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Genetic and Phenotypic Correlations between Characteristics in Local Guinea Fowl in Ghana

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

This study aimed at estimating genetic and phenotypic correlations among traits in local Guinea fowl in Ghana. Animal farm of Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development Mampong-Ashanti campus was where the study took place, from 2015 to 2018. Data for the experiment was obtained from keets made up of 300 males and 300 females. Parents of the keets consisted of 110 dams and 22 sires. Arithmetic method and Pearson's product moment correlation were used for the estimates. In male Guinea fowl, the values of genetic correlations among growth characteristics ranged from -0.63 to 0.93. Between growth and other characteristics, estimates of genetic correlation ranged from 0.29 to 0.97, -0.67 to 0.43, -0.62 and 0.94 respectively. Values of phenotypic correlations among growth parameters were between -0.32 and 0.49. Range of figures of phenotypic correlations recorded between growth characteristics and survival, docility, and dressing percentage were between -0.28 and 0.28, -0.46 and 0.18, and -0.41 and 0.36 correspondently. In female Guinea fowl on the other hand, range of genetic correlations among growth traits was between -0.80 and 0.95. Range of figures of genetic correlation between growth traits and survival, docility, dressing percentage and reproductive characteristics of were from -0.47 to 0.9, -0.52 to 0.58, -0.58 to 0.82 and -0.59 to 0.9 respectively.

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The values of phenotypic correlations among growth characteristics fell between -0.39 and 0.46. Phenotypic correlations recorded between growth traits and survival, docility, dressing percentage and reproductive characteristics were from -0.26 to 0.47, -0.47 to 0.19, -0.35 to0.47 and -0.33 to 0.47 respectively. Values of genetic correlations higher than one (1) among some traits in male Guinea fowl were recorded. To conclude, discoveries of this study are in general agreement of what pertains to Guinea fowl and other farm livestock species.

Keywords: Guinea fowl; hatch weight; feed intake; feed efficiency; survival; phenotypic and genetic correlation.

1. INTRODUCTION

The expectation of global demand for animal products to double by 2050, due to the irresistible growth of the world population, increasing incomes and further urbanization [1], makes establishment of animal genetic improvement programmes a priority to most animal scientists. In Ghana one of the most developmental projects since independence is Guinea fowl production. [2] outlined numerous advantages these birds have over the other domestic animals.

Knowledge of the phenotypic and genotypic characteristics of the indigenous Guinea fowls will immensely aid the achievement of the genetic improvement programme the country is embarking on. Estimates of heritability and phenotypic and genotypic correlations among traits are required inputs for designing breeding programmes and for many methods of genetic evaluation [3]. Works done in the area of genotypic and phenotypic parameter estimates for the indigenous Guinea fowl in the country are insignificant. There are few papers that have reported on phenotypic and genotypic parameters of the indigenous Guinea fowl [4]. The present paper complements a similar one on co (variance) components and heritability of traits of the Guinea fowl presented by [5]. The objective of this work was to estimate phenotypic and genotypic correlations among traits of the Guinea fowl.

2. MATERIALS AND METHODS

The animals, location, experimental procedure and traits have been described in a companion paper [4]. Briefly, the study was conducted at the Poultry Section of the Animal farm of the Department of Animal Science Education, University of Education, Winneba, Mampong-Ashanti campus, now Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Asante Mampong campus, Ghana, from 2015 to 2018. Asante Mampong lies in the transitional zone between the Guinea savanna zone of the north and the tropical rain forest of the south of Ghana along the Kumasi-Ejura road. Mampong lies on latitude 07˚ 03' N and longitude 01˚24'W with an altitude of 289.7 m above sea level. The rainfall pattern is bimodal, with the major rainfall season occurring from April to July with 1000mm of rainfall while the minor season occurs from August to November with 350 mm of rainfall. The average daily temperature is between 25°C and 30°C and the average relative humidity of the area is 70% [6].

The records used in the present experiment were collected from six hundred keets (300 males and 300 females) produced from randomly selecting and mating 110 dams and 22 sires of this base population, between May, 2015 to July, 2018. Seven hundred and eighty (780) records were collected from the keets during this period. The chicks were then taken to a brooding room immediately for brooding. The Guinea fowl keets were kept at a temperature of 35°C with adequate drinker and feeder spaces provided. Light was provided for 24 hours during brooding to avoid pilling and death. The temperature was reduced gradually at the rate of 3.50°C on weekly basis as brooding progressed [7]. The chick phase lasted for 4 weeks (28 days). At the end of the chick phase they were randomly distributed and raised on a slated wooden floor pen partitioned into 20 compartments with each compartment measuring 3 m x 4 m and housing 30 keets. Each sex was kept separately [8].

