GROWTH PERFORMANCE AND SEMEN CHARACTERISTICS OF MARSHALL BROILER BREEDER COCKS FED VARIED LEVELS OF SUPPLEMENTAL ACETYLSALICYLIC ACID AND DIETARY SALT INCLUSIONS

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Abstract

The growth performance and acrosome integrity of Marshall Broiler breeder cocks fed varied supplemental levels of acetylsalicylic acid (ASA) and dietary salt inclusion were investigated in a sixteen-week study. A total of twenty broiler breeder cocks (Marshall Breed) were used for the study. Four diets were formulated and labelled T_1 (the control 0.25% NaCl and 0.00% ASA), T_2 (0.50% NaCl and 0.025% ASA), T_3 (0.75% NaCl and 0.050% ASA) and T_4 (1.00% NaCl and 0.075% ASA). A sixteen-week data on growth performance parameters were recorded and acrosome integrity test was also recorded at the 35th week. The result for the performance did not show any significant difference among initial weight, final weight, weight change, total feed intake and liveability, however, there was a significant difference ($P<0.05$) in the feed conversion ratio with birds fed diet T_3 (11.66 ± 1.12) having the best conversion. The acrosome integrity parameters were significant ($P>0.05$) with diet T_4 having the highest percentage of acrosome integrity (78.50 ± 5.58%**)** while T_3 was highest in live sperm cells (87.00 ± 0.71%) and lowest in dead sperm cells (13.00 ± 0.71%). In conclusion, 0.75% NaCl and 0.050% ASA worked synergistically to improve the feed conversion ratio and sperm cells viability while 1.00% NaCl and 0.075% ASA improved the acrosome integrity of the breeder cocks according to this current study.
Keywords: Acetylsalicylic acid, salt, Marshall Breeder cock, acrosome integrity and performance.

INTRODUCTION

The broiler breeder, also known as broiler parent stock, is a male domestic chicken raised in breeder farms to produce sperm cells and fertilize mature eggs to produce broiler chicks (Jeanna, 2002). This specific line of poultry production necessitates that these broiler breeders be kept on a high level of nutrition, particularly that which will improve their reproductive performance in terms of the breeding capacity of both the male and female broiler breeder stock (Savory *et al.,* 1993). Many authors advocate the use of acetylsalicylic acid (ASA) or aspirin as a first-line treatment for heat stress. (Aro *et al.,* 2017). This drug has been shown to improve egg production and liveability in laying chickens (Aro *et al.,* 2018), prevent wet litter in poultry houses (Aro *et al.,* 2017). Salt has been reported as an immune booster (Pimentel *et al.,* 1987), growth promoter (Aro, 2019) and connected with liveability and improved egg production in laying birds (Aro, 2019). A synergy between the use of ASA and NaCl in combination in the poultry diet has been reported to mitigate wet litter (Aro *et al.,* 2018) and reduce heat stress (Aro *et al.,* 2017). The right combination of both ASA and NaCl in poultry diet especially in Marshall Broiler breeder stock has not been established. This research thus, seeks to unravel the optimum combination of ASA and NaCl in Marshall Broiler breeder cocks that will synergistically mitigate heat stress while improving the liveability, reproductive and performance indices of this particular breed of domestic chicken.

Materials and Methods

Experimental Site

This experiment was carried out at the Poultry Section of the Livestock Unit of the Teaching and Research Farm, Federal University of Technology, Akure, Ondo State, Nigeria.

Procurement and Management of Experimental Animals

Twenty broiler breeder cocks of the Marshall Breed were purchased from Vettinson Breeders' Farms, Oyo State, Nigeria. The birds were twenty weeks of age at the time of their arrival. Sixteen birds with an average live weight of 2.3kg were randomly allotted to four dietary treatments with four replicates in each treatment. Four treatment diets were formulated in which ASA was supplemented at 0g, 250g, 500g and 750g/100kg and dietary salt inclusions at 250g, 500g, 750g and 1000g/100kg of the diets. The diets were labeled as T_1, T_2, T_3 and T_4 respectively in which T_1 served as the control diet. Table 1 shows the gross composition of the Marshall Breeder cock's diets

Table 1: Gross composition (kg/100kg) of the experimental diets

Ingredients	**T_I (kg)**	**T_2 (kg)**	**T_3 (kg)**	**T_4 (kg)**
Maize	47.55	47.55	47.55	47.55
Wheat offal	16.00	16.00	16.00	16.00
Soybean meal	18.00	18.00	18.00	18.00
Rice bran	15.00	14.75	14.50	14.25
Lysine	0.20	0.20	0.20	0.20
Methionine	0.25	0.25	0.25	0.25
DCP	1.30	1.30	1.30	1.30
Limestone	1.20	1.20	1.20	1.20
Breeder's premix	0.25	0.25	0.25	0.25
Salt	0.25	0.50	0.75	1.00
Total	**100.00**	**100.00**	**100.00**	**100.00**
ASA	0.00	0.025	0.050	0.075
ME (Kcal/kg)	2700.93	2700.93	2700.93	2700.93
Crude protein (%)	16.01	16.01	16.01	16.01

