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Egg lipid and vitamin A content in laying pullets administered honey during hot-dry season

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Abstract
An experiment was carried out to determine the effect of honey on lipid profile and vitamin A content of eggs from laying pullets during thehot-dry season. One hundred and twenty laying pullets (aged 28 weeks) used were randomly assigned to 3 doses of honey: 0 (0H), 10 (10H) and 20ml honey (20H) per litre water for 16 weeks. Each treatment group consists of 4 replicates with 10 birds per replicate. During16 weeks experimental period, data on egg cholesterol, HDL, LDL, VLDL and vitamin A were determined and subjected to one-way analysis of variance. Egg cholesterol, HDL, LDL, VLDL and vitamin A concentration were not significantly (P>0.05) affected by dosage of honey in drinking water. In conclusion, administration of honey in drinking water of laying pullets to combat heat stress during hot-dry season may not affect egg lipids and vitamin A content.

Keywords: Egg; Fat, Cholesterol, Climate change; Heat stress

Introduction

The problem of heat stress (HS) in poultry production remains persistent under tropical conditions (Rozenboim *et al*., 2007). High environmental temperaturethat exceeds the thermal comfort of the birds, coupled with raised relative humidity increases the heat load. HS is associated with suppressed feed intake, liveweight, egg production, egg weight, shell quality and internal qualities of eggs in laying chickens (Khan *et al*., 2011). It triggers hypothalamic-hypophyseal-cortex axis releasing corticosterone. Circulating corticosterone exhibits cytotoxic properties and enhances the generations of reactive oxygen species. These are radicals that cause perturbations in oxidative balance, overwhelming the natural oxidative defense mechanisms in the cells. The use of phytochemicals which possess efficacious anti-oxidant properties in the management of heat stress is becoming more popular.Honey has recently received attention as a candidate (Abioja*et al*., 2012; Osakwe and Igwe, 2015; Oke *et al*., 2016) with some positive results.

However, it was reported that there were infiltrations of fat cells in the liver tissue of albino rats (Avwioro *et al*., 2012)when honey was administered for a long period. This may result in non-alcoholic fatty liver disease (Alagwu *et al*., 2009). Besides, improvement in egg vitamin A content is of public health importance.Millions of preschool-aged children in developing countries are suffering from vitamin A deficiency, which may lead to blindness (Underwood, 1998). Fortification of eggs for the children will be a welcome idea.Report on vitamin A content of eggs from pullets fed honey is not readily available.

Therefore, the present study aimed at determining the deposition of cholesterols and vitamin A in eggs of laying pullets offered honey during thehot-dry season.

Materials and methods

This experiment was carried out at Aiyedoto Farm Settlement, Ojo Lagos, Nigeria (latitude 6° 27' 25"N, longitude 3°12' 21"E and altitude of 36 metre above sea level). The climate of the experimental site is humid, located in the rainforest vegetation zone of western Nigeria. Wet-and dry-bulb temperatures and relative humidity at the level of the birds in the pen at 0800 h and 1600 h were monitored throughout the experimental period. The temperature-humidity index was calculated from relative humidity and wet- and dry-bulb temperature data.

One hundred and twenty*ISA Brown* layer chickens aged 28 weeks were used for the experiment which last for 16 weeks. The birds were randomly allocated to three (3) treatments consisting 4 replicates and 10 layer birds per replicate. Birds in the three groups were supplied water for 16 weeks during the hot-dry season with 0ml (Control), 10ml (10H) and 20ml (20H) honey per litre water respectively. Standard ration was given *ad libitum* to the birds for the experimental period. Two eggs were randomly collected from each replicates. The egg yolk was prepared by pooling and blending two yolks per sample. Samples were subjected to extraction and saponification. The lipoprotein content (total cholesterol, high-density lipoprotein (HDL), low-density (LDL) and very low-density lipoprotein (VLDL) were measured by specific commercial kits. Vitamin A levels was determined using HPLC (Catignani, 1986).

