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BODY MEASUREMENT RELATIONSHIPS IN PURE AND CROSSED GOATS

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Target Audience: Practical farmers, Breeding farms, sheep and breeding society and Animal scientist.

ABSTRACT

Body measurment relationships study, among kids of West African Dwarf (WAD) goats and their Red Sokoto (RS) halfbreds, between birth and 150 days of age was carried out at the University of Ibadan Teaching and Research Farm over a perio9d of two and half years. Pecentage variation tended to remain constant between birth and 150 days of age for all measurements taken, except shoulder width. Among body length (BL) and leg length (LL), coefficeint of variation were highest at 30days of age and steadily decreased with increase in age. Among body measurements, phenotypic correlation values at birth were moderately high and positive ranging from 0.31 to 0.76. Similar results were obtainedat 90 and 150 days of age. However, the genetic correlation values were negative between heart girth (HG) and leg length (LL) and between heart girth and body length (BL) at birth. Between body measurements and body weight at birth, 90 and 150 days, genetic and phenotypic correlations were postitive and in general increased with increase in age interval. Phenotypic correlation between measurements and degrees of maturity at birth and at weaning.

Keywords: Body measurements, pure and crossed, goats

DESCRIPTION OF PROBLEM

Body measurenments have been used to study the effect of crossbreeding on productivity (1). characterize breeds (2) and evaluate breeds (3). They have also been used to study the interactions between heredity and environment (4) and investigated as a possible correlate of carcass composition (5). The composition and energy vaues of liveweight gain are influenced by actual and potential frame size (6,7). Neverthless, a knowledge of the variabilities and relationships between body measurements and body measurements with growth traits aid in understanding developmental processes which will eventually improve production efficiency if effectively utilized. According to . (8), positive

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correlations between body measurements and pre-weaning gain at 4 months of age, they concluded that the gene having positive effects ob body measurements also had similiar effects on pre-weaning gain. This paper therefore attempt to study variations and the relationships among linear body measurement correlations between body measurements and between linear body measurements and other growth traits in West African Dwarf and West African Dwarf x , Red Sokoto goats at birth and weaning (90 and 150 days) age. These two weaning age intervals, 90 and 150 days, were chosen because of the controversy about the ideal weaning age for goats in this part of thge world. Weaning takes place between 90 and 150 days of age and since performance to weaning is a guide to possible performance at maturity (9), this study will in addition examine performance relationships at these ages in relation to performance at birth.

MATERIALS AND METHODS

The data (76 records from 6 sire groups) used for this study were obtained from the experiment conducted at the University of Ibadan Teaching and Research Farm, between October 1988 and June 1991. The animals used were goats bred and semi-intensively managed at the aAnimal Breeding unit of the University farm.

The West African Dwarf (WAD) goat is a hardy, small and plumb animal less than 50cm in height and weighing between 20 to 25 kg at maturity. It is found mainly in the south humid zone of Nigeria characterised by high temperature, high annual rainfall, while the Red Sokoto (RS) goat predominantly found in the North-Eastern semi -arid zone is larger framed with long measuring over 60cm in height and weighing between 25 to 35kg at maturity (10,11). Records of performance on body measurements and body weights taken at 30 day intervals were extracted from the information obtained in the course of the experiment and used. Measurements were taken with aid of a measuring tape and ruler according tot he method described by (6)

Body length: The distance between the anterior point of the shoulder to the posterior extremity of the pin bone.

Heart girth: The circumference of the chest, immediately behind the front legs.

Shoulder width: The distance between the lateral tuberosities of the humeri.

Leg length: The distance between the proximal extremity of the process and the mid-lateral point of the coronet.

Degree of maturity at a specific age was estimated for each kid using the method of Fitzhugh and Taylor[12], where **U = Yt/A, U** is degree of maturity at age t, where $\mathbf{Y}_t$ represents weight at age t, **A** is the absolute mature weight defined as the repeated weight of adult non-pregnant goats recorded over a period of time and adjusted for the effects of seasonal variation.

