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Evaluation on Inbreeding Effect on Production Traits in Azarbaijan Native Fowls

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Abstract: Inbreeding rate and effect on production (body weight at age of sexual maturity (BWSM), body weight at 12 weeks (BW12), average egg weight (AEW) and age of sex maturity (ASM)) traits were evaluated in 43180 Azerbaijan native fowls. The individual inbreeding coefficients were calculated using Pedigree soft ware from available performance records across 14 generations. The mean inbreeding coefficients total of birds, female birds, male birds and inbred birds were 4.411, 3.361, 3.612 and 5.246, respectively. The number effects were calculated by Wright̉ s and Gowe̓ s formula that were ranged 411.180 to 6840.662 and 593.263 to 12973.880, respectively. Rate of inbreeding's Wright (ΔF) varied between 0 to 6.82% and for rate of inbreeding using calculation Gowe of number effect 0.004 to 084/0 %. Linear regression coefficient between inbreeding level (%) with body weight at age of sexual maturity (BWSM), body weight at 12 weeks (BW12), average egg weight (AEW) and age of sex maturity (ASM) were estimates 3.444 g, 15.255gr, 0.217 g and -0.001 day, respectively. Our results show that the inbreeding coefficient increased every generation lead to low number effect and population size. It is strongly emphasize that control of inbreeding should be given high priority in animal breeding.
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Key words: number effect, inbreeding coefficient, Azerbaijan native fowls

Introduction

There are two method for genetic improvement of held: selection and cross breeding. Selection method increase similar allele and more heterozygote. Result to, measure of inbreeding to be increased.

Inbreeding coefficient change with number effects (Ne), type of intersection and ration male to females. So, they are studied one by one.

Azerbaijan native fowl center setup in west –north Iran since 1986.primary four generation establish selection only in base male.

The inbreeding coefficient of stuable in poultry is about 0.1 (Nwaqu et al 2007). Increase inbreeding is lead to appearance of overcome allele and lethal. As much as number effect and ration male to femal have high, result to inbreeding coefficient is decreased. So, better method for inbreeding control are calculated Ne and ration male to femal by Wright and Gows formula (Write ., 1922 and Gowe et al ., 1959). Increase the inbreeding for small and closed population is negative especially for traits with low heritability because the traits are most non-addition genetic factor effect. Parameter estimates were obtaining using AIREML software. The inbreeding coefficients of individuals were calculated by pedigree softwar (Sargolzaei, 2000) and for every generation by Wright effect number and Gows number effect that the following their formula were showed:

$$\Delta F = \frac{1}{2\mathrm{Ne}}$$

$$Ne = \frac{4\mathrm{N_f}\,\mathrm{N_m}}{\mathrm{N_f} + \mathrm{N_m}}$$

$$\frac{1}{Ne_{gows}} = \frac{3}{16\mathrm{N_m}} + \frac{1}{16\mathrm{N_f}}$$

Ne=effect number of Wrights,
Ne_{gows}=effective number of Gows;
N_f=number of female;
N_m=number of male;
F= inbreeding coefficient ($F = \frac{1}{2N_e}$).

Different factor on inbreeding rate is effective including size population, effective number and rate male to female that using Ne_{wright} and Ne_{gows} were checked.

In recent years, inbreeding effects in poultry and livestock population were studied (Klemesdul, 1998 and Szwaczkowski et al, 2003). There fore the objective of percent study was evaluate an inbreeding rate and review effective factors on inbreeding and also effects it on production traits.

Maternal and method

In percent study in based on 36308 record of Azerbaijan native on a pedigree for fourteen generation (1986 to 2011). Azerbaijan province is located in a half-tropical in northwest Iran. Native fowl were selected based on their phenotypic characteristics. The chickens were naturally mated and kept on litter. The chicken selections were based on the classical selection. Index, which included BW (1th day, 8th and 12th wk, and BWSM), number egg (3th month of production), egg weight (28th, 30th and 32th wk of age). At the 4th generations, selection base females phenotype recorded and in with using of recording at post generations and males. The next generation used of all records, females and males.

