EFFECT OF DIFFERENT DIETARY LEVELS OF PROTEIN AND ENERGY ON THE PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF DEVELOPED STRAIN HENS UNDER HEAT STRESS CONDITION

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6. SUMMARY AND CONCLUSION

The present study was carried out at El-Sabahia Poultry Research Station, Alexandria Governorate, belonging to Animal Production Research Institute, Ministry of Agriculture, and the chemical analysis was done in the Faculty of Agriculture, Damanhour University. Gimmizah local strain was employed in two experiments. The two experiments were conducted from January to March 2018, and each lasted for 12 wks from 32 to 44 weeks of age. The main objective was to investigate ' The effect of different dietary levels of protein, and energy on the productive, and reproductive performance egg quality, immune responses, some physiological, and blood biochemical constituents of the Gimmizah laying hens exposed to chronic heat stress.

A total of 360 hens, and 45 cocks of Gimmizah developed local strain were divided into ten treatment groups, and housed in 45-floor pens (2 m × 1.2 m × 2 m) furnished with wheat straw. Each treatment was represented by 5 replicates of 8 hens + 1 cock each. Hens were housed in an environmentally controlled light-proof house.
The first treatment was kept in the first sector under thermoneutral condition (22: 24 ^{o}C), and relative humidity (RH) 45: 55 %, and fed the first experiment basal diet only (15% crude protein + metabolizable energy 2700 Kcal/ kg diet) as a positive control (PC). Whereas the other treatments were kept in the last sector under heat stress conditions (38 °C ± 1; 55-65 % RH) for three successive days a week from 10.00 am until 2.00 pm.

First Experiment:

The first experiment was assigned equally into five treatments four nutritional groups.
Treatment 1: 15 % crude protein, ME 2700 kcal fed under thermoneutral condition, and positive control (PC).
Treatment 2: 15 % crude protein, and ME 2700 kcal fed under heat stress condition, and served as negative control (NC).
Treatment 3: 13.5 % crude protein, and ME 2700 kcal/kg diet, and fed under heat stress condition.
Treatment 4: 16.5 % crude protein, and ME 2700 kcal, and fed under heat stress condition.
Treatment 5: 18 % crude protein, and ME 2700 kcal, and fed under heat stress condition.

Second Experiment:

The experimental assigned equally into five treatments four nutritional groups.
Treatment 1: 15 % crude protein, and ME 2700 kcal +0% oil-fed under thermoneutral condition, and served as a positive control (PC).
Treatment 2: 15% crude protein, and metabolizable energy 2700 kcal/ kg diet +0 % oil-fed under heat stress condition, and served as negative control (NC).
Treatment 3: 15% crude protein, and metabolizable energy 2700 kcal/ kg diet +2 % oil-fed under heat stress condition.
Treatment 4: 15% crude protein, and metabolizable energy 2700 kcal/ kg diet +4 % oil fed under heat stress condition.
Treatment 5: 15% crude protein, and metabolizable energy 2700 kcal/ kg diet +6 % oil fed under heat stress condition.

The obtained results could be summarized as follows:

Experiment 1

1. Gimmizah hens exposed to chronic heat stress and fed 13.5, and 15% CP (The NC group) had the lowest significant BW change; the decrease was 9.66, 8.52 %, respectively, compared to the PC group.
2. The survival rate for Gimmizah hens did not affect different levels of dietary crude protein under CHS or control group.
3. The laying rate of all treatment groups was significantly decreased for all groups under HS unless the layer fed 16.5% CP, which was statistically alike with the EP of PC group.
4. Chronic heat stress significantly decreased egg weight and egg mass for all experimental groups since the highest EW was recorded for the PC group compared with the other treatment groups under HS, regardless of layer age. However, the EW, and EM were significantly increased by forwarding of the hen age.
5. Feed intake for all groups exposed to CHS during different periods was significantly lower than the PC group.
6. Feed conversion rate of PC group was the best value compared with the other experimental groups under HS, but it is statistically alike with the groups fed 16.5, and 18.0 %CP under HS, regardless of layer age.
7. Digestibility coefficients of crude protein, ether extract, and crude fiber (%) for the PC group were significantly greater than that of all fed crude protein levels (CP %) under heat stress.
8. Eggshell thickness was significantly decreased in hens fed 13.5% CP compared with the PC group and other groups under CHS.
9. The yolk index was significantly higher for the PC group (45.5) than other groups under CHS.
10. The yolk color was significantly lower for hens offered 18 % CP compared to the other groups. At the same time, the Haugh unit score was significantly decreased for the 13.5%CP group.
11. Hens fed 15% CP (The NC group) under CHS had significantly lower reproductive traits, and relative weight of chicks than the PC group. Layer groups under CHS fed with different levels of CP cannot recovery the adverse effect of CHS. Also, the highest chicks weight (g) and chicks weight (%) were form the PC group. In contrast, there were no significant differences between the PC group, and 16.5, and 18% CP under CHS.
12. Hemoglobin was significantly decreased for hens fed 13.5% CP compared with other experimental groups. While (RBCs), and (PCV %) recorded the lowest significantly for 13.5, and 15 % groups compared with others. In contrast, the MCHC% for the PC group was the highest particularly. The pH, MCH for the PC group, and 16.5 and 18% CP under CHS were significantly low.
13. Hens fed with 13.5 %CP under CHS had significantly decreased WBCs count. Hens fed 16.5% crude protein had substantially higher lymphocyte (%). Also, hens fed with 18% CP had significantly higher eosinophil % but lower lymphocyte than other groups. On the other hand, the chicken fed 16.5 % CP, and The PC group had substantially lower eosinophil %. Groups fed (13.5%, and 16.5% CP) had the most inferior significant heterophil (%), and heterophil/lymphocyte ratio (H/L ratio) than other treated groups.

