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Body Mass and Conformation Traits in Four Breeds of Guinea Fowl

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Abstract
The records for body mass at one day, one, four, twelve, sixteen, twenty, twenty four weeks of age and conformation traits (Shank length, shank diameter, keel length, breast angle) at four, twelve, sixteen, twenty, and twenty four weeks of age were collected from 114 guinea fowl. There were highly significant differences in body mass between breeds and a significant difference between sexes from 4 weeks of age up to 20 weeks of age. At 24 weeks of age the difference in body mass was significant for breeds but not significant for sex. All the conformation trait measurements were higher for males than for females. A steady increase in shank length, shank diameter and keel length was observed from the 4th to the 20th week of age in all the breeds and sexes. During the study greater average breast measurement angles were recorded for females than males.

Key words: Guinea fowl, body mass body measurement

Introduction
Guinea fowls (*Numida meleagris*) are indigenous to Africa (Hastings Belshaw, 1985) and an alternate poultry species for rural production. Today, several breeds of guinea fowl exist. They are hardy and adaptable to a wide range of African environmental conditions. According to Akinwumi, Adegeye & Olayide (1979) the total population of guinea fowl (wild and captive) has been estimated at over 43.6 million. They have considerable potential as a source of animal protein and could supplement meat and egg production (Singh, Pal, and Raheja, 1992). South African literature on growth and conformation traits revealed extremely sparse information of about those traits.
The purpose this study was to estimate and compare phenotypic parameters for growth and conformation traits in four breeds of guinea fowl, which are kept at the Irene Animal Production Institute with the view to future production.

Materials and Methods
Four breeds of guinea fowl: Purple Neck (dark with pearl spots), Royal Purple (dark without spots), Lavender (blue with pearl spots) and Royal Blue (blue without spots) were used in this experiment. All breeds were maintained at the Animal Improvement Institute. Parental stock and offspring were fed *ad libitum* on a standard commercial laying diet. Water was also available ad libitum. Eggs from parental stock were collected daily over a period of 7 days after which they were incubated and hatched using standard methods (two replications). Immediately after hatching (27-28 days) chickens were wing banded and reared on a floor litter system under the same environmental conditions (during the summer).
The records for body mass at one day, one, four, twelve, sixteen, twenty and twenty four weeks of age were collected from 114 guinea fowls while conformation traits (shank length, shank diameter, keel length, breast angle) at four, twelve, sixteen, twenty, and twenty four weeks of age were also measured. For analysis the data from 89 guinea fowls was used since data from 25 guinea fowls which died before the end of experiment was discarded.
All traits were initially analysed by a least squares analyses of variance (model 1, Harvey, 1987) assuming the same fixed model for all traits.

$$Yijkl = + 111 + Bj + Sk + Hj*Bj + Hi*Sk + Bi*Sk + eijkl$$

Yijkl - observation of 1 th progeny of k th sex in th breed in l th hatch;
μ - overall population mean;
Hi - fixed effect of the l th hatch (=1,2);
Bj - fixed effect of the j th breed (j =1);
Sk - fixed effect of the k th sex (k =1, 2);
Hi*Bj interactions between l th hatch and jth breed;
Hi*Sk-interactions between l th hatch and k th sex;
Bj*Sk- interactions between j th breed and k th sex;
eijkl - random error associated with 1 th progeny of k th sex inj th breed hatched in l, th hatch.
A final model:

$$Yjkl = \mu + Bj + Sk + ejkl,$$

which consisted of the fixed effects, breed and sex was determined after identifying hatch and interactions, which were consistently not statistically significant.

Results and Discussion
Pattern of growth (Table 1) and body mass gain (Table 2) from 1st day up to 20 weeks of age was very similar for males, females and breeds. However, superiority of RP and PN over LA and RB increased after the first day and 4th week of age respectively. From the 4th week the average body mass was nearly the same for RP (male) and PN (male). Between the 1st day and 20 weeks of age males were heavier than females but at the 24th week of age females had a higher body mass than males. There were also highly significant differences in body mass between

Table 1: Least square mean ± SE of body mass for four breeds of guinea fowl (g) at different ages

Breed		Week 0	1	4	12	16	20	24
PN	♂	29.4+0.8	69.2+3.8	309.6+14.4	807.3+25.9	1249.2±29.8	1540.4±33.1	1711.2±50.7
	♀	28.6±0.7	62.5±3.3	281.8±12.6	764.7±22.7	1185.5±26.1	1480.3±28.9	1797.1±44.3
RP	♂	27.8±0.8	63.6±4.1	297.3±15.7	810.4±28.2	1244.5±32.4	1567.7±36.0	1701.8±55.1
	♀	27.3±0.8	62.3±3.8	2756.5±14.4	771.2±25.9	1223.4±29.8	1496.9+33.1	1738.0±50.7
LD	♂	27.9±0.8	59.5±4.1	253.2±15.7	707.3+28.2	1157.7±32.4	1456.3±36.0	1590.9±55.1
	♀	26.2±0.7	58.2±3.3	251.2±12.6	696.8±22.7	1101.7±26.1	1384.1±29.9	1671.4±44.3
RB	♂	28.3+1.4	65.0+6.8	278.7+25.9	792.5+46.7	1232.5±53.9	1521.2±59.7	1603.7+91.4
	♀	28.0±1.6	50.0±7.9	210.0±29.9	668.3±53.9	1115.0±62.1	14456.6±68.9	1693.3±105.5

Table 2: Least square mean ± SE of mass gain for four breeds of guinea fowl (g) at different ages.