The linear model used in the analysis of all the traits studied included the following factors: genotype of the kids (pure, crosses), type of birth of kids (single, twin, multiple), sex of kids (male, female), season of birth (dry, rainy), sires nested within breed. Least squares analyses of variance and covariance follwoing Method 3 of Henderson as quoted and outlined by Harvey13 were conducted to obtain estimates of phenotypic coefficeints of variation **(CVp)**, among sires (S^2_s) and within (S^2w) components of variance and covariance. Genetic and phenotypic correlations were then calculated by paternal half-sib procedure.

$$\text{Genetic correlation} = \frac{Ssisj}{S_{si} S_{sj}}$$

Where i and j represent differnt traits.

The exploitation of the possible bias that could exist purebred and crossbred data are pooled to estiamte genetic parameters as a result of dominiance and epistatic variances was the priamry reason for which reciprocal recurrent selection was devised. But the apparent smal or zero advantage of reciprocal recurrent selection in animals indicated that any upard bias in genetic statistics due to dominance and epistatic variance is of little or no significant important. Therfore data of pure and crossbred animals can be pooled to estimate genetic parameter without introducing bias in the expected result.

RESULTS AND DISCUSSION

Variability:

As shown in Table 1, coefficents of variation tended to remain relatively constant with increase in are except for shoulder width(SW). Thre coefficients of variation from 3.78 to 5.01 for body length (BL), 5.45 to 5.59 for heart girth (HG), 6.65 to 10.35 for shoulder width (SW) and 5.33 to 7.07 for leg length (LL).

Table 1: Mean and phenotypic coefficients of variation (Cvp) of body length (Bl), heart girth (HG), shoulder width (SW) and leg length (LL) of goats at different ages.

	Body length		Leg length		Heart girth		Shoulder width	
Ages	mean	CVp	mean	CVp	mean	CVp	mean	CVp
Birth	25.76	5.01±0.21	18.42	6.14±0.14	27.14	5.59±0.07	6.62	10.35±0.16
30days	31.47	5.17±0.11	23.40	7.07±0.12	36.33	5.45±0.12	11.87	6.76±0.11
90days	38.10	4.98±0.13	28.71	6.04±0.08	42.79	7.02±0.14	14.71	6.65±0.14
150days	42.22	3.78±0.11	29.88	5.53±0.10	46.97	5.46±0.09	16.47	6.91±0.11

For (BL) and LL, coefficients of variation were highest at 30 days of age, decreasing with increase in age. Coefficient of variation was highest at birth for SW, while it was highest at 90 days foe HG. Reporting similar results, Brown et al[8] stated that coefficents of variation in pattern of growth is to be expected in most domestic breeds as a consequence of past selection procedures.

Correlations:

The genetic correlation between measurements at birth were high and postive, except for the relationship between HG and LL, and HG and BL, which were negative (Table 2). Between the measurements studied, all phenotypic values at birth were moderately high and positive, ranging from 0.31 to 0.68 At 90 and 150 days of age, the genetic and phenotypic correlations between body measurements were high and positive, indicating that selction for any of the measurements at these ages will result in concomitant increase in all body parts.

Table 2: Genetic and phenotypic correlations among body length (BL), heart girth (HG), shoulder width (SW) and leg length (LL) of goats at successive ages.