14. Hens fed with NC diet significantly decreased PI, BA, IgA, IgM, and IgG compared with the PC group. Also, the PA, and LA % were especially lowest for the group fed 13.5 % CP. While the LTT % were insignificant among all experimental groups.

15. The values of NDV titer recorded for the NC group were significantly decreased compared to that recorded on the PC group unless at 21 d of post-vaccination.

16. Glucose, total protein, globulin, α- globulin, and β- globulin concentration were significantly lowest for the groups fed 13.5, 15% CP (NC) group under CHS than PC, and other experimental groups. There was no significant difference in albumin concentration and γ- globulin among the PC, NC, and the different experimental groups under CHS.

17. The hens fed 13.5 and 15% CP (NC) group had significantly increased plasma AST and ALT than the PC group. In contrast, the PC group had the lowest ALP, creatinine, and urea compared with the other experimental groups. Plasma creatinine /urea ratio was significantly decreased of hens fed 16.5, and 18 % CP groups under CHS.

18. Total lipids, cholesterol, triglyceride concentrations, and LDL for the NC group under CHS were significantly increased than the PC group. Simultaneously, the highest LDL concentration was recorded for the NC group, and the group offered 13.5 % CP under CHS.

19. The lowest significant HDL/LDL ratio, TAC, and CAT, were observed for The NC group, and the group offered 13.5% CP compared with The PC group, and other groups. **E**xposing to CHS significantly increased MDA for the NC group, and the group provided 13.5% CP compared to The PC group. On the other hand, MDA concentration was statistically alike for The PC group, and those offered 16.5, and 18.0%CP.

20. **E**xposing to CHS significantly decreased E_2, P_4, T_3, T4 activity, and Ca concentration for the NC group compared to the PC group, which recorded the highest E_2, P_4, T_3, and T_4 than the other experimental groups under CHS.

21. Exposing to CHS significantly decreased the liver, ovary, and large follicle number of The NC group compared to the PC group. While increasing levels of crude protein from13.5 to 18% CP, it did not recover the previous treats. Also, there were no significant effects on the spleen, pancreas, the total yellow ovarian follicle (TYOF), and small white follicle number (SWF), oviduct weight, and length between all treated groups. However, the abdominal fat % for the group offered 13.5% CP recoded the highest value compared with the other experimental groups.

22. The body temperature rate noted that the lowest cloacal temperature was recorded for the group offered13.5% CP during CHS. In contrast, the group's cloacal temperature and respiration rate were significantly higher for the group offered 18% CP under CHS than all other treatment groups. However, under CHS, the cloacal temperature, and respiration rate for hens fed 13.5, and 15% CP (NC) were significantly ($P<0.01$) decreased compared to 16.5, and 18% CP. Increasing protein levels above 15% under CHS significantly increased cloacal temperature and respiration rate.

23. Economic efficiency (EE) of Gimmizah hen layers from 32-44 wks of age, fed 15% CP NC had the higher EE which recorded 164.00%. While 18 % CP had the worst EE, which recorded 131%.

In summary, increasing protein to 16.5% CP is adequate to improve EP%, EW, EM, FCR, egg quality fertility, hatchability. However, increasing protein levels were more

effective for blood hematological and biochemical traits, antioxidants, and immunity. This is suggested that Gimmizah laying hens can be fed a layer diet with 16.5% CP to maintain egg production, physiological, and immunological performance during 32 to 44 wk of age under CHS.

