Influence of dietary electrolyte balance and arginine: lysine ratio on performance of developed layer chickens reared under heat stress condition

A thesis

Submitted to the Graduate School

Faculty of Agriculture, Damanhour University

In Partial Fulfillment of the

Requirements for the Degree

Of

Doctor of Philosophy

In

Poultry Production

Damanhour University

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2021

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6. SUMMARY and CONCLUSION

The present study was conducted from January to March 2018 to investigate the effect of dietary electrolyte balance and arginine to lysine ratio on productive, reproductive performance, egg quality, immune responses, and physiological and blood biochemical constituents of Mandara laying hens exposed to chronic heat stress. The experiment lasted for 12 wks from 32 to 44 weeks of age.

A total of 245 hens and35 cocks of Mandarah developed local strain (32 Wks age) were divided into seven groups and housed in 35-floor pens furnished with wheat straw. Each treatment was represented by 5 replicates (7 hens + 1 cock, each). Hens were housed in an environmentally controlled light-proof house (close system).

The first treatment was kept in the first sector under thermoneutral conditions (22:24 ^{o}C) and relative humidity (RH) 45:55 %. Whereas the other six treatments were kept in the second sector under chronic heat stress conditions (38 ℃ ± 1, 55-65 % RH) for three successive days a week from 10.00 am until 15.00 pm.

Experimental design:

1-The first treatment: birds were fed the basal diet (corn-soybean meal diet) with dietary electrolyte balance (DEB) equal 180 mEq, and 1.25 arginine/lysine ratio and used as a positive control (control +, PC).

2- The second treatment: birds were fed the basal diet with DEB equal 180 mEq, and 1.25 Arg/Lys and used as a negative control (control -, NC).

3- The third treatment: birds were fed the basal diet with 250 mEq DEB and 1.25 Arg/Lys**.**

4- The fourth treatment: birds were fed the basal diet with 320 mEq DEB and 1.25 Arg/Lys.

5- The fifth treatment: birds were fed the basal diet with 180 mEq DEB and 1.37 Arg/Lys.

6-The sixth treatment: birds were fed the basal diet with 250 mEq DEB, and 1.37 Arg/Lys.

7- The seventh treatment: birds were fed the basal diet with 320 mEq DEB, and 1.37 Arg/Lys.

The obtained results could be summarized as follows:

1-The final body weight of breeding hens at 44 wks of age in different treatment groups was insignificantly affected by HS and other dietary manipulation.

2- The Laying rate for layer groups exposed to HS (NC) was significantly decreased compared with the control group. The Laying rate decrease was 12.1, 12.9, 16.3, and 13.8% during 33-36, 37 – 40, 41 - 44, and 33-44 wks of age, respectively.

3-The laying rate of layers exposed to HS, and fed 250 mEq DEB with 1.37 Arg/Lys recorded the highest laying rate during 33 -36, 41-44, and 33- 44 wks of age by

61.9, 65.1 and 54.2%, respectively than the NC group, and by 54.0, 38.2, and 33.0%, respectively compared with the PC group.

4- The amount of FI was decreased for all experimental groups under HS compare with PC group and the lowest amount was recorded for the group fed monblueted diet equal DEP 320 mEq with 1.37Arg/Lys.

5- Layers exposed to HS (NC) significantly declined FCR than the other groups. The decline in FCR was 22.5, 26.4 and 25.8 % during 33 -36, 37 - 40 and 41 - 44 wks of age, respectively, and 25.89% for the whole experimental period (33- 44 wks of age).

6- DEB equal to 250 mEq, andArg/Lys equal 1.37 recorded the significant improvement on FCR during 33 -36, 41-44, and33- 44 wks of age by 37.79, 21.74, 40.23, and 32.93 %, respectively more than the NC group. Also, the same group significantly improved FCR during the same period by 21.2, 43.5 and 37.5%, respectively compared with the PC group.

7- The EW for the NC layer groups (HC) was significantly decreased compared with those in the PC group for all experimental periods.

8- The layer groups exposed to HS and fed different Arg/Lys ratios or BED were significantly improved EW compared to the EW for the NC group.

9- Layer groups exposed to HS (NC) significantly declined EM compared with the other experimental groups during different periods.

10- Shell weight % for the NC group was significantly decreased by 8.8% compared with that recorded for PC group, also its recorded the significantly lowest percentage compared with the different experimental groups.

