

EFFECT OF COCONUT WATER ON RECTAL TEMPERATURE, HEART RATE AND RESPIRATORY RATE IN BROILER CHICKENS FED COCONUT WATER DURING GROWING PHASE

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Abstract

The efficacy of coconut water (CW) in reducing the unfavourable effects of heat stress in broiler chickens were determined via the determination of rectal temperature (RT), heart rate (HR) and, respiratory rate (RR) during growth phase. Twenty-four, 3-week old broilers were offered either: 0, 25 or 50% CW in drinking water from day 21 to day 49. There were 4 replicates per treatment. Data on RT, HR and RR were collected during weeks 5 and 7 of the experiment when the effects of heat stress are expected to have become noticeable. Data on RT, HR and RR in both experiments were subjected to one-way analysis of variance. Results showed that RT and HR of birds were significantly lower ($P < 0.05$) in birds offered CW in drinking water. RR was not affected ($P > 0.05$) by treatment. Coconut water is effective in reducing RT and HR but not RR.

Key words: Broilers, Heat stress, Environment, Coconut water, Physiological parameters

Introduction

Chickens are homeothermic and therefore can maintain their body temperature within a narrow range (Smith, 2000; Genç, 2005). Compared to other species of domestic animals, broilers are more sensitive to high ambient temperatures. They have a thermo-neutral zone in environmental temperature in which body temperature maintenance is possible (Furlan and Macari, 2002). The ambient temperatures for optimal performance in broilers have been stated to be 18-22°C (Charles, 1985; 2002; Vilanova and Smith, 2004). Often, the environmental temperature in the pen outshoots the thermo-neutral zone of broiler chickens leading to heat stress (Abioja, 2010). Major physiological indicators of heat stress are increase in panting (a physiological mechanism for controlling body temperature), respiratory rate (Shane, 1988) and rectal temperature (Altan *et al.*, 2000).

Fast growing commercial broilers are highly sensitive to high temperature during growing-finishing phase (Abioja, 2010). Heat stress has major effects on the respiratory, thermo-regulatory, circulatory and endocrine systems (Chaiyabutyr, 2004). The energy and other nutrients which are intended for growth, immunity and feathering are often diverted to carry out thermo-regulation which limits the productivity and survival of the birds. Broiler chickens at 35 day of age when exposed to heat stress of 38°C showed increased rectal

temperature (Altan *et al.*, 2000). Shane (1988) reported that there was an increase in respiratory rate of chickens when exposed to a change in temperature from 27°C to 44°C. It is documented that heat stress affects water and ionic balance in broilers (Saif *et al.*, 2003), and thus affecting the homeostasis in the body that relies on metabolic pathways to occur. An increase in body temperature above the regulated range, because of exposure to hot environmental conditions may lead to a cascade of irreversible thermo-regulatory events that may be lethal for the birds (Yahav, 2000). The onslaught of heat stress is even escalating now that signs of the much-publicised climate change have become more evident day by day (IPCC, 2007).

Due to the persistent recognition that heat stress is a constant problem for efficient broiler production in the tropics, many researches have been aimed at reducing its effects. Abioja *et al.* (2012) suggested that various naturally available vegetative resources containing antioxidants could be harnessed and used in poultry to combat stress in stocks. Coconut water, a natural solution obtained inside the endosperm of coconut fruit, is a natural source of natural sugars and enzymes, vitamins, antioxidants, amino acids including L-Arginine, (LMP, 2014) and phytohormones (Yong *et al.*, 2009). Coconut meals (FAO, 2004; Rizal *et al.*, 2010) and oils (Ravindran *et al.*, 1986) had been used in poultry production before but not coconut water. This study is aimed at determining the

possibility that diluted coconut water can lead to a reduction in RT, HR and RR in broiler chickens during growing phase.

Materials and Methods

Animals and management

Twenty-four broiler chickens were used for the study. The chicks were brooded on wood-shaving floor from day-old till day 21. Standard diet containing maize (46%), soybean meal (18.5%), groundnut cake (15%), fishmeal (2%), wheat offal (12.45%), bone meal (2%), oyster shell (15%), salt (0.25%), premix (0.25%), methionine (0.3%) and lysine (0.25%) were given to the birds. Water and feed were supplied to the birds *ad libitum*. Vaccinations and medications were given as recommended. Coconut water treatment was administered between day 21 and day 49. The birds were offered either: ordinary water (0% CW) as control, coconut water diluted with water in ratio 1:3 (25% CW) or coconut water diluted with water in ratio 1:1 (50% CW). Ordinary water was supplied in the morning while diluted coconut water was supplied at 1300 hours daily when the ambient temperature is expected to be at its peak. There were four replicates per treatment.