2.1 Estimate of Genetic Correlation

Estimate of genetic correlations among the traits were obtained using the Arithmetic method [9].

2.2 Estimate of Phenotypic Correlation

Phenotypic correlations among traits were estimated using Pearson's product moment correlation [10].

Correlations were classified as low (0.10 – < 0.30), medium (≥ 0.30 – < 0.50) and high (≥ 0.50 – 1.00), regardless of sign [11].

3. RESULTS

The results of genetic and phenotypic correlations between traits of the Guinea fowl are presented in Table 1 (for males) and Table 2 (for females). In male Guinea fowl, values of genetic correlation were positively high between hatch body weight (HWT) and two month body weight (TMWT) (0.56), low between eight month body weight (EMWT) (0.18) and negatively low between six month body weight SMWT (-0.17). There was no genetic correlation between HWT and four month body weight (FMWT) in the male Guinea fowl. In female Guinea fowl, genetic correlation figures recorded between HWT and TMWT was low (0.13). Negative values were recorded between HWT and FMWT (-0.03), SMWT (-0.75) and EMWT (-0.02). Phenotypically, positive correlation values between HWT and TMWT (0.33) and HWT and EMWT (0.01) were recorded. However, the values between HWT and FMWT (-0.2) and HWT and SMWT (-0.29) were negative in the male Guinea fowl. In the females Guinea fowl, the values of phenotypic correlation between HWT and the other growth traits were positive and negative (TMWT (0.05), EMWT (0.29), FMWT (-0.26) and SMWT (-0.23)).

Positive genetic correlation values recorded between TMWT and the other growth characteristics in the male Guinea fowl were low (SMWT (1.3) and EMWT (1.02)) except that of FMWT which was not important. However, genetic correlation values produced between TMWT and other growth parameters in the female Guinea fowl were all positive (FMWT (0.44), SMWT (0.73) and EMWT (0.05)). Values of phenotypic correlation recorded between TMWT and the rest of the growth traits in both male and female Guinea fowls were all positive (Tables 1 and 2).

Values of Positive genetic and phenotypic correlations obtained between FMWT and SMWT and between FMWT and EMWT were all positive in both males and female Guinea fowls (Tables 1 and 2). Genetically, the correlation figure recorded between SMWT and EMWT in the male Guinea fowl, was positive (1.03). The value of phenotypic correlation of SMWT and EMWT) was also positive (0.26) while in the female Guinea fowl, positive genetic and phenotypic correlation values were recorded between SMWT and EMWT (1.2) and between SMWT and EMWT (0.42) respectively.

Genetic correlation values recorded between HWT and all the body weight gains were all positive (0.21, 0.54, 0.64 and 0.78) in the male Guinea fowl while in the female Guinea fowl, values obtained for genetic correlation were positive between HWT and two month body weight gain (TMWTG (0.11)) as well as HWT and eight month body weight gain (EMWTG (0.35)) but negative between HWT and four month body weight gain (FMWTG (-0.12)) and six month body weight gain (SMWTG (-0.46)). Phenotypic correlation values between HWT and TMWTG, SMWTG and EMWTG were positive (0.12, 0.38 and 0.2 respectively) whereas this was negative between HWT and FMWTG (–0.004)) in the male Guinea four. However, in the female Guinea fowl, phenotypic correlation existed between HWT and all of the weight gains were positive (0.07, 0.15 and 0.21) except HWT and FMWTG which was negative (-0.26).

The values of genetic correlation between TMWT and TMWTG (1.02), FMWTG (0.83) and SMWTG (0.25) were positive but that of TMWT and EMWTG was not important in the male Guinea fowl. In the female Guinea fowl, positive genetic correlation values existed between TMWT and TMWTG (0.75), TMWT and FMWTG (0.23) and TMWT and SMWTG (0.15) but between TMWT and EMWTG (-0.32) the value was negative. Phenotypic correlation values in both male and female Guinea fowls were positive between TMWT and TMWTG (0.11 and 0.09 respectively) and TMWT and FMWTG (0.49 and 0.46 respectively) but negative between TMWT and EMWTG (, -0.28, and -0.04 respectively). However, the value of phenotypic correlation between TMWT and SMWTG (-0.23) was negative in male Guinea fowl and in the female Guinea fowl, positive value between TMWT and SMWTG (0.02) was recorded.