Ages		Birth				90 days				150 days			
		BL	HG	SW	LL	BL	HG	SW	LL	BL	HG	SW	LL
Birth	BL	-	-0.40	0.57	0.80	-	-0.52	-0.78	0.60	-	-0.29	-0.51	0.64
	HG	0.53	-	0.83	-0.01	0.46	-	0.80	0.89	0.53	-	0.90	0.80
	SW	0.31	0.35	-	0.80	0.20	0.30	-	0.90	0.04	0.28	-	0.90
	LL	0.68	0.44	0.38	-	0.50	0.42	0.42	-	0.56	0.41	0.40	-
	BL	-	-	-	-	-	-	-	-	-	-	-	-
	HG	0.36	-	0.78	-0.06	0.52	-	0.94	0.76	0.58	-	0.96	0.78
90	SW	0.20	0.15	-	-0.31	0.41	0.74	-	0.59	0.28	0.61	-	0.60
days	LL	0.30	0.37	0.49	-	0.56	0.69	0.55	-	0.53	0.69	0.55	-
	BL	-	0.71	0.83	0.12	-	0.96	0.95	0.87	-	0.90	0.94	0.88
	HG	0.44	-	0.81	-0.09	0.75	-	0.86	0.90	0.81	-	0.94	0.90
150	SW	0.24	0.21	-	-0.29	0.69	0.75	-	0.69	0.76	0.65	-	0.66
days	LL	0.42	0.43	0.12	-	0.83	0.76	0.62	-	0.85	0.79	0.65	-

Phenotypic correlations below the diagonals, Genetic correaltions above the diagonals.

The implications of this, according to (8), is that BL, for example, can be used int he absence of HG to evaluate traits that are correlated with HG. Between birth, 90 and 150 days, all phenotypic correlations were posotive, but low. Such low phenotypic correlations, according to Wiener & Hayter (1), indicate a marked degree of independence among the body parts.

From these results, it can be deduced that selection for BL at birth will decrease HG and 150 days of age is associated with a decrease in LL at birth. Brown et al. (8) reported positive genetic and phenotypic correlations between body measurements at different ages and concluded that the positive relationship between trhe complex gene influencing size or shape has a similar effect at all ages. They further stated that the variations in the covariance structure in the body measurements were the results of contrasting body shapes, the relationship between which are not always positive as demonstrated by the results presented in Table 2. Developmental homeostatic mechanisms generated these variations in body parts to resist extreme changes in the shape of the animals (8).

Between linear measurements and body weights at birth, 90 and 150 days, genetic correlations were positive and high (Table 3). Phenotypic correlations generally increased with increase in age interval, contradicting the report of (3) that correlations estimates decreased as rams progressed in age. On average, shoulder width at birth was more correlated genetically with body weights than other measurements, while leg length at 90 and 150 days of age were more correlated with body weight at all ages. (2) reported the highest correlations between heart girth and body weightts at birth and 120 days, while (15) reported that height at withers appeared to be more closely associated with body weights.

Table 3: Genetic (G) and phenotypic (P) correlations between body length (BL), heart girth (HG), shoulder width (SW), leg length (LL) and body weights of goats at different ages.

Ages			Birth	90 days	150 days
	BL	G	0.66±0.14	0.95±0.19	0.53±0.11
		P	0.50	0.48	0.57
	HG	G	0.88±0.14	0.81±0.16	1.03±0.33
birth		P	0.25	0.36	0.38
	SW	G	0.95±0.09	0.14±0.02	1.06±0.25
		P	0.23	0.54	0.51
	LL	G	1.03±0.21	0.58±0.10	0.72±0.08
		P	0.57	0.58	0.60
	BL	G	--	--	--
		P	0.21	0.44	0.40
	HG	G	0.66±0.13	0.72±0.11	0.75±0.08
90 days		P	0.57	0.57	0.59
	SW	G	0.34±0.07	0.40±0.06	0.39±0.11
		P	0.39	0.50	0.46
	LL	G	0.87±0.21	1.00±0.20	0.91±0.06
		P	0.60	0.85	0.86
	BL	G	0.78±0.21	0.80±0.14	0.80±0.12
		P	0.54	0.70	0.72
	HG	G	0.70±0.11	0.87±0.14	0.80±0.12
150 days		P	0.59	0.69	0.68
	SW	G	0.35±0.11	0.49±0.09	0.47±0.07
		P	0.35	0.57	0.54
	LL	G	0.94±0.11	0.91±0.12	0.99±0.14
		P	0.63	0.88	0.89

In general, correlation results between linear measurements and body weights in this study agreed with reported results in the literature (3, 8, 15). Its implication, therefore, is that, selection for increase in either body weights or linear measurements will result in a corresponding increase in the other. In addition, body weights, in the absence of measurement records, can be used to evaluate traits that are correlated with linear measurements.