Genetic parameters were estimated by signal trait animal method by REML method and using AIREML soft ware. The following signal trait animal model was employed:

$$y_{ijk} = \mu + sex_i + gh_j + \beta(x_{ijk} - \bar{x}_{...}) + Animal_{ijk} + e_{ijk}$$

y_{ijk}=observation of ijk-th individual,

μ=total mean;

sex_i=Fix effect of i-th sex (i=1, 2);

gh_j=Fix effect of j-th generation-hatch (j=1, 2… 14);

$\beta(x_{ijk} - \bar{x}_{...})$= Coefficient of linear regression;

$Animal_{ijk}$= Random effect of ijk-th individual;

e_{ijk}= Random error with ijk-th observation,

Results and discussion

Table 1 descriptive statistics, heritability and regression coefficient for economical traits are showed. The average body weight of 12week (BW12) and body weight at first egg (BWSM), age at first egg (ASM) and average egg weight were lower than Szwaczkowski et al (2003). Estimates of regression coefficients between inbreeding level and performance traits showed that 1% of inbreeding leading to increase almost 3 and 15 g for BW12 and BWSM, respectively. Szwaczkowski et al (2003) found relationship similar for BWSM in N88 line but for N77 line obtained negative relationship. Effect inbreeding was partial for AEW (0.217g). Kamali et al (2007) reported was different of the result (-0.51, 0.31 and 0.03 for BW12, ASM and AEW). So, different regression coefficient was resulting of type of strain and heritability traits. BW12 have almost higher heritability traits. So, it influenced addition genes and increase of inbreeding level hasn't negative effect rather it is increase. Negative effect of inbreeding on BW12 result to liner and unliner relation with inbreeding.

The total number of poultry, effect number of Wright and Gows and inbreeding over generation are presented in table 2. The number of poultry was limit 1019 to 7749 (for five and fourteen generation, respectively) and inbreeding coefficients (%) was rang 0.4 to 6.8 (another of 1, 2 and 3 generation). $\frac{N_e}{N_{total}}$ and $\frac{N_m}{N_f}$ were ranging from 39.375 to 99.846 (6 and 9 generation, respectively) and 12.447 to 92.485 (6 and 9 generation, respectively) , respectively. Because $\frac{N_e}{N_{total}}$ is determiner expectation genetic variance of population, so it is well known that increased $\frac{N_e}{N_{total}}$ leads to will increase transition of paternal variance to later generation. While the number effect of Wright increased up to the generation 14, the number effect of Gows increased, too. So, for decrees of inbreeding of coefficient must increase number individual and rate male to femal number. Inbreeding of coefficient calculation by number effect of Gows was ranging from 12.846 to 97.425 (5 and 13 generation, respectively). The result showing whatever decreased rate N_m to N_f leaded to increase inbreeding of coefficient.

Mean the number of inbred individuals were 5.246% means of 43180poultry, 36300 poultry was inbred. Generally, the inbreeding rates increased. The result maybe lead to relationship mating, the lack of using of suitable inbreed program and unknown common ancestor in pedigree.

Relation total number of individual and number of male and femal with inbreeding are present in chart 1, 2 and 3. Null inbreeding rate in the first three generation were influenced by unknown common ancestor and lack of enough information. The inbreeding rate increased while the number of individuals increased up to five and then approximately it was fixing. Then of later 6 generation increased that in 6 to 8 generations, inbreeding rate hardly increase. The results were possible influenced by low number individual and high using of relationship matting. In finger 2, 3 showed that numbers of inbred individuals' males are higher than females .generally, inbreeding of coefficient for 16811 males and 24568 females 3.61 % and 3.36 %, respectively (except first 3 generation).

Inbreeding rate calculated every generation in line of laying 0.4%. Generally, inbreeding level must keep lower than 0.1% (Morris and Pollot, 1997).

Regression coefficients between inbreeding and total number (for 14 generation) were calculated by SAS (2003) soft ware that the following was showed.

$y = 0.000849x + 0.356$

y=percent inbreeding

x = total number of poultry

The relation shows with increasing total number until 175 individuals, inbreeding rate increase 0.14%. The results were lower than age reports (Nwaqu et al. 2007 and Szwaczkowski et al, 2003 but similar to those obtain by Sewalem et al, 1999, Nordskorg et al, 1998 and Gowe etal, 1959.the result showed lead to following conclusions:

The inbreeding rate increased maybe lead to relationship mating, the lack of using of suitable inbreed program and unknown common ancestor in pedigree, decreased rate N_m to N_f and number effect. The inbreeding depression for the traits wasn't negative effect.