A negative value of genetic correlation was recorded between FMWT and SMWTG (-0.37) but between FMWT and EMWTG, a positive figure was recorded (1.2) in the male Guinea fowl whereas in the female Guinea fowl, positive values of genetic correlation between FMWT and body weight gains were recorded (FMWTG (1.33), SMWTG (0.05), and EMWTG (0.66)). Phenotypic correlation figures between FMWT and FMWTG were positive in both male (0.39) and female (0.35) Guinea fowls. FMWT and

EMWTG showed similar trend (positive) in both male (0.34) and female (0.36) Guinea fowls in terms of phenotypic correlation figures. In respect of phenotypic correlation FMWT and SMWTG, negative values were observed in both male and female Guinea fowls (-0.25 and -0.02 respectively).

Positive genetic correlation value was obtained between SMWT and EMWTG (0.92) in the male Guinea fowl whereas in the female, this correlation was negative (-1.2). In terms of phenotypic correlation between SMWT and EMWTG, the figure recorded was positive (0.26) in the male Guinea fowl and in the female, it was negative (-0.16).

In the male Guinea fowl, values of genetic correlation between TMWTG and both SMWTG and EMWTG were positive (0.82 and 0.64 respectively) but genetic correlation was negative between TMWTG and FMWTG (-0.43). Genetic correlation values recorded between TMWTG and FMWTG in the female Guinea fowl was negative (-0.53) and positive between TMWTG and SMWTG (1.36). However, no genetic correlation occurred between TMWTG and EMWTG in the female Guinea fowl. Similar phenotypic correlation figures were recorded between body weight gains in both sexes. Between TMWTG and FMWTG, genetic correlation values (positive) were 0.49 and 0.41 for the male and female Guinea fowls respectively. Again, phenotypic correlation figures between TMWTG and SMWTG in the male was -0.25 and -0.2 in the female. Phenotypic correlation values between TMWTG and EMWTG for both male and female Guinea fowls were also negative (-0.3 and-0.02 correspondently).

The values of genetic correlation recorded in the male Guinea fowl, between FMWTG and SMWTG and between FMWTG and EMWTG were all negative (-0.16 and -0.49 respectively). In the female on the other hand, the value of genetic correlation between FMWTG and SMWTG was positive (0.07) and no genetic correlation figure was obtained between FMWTG and EMWTG. In terms of phenotypic correlation, a negative figure was observed between FMWTG and SMWTG (-0.24) and a positive value was recorded between FMWTG and EMWTG (0.18) in the male Guinea fowl but in the female, phenotypic correlation values recorded between FMWTG and SMWTG was negative (-0.1) and between FMWTG and EMWTG was positive (0.11).

Genetic correlation figures between SMWTG and EMWTG in the male Guinea fowl was positive (0.27) and negative (-0.80) in the female. Similarly, phenotypic correlation figures observed between SMWTG and EMWTG was positive (0.06) in the male Guinea fowl and negative in the female (-0.03).

Negative genetic correlation values were recorded between HWT and survival (SVV), (-3.73), docility (DOC) (-1.81), dressing percentage (DRESSP) (-1.15), feed intake (FI) (-0.13) and feed conversion ratio (FCR) (-0.07) in the male Guinea fowl. This was not different from what was observed in the females except FI (0.02) and FCR (0.31) which showed positive correlation with HWT. Apart from HWT and DOC which showed positive value (0.18), phenotypic correlation figures between HWT and SVV, FI, FCR and DRESSP (-0.21, -0.18, -0.24 and-0.41 respectively) in the male Guinea fowl, were all negative. However, phenotypic correlation between HWT and SVV, DOC, FI, FCR and DRESSP in female on the other hand, were all negative (-0.26, -0.01, -0.23, -0.12 and -0.35 respectively).

