Comparative skin histology of Fulani ecotype and broiler chickens (*gallus gallus domesticus*) in Sokoto State, Nigeria

The aim of this study was to compare the histomorphometry of the skin in Fulani ecotypes/local and broiler chickens. A purposive sampling method was used to select ten (10) healthy local and broiler chickens each which were purchased from the meat market of Sokoto metropolis. The birds were weighed and sacrificed by severing the jugular veins. The feathers around the abdomen, neck, pectoral, synsacral and thigh were plucked and skin samples collected from same areas and processed using routine Hematoxylin and Eosin procedures. The epidermal skin thickness of the abdominal, neck and pectoral segments in broilers were significantly thicker (P≤0.05) compared to that of the local chickens. However, the thigh skin in local chicken was significantly thicker (P≤0.05) than in the broilers and the synsacral skin segment showed no significant difference between the two birds. Furthermore, the abdominal skin epidermal thickness has the highest mean thickness in both birds and the lowest epidermal skin thickness was seen in the thigh and neck regions in broiler and local chickens respectively. The loosely arranged fewer number of cells observed in the hypodermis create spaces which connect with air sacs to enhance their flying abilities. It was concluded that broilers have thicker skin compared to the Fulani ecotypes (local chicken) and this difference in the epidermal thickness observed between the two breeds could be related to the difference in their genetic composition, feeding, environmental condition and age. Furthermore, a thicker epidermis signifies a better physical barrier, chemical barrier and immunologically active barrier and also a better water holding capacity of the skin in broilers than in the Fulani Ecotypes.

**Key words:** Broilers, dermis, epidermis, local chicken and skin

**INTRODUCTION**

Poultry is domesticated birds raised for their meat, eggs and/or feathers. They are members of the orders Galliformes (such as chickens and turkeys) and Anseriformes (waterfowls such as ducks and geese). Chicken originate from Southeast Asia and it’s the most popular poultry species utilized in Nigeria. Guinea fowls are also poultry originated from Africa; they are a domesticated form of the helmeted Guinea fowl. Most poultry farms prefer intensive production method instead of the free-range option (David, 2015). There are two breeds of Nigerian Indigenous Chicken (NIC), namely Fulani Ecotypes and Forest savannah Ecotypes, the Fulani Ecotypes are found in the Sahel and Guinea savannah part of Nigeria and their mature weights are between 0.9kg and 2.5kg (Akinbobola, 2018). A broiler is any chicken that is bred and reared for meat production, they slaughter weight
their slaughter age is between 4 to 7 weeks of age and have white feathers and yellow skin (Bessei, 2006).

The skin in birds is modified to enable them to carry out special functions. These modifications are; feathered skin, scale covering of the skin on the lower legs and feet, hard, horny areas of the beak and toenails, padded foot (or planter) and skin of the comb and wattles (Dyce et al., 2010). The skin of local and broiler chickens have the same basic structure as that of mammals, namely an outer epidermis and an inner dermis (Dyce et al., 2010). The outer epidermal layer of the skins provide a barrier to infection from environmental microbial pathogens and regulate the amount of water loss from the body into the atmosphere through transepidermal water loss (Barbara, 2014, Mark and Jeffery, 2006, Proksch et al., 2008).

Furthermore, it is known that birds do not have sweat glands on their skin, hence they lose heat via the respiratory tract by panting (Ahmad and Sarwar, 2006). However, little or no information is available on the skin histology of the Fulani Ecotypes (Nigerian indigenous/local chicken) and broiler chickens. Therefore, data to be generated from this study will bridge the gap of information. The aim of this study is to evaluate and compare the skin thickness and histology of local and broiler chickens.

**MATERIALS AND METHODS**

**Chicken**

Ten (10) adult (8 weeks old) healthy Nigerian indigenous/local (Fulani Ecotypes) and broiler chickens were selected for this study using a purposive sampling method, the chickens were purchased from the meat market in Sokoto metropolis. The birds were housed in a well-ventilated cage and then transported to the Faculty of Veterinary Medicine, Usman Danfodiyo University Sokoto.

**Skin sample**

The birds were weighed and then sacrificed by severing the jugular veins. The feathers around the neck, dorsum, sacrum and thigh were plucked in preparation for skin sample collection. The skin samples were excised taken using a scalpel blade by making a rectangular incision on the de-feathered areas and then put in sampling bottles.

**Histological examination**

The obtained tissue samples were dipped in 10% formaldehyde. The skin tissues were subjected to Hematoxylin and Eosin procedures for routine histology (Suvarna et al., 2019). After the histological preparation of the slides, the slides were viewed using a microscope and their photomicrographs were captured using a Panasonic Lumix Digital Camera (7.2 Megapixels, DMC-FX07 Model) for further evaluation and detailed histological studies.