Data collected was subjected to one-way analysis of variance (ANOVA).

Results and Discussion

Table 1 shows the summary of meteorological observations during the experiment. Environmental temperature averaged 31.5°C during the experiment. Average temperature in the morning (08.00h) and afternoon (16.00h) was 30.4 and 32.5°C respectively. Wet-bulb temperature 27.8°C, 28.8°C and 28.0°C, and relative humidity of 82.3%, 76.7% and 79.5% were recorded in the morning, afternoon and on average respectively. Administration of honey in drinking water did not significantly ($p>0.05$) influence egg cholesterol, high-density, low-density, very low-density lipoprotein and vitamin A (Figures I A - E).

Table 1: Summary of meteorological observations during the experiment

Parameters	08.00h	16.00h	Mean
Dry-bulb temp. (°C)	30.4	32.5	31.5
Wet-bulb temp. (°C)	27.8	28.8	28.0
Rel. humidity (%)	82.3	76.7	79.5
Temp-hum. index	83.8	86.0	84.9

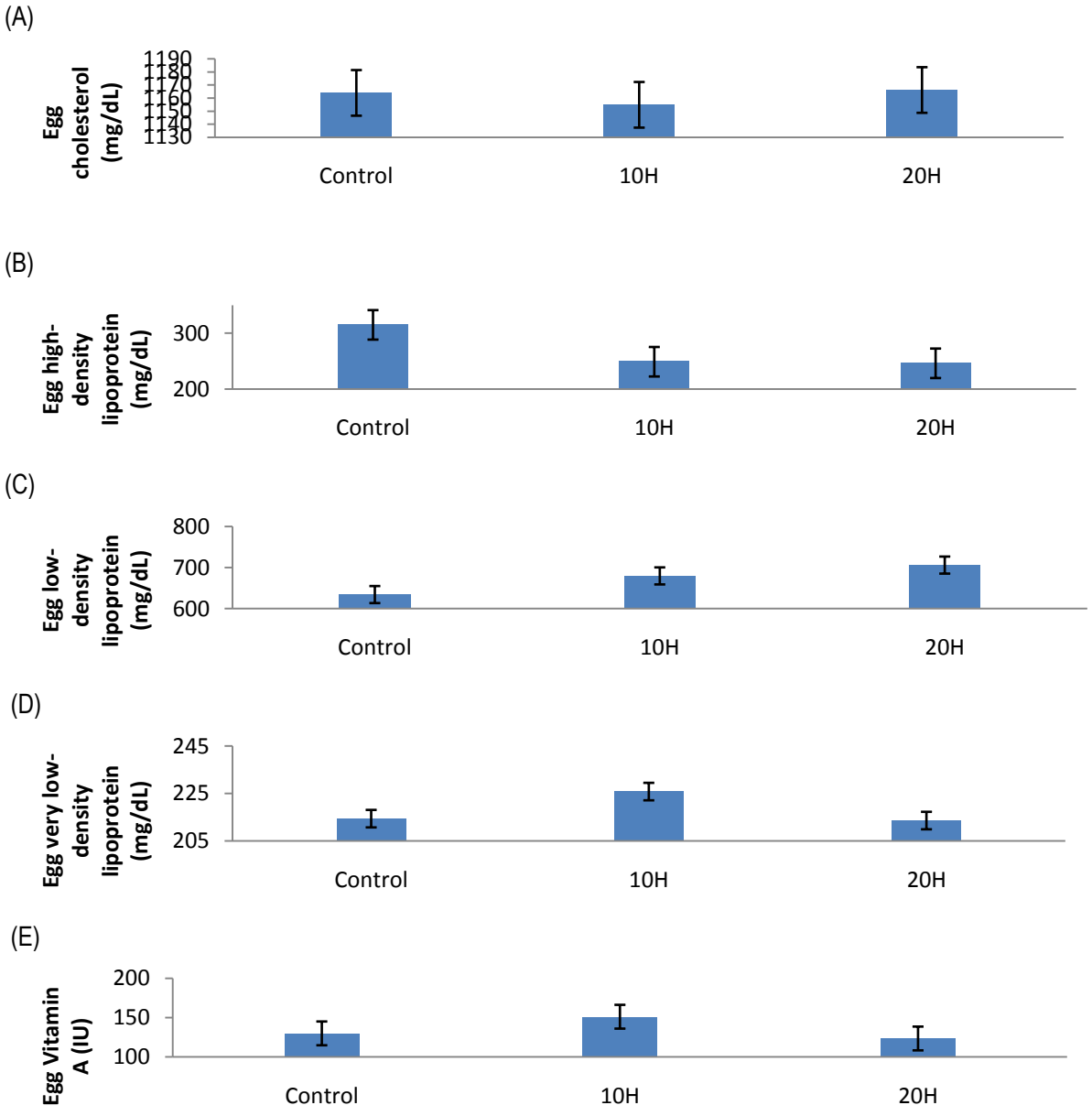


Fig. 1A – E: Effect of honey on (A) egg cholesterol, (B) high-density-, (C) low-density-, (D) very-low-density- and (E) vitamin A content in laying pullets during hot-dry season

Optimal productivity in laying chickens is obtained when at pen temperature range of 16-25^{o}C, beyond which hens exhibit signs of HS (Sahin*et al.*, 2006). The average temperature recorded during this study (31.5^{o}C) was 6.5^{o}C above the upper critical limit of therecommended temperature range. The experimental location, Lagos is a coastal region, with relative humidity as high as 76.7-82.3% during the study. The detrimental effect of HS on birds is further aggravated by the elevated relative humidity (Ciftci*et al.*, 2005). Honey administration resulted in increased egg mass in the first week as well (Abioja *et al.*, 2016; Adekunle *et al.*, 2017). In this studyhowever, no effects of honey were observed in egg lipid (cholesterol, VLDL, LDL and HDL) and vitamin A profiles. In another report, there were no effects of honey consumption for 7 days on plasma cholesterol, HDL, LDL and cholesterol HDL ratio in male Wister Albino rats(Aliyu *et al.