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Correlations Between Some Weaning Traits in Four Strains of F_1 Piglet Genotypes

P.E. Nwakpu and P.N. Onu
Department Of Animal Production and Fisheries Management,
Ebony State University, Abakaliki P.M.B. 053, Abakaliki, Nigeria

Abstract: A total of 183 piglets weaned from 15 L were used to evaluate phenotype/genetic and environmental correlations in 4 F_1 population genotypes of piglets. Traits investigated include litter size at weaning, litter weight at weaning, average piglet weight at weaning and survival rate from birth to weaning at 8 weeks. The F_1 genotypes comprised of Native X Landrace (reciprocal crossbred), Land race X Native (Main crossbred), Native X Large white (reciprocal crossbred) and large white Native (Main crossbred). Each of the genotypes varied in their ability to breed true. Estimates of phenotypic, genetic and environmental correlations were highest between litter size and weight (0.65-0.70, 0. 80-0.82, 0.64-0.73 and 0.72-0.80) for the main crossbreds and reciprocal crossbreds, respectively. Estimate of correlation between filter size and weight were slightly lower in the main crossbred compared with their reciprocal genotypes. Estimates of correlation between litter weight and average piglet weight at weaning and between litter size and litter weight were low and mostly negative. The estimates of phenotypic correlation between survival rate and other traits were lower than their respective genetic correlations. Results obtained suggest that both genetic and environmental sources of variation significantly affect litter size, litter weight and average piglet weight at weaning as a result of different physiological and biochemical mechanisms. The observed negative correlations among some of the traits suggest the impact of pleitropic genes at work. Maternal effect could also be responsible for lowly correlation between survival rate and other weaning traits.

Key words*:* Correlation, weaning, traits, genotypes, native and exotic pigs

INTRODUCTION

In animal breeding, the importance of assessing individuals' breeding value is sufficient reason for theoretically illustrating the concept of breeding value. The additive genetic value is identical with the breeding value (general breeding value), which can be estimated according to certain general principles based upon the phenotype of the individual itself and/or its relatives. The result of these effects is that, an individual in certain mating combinations has special breeding value, the size of which it is impossible, as a rule, to estimate in advance. The special breeding value must be experimentally determined for each separate case, not only in mating between individuals but also in crosses between inbred lines or breeds (Nwakpu and Qmeje, 2001).

The phenotypic correlation between two characters can be influenced by inheritance, environment or both. When the correlation is mainly genetic, consideration must be taken of this in the breeding plans. A genetic correlation can also be due to pleitropy. It is important to have information on genetic parameters such as genetic correlation between economic traits in order to device an efficient method of selection for genetic improvement.

Estimates of genetic and or phenotypic correlations are common in literature for swine (Dalton, 1980), but these are from landrace and large white breeds. Over years, Nigeria has banned the importation of these improved breeds and as such, breeds available are left over crosses available in some commercial farms introduced by the Europeans in the early sixties or seventies. However, these important genetic parameters are rare for our Nigerian native pig or their crosses with the exotic. Most of the available measurements of correlations are limited to phenotypic correlation of physical characteristics (Adebambo, 1984).

The aim of this research is to determine the estimates of phenotypic, genetic and environmental correlations among 4 F_1 population piglet genotypes.

Corresponding Author: P.E. Nwakpu, Department of Animal Production and Fisheries Management, Ebony State University, Abakaliki P.M.B. 053, Abakaliki, Nigeria

MATERIALS AND METHODS

Experimental animals: These comprise F_1 strains generated from 2 exotic breeds of pigs (large white and landrace) and the Nigerian native pig established and maintained at the Piggery Breeding and Research Unit of Ebonyi State University, Abakaliki, Nigeria.

Each of the breed group varies in their ability to breed true. At 81/2 months of age, gilts were crossed by another boar from another breed to generate F_1 strains. Any gilt which did not return on heat after about three weeks (19-24 days) were adjudged to be pregnant.

Management of the animals: The animals were intensively reared in standard pens according to their litter groups. Piglets were brooded and fed *ad libitum* for eight weeks with pig starter diets, which on analysis revealed 22% crude protein and 2900 kcal ME kg^{-1} water for drinking was provided *ad libiturn* throughout the period. The animals were dewormed on routine basis and other therapeutic treatments provided as the need arose. Legumes and fresh forages were provided as supplements for the pigs. Litter mates and their darns were fed together until weaning at 8 weeks. Quantity of feed varied with the number of piglets in each litter.