In the male Guinea fowl, values of genetic correlation between TMWT and SVV was positive (1.3) and negative between TMWT and DOC (-0.32), TMWT and DRESSP (-2.65), TMWT and FI (-0.51) and TMWT and FCR (-0.63). In the female Guinea fowl, positive genetic correlation value was recorded between TMWT and FI (0.25) and between TMWT and the other traits (SVV, DRESSP, FCR and DOC), the genetic correlation figures recorded (-0.16. -0.01, -0.06 and -1.01 respectively) were all negative. However, between TMWT and SVV (0.27) and TMWT and DOC (0.1) in the male Guinea fowl, the values of phenotypic correlation were positive and negative between TMWT and the other characteristics (DRESSP (-0.23), FCR (-0.17) and FI (-0.32). The values of phenotypic correlation in the female Guinea fowl on the other hand, was positive between TMWT and SVV (0.37) and negative between TMWT and DOC (-0.35), DRESSP (-0.15) FI (-0.39), and FCR (-0.01).

Table 1. Genetic (above diagonal) and phenotypic (below diagonal) correlations among 14 traits (sire-son regression)

	HWT	TMWT	FMWT	SMWT	EMWT	TMWTG	FMWTG	SMWTG	EMWTG	SVV	DOC	DRESSP	FI	FCR
HWT		0.56	.	-0.17	0.18	0.54	0.64	0.21	0.78	-3.73	-1.81	-1.15	-0.13	-0.07
SE		0.23	.	0.34	0.41	0.31	0.34	0.42	0.21	0.49	1.25	0.4	0.46	0.39
TMWT	0.33		.	1.34	1.02	1.02	0.83	0.25	-	1.3	-0.32	-2.65	-0.51	-0.63
SE	0.19		.	0.32	0.02	0.02	0.2	0.47	-	1.03	0.41	0.55	0.39	0.27
FMWT	-0.2	0.29		0.93	1.3	-	-	-0.37	1.2	0.75	-0.49	0.95	0.72	0.67
SE	0.2	0.19		0.05	0.33	-	-	0.43	0.26	0.27	0.34	0.05	0.25	0.24
SMWT	-0.29	0.23	0.35		1.03	0.39	0.85	0.6	0.92	0.97	-0.67	-0.35	0.51	0.4
SE	0.19	0.19	0.14		0.03	0.21	0.19	0.52	0.1	0.04	0.26	0.51	0.41	0.39
EMWT	0.01	0.19	0.39	0.26		0.53	0.19	-0.06	0.74	0.65	-0.54	-0.03	0.78	0.91
SE	0.2	0.2	0.13	0.14		0.45	0.78	0.31	0.38	0.45	0.41	0.7	0.26	0.1
TMWTG	0.12	0.11	-0.2	0.11	0.03		-0.43	0.82	0.64	1.7	0.4	-0.01	0.89	0.65
SE	0.2	0.2	0.19	0.2	0.2		0.68	0.21	0.64	1.54	0.5	0.73	0.14	0.34
FMWTG	-0.00	0.49	0.39	0.44	0.18	0.49		-0.16	-0.49	0.79	-0.28	0.02	0.48	0.14
SE	0.18	0.17	0.18	0.18	0.2	0.17		0.83	0.77	0.4	0.72	0.94	0.69	0.75
SMWTG	0.38	-0.23	-0.25	0.07	-0.19	-0.25	-0.24		0.27	0.49	0.13	-0.62	-0.42	-0.66
SE	0.17	0.19	0.15	0.2	0.15	0.19	0.19		0.74	0.63	0.6	0.45	0.58	0.34
EMWTG	0.2	-0.28	0.34	0.26	0.31	-0.3	0.18	0.06		0.84	0.43	-0.19	0.7	0.76
SE	0.19	0.18	0.14	0.15	0.14	0.2	0.2	0.2		0.29	0.59	0.85	0.43	0.3
SVV	-0.21	0.27	-0.06	0.07	0.08	0.28	-0.28	0.16	0.03		1.09	-2.52	0.93	0.29
SE	0.19	0.2	0.15	0.15	0.16	0.19	0.19	0.15	0.15		0.14	0.92	0.12	0.68
DOC	0.18	0.1	-0.21	-0.24	-0.11	0.09	-0.46	-0.05	0.17	0.2		0.49	0.35	0.24
SE	0.2	0.2	0.15	0.14	0.15	0.2	0.18	0.16	0.16	1.6		0.51	0.56	0.51
DRESSP	-0.41	-0.23	0.1	0.00	-0.01	-0.23	0.36	-0.12	-0.01	-0.18	0.08		0.94	1.4
SE	0.18	0.19	0.15	0.15	0.15	0.19	0.19	0.19	0.15	0.15	0.15		0.09	0.16
FI	-0.18	-0.32	0.33	0.2	0.29	-0.32	-0.01	-0.15	0.17	0.15	0.01	0.04		1.01
SE	0.2	0.19	0.14	0.15	0.14	0.19	0.2	0.14	0.15	0.15	0.14	0.15		-0.01
FCR	-0.24	-0.17	0.33	0.21	0.31	-0.16	0.18	-0.13	0.18	0.13	0.01	0.11	0.23	
SE	0.18	0.2	0.15	0.15	0.14	0.2	0.2	0.15	0.15	0.14	0.14	0.16	0.14	

