Faculty of Agriculture

LONG TERM SELECTION FOR AUGMENTING EARLY GROWTH RATE IN JAPANESE QUAIL

By

Doaa Abd El-Hameed Mahmoud Semida

B.Sc. in Agriculture Sciences (Poultry Production)
Fac., Agric., Fayoum, Univ., 2016.
M.Sc. in Agriculture Sciences (Poultry Breeding)
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THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of Ph.D. in Agriculture Sciences (Poultry Breeding)

Department of Poultry Production

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APPROVAL SHEET

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This Thesis for Ph.D. Degree (Poultry Breeding) has been approved by:

1- **Prof. Dr. Hassan Hassan Younis**
Professor of Poultry Breeding, Faculty of Agriculture, The Former vice President of Post Graduate and Research, kafer El-Sheikh University.
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2- **Prof. Dr. Mohamed Bahie El-Deen Mohamed**
Professor of Poultry Breeding, Dean of Faculty of Agriculture, Alexandria University.
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4- **Prof. Dr. Bothaina Yousef Fouad Mahmoud**
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Date of Examination: .. / .. /2023

5. SUMMARY AND CONCLUSION

A total number of 17,806 birds (1,300 in the pre-base population, 1,726 in the base population, 10,609 for the selected line and 4,171 for the control line) were used during a selection experiment that continued for ten generations (eight selection generations) at the Poultry Research Center, Faculty of Agriculture, Fayoum University.

The present study concerned with the investigation of the consequences of a long term selection for early augmenting growth rate during the period from one to 21 days of age (HGR_{1-21}) and aimed to estimate the genetic parameters for quail survival traits, evaluate risk factors with the occurrence of mortality in the two tested lines of Japanese quail.

Traits that studied throughout the course of the selection study were:

Body weight (BW) at hatch, seven, 14, 21, 28 and 35 days of age, body weight gain (BWG) and growth rates (GR) during the periods 1-7, 1-14, 1-21, 1-28 and 1-35 days of age, Age at first egg (AFE, day), body weight at first egg (BW_{AFE}, g), days needed to produce the first ten eggs ($DN_{10,}$ day), age at the first ten eggs (AGE_{10}, day), number of eggs produced (EN_{FM}, egg), egg mass (EM_{FM}, g), average egg weight (AEW_{FM}, g), clutch number (CN_{FM}, clutches/hen), clutch size (CS_{FM}, eggs), pause duration length (PDL_{FM}, days) and age after first month of production (AGE_{FM}, day), fertility%, hatchability% and embryonic mortality% (early and late**)**. A slaughter test was performed at 35 days of age at the 4^{th} and 8^{th} generations, using 200 quail (25 chicks per sex within each line), for whole body carcass analysis and carcass chemical composition analyses. Plasma of tested blood samples were assayed for total cholesterol (mg/dl), high density lipoprotein (HDL, mg/dl), low density lipoprotein (LDL, mg/dl) and triglycerides (TG, mg/dl). After eight generations of selection, a separate hatch

of 687 chicks was used to evaluate risk factors with the occurrence of mortality and survival traits.

Results summarized as follows:

1. GR_{1-21} significantly increased as generation number increased, the G_8 surpassed the G_1 by + 5.2941%. The HGR_{1-21} line significantly exceeded the control line (CL) by + 0.03 (1.7341%).
2. Generation of selection effects resulted in significant differences in all studied growth traits. All studied growth traits except BW at hatch were significantly affected by line favoring the HGR_{1-21} than the CL. Similarly, sex significantly affected all studied growth traits except BW at hatch favoring females than males.
3. All studied egg production- related traits were significantly affected by selection generation. Line significantly affected all egg production–related traits studied favoring the HGR_{1-21} which had earlier AFE at age (46.57days) with heavier BW_{AFE} (268.75g), AEW_{FM} (11.95g) and lower DN_{10} and AGE_{10} (13.11 and 56.57days) than the CL.
4. Generation significantly affected all studied egg production traits. Line significantly affected all egg production studied traits favoring the HGR_{1-21} line that laid more EN_{FM} eggs, higher EM_{FM}, larger CS_{FM} and shorter PDL_{FM} (24.14egg, 289.88g, 5.82egg and 3.73day, respectively) than the CL line.
5. Generation of selection significantly affected all studied fitness traits. Line had significant effects on all fitness traits favoring the HGR_{1-21} line which had higher fertility%, hatchability% and desirably lower late embryonic mortality% than its CL (85.03%, 78.20%, and 2.30%, respectively).
6. Generation significantly affected TG where the 4^{th} generation had higher estimate than the 8^{th} generation. Quails of the HGR_{1-21} line had significantly and

lower HDL, higher LDL, total cholesterol and TG than the CL line. Sex significantly influenced each of LDL, total cholesterol and TG resulting in higher concentrations in females than males.

