

HERITABILITY ESTIMATES OF BODY WEIGHT AND BODY DIMENSIONS IN SOME LOCAL STRAINS OF CHICKENS

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Abstract

Three local strains of chickens, namely, Gimmizah (G), Bandara (B) and El-Salam (S) were used in the present study to reveal some light on the heritability estimates (h^2) based on maternal half sibs (h^2D), paternal half sibs (h^2S) and full sibs (h^2D+S) on body weight and body dimensions, (shank length "SL", keel length "KL" and body circumference "BC").

A total of 3916 pedigreed chickens, males and females produced by 36 sires and 540 dams in two consecutive hatches were used for this study. Body weight (in g) and body dimensions (in cm) were measured at 4, 8, 12, 16 and 20 weeks of age.

Estimation of average body weight and body dimensions showed that these traits increased with the advance in age. Coefficient of variation (C.V. %) for both average body weight and body dimensions tends to decrease by the advance in age in general.

The heritability estimates for paternal half sibs (h^2S) observed for body weight and dimensions were lower than those estimated for maternal half sibs (h^2D) and full sibs (h^2D+S). The estimates of maternal half sibs (h^2D) were the highest. This held true for all parameters studied.

The heritability estimates for Gimmizah chicks had the highest values in most studied traits and all ages for all estimates.

INTRODUCTION

Development of broiler strains in Egypt is still facing a great deal of difficulties regarding to the lack of genetic information about the local strains of chickens, which should be available before embarking on such program.

Recently, the modern computer facilities has encouraged the research workers to carry on breeding programs to improve poultry production more rapidly since the com-

puter programs can carry out the statistical analysis in a short time compared with the past breeding analysis.

MATERIALS AND METHODS

The data used in this study were collected during the period from September 1994 to June 1995 at the Animal Production Research Station in Sids (Middle Egypt) using three strains of chickens, namely: Gimmizah, Bandara and El-Salam. These strains were developed and described by Mahmoud *et al.* (1982), Mahmoud *et al.* (1989) and Abd-El-Gawad *et al.* (1983), respectively.

Families within strains were randomly grouped into fifteen dams (leg banded) for each dam group. A sire from the same strain was assigned for mating to obtain pedigreed chicks. The total of birds was 36 sires and 540 dams (12 sire and 180 dams from each strain). A total of 3916 progeny from all dams was produced by 36 sires in two consecutive hatches. Body weight (in g) and body dimensions (in cm) were measured at 4, 8, 12, 16 and 20 weeks of age.

Growth performance and body dimensions data were analyzed using Mixed Model (Harvey 1990). Also, combined least square analysis of variance for fixed and random effects was analyzed using Harvey (1987 and 1990).

RESULTS AND DISCUSSION

Means and variations

Body weight

Data presented in Table 1 shows that, while El-Salam chicks were heavier at hatch, Bandara chicks were the heaviest at almost other ages. Generally, the present estimates of body weight fall within the range of corresponding means reported for the same strains in most Egyptian studies, (El-Turky, 1981, Mahmoud *et al.* 1982 and 1989, Abd-El-Gawad *et al.*, 1983, Hassen and El-Turky, 1983, Ali 1993, Salem, 1993, El-Wardany *et al.*, 1994, and Shahein 1994).

The coefficient of variation (C.V.%) ranged from 12.68% to 3.74% for Gimmizah chicks at 4 weeks of age and El-Salam chicks at 20 weeks of age, respectively.

Body dimensions

Estimates reported for mean body dimensions (Table 1) showed that body dimensions for Gimmizah chicks were the highest for all traits studied. On the other hand, estimates recorded in this study fall within the range of estimates reported by El-Turky, (1981), Hassan and El-Turky, (1983), and Ali (1993), Salem (1993), and Shahein (1994) for the same strains.

In general, the coefficient of variation for body dimensions measured at different ages studied were low in magnitude and ranged from 8.15% to 5.15% for shank length (LS), from 8.12% to 5.37% for keel length (KL) and from 6.21% to 3.80% for body circumference (BC).

