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RESEARCH ARTICLE

EFFECT OF GENOTYPE ON MORPHOMETRIC TRAITS AND BODY TEMPERATURE OF THREE GENOTYPES OF CHICKEN (*GALLUS GALLUS DOMESTICUS)* RAISED IN THE HUMID TROPICAL STRESSFUL ENVIRONMENT.

[*]N'dri Aya Lyde[1,2], Koua Bekoin Herman Wenceslas[1], Fofana Nambaté[1] and Adepo-Gourene Abouo Béatrice[1,2].

1. Laboratory of Biology and Animal Cytology, Research and Training Unit of Natural Sciences-University of Nangui Abrogoua, 02 BP 801 Abidjan 02, Côte d'Ivoire.
2. Laboratory of Genetic and Bioresources Improvement, Research and Training Unity- University of Nangui Abrogoua, 02 BP 801 Abidjan 02, Côte d'Ivoire.

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Abstract

The objective of this work was to assess the level of stress sensitivity of three genotypes of chickens differing in body weight. A total of 62 birds of the 3 genotypes (21 local chicken, 20 commercial naked neck and 21 fully feathered hybrid chicken were reared in confinement together, under the same conditions. Body parameters and body temperature (BT) at 30 weeks of age was recorded for each genotype 3 days. All other body parameter traits were differed significantly among the genotypes. Commercial naked neck and fully feathered had better in almost all the traits. However, at day1, BT1 were 41.435 °C, 41.709 °C and 41.915 °C respectively for local chickens, naked necks and fully feathered hybrids under 37.1°C of ambient temperature and relative humidity of 46 %.. At day 2, the BT2 were 41.271 °C, 41.637 °C and 41.825 °C respectively for local chickens, the naked necks and the fully feathered hybrids, under 36 °C of ambient temperature and relative humidity of 40 %. At day 3, the BT3 were 41.369 °C, 41.585 °C and 41.784 °C respectively, under 35.2 °C of the ambient temperature and relative humidity of 53 %. These last results showed that the local chickens on susceptibility to humid tropical heat stress were smaller than in commercial hybrid chickens.

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Introduction:-

Poultry production is an important economic activity in Africa. Besides to its economic and social values (**Bettencourt *et al*., 2015**; **Fotsa *et al.*, 2007**), it is the first source of high quality protein food contribution to rural smallholder farming families in Africa (**Sonaiya *et al.*, 1999; Tadelle and Ogle, 2001**). Both poultry egg and meat enrich and contribute to a well-balanced diet to satisfy human nutritional needs. Approximately 20% of protein consumed in developing countries is provided by poultry (**Askov and Dolberg, 2002**). This quantity is not sufficient because it does not cover all the needs of the body.

In Côte d'Ivoire, the backyard products are a staple in the human diet (**Fofana, 2010**). Primarily, poultry production is an essential activity in the animal production system. Furthermore, family farming is a production of about 22

Corresponding Author:- N'dri Aya Lyde.
Address:- Laboratory of Biology and Animal Cytology, Research and Training Unit of Natural Sciences-University of Nangui Abrogoua, 02 BP 801 Abidjan 02, Côte d'Ivoire.

million birds on average, corresponding to 70% of national poultry numbers (**FAO, 2008**). Despite the high number of poultry farms, their contribution to farm households and national income is still very low (2-3%). Specially, Sub-Saharan Africa production represents just 1.5% of world chicken production (**FAO, 2003**). Moreover, this production weighs practically nothing in world trade.

Indigenous chickens are reared in scavenging system with no extra feeds, housing, vaccine, medicine or management. Birds thrive on residual grains in the yard and surrounding residence, kitchen wastes, insects and earthworm (**Islam and Nishibori, 2009**). Moreover, the productivity of birds under the rural production system is very low in terms of egg production, size of eggs, growth rate and survivability of chicks (**Teketel, 1986**), which may be in first time attributed to lack of improved poultry breeds, the presence of predators, the high incidence of diseases, poor management and bad quality of feeding by farmers (**Alemu, 1987**). The indigenous chicken shows low performances comparatively with exotic or hybrid or selected poultries but indigenous chickens seems to have the advantage of being well adapted to the local stressful conditions in the rural areas such as high temperature (**Fotsa *et al.*,2007; Keambou *et al*., 2014a**).