**Statistical analysis**

Morphometric software package (Image; 1.50e version) was used to measure the thickness of the epidermal layers in pixels across the five (5) skin samples (abdominal skin, neck skin, pectoral skin, synsacrum skin and thigh skin) of both 5 broilers and 5 local chicken. The obtained data were statistically compared using student t-test. The difference was considered significant at \( P \leq 0.05 \). The statistical analysis was performed using GraphPadInStat statistical software version 3.0.

**RESULTS**

Our results (Table 1) demonstrated significant difference (\( P \leq 0.05 \)) in the epidermal skin thickness of the abdominal, neck and pectoral segments in broilers compared to the local chicken, however the thigh skin in local chicken was significantly thicker (\( P \leq 0.05 \)) than in broilers and the synsacral skin segment showed no significant difference between the two birds. Furthermore the abdominal skin epidermal thickness had the highest mean value in both birds and the lowest epidermal skin thickness was seen in the thigh and neck in broilers and local chickens respectively.

The basic structure of the epidermis and dermis is similar in all the five segments of the two birds in this study, the photomicrographs showed stratum corneum, stratum germinativum and basale regions of the epidermis and collagen fibres and melanosomes in the dermis (Figure 1-

<table>
<thead>
<tr>
<th>Epidermal skin</th>
<th>Broiler Chicken</th>
<th>Local chicken</th>
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<tbody>
<tr>
<td>1 Abdominal skin</td>
<td>27.57±4.83(a)</td>
<td>22.68±9.09(b)</td>
</tr>
<tr>
<td>2 Neck skin</td>
<td>14.14±2.11(a)</td>
<td>11.9±0.24(b)</td>
</tr>
<tr>
<td>3 Pectoral skin</td>
<td>19.74±4.57(a)</td>
<td>14.28±1.84(b)</td>
</tr>
<tr>
<td>4 Synsacralskin</td>
<td>16.62±1.94(a)</td>
<td>15.59±2.42(a)</td>
</tr>
<tr>
<td>5 Thigh skin</td>
<td>12.18±0.84(a)</td>
<td>16.86±0.76(b)</td>
</tr>
</tbody>
</table>

Means in the same row with different superscript differ significantly (\( P \leq 0.05 \)).
Figure 1: A photomicrograph of abdominal skin in broilers, showing the epidermis (E), stratum corneum (black arrow), stratum germinativum and basale (white arrow), dermis (D), collagen fibers (red arrow) and melanosome (green arrow) X400

Figure 2: A photomicrograph of abdominal skin in local chicken, showing the dermis (D), stratum corneum (black arrow), Stratum germinativum and basale(white arrow), collagen fibers (red arrow) and melanosome (green arrow) X400

Figure 3: A photomicrograph of neck skin in broilers showing the epidermis (E), stratum corneum (black arrow), stratum germinativum and basale(white arrow), dermis (D), collagen fibers (red arrow) and melanosome (green arrow) X400

Figure 4: A photomicrograph of neck skin in local chicken showing the epidermis (E), stratum corneum (black arrow), Stratum germinativum and basale(white arrow), dermis (D), collagen fibers (red arrow) and melanosome (green arrow) X400
Although the pectoral skin in broilers and local chickens had scanty collagen fibres and melanosomes. The dermis had fewer numbers of cells and they appeared loosely arranged unlike the dermis.
DISCUSSION

The epidermal skin thickness of the abdominal, neck and pectoral segments in broilers were significantly thicker (P≤0.05) compared to the local chicken, however, the thigh skin in local chicken was significantly thicker (P≤0.05) than in broilers, and the synsacral skin segment showed no significant difference between the two birds. Furthermore, the abdominal skin epidermal thickness has the highest mean value in both birds and the lowest epidermal skin thickness was seen in the thigh and neck in broiler and local chickens respectively.

The histomorphological observation reveals that the basic structure of the epidermis and dermis is similar in all the five segments of the two birds in this study, although the pectoral skin in broilers and local chickens had scanty collagen fibres and melanosomes. The loosely arranged fewer number of cells observed in the dermis create spaces which connect with air sacs to enhance their flying abilities (Stettenheim, 2000).

It was concluded that broilers have thicker skin compared to the Fulani ecotypes (local chicken) and the difference in the epidermal thickness observed between the two breeds could be related to the difference in their genetic composition, feeding, environmental condition and age. Furthermore, a thicker epidermis signifies a better physical barrier, chemical barrier and immunologically active barrier and also a better water holding capacity of the skin in broilers than in the Fulani Ecotypes (Proksch et al., 2008).

REFERENCES