7. Carcass%, dressing% and BLM% were significantly affected by line favoring the $HGR_{1\text{-}21}$ line.
8. Significant line effect was shown for moisture%, indicating that the $HGR_{1\text{-}21}$ had lower moisture% than the CL. Sex significantly affected ash% as males had higher ash% than females.
9. **The selection program:** The cumulative genetic gain for $GR_{1\text{-}21}$ exceeded the cumulative response based on breeding values by +0.019.
10. Both APDR/G and environmental changes indicated significant values, while AGDR/G had insignificant values in all sex groups studied for $HGR_{1\text{-}21}$ in Japanese quail.
11. After eight generations of selection, the $GR_{1\text{-}21}$ had lower direct h^2 (0.25) than those reported across four selection generation of 0.28.
12. There were significantly positive APCR**/**G for BW's from hatch up to 35 days of age of females, males and combined sex. Environmental changes were significantly positive for all sex groups of BW_7, BW_{28}, males and females BW_{21} and BW_{35} but were significantly negative for $BW_{1.}$
13. Cumulative selection responses for all correlated growth traits were in the favored direction.
14. All studied growth traits had moderate h^2 estimates ranged from 0.18 to 0.25. The $GR_{1\text{-}21}$ had moderate h^2 of 0.25 and found to be positively correlated genetically and phenotypically with all studied growth traits except for bw_1, ranging from 0.17 to 0.41 for rg's vs. 0.20 to 0.42 rp's.

15. APCR estimates were desirably significant for AFE, DN_{10}, CN_{FM}, PDL_{FM}, AGE_{10}, AGE_{FM}, BW_{SM}, EN_{FM}, EM_{FM}, CS_{FM} and AEW_{FM}. Significant and favored AGCR were shown for BW_{AFE}, EN_{FM}, EM_{FM} and DN_{10}.
16. There were significant absolute genetic gains observed for BW_{AFE}, EN_{FM}, and CN_{FM} exhibiting favorable trend of genetic gains in a all egg production traits, whereas insignificant absolute genetic gains were observed for other egg production traits.
17. The h^2 of AGE_{10}, BW_{AFE}, AFE, EM_{FM}, AGE_{FM}, AEW_{FM}, EN_{FM}, PDL_{FM}, CS_{FM} DN_{10} and CN_{FM} ranged from 0.09 to 0.24. $GR_{1\text{-}21}$ had preferably negative genetic and phenotypic correlations with AFE, DN_{10}, $PDL_{FM,}$ AGE_{10} and AGE_{FM} ranging from -0.03 to - 0.20 for rg and from -0.02 to -0.26 for rp, and was positively correlated genetically in a favorable trend with each of BW_{AFE}, EN_{FM}, EM_{FM} and CS_{FM} (rg: 0.25, 0.29, 0.17 and 0.21, respectively).
18. APCR estimated of fitness traits were significant of +3.00% and +2.80% associated with preferable decline in late embryonic mortality% (-0.16%). AGCR for fertility% was significantly increased by +0.94.
19. All relative gain values`% for selection criterion and all studied traits were consistently in the desirable direction, except for early embryonic mortality% reflecting the effectiveness of the selection program applied in the present study.
20. Concerning the survival study, both the $HGR_{1\text{-}21}$ and the CL lines had the same risk factors indicating that selection for a high growth rate did not negatively affect survival traits. Survival and longevity had low h^2 values, low rg and rp correlations between survival and longevity with $GR_{1–21}$ and ranging from 0.025 to 0.208. The survival tended to be less correlated with $GR_{1–21}$ and body weight at marketing age than the longevity.

It can be concluded that continuous selection for high growth rate has resulted in a well-established paternal line of Japanese quail specialized in meat production which can be proposed as a sustainable solution for food security problem.