Heritabilities

Body weight

Heritability estimates for body weight (Table 2) showed that heritability estimated from dam half sibs (h^2D) was higher than that estimated from full sibs (h^2S+D), while, the heritability estimated from sire half sibs (h^2S) showed the least values. This held true for all strains at all ages studied, where it ranged from 0.082 to 0.441, from 0.064 to 0.258 and from 0.027 to 0.216 for h^2D , h^2S+D and h^2S for Gimmizah chicks, respectively, and from 0.063 to 0.586, from 0.041 to 0.530 and from 0.021 to 0.397, respectively in the same order for Bandara chicks and from 0.083 to 0.151, from 0.052 to 0.122 and from 0.042 to 0.097, respectively for El-Salam chicks. The same finding was reported by Hassan and El-Turky, (1983).

Generally speaking, heritability estimates for Bandara chicks had the highest values at all ages except for chicks at hatch and at 20 weeks of age, where Gimmizah and El-Salam chicks had the highest values, respectively. This held true for all heritability estimates.

Shank length

The same trend noticed for h^2 estimates of body weight, existed also for h^2 estimates of shank length (Table 3), where heritability estimates of dam half sibs for shank length showed higher values followed by full sibs and sire half sibs, respectively, where it ranged from 0.365 to 0.697, from 0.313 to 0.616 and from 0.226 to 0.595 for dam half sibs, full sibs and sire half sibs, respectively for Gimmizah chicks, and from 0.204 to 0.354, from 0.193 to 0.287 and from 0.182 to 0.273, respectively for Ban-

dara chicks and from 0.204 to 0.588, from 0.140 to 0.505 and from 0.073 to 0.486, respectively for El-Salam chicks.

Heritability estimates for shank length of Gimmizah chicks had the highest values at all ages studied except for chicks at 4 weeks of age where El-Salam chicks had the highest values for all heritability estimates.

Keel length

Table 4 presented heritability estimates of keel length. As mentioned for body weight and shank length, heritability estimates for keel length from dam half sibs showed higher values than those for heritability of full sibs and sire half sibs. The heritability estimates ranged from 0.162 to 0.625, from 0.085 to 0.575 and from 0.028 to 0.545, for dam half sibs, full sibs and sire half sibs, respectively from Gimmizah chicks, and from 0.272 to 0.445, from 0.207 to 0.305 and from 0.143 to 0.264, respectively for Bandara chicks, and from 0.161 to 0.555 from 0.108 to 0.487 and from 0.053 to 0.469, respectively for El-Salam chicks.

Heritability estimates for keel length showed that Gimmizah chicks recorded the highest values at all ages studied except for 4 weeks chicks, where El-Salam chicks recorded the highest values for all heritability estimates.

Body circumference

As shown in Table 5, heritability estimates for body circumference showed the same trend in their estimates where estimates, of heritability for dam half sibs were higher than those for full sibs and sire half sibs, ranging from 0.406 to 0.632, from 0.385 to 0.597 and from 0.264 to 0.582, respectively for Gimmizah chicks, and from 0.252 to 0.417, from 0.226 to 0.383 and from 0.125 to 0.371, respectively for Bandara chicks and from 0.277 to 0.523, from 0.252 to 0.461 and from 0.198 to 0.398, respectively for El-Salam chicks.

Concerning body circumference, as for shank length and keel length, Gimmizah chicks had the highest estimate values at all ages except for 16-week chicks where El-Salam chicks recorded higher values.

Generally, heritability estimates for body dimensions for the strains studied fall within the range of the estimates reported by Hassan and El-Turky (1983) for Gimmizah and Bandara chicks.

Table 1. Overall means (X), standard deviation (SD) and coefficient of variation (CV %) for body weight and body dimensions traits of studied strains at different ages.

