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## HAEMATOLOGICAL RESPONSES OF NIGERIAN LOCALLY ADAPTED CHICKENS WITH DIFFERENT HEAT SHOCK PROTEIN 70 GENOTYPES TO ACUTE HEAT STRESS

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### ABSTRACT

*Heat stress is among the most challenging environmental conditions affecting poultry growth and production, particularly in the tropical regions. Selective breeding of poultry for improved productivity and thermo-tolerance requires a deep understanding of heat-tolerance genes and their association with economic traits. Thus, this study aimed at assessing hematological responses of Nigerian locally adapted chickens with different HSP70 genotypes (AA, AB, BB) to acute heat stress. A total of thirty-six (36) 23-weeks-old FUNAAB Alpha Chicken (FAC) and Yoruba Ecotype Chickens (YEC) with known HSP 70 gene genotype were used for this study. Six chickens per identified HSP70 genotypes (AA, AB, BB) selected from each of FAC and YEC were exposed to heat stress (40±1°C) for one hour. Blood was sampled before and after the exposure. Packed Cell Volume (PCV), Red Blood Cell (RBC), Lymphocytes, heterophil and heterophil/lymphocytes ratio were analysed using standard procedures. Data were analysed using descriptive statistics and ANOVA. After acute heat-stress, the highest PCV value was obtained from birds with genotype BB (32.91±0.26%) while the homozygote AA birds had the least observed value (31.52±0.25). The HSP70 genotype had no significant effects on the RBC, Lymphocytes, heterophil and heterophil/lymphocytes ratio of the studied birds prior to acute heat stress exposure. However, the packed cell volume and haemoglobin values were significantly influenced by the HSP70 genotypes.*

**Keywords: heat stress, HSP70, hematological indices, PCR-RFLP, indigenous chickens.**

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### INTRODUCTION

Environmental extremes have deleterious effects on the performance and health status of the poultry species, particularly in tropical countries where temperature in most parts exceeds thermo-neutral zones during peak period of dry season. Hematological parameters are useful indicators to predict potential resistance of livestock to stresses. Environmental stresses induce leucocytosis which are responsible for defending the body against infections, in avian species and are routinely used as indicators of stress responses (Maxwell, 1993, Shaniko 2003). Changes in haematological and serum biochemical parameters have been used to predict potential resistance of livestock to environmental and nutritional stresses (Kral *et al.*, 2000). Studies that focus on identification of indigenous chicken breeds with superior adaptability to heat stress such as intended in this study is therefore not only crucial but also a requisite for selection of these valuable stocks for improve performance and adaptability. Earlier researchers have reported hematological and biochemical values of chickens (El-bahy and Nadia 1994, Ladokun 2008, Albokhadaim and Ibrahim 2012, Isidahomen *et al.*, 2012, Chikumba *et al.*, 2013), effect of seasonal changes in environmental temperatures on blood parameters of chickens (Huthail and Abdulaziz 2015). Huthail and Abdulaziz, 2015 found that seasonal changes of the environmental temperature of the year influenced the hematological parameters of chickens while, Shower *et al.*, (1984) reported significant effects of breed, age and sex on the Red blood cells of Saudi Baladi chickens. Several attempts have also been made to assess polymorphism in Heat Shock Protein (HSP) genes in chicken and some HSP 70 variants have been linked with heat tolerance (Mazzi *et al.*, 2003, Zhen *et al.*, 2006, Tamzil *et al.*, 2013, Gaviol *et al.*, 2008 and Fatai *et al.*, 2023.). However, the effect of HSP70 genotype on the haematology of Nigerian indigenous chickens under extreme ambient temperature have been poorly documented.

## **MATERIALS AND METHODS**

### **Experimental Birds and Acute Heat Stress Exposure**

A total of thirty six (36) 23-week-old Yoruba ecotype and FUNAAB-Alpha chickens (6 birds per identified HSP70 genotype) whose genotypes have earlier been determined using PCR-RFLP (Fatai *et al.*, 2023) were randomly selected from the flock and exposed to an acute heat stress at 40-41°C for 1.0 hour.