Heat stress had multiples consequences on poultry under both rural smallholder and large-scale systems. Heat stress increases mortality and, decreases growth performances and reproduction (**Lefcourt and Adams, 1996; Hahn and Mader, 1997; St-Pierre *et al.*, 2003; N'dri *et al.*, 2007**). Livestock performances are affected by heat stress because an animal having difficulties in dissipating excess body heat to its environment. In effect, because of its physiological characteristics, chicken is particularly sensitive to changes in temperature and heat stroke. This sensibility is even more pronounced in commercial strains selected and causes significant losses due to cessation of breeding activity or shortfalls during the hottest time of the year (**Collins *et al.*, 2005; Temim *et al.*, 2009**). High environmental temperature is perhaps the most important inhibiting factor to poultry production in hot regions above all in hot-humid zones of the world (**Ayo *et al.*, 2005; keambou *et al.*, 2014b**).

The term heat stress has different connotations in different regions of the world. In tropical countries, ambient temperatures can remain consistently high for extended periods of time, whereas in temperate regions short, the acute periods of heat stress can be the major problem.

Many criteria like, body temperature, respiration rate, and open-mouthed breathing (**Mader *et al.*, 1997, 1999; Gaughan *et al.*, 2004; Brown-Brandl *et al.*, 2005, N'dri *et al.*, 2006, Keambou *et al*., 2013**) and Left-right asymmetry of bilateral traits (**Van Poucke *et al.*, 2007**) have been used for heat stress evaluation in studies. Body temperature is a method of assessing the physiological response of an animal to the climatic environment. It was evaluated through rectal temperature. The rectal temperature is an important indicator for heat tolerance in poultry because it truly reflects the internal body temperature and it is a reliable index of thermal balance (**Ozkan *et al.*, 2003**).

The objective of the present study was to assess the level of stress sensitivity of three genotypes of chickens differing in body weight. Specifically, local chickens, commercial hybrid (such as fully feathered and heterozygous naked neck chickens) were compared using some morphological traits and body temperature, raised in a humid tropical environment.

Materials and Methods:-

Description of the Study Area

The study was performed in a poultry farm in Tieple (10o29/N, 08o03/E), a village located near Bouake (Figure 1)**.** Bouake is located about 350 km from Abidjan, with a population of approximately 695.000 inhabitants for the department, and about 1.5 million people with all localities agglomerated attached to them. It is the second most populous city after Abidjan. The Central region climate is classified as humid tropical. Temperature recordings ranged between 22°C and 35°C with relative humidity rate which ranged between 50% and 60%. The mean of the rainfall was 1200 (mm/year).