Breed		Week 0-1	1-4	4-8	8-12	12-16	16-20
PN	♂	39.8±3.6	240.4±11.5	497.7±16.6	441.9±15.9	291.2+14.8	170.8±13.5
	♀	33.9+3.4	219.3+10.1	482.9+14.1	420.9±13.9	294.7±12.9	316.7±14.4
RP	♂	36.3±3.9	233.6±12.5	513.2±17.7	434.1±17.4	323.2±16.1	134.1±11.5
	♀	36.1±3.6	214.2±11.5	494.6±16.3	452.3±15.9	273.5±14.8	241.1±12.7
LD	♂	30.4±3.9	192.9±12.5	456.1±17.7	450.4±17.4	298.6+16.2	142.3±11.5
	♀	29.3+3.1	177.7+10.0	463.6+14.2	405.0±13.9	282.3±12.9	287.3+15.4
RB	♂	36.7±6.5	213.70±20.7	513.7±29.3	440.0+28.8	288.7±26.6	85.0±8.7
	♀	21.9+7.5	160.0+23.9	458.3+33.9	446.7±33.3	341.7±30.7	236.6+14.1

Table 3: Least square mean ± SE of body measurements for different breeds of guinea fowl (mm).

Breed	Week	Male Shank length	Shank diameter	Keel length	Female Shank length	Shank diameter	Keel length
PN	4	51.5±1.5	5.4+0.1	68.5±1.5	50.3±1.3	5.3±0.1	66.3±1.3
	12	74.3±1.1	6.7±0.1	99.7±1.5	72.1±1.0	6.6±0.1	96.3±1.3
	16	90.0±1.0	7.6+0.1	118.7±1.2	86.6±0.9	7.3±0.1	116.2±1.1
	20	97.1±1.0	8.1±0.1	129.2±1.2	93.0±0.9	7.6+0.1	127.9±1.1
	24	97.5±1.3	8.2±0.1	130.8±1.4	93.0±1.1	7.7±0.1	130.4±1.3
RP	4	51.2±1.6	5.2±0.2	66.6±1.7	49.6±1.5	5.0+0.1	62.5±1.5
	12	76.0±1.2	6.9±0.1	98.8+1.7	74.1±1.1	6.5±0.1	94.3±1.5
	16	92.8±1.1	7.5±0.1	118.9±1.3	89.0±1.0	7.4±0.1	115.7±1.2
	20	100.7±1.1	7.8±0.1	131.5+1.5	94.8±1.0	7.3±0.1	125.2±1.2
	24	98.0±1.4	7.9±0.1	135.6±1.6	94.8±1.3	7.5+0.1	129.5±1.5
LD	4	48.2±1.6	5.2±0.2	63.1+1.7	47.5±1.3	4.9±0.1	62.0±1.3
	12	72.2±1.2	6.4±0.1	92.1±1.7	70.6±1.0	6.3±0.1	90.2±1.3
	16	88.8±1.1	7.3±0.1	113.4±1.3	86.4±0.9	7.1±0.1	112.5+1.1
	20	98.6+1.1	7.6±0.1	125.5±1.4	94.2+0.9	7.3±0.1	123.6±1.1
	24	98.1±1.4	7.6±0.1	130.5±1.6	94.3±1.1	7.5±0.1	127.0±1.3
RB	4	49.2±2.6	5.0±0.3	63.7+2.8	44.3±3.1	4.5±0.3	56.7±3.2
	12	76.7±2.0	6.5±0.2	98.7±2.8	69.7±2.3	6.0±0.3	89.3±3.2
	16	93.0±1.8	7.2±0.2	116.2±2.2	86.0±2.1	7.0±0.2	109.0±2.6
	20	100.0±1.0	7.3±0.2	128.5±2.2	92.3±2.1	7.1±0.2	120.3±2.6
	24	100.7±2.3	7.3±0.2	130.2±2.6	92.3±2.6	7.1±0.2	125.6±3.0

breeds and a significant difference between sexes from 4 weeks of age up to 20 weeks of age (Table 5). At 24 weeks of age the difference in body mass was significant for breeds but not significant for sex. The average body mass estimated by Mundar *et al.* (1992) at various ages was much lower than in this study. The results presented by Ricard (1980) from two commercial French crosses showed a higher body mass than in this experiment. Between the 1st day and 12 weeks of age (Royal Blue), 1st day and 16 weeks of age (Purple Neck), 1st day and 20 weeks of age (Royal Purple and Lavender) males had better body mass gain than females. It is worth noting that the average body mass gain for females between 20 and 24 weeks of age was much higher than for males. A statistical assessment (Table 6) showed that the high differences between breeds in body mass gain was found from the 1st week to the 4th week and from the 4th week to the 12th week while between sexes from the 20th to the 24th week of age. The estimates of growth rate for commercial guinea fowl reported by Hastings Belshaw (1985) were higher than our estimates. Higher body mass and much higher growth rate for female in this time was probably due to heavier sexual organs and (or) alimentary tract. Wilson et al. (1961) indicated that Japanese quail male were lighter than female because the lower mass of gonads, liver and intestines. According to Migryt (1967) sexual organs in Japanese quail female weighed approximately 10 per cent of body mass and for male only 2 per cent. It appears that additional studies ought to be done (the relation of body mass to dissected portion at various ages) in order to solve this problem in guinea fowl.