### **Sample Collection and Laboratory Analysis**

Blood samples were collected at 0 and 1 h after heat stress into an Ethylene Diamine Tera-acetic Acid (EDTA) containing tubes. Packed Cell Volume (PCV), hemoglobin (Hb), red blood cells, lymphocyte, heterophil and heterophil/lymphocyte ratio were determined using standard procedures as described by (Ewuola and Egbunike, 2007).

## **RESULTS AND DISCUSSION**

Changes in hematological parameters are good indicators in assessing the response of animals to stresses. The Results of hematological parameters of Yoruba ecotype chicken and FUNAAB-Alpha chicken before and after exposure to heat stress are presented in Table 1.0. The highest PCV value was obtained from birds with genotype BB (32.91±0.26%) while the homozygote AA birds (31.52±0.25) had the least observed value (Table 2.0). Earlier, Isidahomen *et al.* (2012) reported a significant difference between the PCV values of heat stressed frizzle feathered, naked neck and normal feathered chickens of Nigeria. The authors ascribed the decreased PCV values to adverse climatic condition. While, the frizzle feathered birds were reported to have the highest PCV values compared to the naked neck and normal feathered chickens. In this study, the HSP70 genotype had no significant effects on the RBC, Lymphocytes, heterophil and heterophil/lymphocytes ratio of the studied birds prior to acute heat stress exposure. Following acute heat stress, the average RBC value of the homozygote BB birds were not significantly different from those of the heterozygote AB individuals. The obtained RBC values of birds with genotypes AA and AB followed similar trend. Also, the heterophil/lymphocytes ratio values are not significantly different following the acute heat stress exposure. Acute heat stressed FUNAAB-Alpha birds with genotype BB had significantly higher heterophil compared to those with AA and AB. This is in disagreement with the findings of Huthail and Abdulaziz (2015) who reported significant effect of seasonal changes in environmental temperature on the RBC, WBC, PCV and blood glucose of chickens that are native to Saudi Arabia. Yoruba chickens had the least PCV (31.23±0.27%) and Hb (8.56±0.11) value. The obtained values of PCV and Hb are in agreement with the findings of Clubb and Schubot (1991). The authors attributed higher PCV and Hb values to a higher weight gain in the studied population. Similar submission was made by Oke *et al.*, (2007) where the reported highest PCV and Hb values of naked neck chickens was adduced to its comparatively higher body weight compared to the Normal feathered genotype. However, breed, environment and season have been reported to have significant effects on chicken haematological parameters (Isidahomen *et al.*, 2012). The observed values of heterophils, lymphocytes and heterophils/lymphocytes are not significantly different between the two acute heat-stressed chicken populations. This observation implies that acute heat stress has no significant effect on the heterophil, lymphocytes and heterophil/lymphocytes values of the studied birds. The significant effects of breed on the haematological responses of the studied birds to acute heat stress corroborated the submission of Adedeji *et al.* (2015). The packed cell volume and haemoglobin values were significantly influenced by the HSP70 genotypes. Birds with homozygote BB genotype had the highest average PCV and Hb values while the least was observed in Yoruba chickens (Table 1.0). However, there was no significant difference in the obtained values of RBC, Lymphocytes, heterophil and heterophil/lymphocytes ratio in all the studied chicken populations (Table 2.0). These observations slightly disagreed with the findings of Tamzil *et al.* (2014). The authors reported significant increase in the percentage of heterophil, basophil, lymphocyte and heterophil/lymphocyte ratio with the exception of eosinophil and monocyte which were not statistically different in the acute heat stressed Arabic, kampong and commercial chickens.