Experiment 2

1. The final body weight of laying hens in different treatment groups was insignificantly affected by different oil levels under the CHS or the PC group. However, the lowest significant BW change was observed for the NC group (0 % oil), and 2% oil. The decrease was 8.52, and 7.39% compared to the PC group.
2. The survival rate for Gimmizah hens did not affect different dietary oil levels under CHS or control group.
3. Hens fed with the NC group exposed to HS have significantly decreased egg production (EP %), egg weight (EW g), and egg mass (EM g) compared with the PC group. The incorporation of different levels of oil significantly improved the EP, EW, and EM compared with the NC group.
4. Feed intake for all groups exposed to CHS during different periods was significantly decreased compared to the PC group, regardless of layer age. However, the amount of FI for all experimental groups under HS was statistically alike.
5. Laying hens fed with the NC group which was exposed to HS was recorded the significantly worst FCR compared with the PC group. On the other hand, incorporating different oil levels significantly improved the FCR compared with the NC group, and completely recovered the FCR, regardless of layer age.
6. Digestibility coefficients of ether extract (%) for The PC group, and all levels of oil % were significantly greatest compared to (NC) group under CHS. The crude protein digestibility (%) was significantly decreased for all experimental groups under CHS compared the PC group.
7. The lowest yolk index was observed for the NC group, and 2% oil compared to other groups.
8. Fertility, hatchability of total eggs, fertile eggs, piped, and chicks weight (%) were significantly decreased for the group supplied with 2% oil than the NC group. The NC group under CHS recorded the highest dead % for embryos compared to other groups.
9. Hemoglobin**,** RBCs, PCV, and MCHC (%) were significantly decreased for (NC) group. It can be observed that the values of Hgb, and PCV were especially the highest for the PC group.
10. The value of MCV, and MCH was the lowest value of the group supplied with 2 % oil. In contrast, the lowest significant blood pH was recorded for the PC group.
11. Hens fed 4% oil under heat stress had the lowest WBC significantly compared with other groups. On the other hand, the group provided the PC group had substantially higher WBC,s, and lymphocyte percentages. However, the group fed (NC) had the significantly lowest lymphocyte percentage. The group fed the NC had a higher significantly heterophil (%), and H/L ratio. The group fed (PC), and 6% oil under heat stress had substantially lower heterophil **%**, and H/L ratio.
12. Compared with other groups, hens on the NC diet had significantly decreased PI, IgA, IgM, and IgG. However, chicken on NC, and those supplied with 4, and 6% oil under CHS had the lowest significant IgM values than the PC group. Also, chicken fed with 2, 4, and 6% oil under CHS had the lowest LTT, LA than PC, and NC.

13. Hens fed The PC group, and all oil levels under CHS on PA %, NDV titer at 14, and 21 days of post-vaccination were insignificant. However, chicken on NC, 2, 4, and 6 % oil groups had a significantly lower BA, and NDV at 7 days than the PC group.
14. Glucose for the groups supplied with 2, 4, and 6 % oil groups was significantly greater than other experimental groups. However, the NC group had the lowest glucose concentration.
15. The total protein, globulin, α- globulin, and β- globulin were decreased considerably for chicken on the NC diet compared to other treated groups. The opposite trend was observed in the albumin/globulin ratio. On the other hand, albumin, α- globulin, β- globulin, and γ- globulin were little difference between the groups supplied with 0, 2, 4, 6 % oil under CHS PC group.
16. The layers group exposed to CHS without oil supplementation recorded a significantly higher concentration of plasma AST, and ALT than the PC, and other groups. There were insignificant differences in AST/ALT ratio, urea, and creatinine /urea ratio between the PC, and all groups under CHS. While, the plasma ALP, and creatinine were significantly increased in the NC group compared to the PC group.
17. Total lipids, triglyceride, cholesterol, LDL, and MDA concentrations for the NC group were significantly the highest compared with the PC group. The lowest significant TAC, CAT, and HDL/LDL ratio were observed for the NC group compared with PC, and other groups.
18. Gimmizah hens on NC diet had significantly lower E2, P4, T3, T4, and Ca concentrations than the PC group. On the other hand, supplementation of different oil levels increased the activity of the previous traits compared with The NC group.
19. The spleen, pancreas, ovary, large yellow follicle, oviduct weight, oviduct length, and abdominal fat (%) insignificantly differed among the PC, and other groups under CHS. On the other hand, the NC group shows a significantly lower liver percentage than The PC group, and supplementation of different oil levels increased the liver % than The NC group. The lowest TOF, and SWF were observed for the group supplied with 4 % oil compared with PC.
20. The cloacal temperature rate, and respiration rate of breeder hens before the exposure to heat stress had no significant differences between all treatment groups. The changes in cloacal temperature were similar during, and after exposure of CHS.
21. The changes in respiration rate were similar during, and after exposure to CHS. It was found that the respiration rate for the NC group was the highest, and supplementation 2, 4, and 6% oil significantly decreased the respiration rate compared to the NC group.
22. Economic efficiency of Gimmizah hen layers from 32-44 wks of age. The results indicate that hen fed (NC) 0% oil had the higher EE, which recorded 164.00%. In contrast, 6% oil had the worst EE, which recorded 138%.

In summary, it can be concluded that layer fed a diet supplemented with 4 or 6% oil enhanced tolerance to a high ambient temperature (38ºC, 55–65% RH) during the laying period (32-44) weeks, as evidenced by increases in the productive performance, egg quality, blood haematological, and biochemical traits, antioxidants, and immunity.