T_1 = Diet with 0.25% NaCl and 0.00% ASA; T_2 = Diet with 0.50% NaCl and 0.025% ASA; T_3= Diet with 0.75% NaCl and 0.050% ASA; T_4 = Diet with 1.00% NaCl and 0.075% ASA; ASA = Acetylsalicylic Acid; NaCl = Sodium Chloride; ME = Metabolizable Energy DCP = Dicalcium Phosphate and Breeder premix

Performance Assessment of Marshall Broiler Breeder Cock

The initial weight, final weight, weight change, total feed intake, feed conversion ratio, mortality, morbidity and liveability were recorded throughout the sixteen-week experimental period.

Determination of Acrosome Integrity of Breeder Cocks

Total ejaculate volume was determined using calibrated sample bottles, sperm motility was done by placing fresh semen on a cover slip and a drop of saline water was added which was then viewed under 40x magnification with a light microscope and Eosin/nigrosin stains were used on smears for live/dead and sperm cell counts. The smears were dried on a warm slide and observed immediately with a light microscope at high power magnification (×100) as described by Rekwot, (2013). Semen samples of 50µl were added to 500µl of formalin citrate solution (96ml of 2.9% sodium citrate with 4ml of 37% of formaldehyde). A drop of each of the mixtures was placed on microscope slides and a count of 200 sperm cells from different microscopic fields with normal apical ridges versus those with abnormal apical ridges was made and expressed in percentage as described by Jeyendran *et al.* (1984).

Statistical analysis

The data obtained from the experiment were subjected to a one-way analysis of variance in a Completely Randomized Design (CRD) using Statistical Package for Social Sciences, (2013), version 25. Significant means were separated using the Duncan Multiple range test of the same statistical package.

Results and discussion

The performance parameters in Table 2: final weight, weight change, feed intake and liveability were not significant (P>0.05). Ogihara *et al.* (2001) found that feeding rats with high salt diets had no significant effect on the final weight and weight change. However, the feed conversion ratio values varied significantly ($p<0.05$) among treatments, with birds fed diet T_3 (11.88 ± 0.61) having the lowest value in this performance parameter. This showed that birds fed diet T_3, ensured efficient feed utilization because NaCl and ASA in the diets might have worked synergistically to improve health and aid beneficiary gut microbiota (Aro *et al.*, 2017). The finding in this current study is similar to the report of Aro and Onuoha (2020) who recorded the highest FCR in Isa White cocks fed 0.75% NaCl and 0.10% ASA diets.

According to this present study, it was observed in Table 3 that the acrosome integrity, live and dead sperm cells were significantly different (P<0.05) in respect to the treatment diets with diet T_4 showing the highest percentage in acrosome integrity (78.50 ± 5.58%**)** while diet T_3 was highest in live sperm (87.00 ± 0.71%) cells and lowest in dead sperm cells (13.00 ± 0.71%). Na^+ is involved in the regulation of fluid balance within sperm cells, which is essential for maintaining structural integrity and protecting it from damage (Hall and Guyton, 2006). The findings in this current study is similar to the finding of Tanyildizi and Turkan, (2003) that rams fed diet containing ASA and metamizole at the doses of 50 and 75 mg/kg had a significant increase in hyaluronidase when compared with the control group. In addition, Aro, (2019) also suggested that 0.75% NaCl seemed the optimum level for the enhancement of egg production and livability in laying chickens at their late phase of egg production. The use of ASA-supplementation and dietary NaCl-inclusion in the Marshall Broiler breeder cocks' diets is still beneficial to their acrosome integrity and sperm viability at 0.75% NaCl and 0.050% ASA and 1.00% NaCl and 0.075% ASA respectively in this study..

Table 2: Performance Parameters of Marshall Broiler Breeder Cocks Fed Supplemental ASA and Dietary Salt Levels.

Parameters	T1	T2	T3	T4	P-value
IW (kg)	2.17 ± 0.07	2.20 ± 0.05	2.10 ± 0.04	2.13 ± 0.06	0.277
FW(kg)	3.17 ± 0.12	3.17 ± 0.09	3.25 ± 0.9	3.23 ± 0.09	0.687
WC (kg)	1.00 ± 0.06	0.97 ± 0.33	1.15 ± 0.06	1.1 ± 0.06	0.065
TFI (kg)	12.58 ± 0.79	13.50 ± 0.29	13.56 ± 0.43	13.59 ± 0.24	0.176
FCR	12.64 ± 0.50^{ab}	13.90 ± 0.27^{a}	11.88 ± 0.61^{b}	12.43 ± 0.44^{ab}	0.008
LIV (%)	75.00 ± 25.00	75.00 ± 25.00	100.00 ± 0.00	100.00 ± 0.00	0.372

a, b = Means on the same rows but different superscripts are statistically (P<0.05) significant. IW= Initial Weight; FW = Final Weight; WC = Weight Change; TFI = Total Feed Intake; FCR = Feed Conversion Ratio; LIV = Livability; T_1 = Diet with 0.25% NaCl and 0.00% ASA; T_2 = Diet with 0.50% NaCl and 0.025% ASA; T_3= Diet with 0.75% NaCl and 0.050% ASA; T_4 = Diet with 1.00% NaCl and 0.075% ASA.