Table 1.0 Interaction effects of HSP70 gene and breed on Haematological Parameters of Acute heat-stressed Yoruba, Fulani and FUNAAB-Alpha Chickens

	PCV (%)		RBC (x 10 <sup>6</sup> ul)		Heterophil (%)		Lymphocyte (%)		Het/Lymph	
Yoruba										
	0 hour	1 hour	0 hour	1 hour	0 hour	1 hour	0 hour	1 hour	0 hour	1 hour
AA	30.43±0.3	30.35±0.5	2.77±0.3	2.73±0.3	29.8±5.6	31.3±4.9	62.3±6.3	60.6±5.0	0.51±0.2	0.53±0.1
AB	30.87±0.5	31.57±1.6	2.68±0.6	2.54±0.7	28.3±4.3	35.0±6.1	64.5±1.6	61.8±2.9	0.46±0.1	0.57±0.1
BB	31.69±0.4	31.76±0.4	2.80±0.4	2.69±0.6	28.8±5.1	29.0±4.9	57.8±3.3	62.8±4.4	0.50±0.1	0.47±0.1
FUNAAB-Alpha										
AA	32.54±0.8	33.82±2.3	3.10±0.3	3.00±0.3	34.3±2.0	28.5±1.3 <sup>b</sup>	59.8±6.8	56.6±7.3	0.54±0.1	0.61±0.1
AB	32.23±1.1	32.71±1.0	2.92±0.4	2.87±0.4	31.8±6.5	27.7±9.9 <sup>b</sup>	61.7±2.0	56.8±6.9	0.51±0.1	0.53±0.2
BB	33.24±0.8	33.94±1.1	3.04±0.4	3.30±0.4	32.6±2.9	37.7±5.2 <sup>a</sup>	64.6±2.4	61.3±3.6	0.49±0.04	0.51±0.1

Means ± SD with the same superscript along the column are not significantly different (P<0.05)

PCV: Packed Cell Volume, RBC: Red Blood Cell, Het/Lymph: Heterophil/Lymphocyte Ratio, 0 hour: before heat stress exposure, 1 hour: after heat stress exposure

The obtained values of heterophil, lymphocytes and heterophil/lymphocytes were similar before and after the acute heat stress exposure in this study (Table 2.0). Huthail and Abdulaziz (2015) also submitted that most blood parameters were not affected by breed of chicken but significantly influence by the seasonal changes in environmental temperature.

Table 2.0 Haematological responses of acute heat-stressed Yoruba and FUNAAB-Alpha chickens

Parameters	Duration (hour)	Yoruba	FUNAAB-Alpha
PCV (%)	0	30.00±0.70 <sup>b</sup>	32.67±0.94 <sup>a</sup>
	1	31.23±1.15 <sup>b</sup>	32.55±1.57 <sup>a</sup>
HB (g/dL)	0	9.60±0.26 <sup>b</sup>	10.30±0.41 <sup>a</sup>
	1	8.56±0.48 <sup>b</sup>	9.59±0.53 <sup>a</sup>
RBC (x10 <sup>6</sup> Ul)	0	2.75±0.49	3.02±0.34
	1	2.65±0.52 <sup>b</sup>	2.97±0.41 <sup>a</sup>
Lymphocyte (%)	0	63.67±4.28 <sup>a</sup>	59.67±6.51 <sup>b</sup>
	1	61.76±4.01	58.26±6.21
Heterophil (%)	0	31.89±4.96	31.00±3.64
	1	31.78±5.60	31.30±8.25
Het/ Lymph	0	0.503±0.10	0.524±0.09
	1	0.5200±0.12	0.538±0.14

Means ± SD with different superscript along the rows are significantly different (p<0.05)

PCV: Packed Cell Volume, HB: Hemoglobin, RBC: Red Blood Cell, Het/ Lymph: Heterophil/Lymphocyte Ratio

## CONCLUSION

The haematological parameters of the studied Yoruba ecotype and FUNAAB-Alpha chickens were not significantly influenced by their HSP70 genotypes. However, the obtained packed cell volume and hemoglobin values for FUNAAB-Alpha were significantly higher than that of the Yoruba chickens.

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