Hatch weight (HWT); two month weight (TMWT); four month weight (FMWT); six month weight (SMWT); eight month weight (EMWT); two month weight gain (TMWTG); four month weight gain (FMWTG); six month weight gain (SMWTG); eight month weight gain (EMWTG); survival (SVV); docility score (DOC); dressing percentage (DRESSP); feed intake (FI); feed conversion ratio (FCR) and standard error (SE)

Table 2. Genetic (above diagonal) and phenotypic (below diagonal) correlations among 19 traits (sire and dam-daughter regression)

	HWT	TMWT	FMWT	SMWT	EMWT	TMWTG	FMWTG	SMWTG	EMWTG	SVV	DOC	DRESSP	ATFE	EGGWT	HDEP	FERT	HATCH	FI	FCR
HWT		0.13	-0.00	-0.75	-0.02	0.11	-0.12	-0.46	0.35	-0.47	-0.05	-0.16	2.43	0.53	-0.18	0.03	0.56	0.02	0.31
SE		0.34	0.35	-0.75	0.45	0.47	0.53	0.37	0.54	0.42	0.37	0.44	-1.61	0.20	0.20	0.67	0.38	0.42	0.35
TMWT	0.05		0.44	0.73	0.05	0.75	0.23	0.15	-0.32	-0.16	-1.01	-0.01	0.69	-0.3	0.02	0.17	0.57	-0.25	-0.06
SE	0.21		0.32	0.21	0.50	0.23	0.31	0.52	0.63	0.59	-0.01	0.50	0.19	0.28	0.23	0.74	0.42	0.44	0.43
FMWT	-0.26	0.24		1.1	1.2	-0.89	1.33	0.05	0.66	-0.11	-0.19	0.16	-3.7	0.31	-0.04	0.01	-1.4	0.64	0.78
SE	0.2	0.19		0.10	0.23	0.15	0.48	0.55	0.41	0.63	0.41	0.51	-4.88	0.29	0.24	0.79	-0.62	0.29	0.18
SMWT	-0.23	0.37	0.42		1.2	1.1	1.4	0.19	-1.2	-0.07	-0.32	1	.	-0.53	0.05	-0.02	0.77	0.4	0.55
SE	0.19	0.18	0.14		0.26	0.22	0.49	0.04	0.36	0.72	0.44	0.00	.	0.26	0.27	0.90	0.30	0.47	0.36
EMWT	0.29	0.1	0.43	0.42		0.60	0.51	-0.01	1.10	0.73	-0.35	-0.58	1.15	0.12	-0.59	0.9	1	0.87	0.95
SE	0.2	0.2	0.14	0.14		0.41	0.61	0.59	0.16	0.37	0.48	0.44	0.16	0.40	0.20	0.19	0.00	0.15	0.06
TMWTG	0.07	0.09	-0.32	0.12	0.17		-0.53	1.36	.	.	-0.45	.	.	.	1.30	.	1.77	-0.21	-0.71
SE	0.21	0.19	0.19	0.2	0.2		0.60	0.63	.	.	0.46	.	.	.	0.22	.	-1.85	0.62	0.30
FMWTG	-0.26	0.46	0.35	0.35	0.34	0.41		0.07	.	.	-1.16	.	.	.	-0.14	.	-0.08	0.37	-0.08
SE	0.2	0.18	0.19	0.19	0.19	0.18		0.83	.	.	-0.23	.	.	.	0.35	.	0.97	0.63	0.67
SMWTG	0.15	0.02	-0.02	0.17	-0.03	-0.02	-0.1		-0.80	0.16	-0.11	-3.82	-0.58	.	0.52	.	.	0.10	-0.50
SE	0.2	0.19	0.16	0.15	0.15	0.2	0.2		0.35	0.82	0.57	-9.47	0.34	.	0.23	.	.	0.64	0.45