*, 2012). In contrast, the same authors observed decreased level of VLDL.The present finding is in agreement with (Ramesh *et al.*, 2009) that the use of herbal preparation Abana™ and garlic paste on lipid profile of layers showed no significant change in yolk cholesterol.

The fact that honey administration in laying pullets during hot-dry season does not alter lipids content of eggs may be adduced to little or no fat content in honey(Buba *et al.*, 2013; Alvarez-Suarez *et al.*, 2014; Chua and Adnan, 2014). Some reports listed out the nutritional composition of honey without any reference to fat or lipid content (Adenekan *et al.*, 2012; Omoya *et al.*, 2014). The report on the composition of different unifloralhoneys in Bangladesh indicated that honey contains little amount of lipid and therefore not considered a good source of lipid (Buba *et al.*, 2013). In previous work with honey in poultry species, percentage abdominal fat was reported to remain constant in broiler chickens offered varying levels of honey in drinking water (Oke *et al.*, 2016). Other reports show a decrease in serum cholesterol level (Obun*et al.*, 2013). In a study determining the yolk retinol content in eggs from hens fed different levels of dietary vitamin A, egg yolk retinol content increased linearly as maternal dietary vitamin A increased(Mendonça*Jr et al.*, 2002). These authors concluded that the nutritional value of eggs, related to vitamin A, can be improved by dietary manipulation of hen diets. However, honey administration in drinking water did not alter vitamin A content of egg yolk in the present study.

Conclusion and Recommendation

Honey in drinking water of laying pullet during heat spell did not affect both lipid profile and vitamin A content in eggs. It could be used up to 20ml per litre water for laying pullets.

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