T**able 3: Acrosome integrity test parameters of Marshall Broiler breeder cock fed supplemental ASA and graded salt levels**

Parameters	T1	T2	T3	T4	P-Value
TEV (ml)	0.30 ± 0.18	0.60 ± 0.20	0.30 ± 0.11	0.40 ± 0.21	0.27
MT (%)	91.75 ± 8.25	100.00 ± 0.00	100.00 ± 0.00	87.50 ± 7.25	0.62
DSC (%)	30.67 ± 4.91^{a}	28.33 ± 4.33^{a}	13.00 ± 0.71^{b}	31.00 ± 3.70^{a}	0.00
LSC (%)	69.33 ± 4.90^{b}	71.67 ± 4.33^{b}	87.00 ± 0.71^{a}	69.00 ± 3.70^{b}	0.00
AI (%)	75.33 ± 4.26^{a}	69.25 ± 4.64^{b}	78.50 ± 5.58^{a}	74.67 ± 5.78^{a}	0.00

a, b = Means on the same rows but different superscripts are statistically ($P<0.05$) significant. T_1 = Diet with 0.25% NaCl and 0.00% ASA; T_2 = Diet with 0.50% NaCl and 0.025% ASA; T_3= Diet with 0.75% NaCl and 0.050% ASA; T_4 = Diet with 1.00% NaCl and 0.075% ASA: TEV = Total Ejaculate Volume; MT = Motility; DSC = Dead Sperm Cell; LSC = Live Sperm Cell and AI = Acrosome Integrity

Conclusions and Recommendations

The feed conversion ratio had its best improvement in diet T_3 (0.05% ASA and 0.75% NaCl), however, the final weight, weight change, total feed intake, mortality, morbidity and livability showed no statistical significant differences among the dietary treatments. The study also established that the acrosome integrity and sperm viability were significant and highest in diet T_3. Therefore, based on the findings of this study, it is recommended that 0.050% ASA and 0.75% NaCl be used to improve feed conversion ratio and acrosome integrity of breeder cocks.

References

Aro S.O. and Onuoha, A.N. (2020). Performance and ambient temperature of cockerels under varied acetylsalicylic acid supplementation and different sodium chloride inclusion level. *FUTA Press.*

Aro, S.0. (2019). Qualitative analysis of ejaculates and sperm production potentials of Marshall Broiler breeders fed dietary supplementation of acetylsalicylic acid. *Nigeria Journal of Animal Production*. 21 (3): 95-106.

Aro, S. O., Arogbodo, J. O., Faluyi, O. B. and Abere, O. (2018). Faecal Bio-Physical Parameters of Two Strains of Laying Chickens Fed Dietary Supplementation of Acetylsalicylic Acid. In: Proceedings of the 43rd Annual Conference of Nigerian Society for *Animal Production (NSAP)*. Pp. 682-685.

Aro, S.O., Osho, I.B. and Awoneye, O.O. (2017). Comparison of rectal and ambient temperatures of Isa Brown and Harco Black layers fed different levels of acetylsalicylic acid. *Animal Research International*. 14: 2691-2696.

Hall, J.E. and Guyton, A.C. (2006). Textbook of medical physiology. St. Louis, Mo: Elsevier Saunders. *Fourth Edition*. ISBN 978-0-7216-0240-0.

Jeanna, L.W. (2002). Understanding the factors that influence Broiler breeder flock fertility. *Hatchery/Breeder Poultry Tip*. 2(4).

Jeyendran, R.S., Van der Ven, H.H., Perez Pelaez, M., Crabo, B.G. and Zaneveld, L.J.D. (1984). Development of an assay to access the functional integrity of the human sperm and its relationship to other semen characteristics. *Journal of Reproductive Fertility*. 70: 219-228

Ogihara, T., Asano, T., Ando, K., Chiba, Y., Sekine, N. and Sakoda, H. (2001). Insulin resustsnce with enhanced insulin signalling in high-salt diet-fed rats. *Diaebetes.* 50:573-583.

Pimentel, J. L. and Cook, M. E. (1987). Suppressed humoral immunity in chicks fed diets deficient in sodium, chloride, or both sodium and chloride. *Poultry Science*. 66: 2005.

Savory, C.J., Maros, K. and Rutter, S.M. (1993). Assessment of hunger in growing broiler breeders in relation to a commercial restricted feeding programme. *Animal Welfare*. 2(2): 131-152.
SPSS. Statistical Package for Social Sciences. Released 2013 for Windows, *Version 22.0. Armonk.*
Tanyildizi, S. and Turkan, B. (2003). Effects of ASA and metamizole on the hyaluronidase activity and sperm characteristics in rams. *Animal Reproduction Science*. 76(34): 195-204.