Da ta collection and analysis: Records of 183 piglets weaned in 15L were analyzed (Table 1). Mixed model least squares arid maximum likelihood computer programme (Harvey, 1990) were used to obtain variances used for the estimation of phenotypic, genotypic and environmental correlations among weaning litter size, weaning litter weight, average piglet weaning weight and survival rate to weaning for each breed group.

RESULTS

Mean litter size and average piglets weight at weaning among the main and reciprocal crossbreeds of piglets from Nigerian native and 2 exotic breeds of landrace and large white varied from 6.60±0.20-10.00±0.60 and 11.17±0.02-13.30±0.15 kg, respectively. Litter size was statistically ($p<0.05$) different among the genotypes with the reciprocal crossbreds having more than the main crossbreds. This is evidenced from native gilts that provided the maternal effect and whose preponderant genes brought down the litter size number. Litter weight and survival rate to weaning ranged from 17.30±0.39-11.99±0.29 kg and 65-80%, respectively (Table 1). There was an increase in litter weight with increase in litter size.

The highest phenotypic correlation was observed between liter size and weight (Table 2). It was slightly less in the crossbreds of LW X N and LR X N (r = 0.65 and 0.70) than in the reciprocal crossbreds N x LR and N x LW (r = 0.80 and 0.82), respectively. The phenotypic correlation between litter size and average piglet weight decreased with increase in the number of piglets in a litter. Phenotypic correlation between litter size and average piglet weight were negative for two main crossbred groups and positive for the reciprocal groups (Table 2). Estimates of phenotypic correlation between litter weight and average piglet weight were generally low. Survival rate showed the highest phenotypic correlation with average piglet weight in the main crossbred of LR x N (r-0.70) although it was lowly correlated with other weaning traits.

The highest genetic correlation was observed between litter size and litter weight (r = 0.64 and 0.73) from main crossbreds and (r = 0.72 and 0.80) from the reciprocal crossbreds. Negative genetic correlations observed between litter size and litter weight were generally high while that of litter size and average piglet weight were generally very low and negative (Table 3). The highest estimate of genetic correlation between litter size and survival rate was from the main crossbred LR x N (r = 0.52) followed by main crossbred LW x N (r = 0.43). The least were from the reciprocal crossbreds. Estimates of genetic correlations between survival rate and litter weight at weaning and average piglet weight at weaning were generally low but positive (Table 3).

Table 1: Litter characteristics in four piglet genotypes traits

Genetic Groups	Traits: No. of parties	No of piglets	Litter size at weaning	Litter weight at weaning	Av. Piglet weight at weaning	Survival rate %
NxLR	5	65	$10.0±0.60^c$	19.05±0.55	11.17±0.02	70±15
LrxN	5	45	$7.00±0.51^a$	11.99±0.29	12.80±0.03	80±10
NxLW	5	60	$8.10±0.31^b$	17.39±0.30	10.10±0.10	65±20
LwxN	5	46	$6.50±0.20^a$	I8.54±0.46	13.30.±0.I5	73±50

N xLR = Native Boar x Landrace gilt (reciprocal crossbred); LRxN = Landrace boar x Native gilt (main crossbred); N x LW = Native boar x Large White gilt (reciprocal crossbred); LWxN = Large White boar x Negative gilt (main crossbred); a,b,c = Means in a column not bearing same superscript are different ($p<0.05$)

Table 2: Estimate of Phenotypic Correlation among weaning characteristics in the F1 genotypes of Piglets-Traits

	Traits				
Genetic groups	Group	LSW	LWT	APWT	SR
NxLR	LSW	-	0.80	0.30	0.45
	LWT	-	-	0.16	0.55
	APWT	-	-	-	0.35
LrxN	LSW	-	0.70	-0.20	0.15
	LWT	-	-	0.10	0.30
	APWT	-	-	-	0.70
NxLW	LSW	-	0.82	+0.31	0.43
	LWT	-	-	0.10	0.36
	APWT	-	-	-	0.28
LwxN	LSW	-	0.65	-0.15	0.50
	LWT	-	-	0.20	0.40
	APWT	-	-	-	0.31