The results of the phenotypic correlation between body measurements and degrees of maturity (Table 4) revealed that measurements at birth were relatively independent of the degrees of maturity at birth, 90 and 150 days of age.

Table 4: Genetic (G) and phenotypic (P) correlations between body length (BL), heart girth (HG), shoulder width (SW), leg length (LL) and of maturity at different ages.

Ages			Birth	90 days	150 days
	BL	G	0.55±0.11	--	0.71±0.13
		P	0.13	-0.07	0.11
	HG	G	0.54±0.14	0.73±0.11	0.31±0.07
birth		P	-0.01	0.27	0.20
	SW	G	1.12±0.33	0.55±0.11	0.31±0.10
		P	-0.17	0.17	0.05
	LL	G	0.06±0.02	0.27±0.08	0.48±0.09
		P	0.10	-0.01	0.01
	BL	G	--	0.81±0.09	0.88±0.10
		P	0.45	0.35	0.67
	HG	G	0.86±0.19	1.03±0.21	0.97±0.11
90 days		P	0.54	0.31	0.66
	SW	G	0.53±0.08	1.40±0.12	0.62±0.11
		P	0.47	0.50	0.60
	LL	G	1.03±0.13	0.54±0.09	1.00±0.10
		P	0.76	0.43	0.78
	BL	G	0.78±0.21	0.80±0.14	0.80±0.12
		P	0.54	0.70	0.72
	HG	G	0.84±0.14	--	0.92±0.19
150 days		P	0.32	0.56	0.64
	SW	G	1.06±0.16	0.56±0.09	0.61±0.11
		P	0.43	0.55	0.56
	LL	G	0.65±0.11	0.63±0.12	0.02±0.01
		P	0.39	0.73	0.76

However, genetic correlation coefficients showed moderate relationship between them (estimate of 1.12 between shoulder width and degrees of maturity at birth could well be associated with eroor either in estimations or in data colation). With low phenotypic correlation between body measurements at birth and degrees of maturity at birth, 90 and 150 days of age, selection for degrees of maturity will result in little or no increase in any of the linear measurements studied. At 90 and 150 days higher degrees of positive correlation between the mneasurements and degrees of maturity was noted, which signified that selection for increased degrees of maturity or body dimension will result in a corresponding increase in the other. Observations revealed that shoulder width and heart girth were more correlated with degrees of maturity at 90 days. In general, faster maturing animals tended to have larger frames than slow maturing ones.

Crossbreeding is normally used to combine difference in additive genetic merit for specific character to synchronize effective performance characteristics and adaptability resources that are economic importance. It is genrally accepted as an effective means of increasing efficiency and profitability meat producing animals (9). The performance of crossbred animals had generally been acknowledged to be better than those in their purebred counterparts were crossbreeding is parcticed (1,5). Similar results were obtained in this study. To exploit the advantages of crossbreeding, it is necessary to determine the magnitude of the additive gene effects of alleles on the economic trait being considered as partially reflected in the correlations values. THe heterotic effect being not important in parameter estimate (14).

CONCLUSIONS AND APPLICATIONS

In conclusion, the results of the study revealed that kids with larger frames at birth had heavier weights and amtured faster at all pre-weaning ages. According to Fitzhugh et al. (9), performance at weaning is a guide to possible perforamnce at maturity and also an indicator of individual growth potential. Therefore, kids with large frames, heavier weights and faster growth/maturing rate as observed in this study both at 90 and 150 days of age are likely to maintain their superiority to puberty and market age. Hence, selection for large frames at these ages would increase weight and size at market age as well as ensure rapid growth, resistance to disease and early maturity which will, in turn, reduce generation interval nenabling faster rate of improvement in total flock productivity.

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