

## RELATIONSHIP BETWEEN SERUM ALKALINE PHOSPHATASE AND MEAT QUALITY TRAITS IN MALE AND FEMALE BROILER LINES IN SHIKA, NIGERIA

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### ABSTRACT

This study was conducted to genetically evaluate the relationship between serum alkaline phosphatase (SAP) and meat quality traits of male and female broiler lines in National Animal Production Research Institute (NAPRI). A total of 350 broiler birds were used, which consisted of 100 birds each for sire and dam line and 75 birds each for sire control and dam control. Data on blood and meat quality traits were analyzed using General Linear Model procedures of SAS (2002). The results obtained indicated that there was no significant ( $P>0.05$ ) difference in all the biochemical traits observed except in the SAP where sire control showed the highest value of 69.00mg/dl. No significant ( $P>0.05$ ) differences were observed in meat quality traits except in the energy value of sire control (3945.3kcal/kg). Genetic correlations obtained in this study revealed that SAP showed positive and negative correlations with meat quality traits for the selected lines. It was therefore concluded that, lines had significant effects on SAP and energy. High genetic correlations between SAP and meat quality traits are indications of linkage and pleiotropy effects among these traits.

Keywords: Broiler birds, meat quality traits, serum alkaline phosphatase (SAP)

### INTRODUCTION

The production of broilers in free-range systems may pose a determined meat traits sought by consumers of chicken meat. The main differences in meat quality between free-range and conventionally reared chickens are related to colour, flavour and texture (Castellini *et al.*, 2002). The differences may be related to sex, due to different growth and muscle development potential between males and females (LE Bihan-Duval, 2004). Broiler meat quality is influenced by several factors; however, it is mostly by genetics. Therefore, selection for economic traits might be induced by several changes in broiler meat quality (Dramsfield and Sosnicki, 1999). A significant difference in SAP and blood biochemical traits of birds could be of value to breeders for selection in early life. SAP is an important enzyme in chicken which is majorly found in bones, kidney, liver, plasma and intestinal mucosa. It functions to help in absorption of protein, carbohydrate and fat (Das and Deb 2008). These functions could pose significant effects on meat quality traits. Therefore, this study was designed to determine the relationship between SAP and meat quality traits in male and female broiler lines in NAPRI, Shika, Zaria.

### MATERIALS AND METHODS

The research was carried out at the Poultry Research Unit of National Animal Production

Research Institute (NAPRI) Shika, Zaria, Kaduna State. Shika lies between latitude  $11^{\circ} 12' N$ , longitude  $7^{\circ} 33' E$  and at altitude of 640m above sea level. The area falls within the Northern Guinea Savannah having an average annual rainfall of 1100mm (Akpa and Jokthan, 1996).

The birds used for this study comprised of 4 groups each of sire line, dam line, sire control and dam control line in National Animal production Research Institute (NAPRI). The same type of feed was given to all the groups. Water and feed were provided with standard recommendations. Six birds were sampled out each from the four groups making a total of 24 birds. A portion of breast muscle was cut for meat quality analysis from the sampled birds that were used for carcass evaluation. Analysis of the proximate composition of the meat was carried out in NAPRI biological laboratory according to the methods of AOAC (1995). Traits measured for meat quality traits were Protein, Fat, Moisture, and Energy. Blood samples were taken from the wing veins of the 6 birds sample from each group and stored into non anticoagulated tube for serum analysis of SAP and other blood chemistry which include TP and Ach. Methods described by Bassey *et al.* (1946), George *et al.* (1961) and Abd El Azim (2012) were adopted for the analysis of SAP, Ach and TP respectively. Data on blood and meat quality traits were analyzed using General Linear Model

procedures of SAS (2002). The genetic correlations between two traits were obtained by analysis of covariance using a procedure of statistical analysis system (SAS, 2002). The general formula for estimating correlation is as described by Falconer (1989).