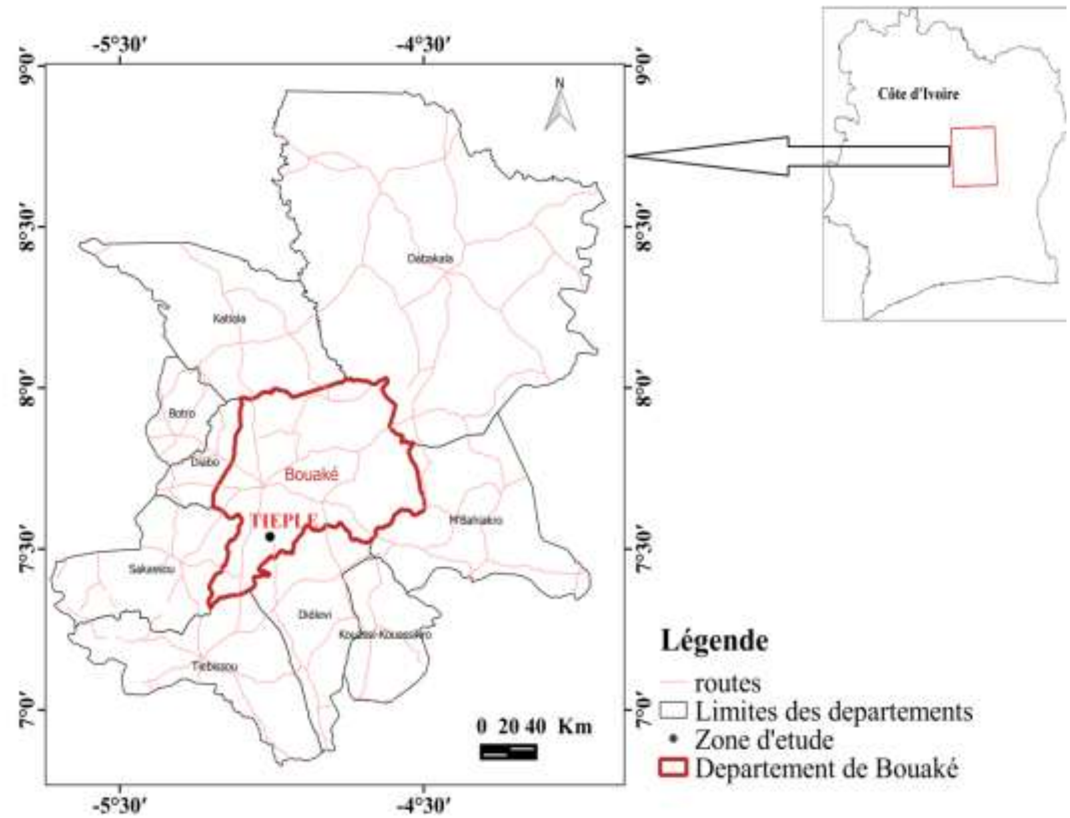

Figure 1:- Location of the area of survey (QGIS)

Birds and flock management:-

A total of 62 chickens compound 3 genotypes (Figure 2) were used in this study. An effect, a total of 65 eggs of local birds were obtained from famers. These eggs without treated were kept in a conventional way (maximum 7 days) before being artificially incubated. Among the chicks resulting from incubations, only a total of 21 viable ones presenting good health were retained for the experiment. Furthermore, 41 commercial exotics hybrids chickens with two genotypes (21 fully feathered birds and 20 heterozygous naked neck birds) were used. All birds, local and exotics, were obtained from the same commercial hatchery at 1-d-old. All three genotypes were subjected to similar treatment throughout the study period. Birds were reared together in a single room on wood chip litter. Routine vaccinations of birds against common infectious diseases at the recommended doses were carried out. These are vaccinations against Newcastle, Gumboro and fowl pox diseases were carried out while prophylactic antibiotics and anticoccidial drugs were appropriately administered. Other routine management practices were also carried out. Feed and clean water were provided ad libitum and the birds were provided 12 h of natural lighting.

Figure 2:- The studies genotypes

Traits measured:-

Body weight (W) (in grams) and seven linear body measurements (in millimeter) namely shank length (SL), comb length (CL), comb height (CH), wattles length (WL), wattles width (WW), tarsus length (TL) and tarsus diameter (TD) were measured on each bird respectively with a digital scale 0.01g accuracy, a caliper and a tape of 1 mm accuracy respectively. All of these measurements were done according **Francesch *et al*. (2011)**. Concerning the body weight, individual day-old and 1-week interval body weights until 12 weeks of age were obtained, to the nearest gram, for all chicks. Then, body weight at 30 week of age was also recorded.

Rectal body temperature (BT) was measured by SHARPTEMP a digital thermometer (±0.1°C) with an insertion probe and recorded when the reading was stable for 15 s. This operation was performed by one operator, using inserted about 2 cm via the cloaca into the rectum. For body temperature measurement, bird was caught and sampled one immediately after another. The catching procedure did not exceed 1 min. Measurements of BT in pullets were taken during three days, three days apart, BT1, BT2 and BT3. The three BT1, BT2 and BT3 were made with 1 day of interval for the age of 30 weeks. During these measures, the ambient temperature and the relative humidity were also raised. The meteorological data for rearing local during the study period are given in table 1.

Analyses statistique:-

The sexing has not been made before 12 weeks of age because of the difficulty to distinguish the cock and local hen, so the effect of the sex was considered just for the characters of body composition and body temperature. The data were seized on table Excel 2010 and analyzed with the statistical software R, 3.3.1 version concerning the weights, their variations as well as the daily average profits. According the body temperatures and body measurements, they were analyzed with the software Statistica 10 trial, evaluation's version. The statistical comparisons are carried out by using analysis of variance (one factor) for multiple comparisons among the genotypes for animals' growth. Concerning, the parameters of body measurement and the rectal temperature, the variance analysis of 2 factors (genotype and sex) was used.

Results and Discussion:-

The goal of this study was to assess the effects of tropical environmental conditions on the heat stress responses of 3 different genotypes of chickens, with a specific focus on the body temperature, some body weight and morphological traits. The tropical climate can best be described as hot and humid, and the ambient temperature and relative humidity (RH) have been well documented as stress factors in chickens (**Lin *et al.*, 2005**). In this study, 3 different genotypes of chicken, ranging from high- to low-yield meat producers (i.e., two commercial hybrid chickens and a local indigenous chicken, respectively) were compared in the tropical stressfully ambient temperature.

