding. They include brewer's dried grain (BDG), cassava peel, orange pulp, rice bran, maize bran and palm kernel cake (Adejinmi *et al*., 2013; Oke *et al*., 2016). Brewer's dry grain (BDG) is a solid waste from brewery industries. It is available and cheap, but difficult to dry due to its high moisture content for easy storage and use, especially during the wet season. There is a wide variation in the proximate composition of BDG depending on the brewery that produced it (Adejinmi *et al*., 2013). The BDG contains about 19-25% crude protein, 10-22% crude fibre, Metabolizable Energy of 7.38 MJ/kg and gross energy of 3030-3170 kcal/kg (Olupona *et al*., 2002). The DBG from sorghum contains 31.6% CP, 7.8% CF, 13.7% EE, 16% ash and 3.07 Mcal/kg ME (Adama *et al*., 2007). Fasuyi *et al*. (2018) reported that BDG contains 87.5 dry matter, 22.1% CP, 7.6% EE, 53.3% NFE, 4.7% total ash, 12.3% crude fiber and 2485 kCal/kg metabolizable energy. As reviewed by Mussatto *et al*. (2006), BDG contains other nutrients, including minerals, vitamins and amino acids.

Thermoregulation in rabbits is rather poor as they have few functional sweat glands (Jimoh and Ewurola, 2016). The ears are also important for cooling as the blood moves to the farthest (coolest) points away from the body core. The rabbit will also stretch its body out as far as possible to cool through radiation/convection. However, due to presence of few functional sweat glands, rabbits lose small amount of moisture through the skin by perspiration (Anoh *et al.*, 2016). Therefore, the

objective of the study was to evaluate the thermoregulatory parameters of adult rabbit bucks fed diets supplemented with BDG.

MATERIALS AND METHODS

Location of Experimental Site

The study was conducted in the Rabbit Unit of the National Animal Production Research Institute (NAPRI), Shika, Zaria. Shika is geographically situated on latitude 11° 12´42´´N of the equator and longitude 7°33'14" E with an altitude of 691 m above sea level (Ovimaps, 2020).

Experimental Animals and Management

Twenty (20) adult rabbit bucks were used for the study. Diet was formulated to meet the nutrients 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 a period of one week. They were kept in individual metal wire cages measuring 120 × 50 × 60 cm and 75 cm above the ground level. Earthen pots were used as feeders and waterers in each cage.

The rabbits were equally assigned to one of the following levels of BDG 0, 20%, 30% and 40%. They were weighed and randomly allotted to four dietary groups in a completely randomized design. Each group constituted a treatment and each rabbit within a group a replicate. The rabbits were fed 100 g of concentrate daily and given 100 g of hay as supplement three times weekly.

Thermoregulatory parameters; pulse rate, rectal temperature, respiratory rate, ear temperature, skin temperature and scrotal temperature were measured and recorded.

Proximate Analysis of BDG

Samples of BDG were analyzed according to the methods described by AOAC (1995) at the Biochemical Laboratory, Department of Animal Science, A B U, Zaria

Table 1: Proximate analysis of the Brewer's Dried Grain

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

.Data Analysis

Data generated were analyzed using the analysis of variance (ANOVA) of SAS (2002). The significant differences in means were separated using pairwise-difference (P-DIFF SAS, 2002).

RESULTS AND DISCUSSION

Thermoregulatory parameters of adult rabbit bucks fed diets supplemented with BDG are shown in Table 2. There was no significant ($P > 0.05$) difference in pulse rate, rectal, ear, skin and scrotal temperatures across treatments. However, respiratory rates was significantly ($P < 0.001$) higher in rabbits fed diets supplemented with 30 and 40% BDG than in those fed 0 and 20% BDG diets. The respiratory rate (137.29 – 144.29 bpm) in the present study were within the range reported for stressed rabbits (60 – 300 bpm), (Willmer *et al*., 2000), but above the normal range of 30 -60 bpm for domestic rabbits (MVM, 2012). The result obtained in this study disagrees with the findings of Chintem *et al*., (2018) and Jimoh and Ewuola (2016) but corroborates with that of Marai *et al*. (2008). Due to high temperatures resulting to heat stress, the high respiratory rate observed could be attributed to failure of thermoregulatory mechanism of the rabbit bucks as reported by (Farghly, 2011).

CONCLUSION

From the findings of the present study it was concluded that supplementing BDG in the diets of had little or no effect on thermoregulatory parameters measured although it didn't seem to have any deleterious effect.

Table 2: Effect of feeding diets supplemented with Brewer's Dried Grain on thermoregulatory parameters of rabbit bucks.

Parameters	Levels of BDG inclusion (%)				SEM	P-Value
	0	20	30	40		
Pulse Rate (beat/min)	183.21	142.36	146.54	147.32	21.03	0.4862
Respiratory Rate (breath/min)	137.29^{c}	139.29^{bc}	144.29^{a}	143.43^{ab}	1.29	0.0004
Rectal Temperature (^{0}C)	39.10	39.10	38.97	39.42	0.22	0.4894
Ear Temperature (^{0}C)	38.25	38.13	38.13	38.30	0.12	0.6714
Skin Temperature (^{0}C)	49.51	38.41	39.08	38.94	5.36	0.3957
Scrotal Temperature (^{0}C)	48.60	38.81	38.04	38.08	5.34	0.4004

^{abc}means with different superscripts within the same row are significantly different, SEM-standard error of mean.

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