11-Hens on diets had 320 mEq of DEB with 1.25 Arg/Lys, 180 mEq of DEB with 1.37Arg/Lys, and 250 mEq of DEB with 1.37 Arg/Lys recorded the highest eggshell weight compared with the other groups.

12- Fertility and hatchability (of total or fertile eggs) were significantly decreased of chickens exposed to HS (NC) from 87.36, 82.91, 97.3 to 85.3, and 97.3 85.3, 79.9, and 91.5% respectively compared with the PC group**.**

13- Laying hen on 180 mEq of DEB with 1.37 Arg/Lys significantly improved fertility, and both hatchability traits, percentages compared with the NC group from 85.3, 79.9, and 91.5 % to 92.2, 90.5, and 98.1 %, respectively.

14- Feeding 180 DEB with 1.37 Arg/Lys recorded the significantly lowest embryonic mortality (4.88 %) than the other experimental groups.

15- The relative weight of baby chick (%) hatched from the group fed manipulated DEB diet equal 250 mEq/kg, andArg/Lys 1.37 was the highest than that of the other groups.

16- The digestibility percentage of protein significantly differed among experimental groups and the groups under HS and fed monblueted diet with different levels of DEB and Arg/Lys were statistically equal with the PC group and the lowest value was recorded for the NC group.

17- Layer groups exposed to HS (NC) significantly decreased spleen, abdominal fat, total ovarian follicle numbers, large yellow follicle numbers, small white follicle

numbers (SWF), and oviduct weight compared to the PC group. At the same time, different DEB with Arg/Lys significantly improved those treats.

18-Layer exposed to HS (NC) had significantly decreased RBCs characteristics (RBCs count, PCV, Hgb, MCV, MCH, and MCHC) compared with PC group, while blood pH was significantly increased.

19- Layers fed different DEB with Arg/Lys significantly enhanced RBCs count, PCV, Hgb, MCV, MCH, and MCHC values compared with those recorded for the NC group.

20- CH had a significant adverse effect on WBCs, and its fractions (lymphocyte, monocyte, heterophil, neutrophil percentages) and increased on heterophil/lymphocyte ratio (H/L ratio).

21- Layers fed different DEB with Arg/Lys resulted in diminishing the negative effect of CH on WBCs, lymphocyte, heterophil, and neturophile, percentages compared with the NC group.

22- Layer exposed to HS (NC) had significantly lower glucose than the PC.

23- Layer exposed to HS had significantly increased plasma total lipid, total cholesterol, low-density lipoprotein (LDL), triglyceride constituents, and malondialdehyde (MDA) activity compared to PC and all the other experimental groups.

24- The layer under HS, and fed on 250 and 320 DEB with 1.37 Arg/Lys recorded the lowest concentration of low-density lipoprotein (LDL) compared with the other experimental groups.

25- The activity of alkaline phosphatase activity (ALP) was significantly increased for the NC group (under HS) compared with the PC group, while the other experimental groups were almost statistically equals.

26-Layers exposed to HS (NC) had significantly decreased plasma calcium (Ca) and phosphorus (P) concentrations compared with the PC and the other experimental groups.

27- Triiodothyronine (T3) activity was not differed among all experimental groups, while T4 activity for layer exposed to HS (NC group) recorded the significantly highest activity compared with PC group.

28- Layers exposed to CH (NC group) significantly decreased TAC, LTT and BA compared with PC group, and Haemagglutination inhibition of the Newcastle disease virus (HINDV) at 7 d post-vaccination compared with the PC, and the other experimental groups.

29- Haemagglutination inhibition of Newcastle virus was significantly incensed at 14, and 21 d compared with the titer value at 7 d of post-vaccination.

30- Laying hens exposed to HS (during and after HS time) significantly increased cloaca temperature for all experimental heat stress groups compared with the PC group.

31- The highest economic efficiency (EE), and relative economic efficiency (REE) were recorded for the group fed dietary manipulation diet 250 DEB with 1.37 Arg/Lys than the other experimental groups.

In conclusion,

It can be concluded that Mandara laying hens fed monblueted diet equal DEP 250 mEq with 1.37Arg/Lys could be applied to elevate the adverse effect of HS and improve the productive, reproductive, egg quality traits, blood haematological and biochemical traits, antioxidants, and immunity and represented the highest EE.