Traits	Gimmizah				Bandara				El-Salam			
	No	X	SD	CV%	No	X	SD	CV%	No	X	SD	CV%
BW (gm):												
w0	1308	34.13	2.99	7.10	1307	36.14	3.07	6.90	1301	37.90	2.93	6.24
w4	1226	246.90	37.31	12.68	1243	263.02	33.57	6.90	1220	246.34	37.35	11.38
w8	1168	534.37	48.81	7.20	1195	542.31	52.35	7.29	1174	536.70	53.58	7.20
w12	1130	951.94	81.98	7.38	1166	926.48	78.77	6.71	1136	920.69	79.78	6.86
w16	1094	1299.00	90.16	6.15	1131	1315.37	88.12	5.40	1105	1233.17	98.20	6.33
w20	1005	1704.75	167.17	9.37	1044	1790.92	113.41	4.77	1016	1652.78	96.76	3.74
SL (cm):												
w4	1226	4.71	0.486	7.94	1243	4.47	0.554	8.07	1220	4.43	0.638	7.14
w8	1168	5.90	0.561	7.93	1195	5.69	0.543	7.25	1174	5.74	0.605	7.28
w12	1130	7.26	0.647	8.15	1166	6.96	0.584	6.89	1136	6.98	0.572	5.73
w16	1094	8.64	0.696	7.13	1131	8.19	0.688	5.40	1105	8.21	0.652	5.71
w20	1005	9.63	0.713	6.32	1044	9.12	0.705	5.80	1016	9.11	0.725	5.15
KL (cm):												
w4	1226	5.12	0.477	7.31	1243	4.93	0.534	7.31	1220	4.84	0.633	6.85
w8	1168	6.40	0.675	8.12	1195	6.19	0.535	6.40	1174	6.21	0.602	6.03
w12	1130	7.99	0.742	8.01	1166	5.57	0.633	6.74	1136	7.60	0.672	6.58
w16	1094	9.23	0.799	7.58	1131	8.77	0.716	6.14	1105	8.84	0.779	6.50
w20	1005	10.24	0.821	6.69	1044	9.68	0.704	5.37	1016	9.78	0.776	6.05
BC (cm):												
w4	1226	14.73	0.852	4.50	1243	14.24	0.899	4.15	1220	13.97	1.263	4.75
w8	1168	17.34	0.977	4.55	1195	16.84	1.021	4.24	1174	16.48	1.272	4.20
w12	1130	20.48	1.730	6.21	1166	20.11	2.093	4.90	1136	19.21	1.853	4.74
w16	1094	23.45	2.037	5.88	1131	22.98	2.202	5.60	1105	22.01	2.061	5.28
w20	1005	26.76	1.514	4.14	1044	26.09	1.608	3.80	1016	25.03	1.806	4.03

BW = body weight SL = shank length KL = keel length BC = body circumference.

Coefficient of variation computed as the remainder standard divided by overall mean of a given different traits (Harvey, 1990).

Table 2. Heritability estimates for body weight of studied strains at different ages.

Strain	Age	$h^2S + SD$	$h^2D + SD$	$h^2S + D + SD$
Gimmizah	w 0	0.111 + 0.065	0.194 + 0.070	0.123 + 0.036
	w 4	0.123 + 0.076	0.203 + 0.068	0.186 + 0.033
	w 8	0.027 + 0.031	0.082 + 0.071	0.064 + 0.028
	w 12	0.171 + 0.103	0.346 + 0.098	0.258 + 0.078
	w 16	0.216 + 0.146	0.441 + 0.087	0.248 + 0.053
	w 20	0.045 + 0.025	0.132 + 0.086	0.064 + 0.039
Bandara	w 0	0.021 + 0.026	0.063 + 0.055	0.041 + 0.028
	w 4	0.202 + 0.144	0.310 + 0.072	0.256 + 0.043
	w 8	0.343 + 0.161	0.441 + 0.072	0.392 + 0.048
	w 12	0.397 + 0.181	0.478 + 0.077	0.407 + 0.050
	w 16	0.275 + 0.354	0.586 + 0.088	0.530 + 0.076
	w 20	0.057 + 0.048	0.075 + 0.086	0.066 + 0.033
El-Salam	w 0	0.075 + 0.050	0.111 + 0.072	0.093 + 0.035
	w 4	0.045 + 0.038	0.088 + 0.068	0.052 + 0.029
	w 8	0.097 + 0.058	0.108 + 0.071	0.099 + 0.032
	w 12	0.075 + 0.053	0.129 + 0.088	0.102 + 0.040
	w 16	0.042 + 0.039	0.083 + 0.082	0.063 + 0.036
	w 20	0.092 + 0.063	0.151 + 0.094	0.122 + 0.045