Performances:-

The Least squares (LS) mean of body weight, weight variation and daily body weight gain (W1, W12, W30, WG_{12-30} and dWG_{12-30}) of birds used in this study were assigned in table 2. Growth parameters at 30 week of age of birds used was ranged between 929.41 and 1987.50 g for body weight, and between 2.53 and 6.71 daily body weight gain. Growth value exhibited for studies animals confirm these slow growing conditions compared to broilers.

SL means of body measured parameters of birds takes together are summarized in tables 3, 4 and 5. Sexual dimorphism was observed for all body traits. Better values were in favor of the cocks. This is due to the marked sexual dimorphism between the two sexes in favor of the cocks in chickens **Mignon-Grasteau and Beaumont (2000)**.

LS means for each rectal temperature in the three recorded for our study populations are given in tables 6, 7 and 8. Rectal temperature values observed in our study ranged between 41. 119 and 41.937°C. Otherwise, for the three temperature recording, birds used in our study all genotypes takes together showed out similar rectal temperature (p>0.05). LS mean of this traits was 41.69°C. This value was the same with other findings in previous study (**N'dri *et al.*, 2006**). These authors found out rectal temperature ranging from 41.6 to 41.8°C. However, birds used in their study were an exotic label chickens raised at normal temperature (ranging to 17° at 23°C).

Effect of genotype on growth, body parameters and body temperature:-

The detailed analyses showed a high significant (P< 0,001) effect of genotypes for all traits (Tables 2, 3 and 6). In fact, for growth parameters, hybrids birds (i.e. naked neck birds and fully feathered hybrids birds) exhibited better body weight value than local fully feathered birds. Specifically, naked neck hybrid birds exhibited better values, followed by fully feathered hybrid birds and local feathered birds, excepted for the body weight gain between 12 and 30 weeks of age (WG_{12-30}) and consequently for the daily body weight gain between 12 and 30 weeks of age (dWG_{12-30}). In fact, fully feathered birds showed lower weight gain between twelve to thirty days of age (320.80g) and daily body weight gain (02.53g) than those of local birds and naked neck birds. For the two variables, the obtained mean value was 375.01g and 866.10g, and 02.91g and 06.71g respectively. Our results are consistence with those of **Njoya (1995)**.

Concerning body measured parameters, naked neck hybrid birds exhibited better value followed by fully feathered hybrid birds, the local fully feathered birds with the lower values for all parameters, excepted for the width of wattles. In fact for this trait, the local chickens and fully feathered hybrids genotype showed the same value (23.27 and 23.53 mm respectively). Our results were in the same range of previous studies (**N'dri *et al*., 2006**). These authors found that, carriers of the Na gene exhibited a better carcass, breast and leg yield than the normally feathered chickens. However, in their study, carriers of Na gene tented to have abdominal fat. While variation in body parameters in this study could be mainly attributed to genetic differences, heat tolerance trait (rectal temperature) is more likely to be affected by environmental influences for all genotypes.

Concerning heat stress, body temperature was a method of assessing the physiological response of an animal to the climatic environment. In table 6, the effect of genotype was highly significant ($P<0.001$) for all of the recorded temperature (BT1, BT2 and BT3). The least squares means of the effects of genotype on heat tolerance traits were showed that the fully feathered hybrid birds had the highest rectal temperature (41.84 °C), followed closely by the naked-neck hybrid birds (41.64 °C), the local fully feathered genotype exhibited the better value (41.36 °C). Similar results were exhibited in others studies. In fact, high temperature in addition to changes in rectal temperature could lead to disturbance of thermal balance of birds (**Lin *et al*., 2005**). According to **Dana *et al*. (2010)**, adaptation to the production environment was found as an important attribute of village chickens in Ethiopia and of naked neck birds (**N'dri *et al*., 2007**). Theremore, **Kohler-Rollefson *et al.* (2009)** reported that, in the event of climate change, ability to maintain production and cope with thermal stress could give the indigenous breeds an edge over their exotic counterparts.