Table 1. Deriptive statistics, heritability and regression coefficient (R.C)

traits	N	mean	S.E	C.V	R.C	h^2
BW12 (g)	36308	1332.381	1.226	17.535	0.390	15.255
BWSM(g)	11886	2166.638	1.813	9.124	0.161	0.217
ASM(day)	9695	180.605	0.158	0.010	0.204	3.444
AEW(g)	14028	51.98	0.029	6.702	0.249	0

Table 2. The inbreeding rate for 14 generation

generation	N_m	N_f	N_{total}	$\frac{N_m}{N_f}$ (%)	Parents of $\frac{N_e}{N_{total}}$ (%)	effective $N_{e_{wright}}$	$N_{e_{gows}}$	CF	CF_{gows}
1	130	1013	1143	12.833	40.320	460.857	664.891	0.000	0.075
2	149	938	1087	15.885	47.314	514.304	754.705	0.000	0.066
3	162	938	1100	17.271	50.233	552.567	816.968	0.003	0.061
4	144	944	1088	15.254	45.934	499.765	730.839	2.351	0.068
5	116	903	1019	12.846	40.351	411.180	593.263	0.418	0.084
6	117	940	1057	12.447	39.375	416.197	599.142	0.417	0.083
7	303	1214	1517	24.959	63.937	969.920	1491.881	3.141	0.034
8	2412	2677	5089	90.101	99.729	5075.201	9892.826	4.217	0.005
9	2219	2400	4619	92.458	99.846	4611.907	9046.565	3.202	0.006
10	1802	2479	4281	72.691	97.499	4173.939	7736.176	4.601	0.006
11	1608	2569	4177	62.592	94.707	3955.903	8940.245	5.046	0.006
12	539	1529	2068	35.252	77.082	1594.064	2572.395	5.474	0.019
13	3065	3146	7185	97/425	86/429	6209/944	12339/426	6/816	0/004
14	3084	3839	7749	80/333	88/278	6840/662	12973/880	6/068	0/004

Ne=effect number of Wrights, Ne_{gows}=effective number of Gows; N_f=number of female;N_m=number of male.