$h^2 S$ = paternal half sibs $h^2 D$ = maternal half sibs $h^2 S+D$ = full sibs.

Table 3. heritability estimates for shank length of studied strains for different ages.

Strain	Age	$h^2S + SD$	$h^2D + SD$	$h^2S + D + SD$
Gimmizah	w 4	0.226 + 0.115	0.365 + 0.185	0.313 + 0.039
	w 8	0.421 + 0.315	0.583 + 0.211	0.502 + 0.071
	w 12	0.595 + 0.309	0.697 + 0.388	0.616 + 0.074
	w 16	0.482 + 0.247	0.639 + 0.293	0.510 + 0.069
	w 20	0.483 + 0.217	0.531 + 0.180	0.497 + 0.068
Bandara	w 4	0.182 + 0.097	0.204 + 0.082	0.193 + 0.047
	w 8	0.201 + 0.105	0.281 + 0.090	0.241 + 0.053
	w 12	0.221 + 0.114	0.272 + 0.091	0.247 + 0.054
	w 16	0.273 + 0.135	0.354 + 0.085	0.274 + 0.052
	w 20	0.257 + 0.132	0.307 + 0.092	0.287 + 0.053
El-Salam	w 4	0.486 + 0.211	0.588 + 0.275	0.505 + 0.157
	w 8	0.280 + 0.139	0.285 + 0.091	0.284 + 0.057
	w 12	0.329 + 0.157	0.386 + 0.096	0.338 + 0.062
	w 16	0.140 + 0.082	0.204 + 0.090	0.172 + 0.048
	w 20	0.073 + 0.055	0.208 + 0.097	0.140 + 0.047

$h^2 S$ = paternal half sibs $h^2 D$ = maternal half sibs $h^2 S+D$ = full sibs.

Table 4. Heritability estimates for keel length of studied strains at different ages.

Strain	Age	$h^2S + SD$	$h^2D + SD$	$h^2S + D + SD$
Gimmizah	w 4	0.028 + 0.018	0.162 + 0.097	0.085 + 0.033
	w 8	0.302 + 0.116	0.446 + 0.182	0.374 + 0.092
	w 12	0.207 + 0.138	0.324 + 0.189	0.275 + 0.075
	w 16	0.545 + 0.235	0.625 + 0.287	0.575 + 0.164
	w 20	0.280 + 0.120	0.417 + 0.178	0.390 + 0.070
Bandara	w 4	0.143 + 0.160	0.272 + 0.072	0.207 + 0.049
	w 8	0.146 + 0.083	0.315 + 0.092	0.231 + 0.052
	w 12	0.180 + 0.097	0.304 + 0.093	0.242 + 0.045
	w 16	0.227 + 0.117	0.277 + 0.097	0.262 + 0.051
	w 20	0.264 + 0.135	0.445 + 0.084	0.305 + 0.048
El-Salam	w 4	0.469 + 0.205	0.555 + 0.072	0.487 + 0.054
	w 8	0.271 + 0.134	0.287 + 0.090	0.279 + 0.056
	w 12	0.206 + 0.109	0.272 + 0.093	0.239 + 0.054
	w 16	0.104 + 0.066	0.161 + 0.083	0.108 + 0.040
	w 20	0.053 + 0.046	0.179 + 0.096	0.116 + 0.044

 h^2S = paternal half sibs h^2D = maternal half sibs h^2S+D = full sibs.