Table 4: Least square mean of breast angle (*) for four breeds of guinea fowl at different ages

Breed		Week 12	16	20
PN	♂	53.1 ± 1.9	56.5 ± 1.2	57.3 ± 1.2
	♀	55.2 ± 1.6	57.3 ± 1.0	60.6 ± 1.0
RP	♂	50.9 ± 2.0	56.3 ± 1.3	56.3 + 1.3
	♀	52.3 ± 1.9	56.5 ± 1.2	58.8 + 1.2
LD	♂	49.5 ± 2.2	56.4 ± 1.3	57.3 ⊥ 1.3
	♀	51.5 ± 1.6	58.4 ± 1.0	60.5 ± 1.0
RB	♂	51.2 ± 3.4	55.7 ± 2.1	57.7 ± 2.2
	♀	56.4 ± 3.9	57.3 ± 2.5	60.0 ± 2.5

Table 5: Statistical differences (probability) between breeds and sex for body mass at different ages

Weeks	Breed	Sex
BM-CH	0.06	0.25
BM-1W	0.21	0.08
MB-4W	0.01	0.03
BM-8W	0.00	0.03
BM-12W	0.00	0.02
BM-16W	0.01	0.03
BM-20W	0.07	0.12

Table 6: Statistical differences (probability) between breeds and sex for gain mass at different ages

Weeks	Breed	Sex
1D-1W	0.45	0.24
1W-4W	0.00	0.06
4W-12W	0.01	0.17
12W-16W	0.63	0.21
16W-20W	0.84	0.25
20W-24W	0.31	0.00

The average body measurement with standard error at various ages is shown in Table 3. All the conformation traits measurements (shank length, shank diameter and keel length) for the duration of the experiment were higher for males than females (Table 3). Statistical analysis indicated highly significant differences between sexes for shank length from 12 weeks, shank diameter from 20 weeks and keel length from 4 weeks of age. A steady increase in shank length, shank diameter and keel length from the 4th week to the 20th week of age was observed for all breeds and sexes. Little or no increase in all measurements was observed after 20 weeks of age. At 24 weeks of age the longest shank was recorded for Royal Blue (male) and Royal Purple (female) while the shortest was recorded for Purple Neck (male) and Royal Blue (female). The highest shank diameter for the same age was recorded for Purple Neck (male and female) while the longest keel length at 24 weeks was recorded for Royal Purple males and Purple Neck females. Also at 24 weeks Royal Blue (male and female) had the lowest shank diameter and shortest keel length. The significant difference between breeds was manked: for shank length at 12 week and 16 week of age (high), for shank diameter 12, 20 and 24 week (all high) and for keel length from 4th week to 20 week (high significant), and high significant at 24th week (Table 7, Table 8). The measurements, which were done by Mundra et al. (1993) for indigenous guinea fowl at 12 and 16 weeks of age, were much lower than for four breeds of guinea for using in this experiment.

Table 7: Statistical differences (probability) between breeds and sex for shank length (SL) and shank diameter (SD)

Weeks	Breeds	Sex
SL 4 W	0.07	0.12
SL 12W	0.02	0.00
SL 16W	0.01	0.00
SL 20W	0.06	0.00
SL 24W	0.39	0.00
SD 4 W	0.04	0.06
SD 12W	0.01	0.02
SD 16W	0.07	0.18
SD 20W	0.00	0.00
SD 24W	0.00	0.00

Table 8: Statistical differences (probability) between breeds and sex for keel length (KL) and breast angle (BA)

Weeks	Breeds	Sex
KL 4W	0.00	0.01
KL 12W	0.00	0.00
KL 16W	0.00	0.00
KL 20W	0.00	0.00
KL 24W	0.05	0.00
BA 16W	0.20	0.11
BA 20W	0.30	0.89
BA 24W	0.67	0.01

The average breast angle measurement, which is generally a good predictor of edible meat yield, had the highest value at 24 weeks of age and the lowest value at 16 week for all the breeds and sexes (Table 4). During the initial measurement at 16 weeks, greater breast angles were recorded for females than for males, although highly significant differences were only recorded at 24 weeks of age (Table 8). The average estimates for breast angle at 16 week of age was much higher than those reported by Singh *et al.* (1993) and Mundra *et al.* (1993) for indigenous guinea fowl, and almost the same as that noted by Ricard (1980) for two commercial strain of guinea fowl slaughtered at the 13th week of age in 1973 but lower than guinea fowl slaughtered in 1966.

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