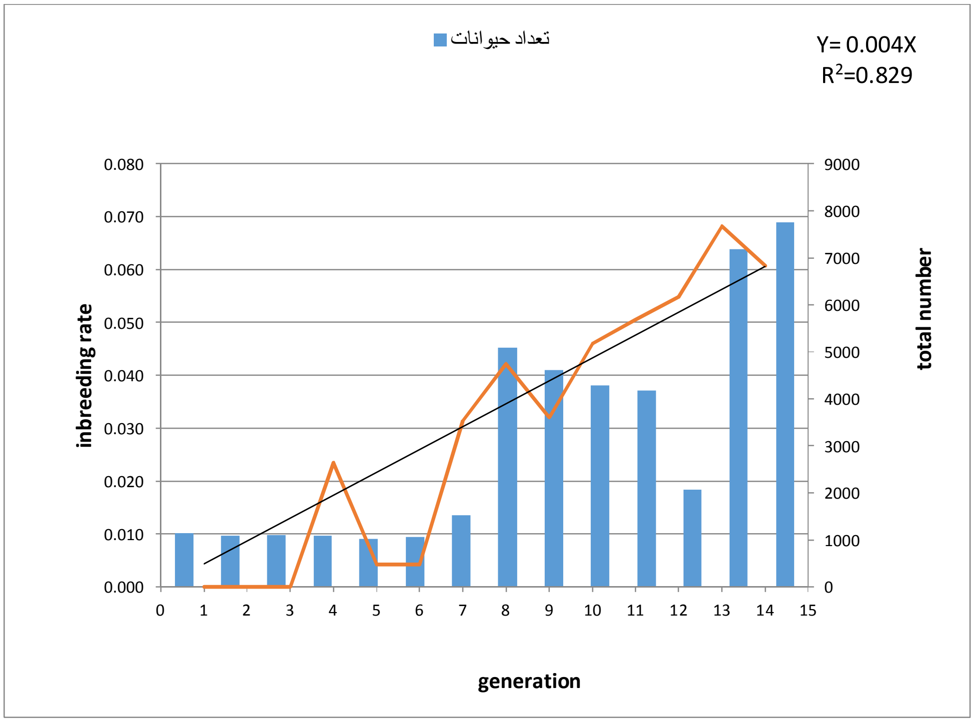

Fig.1. Inbreeding rate and total number

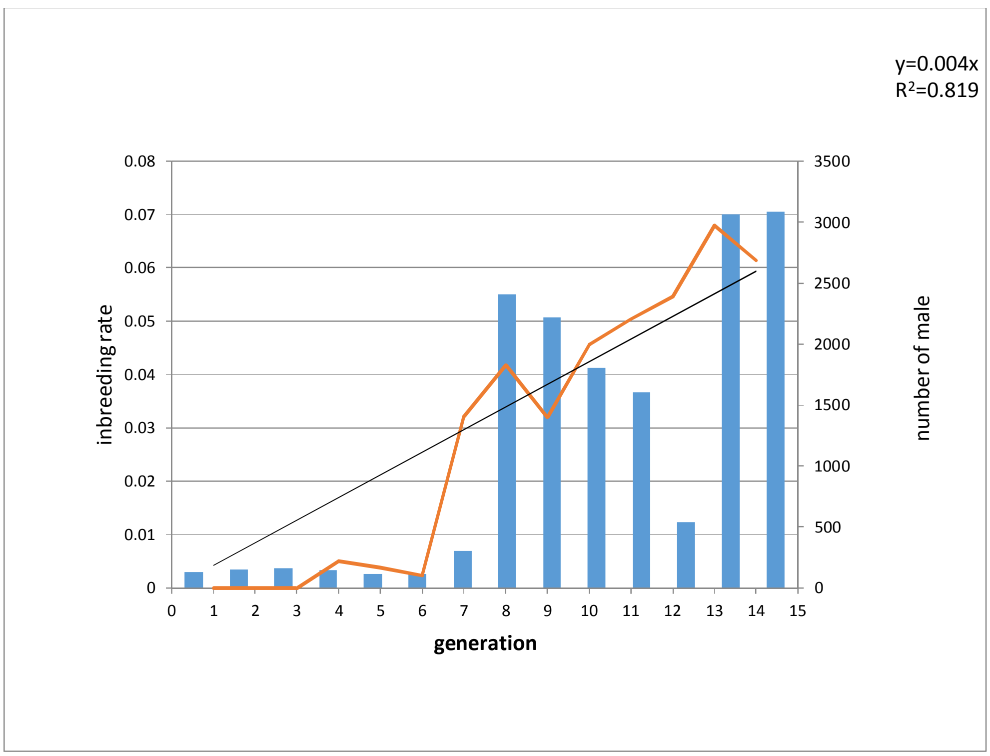

Fig.2. Inbreeding rate and number of femal

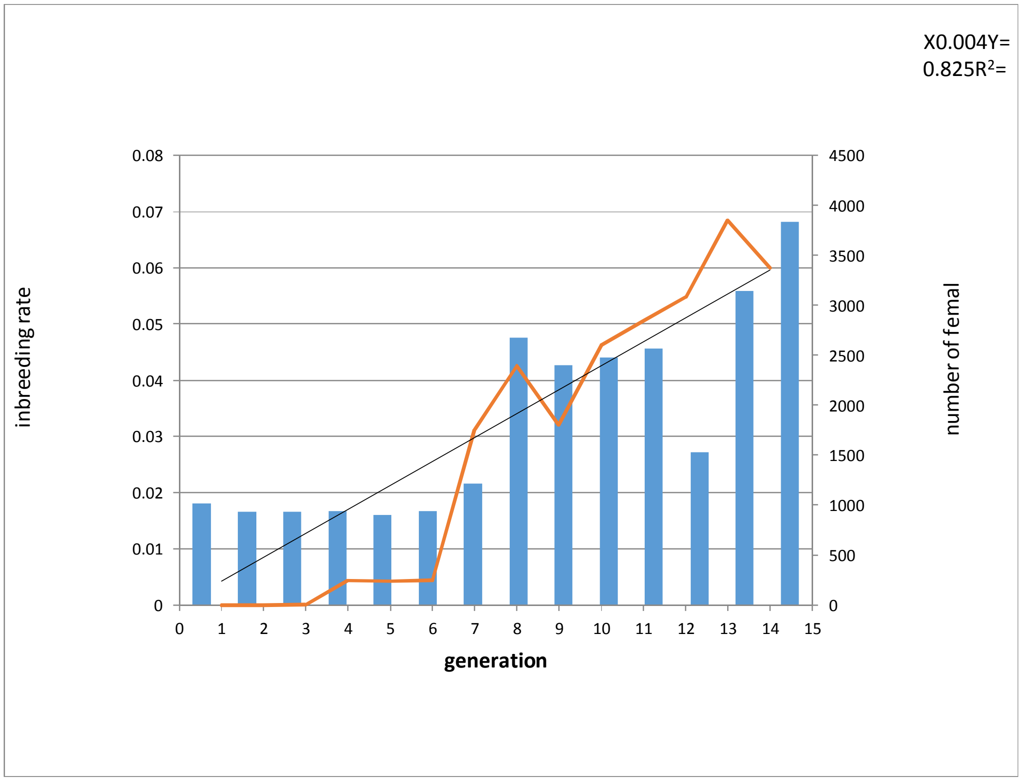

Fig.3. Inbreeding rate and number of male

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