EMWTG	0.21	-0.04	0.36	-0.16	0.35	-0.02	0.11	-0.03		1.43	-0.52	-2.77	0.37	.	-0.48	.	.	1.57	1.35
SE	0.19	0.2	0.14	0.15	0.14	0.2	0.2	0.15		2.38	0.55	6.10	0.58	.	0.32	.	.	1.25	0.64
Survival	-0.26	0.37	-0.11	-0.01	0.03	0.31	0.47	0.1	-0.1		0.07	-0.8	.	.	0.45	0.34	1.11	0.9	0.75
SE	0.18	0.18	0.16	0.16	0.16	0.19	0.18	0.15	0.15		0.65	0.29	.	.	0.29	1.07	-0.23	0.14	0.30
DOC	-0.01	-0.35	-0.47	-0.43	-0.41	-0.31	-0.22	0.03	-0.04	-0.1		-0.01	.	.	-0.49	0.19	-0.2	0.58	0.33
SE	0.2	0.19	0.14	0.14	0.14	0.19	0.19	0.15	0.15	0.15		0.54	.	.	0.19	0.79	0.64	0.28	0.43
DRESSP	-0.35	-0.15	0.23	0.07	-0.03	-0.14	0.47	-0.24	-0.15	-0.11	-0.19		.	.	.	.	.	-0.82	1.31
SE	0.19	0.2	0.15	0.14	0.14	0.2	0.18	0.14	-0.15	0.15	0.17		.	.	.	.	.	0.20	0.40
ATFE	0.42	0.24	-0.2	-0.23	0.06	0.16	0.11	-0.2	0.19	0.49	0.14	0.07		-0.32	0.25	-0.15	-0.48	.	.
SE	0.18	0.19	0.19	0.19	0.2	0.2	0.2	0.15	0.15	0.17	0.2	0.19		0.26	0.21	0.71	0.46	.	.
EGGWT	0.35	-0.07	0.36	-0.25	0.00	-0.07	0.11	0.19	-0.19	0.16	-0.15	0.12	0.07		0.42	0.88	0.48	0.73	.
SE	0.19	0.18	0.19	0.7	0.17	0.2	0.2	0.15	0.15	0.18	0.18	0.15	0.19		1.75	-0.49	1.62	0.30	.
HDEP	0.23	0.06	-0.09	0.04	-0.27	0.36	0.1	-0.17	0.08	0.08	-0.25	0.08	-0.13	0.15		0.73	-0.53	0.56	0.73
SE	0.18	0.2	0.19	0.2	0.19	0.19	0.2	0.15	0.15	0.2	0.19	0.15	0.2	0.09		0.99	1.53	0.44	0.12
FERT	0.25	0.09	-0.01	-0.24	0.39	0.47	-0.09	0.19	-0.25	0.09	-0.12	-0.04	0.08	0.19	0.2		-0.57	0.05	0.01
SE	0.25	0.2	0.17	0.19	0.18	0.18	0.2	0.15	0.14	0.19	0.2	0.15	0.2	0.08	0.08		1.44	0.63	0.85
HATCH	0.25	0.12	-0.2	0.17	0.12	0.04	-0.19	0.11	-0.13	0.21	-0.02	0.17	-0.2	-0.01	0.02	-0.02		-1.2	-0.43
SE	0.19	0.2	0.18	0.2	0.2	0.2	0.2	0.15	0.15	0.18	0.2	0.15	0.2	0.09	0.08	0.09		-0.28	0.57
FI	-0.23	-0.39	0.34	0.27	0.38	-0.32	-0.01	-0.09	0.2	0.16	0.14	-0.09	0.1	0.3	0.27	0.37	-0.33		0.91
SE	0.19	0.18	0.14	0.15	0.14	0.19	0.2	0.15	0.18	0.15	0.16	0.15	0.18	0.18	0.19	0.17	0.19		0.11
FCR	-0.12	-0.01	0.31	0.19	0.03	0.04	-0.01	-0.13	0.18	0.19	0.05	0.1	0.06	0.05	0.23	0.2	-0.13	0.19	
SE	0.2	0.2	0.15	0.14	0.15	0.2	0.2	0.15	0.18	0.15	0.15	0.15	0.2	0.21	0.19	0.2	0.19	0.15	