Because the 3 genotypes of birds used in this study were raised under identical rearing and feeding conditions, better heat stress tolerance (i.e. better body temperature) of local feathered birds and the naked neck birds of our study are attributed to better adaptability in part and to Na gene in second way. Variations arising from body temperature and body parameters for normal feathered hybrid, naked neck hybrid and local feathered birds could be attributed to their different genetic background and their natural tendencies as also noted by **Peters *et al*. (2008**) who reported differences between strain in terms. For the most part modern genetic lines of poultry have been selected in temperate climates.

Effect of sex on body measured and temperature traits:-

This study exhibited significant effects of sex ($P<0.05$) on body measured traits in birds populations takes together. Male birds exhibited better measurements parameters comparing to those of females. This result was in the same range of that of body weight. However, there were no rectal temperature differences ($P>0.05$) between the male (41.51 ± 0.35°C) and female (41.74 ± 0.33°C) in all populations takes together. Body temperature ranged between 41.44 ± 0.34 °C and 41.62± 0.31 °C, and 41.70 ± 0.32 °C up to 41.80 ± 0.30 °C respectively for males and females. These results may mean that male and female birds had perceived stressful condition similarly.

Genotype by sex interaction on body measured parameters and in rectal temperature:-

SL means of body parts measured by sex in each genotype were presented in tables 5 and 8. Within genotype, significant difference ($p<0.05$) between males and females was also exhibited. Otherwise, significant difference was found among birds having the same sex but different genotype. The effect of genotype by sex interaction (GxS) were significant ($P<0.05$) for all of the recorded morphological traits excepted for crest and tarsus length ($p>0.05$) (Table 3). However, no significant ($P>0.05$) GxS interaction was noticed for all body temperature excepted for BT3. This found are in agreement with others studies. In fact, no genotype by sex interaction (GxS) was found for body temperature by **Deeb and Cahaner (1999)**. Moreover, the GxS on BT3 only could be due to the fact that female birds exhibited the same body temperature whatever the naked neck genotype, whereas body temperature of males depended on the ambient temperature. This lack of effect of the Na gene in females could be associated with the smallest growth rate of female as compared to males. The effect of the Na gene was particularly obvious in heavy animal (**Eberhart and Washburn, 1993**).

		Génotypes		
Parameters	**Naked neck (Mean ± SE**[†]**)**	**Local (Mean ± SE)**	**Fully feathered (Mean ± SE)**	**Genotype Effect**
W_1 (gm)	$33.80±3.76^a$	$26.00±3.11^b$	$32.00±4.53^c$	***
W_{12} (gm)	$1121.40±224.96^a$	$554.40±104.22^b$	$1103.08±203.47^c$	***
W_{30} (gm)	$1987.50±664.20^a$	$929.41±236.55^b$	$1381.40±219.58^c$	***
WG_{12-30} (gm)	$866.10±224.96^a$	$375.01±104.22^b$	$320.80±168.05^c$	**
dWG_{12-30} (gm)	$06.71±1.74^a$	$02.91±0.81^b$	$02.53±1.25^c$	***

Table 1:- Rearing local temperature and hygrometry variation per week

Weeks	**Time**	**Temperature variation**	**Hygrometry variation**
1		23-35°C	64-96%
2		22-35°C	84-96%
3		24-32°C	88-90%
5	6 a.m.	24-26.2°C	87-96%
	4 p.m.	33-35.1°C	47-66%
	9 p.m.	28.8-30.2	70-78%
6	6 a.m.	25.8-26.1°C	89-95%
	4 p.m.	32.1-34.2°C	51-64%
	9 p.m.	28.1-30.7°C	74-84%
7	6 a.m.	24.9-25.9°C	92-99%
	4 p.m.	31.5-33.8°C	51-69%
	9 p.m.	28.2-30.4°C	74-83%
8	6 a.m.	25.5-26.2°C	88-99%
	4 p.m.	30.6-34.8°C	51-71%
	9 p.m.	29.6-30.8°C	75-80%
9	6 a.m.	25.4-26.7°C	87-97%
	4 p.m.	32.8-35°C	46-62%
	9 p.m.	28.9-31,1	74-79%
10	6 a.m.	26-26.7°C	91-97%
	4 p.m.	31.8-34.8°C	51-70%
	9 p.m.	28.7-30.9°C	69-86%
11	6 a.m.	31.46°C	62.40%
	4 p.m.	37.64°C	43.80%
12	6 a.m.	29.49°C	71.57%
	4 p.m.	37.26°C	45.71%
30	Day 1	37.1°C	46%
	Day 2	36°C	40%
	Day 3	35.2°C	53%