The acronyms N x LR, LR x W, N x LW and LW x N are as defined in Table 1; LSW- Litter size at weaning; LWT- Litter Weight; APWT - Average Piglet Weight (kg) at weaning; SR- Survival rate (%)

Table 3: Estimates of genetic and environmental correlation among F1 weaning piglet genotypes traits

	Traits				
Genetic groups	Group	LSW	LWT	APWT	SR (%)
NxLR	LSW	-	0.80	-0.22	0.31
	LWT	-0.72	-	0.16	0.43
	AI'WT	0.24	0.11	-	0.40
	SR(%)	-0.28	-0.43	-0.25	-
LrxN	LSW	-	0.73	0.40	+0.52
	LWT	-0.63	-	0.20	0.46
	APWT	0.43	-0.24	-	0.45
	SR(%)	-0.61	0.44	1.20	-
NxLW	LSW	-	0.72	-0.27	0.4!
	LWT	-0.56	-	0.11	0.46
	APW!'	0.30	-0.16	-	-0.38
	SR(%)	-0.21	-0.30	-0.20	-
LwxN	LSW	-	-0.64	-0.26	0.43
	LWT	-0.52	-	0.32	0.41
	APWT	0.36	0.17	0.17	-0.51
	SR(%)	-0.70	0.41	1.56	-

Genetic Correlations are in the upper diagonal. Acronyms are as defined in Table 1

DISCUSSION

Values of litter sizes and litter weight at weaning are in consonance with values reported by Adebambo (1984) and Bidanel (1993). The high phenotypic correlation between litter size and weight is expected since an increase in the numbers of piglets in a litter will normally lead to an increase in the total weight of such a litter. The highly positive phenotypic correlation between litter size and litter weight in this study is corroborated by the findings of Nwagu *et al.* (2000) that there was a positive and significant correlation between litter size and litter weight and number of piglets that survived. The negative phenotypic correlation between litter size and average piglet weight suggests that factors, which tend to increase the litter size also tend to reduce the average weight of piglets in such litters. An earlier report by Nwagu *et al.* (2000) showed a highly negative and significant correlation between litter size and mean kit weight at birth for rabbits. The relationship between litter size and average piglet weight is however not invariable. For instance, Ehiobu and Kyado (2000) reported of a highly positive genetic correlation between litter size at weaning and average piglet weaning weight in swine.

The present results suggest that, genetic and environmental correlations are important between a litter size and litter weight and between litter size and piglet weight. This implies that selection for higher litter size may lead to an improvement in the litter weight. It seems, however, that genetic and environmental sources of variation affect some of the investigated trait through different physiological and biochemical mechanisms. Gunset and Robinson (1990) had earlier opined that genetic and environmental sources of variation affect characters through different physiological mechanisms.

Negative genetic correlation between litter size and average piglet weight at weaning among the genotypes suggest that pleitropic genes which affect both characters in the desired direction will be acted on by selection pressure and may become fixated. They will then contribute little to the variance and covariance components of the two characters and the genetic correlation between them will eventually become negative.

Negative genetic correction is not uncommon among bio-economic traits. For example, Ozoje (1997) obtained a negative genetic correlation between average growth rate from 90-150 days in pure bred and crossbred West African dwarf goats and concluded that negative bias due to variation in weights could cause a negative correlation coefficient. It appears from the present study that genes, which promote fertility of dam and variability of young, also contribute favourably to the litter weight at weaning.

The low phenotypic and genotypic correlations between weaning litter weight and average piglet weight suggest that the number of piglets in a litter contributes more to the litter weight at weaning than the weight of individual piglets. The lower genetic and environmental correlations between litter size and survival rate compared with the correlations between litter size and litter weight suggest greater maternal (genetic and environrnental) effect on postnatal survival than for litter weight (Haley *et al*., 1995).

The positive environmental correlation between litter size and litter weight suggest that good management practices that could, support good body weight of individual piglets will also favour their livability and consequent litter size in such population.

Estimates of phenotypic correlation in this study were generally lower than the genetic correlation especially for correlation between survival rate and other traits. Similar observations were made by Bullock *et al.* (1993) and Fayeye and Ayorinde in cattle and rabbits, respectively. Genetic correlations are believed to be strongly influenced by gene frequencies, so they may differ markedly in different populations.

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