Hatch weight (HWT); two month weight (TMWT); four month weight (FMWT); six month weight (SMWT); eight month weight (EMWT); two month weight gain (TMWTG); four month weight gain (FMWTG); six month weight gain (SMWTG); eight month weight gain (EMWTG); survival (SVV); docility score (DOC); dressing percentage (DRESSP); age at first egg (ATFE); egg weight (EGGWT); hen day egg production (HDEP); percent fertility (FERT); percent hatchability (HATC); feed intake (FI); feed conversion ratio (FCR) and standard error (SE)

Genetic correlation figures recorded between FMWT and SVV, DRESSP, FI and FCR in male Guinea fowl, were positive (0.75, 0.95, 0.72 and 0.67 respectively) but the correlation between FMWT and DOC was (-0.49) whereas in the female, genetic correlation values between FMWT and both SVV and DOC were negative (-0.11 and -0.19 respectively). However, between FMWT and DRESSP (0.16), FI (0.64) and FCR (0.78), positive genetic correlation figures were recorded. In terms of phenotypic correlation, values recorded between FMWT and the other traits (SVV, DOC, DRESSP, FI AND FCR) were both negative and positive (-0.06, -0.21, 0.1, 0.3 and 0.3 respectively) in the male Guinea fowl. In the female, phenotypic correlation recorded between FMWT and SVV, DOC, DRESSP, FI and FCR (-0.11, -0.47, 0.23, 0.34 and 0.31 respectively) also consisted of both negative and positive values.

Apart from DOC (-0.67) and DRESSP (-0.35) which recorded negative genetic correlation values between SMWT in the male Guinea fowl, positive genetic correlation figures were obtained between SMWT and SVV (0.97), FI (0.51) and FCR (0.4). However, in the females, genetic correlation values recorded between SMWT and SVV (-0.07) and DOC (-0.32), were negative but positive correlation figures were obtained between SMWT and DRESSP, FI and FCR (1, 0.4 and 0.55 respectively). Phenotypic correlation values recorded between SMWT and SVV, FI and FCR in the males, were all positive (0.07, 0.2 and 0.21 respectively). However, negative phenotypic correlation values were observed between SMWT and DOC (-0.24) but no phenotypic relationship existed between SMWT and DRESSP (0.00). In the female, phenotypic correlation values recorded between SMWT and SVV (-0.01) and DOC (-0.43) were negative but the correlation figures between SMWT and DRESSP (0.07), FI (0.27) and FCR (0.19) were all positive.

In the male Guinea fowl, values of genetic correlation recorded between EMWT and SVV (0.65), FI (0.78), and FCR (0.91) were positive and negative between DOC (-0.54) and DRESSP (-0.03). In the female, genetic correlation values recorded were also positive between EMWT and SVV (0.73), FI (0.87), and FCR (0.95) but negative between DOC (-0.35) and DRESSP (-0.58). Phenotypic correlation figures existed between EMWT and SVV (0.08), FI (0.29) and FCR (0.31) in the males were all positive and negative between EMWT and DOC (-0.11) and DRESSP (-0.01) whereas in the females similar phenotypic correlation trend was recorded between EMWT and SVV (0.03), FI (0.38), FCR (0.03), DOC (-0.41) and DRESSP (-0.03).

Besides genetic correlation between HWT and hen day egg production (HDEP) which recorded negative value (-0.18), all the values of genetic correlation between HWT and age at first egg (ATFE), egg weight (EGGWT), percentage fertility (FERT) and percentage hatchability (HATCH) were positive (2.43. 0.53, 0.03 and 0.56 respectively). Values of phenotypic correlation on the other hand, were positive between HWT and ATFE (0.42), EGGWT (0.35), HDEP (0.23), FERT (0.25) and HATCH (0.25).