$$r = \frac{COV_{xy}}{\sqrt{\sigma_x^2 \sigma_y^2}}$$

## RESULTS AND DISCUSSION

The result of the least squares means for the biochemical traits for sire line, dam line, sire control and dam control is presented in Table 1. The values of the serum alkaline phosphatase (SAP) obtained in this study was 64.67 $\mu$ l for sire line, 63.33 $\mu$ l for dam line, 69.00 $\mu$ l for sire control and 63.17 $\mu$ l for dam control. The values for Acetylcholine esterase (Ach) ranged from 19.17 to 21.50mg/dl for all the lines. The values for total protein (TP) also ranged from 6.83 to 7.08mg/dl for all the lines. There was no significant ( $P>0.05$ ) difference in all the biochemical traits observed except in the SAP. The significant difference obtained in SAP showed that there is line effect of SAP and this could pose advantage of better performance in terms of body weight. The similarities obtained in the other traits for all the lines are indications that line had no effect on these traits. The values of TP ranged from 6.83 to 7.08mg/dl and SAP ranged from 63.17 to 64.67 $\mu$ l and these disagreed with the value obtained by Abd El Azim (2012) for TP (4.60) and SAP (143), respectively. The differences could be due to breed and environmental effects. The least squares means of the meat quality traits for male line, female line, sire control line and dam control line were presented in table 2. The values of the energy ranged from 3735.7 $\pm$ 92.8 to 3945.3 $\pm$ 101.68 Kcal/kg and sire control showed significantly different value from other groups. The values of the protein were 72.43 $\pm$ 1.89%, 69.88 $\pm$ 1.89%, 72.60 $\pm$ 1.89% and 68.03 $\pm$ 1.73% and the corresponding values of fat were 11.33 $\pm$ 0.87%, 13.55 $\pm$ 0.87%, 3.24 $\pm$ 0.87% and 12.04 $\pm$ 0.79% for sire line, dam line, sire control and dam control respectively. These values were lower than the values obtained by Eva *et al.* (2011). The differences could be as a result of breed or line

differences. The non significant differences obtained in this study for meat quality traits for sire line, dam line and dam control agreed with the report of Elie *et al.* (2010) who stated that the means of protein (%), fat (%) and moisture (%) did not differ regardless of the nature of the four treatments in their study. And it also agreed with the report of Souza *et al.* (2011) who suggested that meat composition was not influenced by genetic strains. The range of fat content obtained in this study showed that meat of the broilers kept in NAPRI is palatable and with no health implication. Correlations between Serum Alkaline Phosphatase (SAP) and Meat Quality Traits were presented in table 3. The high and positive genetic correlations obtained between SAP and protein and moisture imply that there is strong relationship among the traits considered. The high and negative correlation between SAP and fat indicates that strong and inverse relationship exists between them. The low correlations between SAP and energy imply that selection for one trait will lead to little or no progress. The high and positive genetic correlations between SAP and protein in sire line and between SAP and protein, SAP and moisture and SAP and energy in dam line is an indication of strong interrelationship hence improvement in SAP will lead to improvement in these traits. Genetic correlations among the proximate composition were low and negative in dam line between protein and moisture meaning that weak and inverse relationships exist between these traits. Strong relationship exists between positively correlated traits.

## CONCLUSION

From the results obtained in this study, the significant differences obtained in the SAP and meat quality traits imply they are influenced by lines. The meat of the broilers kept in NAPRI is fit for consumption with no health implication because of its moderate fat content. High genetic correlations between SAP and meat quality traits are indications of linkage and pleiotropy effects among these traits. It is therefore recommended that SAP could be used as a marker for selection for improved meat quality traits.