Table 2:- Least square mean (±SE) of weight, weight gain and daily weight gain by genotype

SE[†] *= Standard Error ; W_1 : Weight at 1d of age ; W_{12} : Weight at 12w; W_{30} : Weight at 30w; WG_{12-30} : Weight gain between 12 and 30 weeks; dWG_{12-30} : daily Weight Gain on the period of 12 to 30 week; On the same line, affected values having the same letter aren't significantly different(* P<0.05, ** P<0.01, *** P<0.001).*

Table 3:- Elementary statistics and variance analysis for body mensuration traits

Parameters	**Total effective M±ET**	**Cock (Mean ± SE**[†]**)**	**Hen (Mean ± SE)**	**Genotype effect**		**Sex effect**	**Sex X Genotype effect**
Comb length (mm)	59.12±32.98	$104.31±22.88^a$	$40.67±11.61^b$	*		*	NS
Comb height	30.59±20.58	$58.82±13.53^a$	$19.07±7.76^b$	*		*	*

(mm)							
wattles length (mm)	27.62±18.40	50.295±17.02^{a}	18.36±7.93^{b}	*		*	*
Wattles width (mm)	26.91±12.69	42.14±14.23^{a}	20.69±3.47^{b}	*		*	*
Shank length (mm)	125.71±13.46	135.08±13.08^{a}	121.88±11.73^{b}	*		*	*
Tarsus length (mm)	73.26±9.60	80.675±9.95^{a}	70.23±7.68^{b}	*		*	NS
Tarsus diameter (mm)	13.72±1.86	15.425±2.18^{a}	13.02±1.15^{b}	*		*	*

SE† = Standard Error; on the same line, affected values having the same letter aren't significantly different (P<0.05, ** P<0.01, *** P<0.001).*

Table 4:- Least square mean (±SE) of body mensuration traits by genotype

*SE† = Standard Error; on the same line, affected values having the same letter aren't significantly different (**

Parameters	**Local (Mean ± SE†)**	**Naked neck (Mean ± SE)**	**Fully feathered (Mean ± SE)**
Comb length (mm)	53.29±33.32^{a}	91.34±41.28^{b}	50.02±21.42^{c}
Comb height (mm)	29.79±20.64^{a}	50.37±25.87^{b}	23.95±13.31^{c}
wattles length (mm)	21.92±16.82^{a}	48.61±23.83^{b}	22.40±10.03^{c}
Wattles width (mm)	23.27±10.79^{a}	40.46±18.45^{b}	23.53±6.56^{a}
Shank length (mm)	111.29±14.06^{a}	136.47±12.97^{b}	127.35±8.04^{c}
Tarsus length (mm)	63.49±10.01^{a}	80.57±9.72^{b}	74.36±6.00^{c}
Tarsus diameter (mm)	12.03±1.40^{a}	15.93±2.02^{b}	13.58±1.06^{c}

*P<0.05, ** P<0.01, *** P<0.001).*

Table 5:- Least square mean (±SE) of body mensuration traits by genotype and sex interaction

Parameters	**Local (Mean ± SE†)**		**Naked neck (Mean ± SE)**		**Fully feathered (Mean ± SE)**	
	Cock	**Hen**	**Cock**	**Hen**	**Cock**	**Hen**
Comb length (mm)	85.56±16.04^{a}	25.06±6.93^{b}	123.9±17.74^{c}	47.92±5.61^{d}	99.22±11.63^{e}	42.99±10.19^{f}
Comb height (mm)	48.27±8.23^{a}	13.63±12.39^{b}	71.16±8.30^{c}	22.65±5.48^{d}	53.84±10.83^{e}	19.7±6.27^{f}
wattles length (mm)	37.77±9.20^{a}	8.05±4.70^{b}	66.86±12.27^{c}	24.28±4.77^{d}	41.32±7.83^{e}	19.7±6.92^{f}
Wattles width (mm)	31.37±10.85^{a}	16.19±3.02^{b}	54.3±10.80^{c}	22±2.52^{d}	37.76±7.64^{e}	21.5±2.90^{d}
Shank length (mm)	122.69±12.10^{a}	101.31±5.11^{b}	145.89±4.89^{c}	123.92±8.53^{d}	135.14±6.97^{e}	126.24±7.63^{f}
Tarsus length (mm)	71.13±9.29^{a}	56.81±4.11^{b}	87.63±6.20^{c}	71.17±2.44^{a}	82.92±3.35^{d}	73.14±5.26^{e}
Tarsus diameter (mm)	13.07±1.22^{a}	11.13±0.80^{b}	17.45±0.67^{c}	13.9±1.17^{a}	15.48±1.25^{d}	13.31±0.70^{a}