Rectal temperature

Rectal temperature (RT) was measured with a Jorita digital thermometer (model: ECT-5) with 0.1°C accuracy inserted into the rectum (colon) of the birds for one minute as previously described by Yahav and McMurtry (2001) until the thermometer makes a beep sound.

Heart rate

HR was taken as number of beats per minute using a stethoscope.

Respiratory rate

RR of the birds was taken as the number of breaths per minute. It was measured visually with the aid of a stop watch. The wing feather was raised to expose the skin of the bird and then the breathing movements were counted when breathing was observed to be stable.

Statistical analysis

Data on RT, RR and HR were subjected to one-way analysis of variance using SYSTAT, 1992.

Model is:

$$Y_{ij} = \mu + C_i + \Sigma_{ij}$$

where:

Y_{ij} = yield; μ = population mean, C_i = i^{th} effect due to coconut water ($i = 1, 2, 3$) and Σ_{ij} = residual error.

Means observed to be significantly different were subjected to mean separation using Tukey's procedure of SYSTAT with level of significance taken as $P \leq 0.05$.

Results and Discussion

Table 1 shows result on effect of coconut water on RT, RR and HR of broiler chickens during their growing phase. The effect of coconut water on RT and HR of birds was significant ($P < 0.05$). The control group had higher RT than birds offered 25% CW. The RT of birds on 50% CW was not significantly different ($P > 0.05$) from that of control and 25% CW. The effect of coconut water on HR indicated that control had higher HR than birds offered 50% CW while the HR of birds offered 25% CW was similar ($P > 0.05$) to control and 50% CW. However, the effect of coconut water on RR was not significant ($P > 0.05$) in growing broiler chickens.

It appears that CW was effective in reducing RT of broilers. This is in consonance with the reports of Sayed and Shoeib (1996) and Kutlu and Forbes (1993) that ascorbic acid (vitamin C) reduced skin and RT of broiler chickens. However, this result is contrary to the report of Miraei-Ashtiani (2004) that the inclusion of vitamin C in feed of broilers did not result in any difference in cloacal temperature and that of Abioja *et al.* (2012) that addition of honey to the drinking water of birds at 10ml and 20ml respectively was not effective in reducing the RT of broiler chickens. Lowest RT was observed in the 25% CW treatment group. Although a higher level of inclusion of CW (50% CW) in drinking water did not result in lowering the RT of birds at adult age when compared to 25% CW.

This result coincides with the report of Abioja *et al.* (2012) that a dosage of 20ml of honey per litre of water resulted in increased HR as a result of forceful pumping of blood by the heart in order to supply all parts of the body. The reduction in HR means that the heart is faced with less stress and is not pumping blood at a higher force as found in heat-stressed birds. This indicates the effectiveness of coconut water in lowering the HR of broiler chickens as some additional materials other than vitamin C found in CW may have been responsible for this reduction.

CW had no significant effect on RR of broilers and was not effective in reducing the respiratory rate of birds at all treatment levels. This does not agree with the reports of Kutlu and Forbes (1993) that panting rate (RR) was reduced in heat-stressed chickens given ascorbic acid (vitamin C); and that of Abioja *et al.* (2012) that addition of 20ml honey to drinking water of birds lowered their RR at 8 weeks during hot-dry season.

Conclusion

The addition of CW to drinking water of broiler chickens may help in reducing RT and HR of

growing broiler chickens and can be given during 4th -7th week of growth when broilers are likely to experience higher thermal challenge.

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Table 1:- Effect of coconut water on RT, RR and HR of growing broiler chickens

Parameters	Control	25%CW	50%CW
Rectal temperature (°C)	40.4±0.32 ^a	39.7±0.22 ^b	40.3±0.22 ^{ab}
Heart rate (beats/minute)	64.0±4.98 ^a	61.0±3.52 ^{ab}	49.0±3.52 ^b
Respiratory rate (breaths/minute)	205.0±7.59	218.0±5.36	217.0±5.36

^{a,b}Means within the same row with different superscripts differ significantly (P<0.05), CW- coconut water