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## REFERENCES

- Abd El Azim (2012). Improve Heat Tolerance of Broilers through heat treatment during the first two weeks. *Egyptian Poultry Science*, Vol. (32)(III). (483-495)
- Akpa, G.N., and Jokthan, G.E., (1996). Effect of feeding and routine management in rabbit production in Zaria area of Kaduna State, Nigeria. *Agricultural System in Africa*, 6(1):60-64
- Bassey O.A., Lowry O.H., and Brock M., (1946). A method for the rapid determination of alkaline phosphatase with five cubic millimetre of serum. *Journal of Biochemical Chemistry*, 614 : 321 – 329.
- Castellini, C., Mugnai, C. and Dal Bosco, A. (2002). Effect of organic production system on broiler on broiler carcass and meat quality. *Meat Science* 2002; 60(3): 219 – 225.
- Das, A.Kr., and Deb, R., (2008). Biochemical Polymorphism and its relation with some traits of importance in poultry. *Veterinary World Journal*, Vol.1(7): 220-220.
- Dramsfield, E., and Sosnicki, A. A. (1999). Relationship between muscle growth and poultry meat quality. *Poultry Science*.78:743–746.
- Elei, K. B., Ihsan, T., Housam, S. and Ibrahim, M.(2010). Physiological and carcass traits in heat-stressed broilers differing in heat acclimatization, chemical of feed restriction treatments. *Agricultural and Biological Journal of Northern America* 1(2) : 65-74.
- Eva, S., Pavel, S. S., Katerina, K., Mark, Jambor and Petr, N. (2011). Comparison of nutritional values of pheasant and broiler chicken meats. *ACTA VETERINARY BRAND* 2011, 80:373-377.
- Falconer, D.S. (1989). Introduction to Quantitative Genetics, 3<sup>rd</sup> Edition. Longman Scientific and Technical London.
- George, L.E., Diane, K.C., Valentino, A. JR. and Robert, M.F. (1961). A new and rapid colorimetric determination of acetylcholinesterase activity. *Biochemical Pharmacology* 7:88-95.
- LE Bihan-Duval E. (2004). Genetic variability within and between breeds of poultry technological meat quality. *World Poultry Science Journal* 2004; 60:331 – 340.
- SAS (2002). Statistical analysis system multiple incorporation. Users' Guide Statistical version Cary, NC. USA.

Table 1: The least squares means ( $\pm$ SE) of the blood biochemical traits of sire line, dam line, sire control and dam control

| Traits     | Sire line                      | Dam line                       | Sire control                   | Dam control                    |
|------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| SAP(mg/dl) | 64.67 $\pm$ 2.830 <sup>b</sup> | 63.33 $\pm$ 2.830 <sup>b</sup> | 69.00 $\pm$ 2.830 <sup>a</sup> | 63.17 $\pm$ 2.830 <sup>b</sup> |
| Ach(mg/dl) | 21.50 $\pm$ 1.600              | 20.83 $\pm$ 1.610              | 21.33 $\pm$ 1.600              | 19.17 $\pm$ 1.610              |
| TP(mg/dl)  | 7.05 $\pm$ 0.880               | 6.83 $\pm$ 0.880               | 7.08 $\pm$ 0.880               | 6.92 $\pm$ 0.880               |

<sup>a,b,c</sup> = Means with the same superscript within the same row for a particular parameter are not significantly ( $P>0.05$ ) different. SAP=Serum Alkaline phosphatase, Ach=Acetylcholine esterase, TP=Total Protein.

Table 2: The least squares means ( $\pm$ SE) of the meat quality traits for male line, female line, male control and dam control

| Analyzed traits | Sire line                        | Dam line                         | Sire control                     | Dam control                    |
|-----------------|----------------------------------|----------------------------------|----------------------------------|--------------------------------|
| Energy(kcal/kg) | 3874.9 $\pm$ 101.68 <sup>b</sup> | 3944.7 $\pm$ 101.68 <sup>b</sup> | 3945.3 $\pm$ 101.68 <sup>a</sup> | 3735.7 $\pm$ 92.8 <sup>b</sup> |
| Protein (%)     | 72.43 $\pm$ 1.89                 | 69.88 $\pm$ 1.89                 | 72.60 $\pm$ 1.89                 | 68.03 $\pm$ 1.73               |
| Fat (%)         | 11.33 $\pm$ 0.87                 | 13.55 $\pm$ 0.87                 | 13.24 $\pm$ 0.87                 | 12.04 $\pm$ 0.79               |
| Moisture (%)    | 74.21 $\pm$ 1.89                 | 73.61 $\pm$ 1.89                 | 69.74 $\pm$ 1.89                 | 75.52 $\pm$ 1.72               |

<sup>a,b,c</sup> = Means with the same superscript within the same row for a particular parameter are significantly ( $P>0.05$ ) different.

Table 3: The genetic correlation of serum alkaline phosphatase with proximate composition of meat quality traits of sire line (above diagonal) and dam line (below diagonal)

|          | SAP    | Fat    | Protein | Moisture | Energy |
|----------|--------|--------|---------|----------|--------|
| SAP      |        |        |         |          |        |
| Fat      | -0.452 |        |         |          |        |
| Protein  | 0.652  | -0.419 |         |          |        |
| Moisture | 0.658  | 0.811  | -0.332  |          |        |
| Energy   | 0.146  | 1      | -0.105  | 0.371    |        |

SAP=Serum alkaline phosphatase