SE† = Standard Error; on the same line, affected values having the same letter aren't significantly different (P<0.05, ** P<0.01, *** P<0.001).*

Table 6:- Elementary statistics and variance analysis for body temperature traits

Parameters	**Total effective (Mean ± SE†)**	**Cock (Mean ± SE)**	**Hen (Mean ± SE)**	**Genotype effect**	**Sex Effect**	**Sex X Genotype Effect**
DT1 (°C) T/H=37.1°/46%	41.766±0.035^{a}	41.62±0.31^{a}	41.80±0.30^{a}	***	NS	NS
BT2 (°C) T/H=36°/40%	41.664 ±0.042^{a}	41.44±034^{a}	41.72±0.36^{a}	***	NS	NS
BT3 (°C) T/H=35.2°/53%	41.650 ±0.039^{a}	41.48±0.40^{a}	41.70±0.32^{a}	***	NS	*

SE† = Standard Error; BT1: Body temperature of the first day; BT2: Body temperature of the second day; BT3: Body temperature of the third day; T/H: ambient temperature and relative humidity; on the same line, affected values having the same letter aren't significantly different (P<0.05, ** P<0.01, *** P<0.001)*

Table 7:- Least square mean (±SE) of body temperature traits by genotype

Parameters	Local (Mean ± SE†)	Naked neck (Mean ± SE)	Fully feathered (Mean ± SE)	Genotype effect	
BT1 (°C) T/H=37.1°/46%	41.435±0.079[b]	41.709±0.067[a]	41.915±0.028[c]	***	
BT2 (°C) T/H=36°/40%	41.271±0.079[b]	41.637±0.085[a]	41.825±0.040[c]	***	
BT3 (°C) T/H=35.2°/53%	41.369±0.081[b]	41.585±0.090[a]	41.784±0.041[c]	***	

SE† = Standard Error; BT1: Body temperature of the first day; BT2: Body temperature of the second day; BT3: Body temperature of the third day; T/H: ambient temperature and relative humidity; on the same line, affected values having the same letter aren't significantly different (P<0.05, ** P<0.01, *** P<0.001)*

Table 8:- Least square mean (±SE) of body temperature traits by genotype and sex interaction

SE† = Standard Error; BT1: Body temperature of the first day; BT2: Body temperature of the second day; BT3: Body temperature of the third day T/H: ambient temperature and relative humidity; on the same line, affected values having the same letter aren't significantly different (P<0.05, ** P<0.01, *** P<0.001)*

Parameters	Local (Mean ± SE)		Naked neck (Mean ± SE)		Fully feathered (Mean ± SE)	
	Cock	Hen	Cock	Hen	Cock	Hen
BT1 (°C) T/H=37.1°/46 %	41.397 ± 0.115[a]	41.461 ± 0.112[a]	41.794 ± 0.095[b]	41.650 ± 0.091[a]	41.744 ± 0.112[b]	41.937 ± 0.027[c]
BT2 (°C) T/H=36°/40 %	41.214 ± 0.083[a]	41.311 ± 0.123[a]	41.603 ± 0.123[b]	41.661 ± 0.122[b]	41.600 ± 0.135[b]	41.855 ± 0.040[c]
BT3 (°C) T/H=35.2°/53 %	41.119 ± 0.095[a]	41.544 ± 0.085[b]	41.683 ± 0.140[b]	41.517 ± 0.118[b]	41.722 ± 0.122[b]	41.792 ± 0.043[c]

Conclusion:-

The ambient temperature conditions (temperature and humidity) at the study site were deemed sufficient to elicit a heat stress response in the different genotypes. The local chickens and naked neck hybrid chickens exhibited better adaptability in terms of heat-tolerant traits when compared with the fully feathered hybrid. Adaptation to the production environment was found as an important attribute of local chickens in Côte d'Ivoire compared to commercial hybrid birds. While variation in body parameters in this study could be mainly attributed to genetic differences, heat tolerance trait is more likely to be affected by environmental influences.

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