Table 5. Heritability estimates for body circumference of studied strains at difference.

Strain	Age	$h^2S + SD$	$h^2D + SD$	$h^2S + D + SD$
Gimmizah	w 4	0.464 + 0.137	0.552 + 0.186	0.488 + 0.167
	w 8	0.582 + 0.231	0.632 + 0.295	0.597 + 0.079
	w 12	0.453 + 0.202	0.486 + 0.101	0.469 + 0.070
	w 16	0.264 + 0.241	0.406 + 0.091	0.385 + 0.067
	w 20	0.407 + 0.259	0.542 + 0.094	0.475 + 0.069
Bandara	w 4	0.201 + 0.104	0.252 + 0.085	0.226 + 0.051
	w 8	0.125 + 0.074	0.417 + 0.098	0.271 + 0.065
	w 12	0.215 + 0.213	0.417 + 0.091	0.235 + 0.065
	w 16	0.371 + 0.242	0.395 + 0.101	0.383 + 0.073
	w 20	0.303 + 0.150	0.325 + 0.103	0.314 + 0.063
El-Salam	w 4	0.208 + 0.139	0.277 + 0.084	0.252 + 0.054
	w 8	0.198 + 0.104	0.497 + 0.104	0.347 + 0.063
	w 12	0.285 + 0.140	0.506 + 0.107	0.395 + 0.067
	w 16	0.398 + 0.183	0.523 + 0.110	0.461 + 0.072
	w 20	0.333 + 0.162	0.441 + 0.111	0.397 + 0.070

 h^2S = paternal half sibs h^2D = maternal half sibs h^2S+D = full sibs.

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تقدير قيم المكافئ الوراثي لوزن وأبعاد الجسم في بعض سلالات الدجاج المحلي

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تم إجراء هذه التجربة فى محطة بحوث الإنتاج الحيوانى بسدس - بنى سويف واستخدم فيها ثلاث من السلالات المحلية هي : الجميزه - البندره - السلام . وذلك بهدف إلقاء المزيد من الضوء على بعض قيم المكافئ الوراثي لوزن وأبعاد الجسم المختلفة (طول عظمة الساق - طول عظمه القص - محيط الجسم) وذلك عند أعمار ٤، ٨، ١٢، ١٦، ٢٠ أسبوعاً ، وكان عدد الكتاكيت المنسية المستخدمة فى هذا البحث ٣٩١٦ كتكوئاً ناتجة من استخدام ٣٦ ذكراً ، ٥٤٠ أنثى من تفر يختين متتاليتين .

وقد أوضحت النتائج ما يلي :

- ١- أظهرت قيم متوسطات وزن ومقاييس الجسم زيادة هذه القيم بتقدم الكتاكيت فى العمر .
- ٢- كان معامل الاختلاف للصفات المدروسة يرتفع للأعمار الصغيرة ثم ينخفض تدريجياً بالتقدم فى العمر .
- ٣- كانت قيم المكافئ الوراثي المقدر عن طريق الأشقه الاميه لمقاييس الجسم المختلفة أعلى من مثيلاتها المقدره عن طريق الأشقه الكامله وأنصاف الأشقه الابويه وكذلك قيم المكافئ الوراثي المقدره عن طريق الأشقه الكامله لمقاييس الجسم المختلفه تمثل قيم وسطيه بين تلك المقدره عن طريق أنصاف الأشقه الابويه وأنصاف الأشقه الاميه .
- ٤- كانت قيم المكافئ الوراثي المقدره لسلاله الجميزه للصفات المدروسه هى الاعلى بين الثلاث سلالات وذلك لجميع الصفات وفى جميع الاعمار تقريباً .