Positive genetic correlation values between TMWT and ATFE (0.69), HDEP (0.02), FERT (0.17) and HATCH (0.57) were all positive and negative between TMWT and EGGWT (-0.3). Similarly, negative phenotypic correlation value was recorded between TMWT and EGGWT (-0.07) as in the genetic correlation and between TMWT and ATFE (0.24), HDEP (0.06), FERT (0.09) and HATCH (0.12) the phenotypic correlation values observed were all positive.

The values of genetic correlation existed between FMWT and ATFE (-3.7), HDEP (-0.04). and HATCH (-1.4) were negative. However, positive genetic correlation values also existed between FMWT and EGGWT (0.31) and FERT (0.01). Phenotypic correlation between FMWT and these egg characteristics on the other hand, were all negative (ATFE (-0.2), HDEP (-0.09), FERT (-0.01) and HATCH (-0.2)) except FMWT and EGGWT which was positive (0.36).

No genetic correlation existed between SMWT and ATFE but negative genetic correlation values (-0.53) and (-0.02) were recorded between SMWT and EGGWT and between SMWT and FERT in that order. Again, the genetic correlation figures obtained between SMWT and HDEP (0.05) and HATCH (0.77) were positive. Phenotypic correlation values recorded between SMWT and HDEP (0.04) and Hatch (0.17) were positive and negative between SMWT and ATFE (-0.23), EGGWT (-0.25) and FERT (-0.24).

Positive genetic correlation figures were observed between EMWT and ATFE (1.15), EGGWT (0.12), FERT (0.9) and HATCH (1). A genetic correlation figure recorded between EMWT and HDEP was negative (-0.59). Phenotypic correlations observed between

EMWT and ATFE (0.06), HATCH (0.12) and FERT (0.39) were all positive but between EMWT and EGGWT was zero (0) and negative between EMWT and HDEP (-0.27).

4. DISCUSSION

The higher genetic correlations between body weights at different ages than their respective phenotypic correlations have been reported by several others [12,13]. The moderate to high positive genetic correlations obtained among traits observed in the current studies indicate that genetic improvement in anyone of them can improve the other [14]. The high genetic association between body weights at early ages with body weights at later ages could indicate that selection for body weight at early ages would improve body weight at later (maturity) ages [7]. The observation also means that selection for SVV can improve higher HDEP and earlier ATFE. Selection for higher FERT could also improve hatchability [14]. The association between body weight and egg weight was similar to the findings of [15] who observed a fairly high association between egg production and weight gain in the Black and Pearl Guinea fowl. This means that point of lay does not terminate live weight increases in the Guinea fowl [15].

Similar results to this work on genetic correlations have been reported in other livestock species. [13] and [7] reported high genetic correlations between body weights at different ages in Japanese quails. [16] reported high positive genetic correlations between 4-month weight and 8-month weight in the grasscutter. [3] also reported medium to high positive genetic correlations among body weight and growth traits in beef cattle. The realization of these results could be attributed to the fact that many of the body weights and gains were measured at different ages [3]. On the other hand, genetic correlation higher than 1 as obtained among some of the traits (e.g. between FMWT and EMWT) is exceeding parametric range. [17] and [18] also recorded values greater than 1 for genetic correlation between body weights in Japanese quails and in feed efficiency in indigenous chicken in Kenya respectively. This may be due to problems associated with small data size, sampling error and data imbalance (unequal group sizes) which could indicate very high genetic correlations between traits involved, which sometime could be outside parametric range [7].

The moderate to high negative genetic correlations observed among some of the traits on the other hand, indicate that genetic improvement in any of them will decrease the development of the other. Specifically, the high negative genetic correlation between HWT and SMWT means that heavy mothers lay small eggs. This may be the reason why poultry layers are usually light weight. [19] also reported high negative (-1.726) genetic correlation between 5th and 20th week body weight in female colored synthetic broiler breeder chicken of Odisha, India.

The moderate to high positive phenotypic correlations recorded between some of the traits in this experiment means that any of these traits can be used to measure the other in a selection programme whereas those showing moderate negative phenotypic correlations could mean that the traits involved cannot be used as measures for each other and selection cannot bring about correlated response in them [20].

5. CONCLUSION

The discoveries in this study are not different from values from similar studies conducted by other scientists in indigenous Guinea fowls. In Guinea fowl selection breeding programmes, the results could be used in defining breeding objectives, estimating breeding values, and calculating annual rate of genetic gain.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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