

Effect of Parity and Non-Genetic Factors on the Reproductive Traits in Nigerian Indigenous Pigs

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ABSTRACT

The phenotypic expression of any trait in animals is determined by genetic and non-genetic factors. Records of 252 litters of Nigerian indigenous pigs sired by 48 boars and 83 sows at the Swine Unit of Obafemi Awolowo University Teaching and Research Farm between 1990 and 1998 (8 years) were collected and used to investigate the effect of parity and non-genetic factors on the litter traits. The pigs were kept under intensive and routine management. Data collected were on litter size at birth and weaning, litter weight at birth and weaning, pig weight at birth and weaning, sex ratio at birth and weaning and mortality at weaning were subjected to analysis of variance. The means values of the traits were: litter size at birth (5.78 ± 2.07), litter size at weaning (5.51 ± 2.02), litter weight at birth (6.15 ± 2.36 kg), litter weight at weaning (25.14 ± 11.13 kg), pig weight at birth (0.95 ± 0.12 kg), pig weight at weaning (4.17 ± 1.33 kg), sex ratio at birth (0.48 ± 0.23), sex ratio at weaning (0.48 ± 0.25) and mortality ($4.58 \pm 1.70\%$). Parity had significant effect ($p < 0.05$) on pig weight at weaning while the effect of parity was not significant ($p > 0.05$) on other litter traits. The effect of season was significant ($p < 0.05$) on litter size at weaning, pig weight at weaning and mortality. Year of birth did not have significant effect on most of the traits except on litter weight at birth and weaning as well as weight at weaning. The correlation coefficients among the traits ranged from -0.01 to 0.96. Parity and the non-genetic factors were not important source of variation on most of the litter traits considered in Nigerian indigenous pig. It could be recommended that parity, season and year of birth should be considered for those traits they have significant effect on for better production.

Key words: Parity, mortality, non-genetic factors, litter traits, Nigerian indigenous pig

INTRODUCTION

The Nigerian indigenous pigs are found in the southern part of the country and along the coast of countries in West Africa. They are small bodied, produce small litters and roam about as scavengers in compounds and villages. They were considered of poor performance, inefficient and uneconomic to be used for commercial production (Umesiobi, 2000). The litter traits performance reported by Adeoye *et al.* (2003) for Nigerian indigenous pigs were poor compared to the values reported in the literature for exotic breeds. These notwithstanding, the indigenous pigs have some superiority characteristics over the exotic ones. The indigenous pigs have superior adaptation ability to tropical conditions compared to the exotic ones. Under intensive management and adequate rations (Fetuga *et al.*, 1976) indigenous pigs had less mortality up to weaning. The study conducted by Ilori *et al.* (1976), had revealed that local pigs weaned more piglets compared with the exotic breeds under low protein intake. Chiboka

(1981) noted that indigenous pigs reached puberty at earlier age than exotic pigs such as Large White or Duroc. Indigenous pigs can be maintained on low dietary ration (Ilori *et al.*, 1974), which implies that they have low cost of feeding as reported by Adebambo and Dettmers (1979). Profitability in pig enterprise primarily depends upon overall reproductive performance of the pigs comprising age at first farrowing, farrowing interval, litter traits, sex ratio, and pre-weaning mortality (Singh and Khanna, 2000). These traits are important to reduce cost of rearing up to rearing age, reduce generation interval and increase genetic gain per unit time (Das, *et al.*, 2005).

The phenotypic value of any trait depends on the genetic make-up and the environment. Since all the reproductive activities except the production of sperm cells take place within the female reproductive tract, any factor that affects the sow will influence litter traits. Effect of

different factors have been reported on litter traits in exotic breeds and crossbreeds: Genotype (Adeoye and Adebambo, 2010); year of birth (Orheruata, 2000); nutrition (Akinfala, 2001); parity (Pokhare *et al.*, 2013) and season (Oseni, 2005). However, little or no work has been done on the effect of parity and some non-genetic factors on the litter traits in Nigerian indigenous pigs. Therefore, the objective of this study was to evaluate the effect of parity and some non-genetic factors on the litter traits in Nigerian indigenous pigs.

MATERIALS AND METHODS

Records of litter size at birth and weaning, litter weight at birth and weaning, pig weight at birth and weaning, pre-weaning mortality, and sex ratio at birth and weaning routinely kept at Swine Unit at Obafemi Awolowo University Teaching and Research Farm between 1990 and 1998 were used for his study.

Herd Management

The swine herd used in this study was maintained at an altitude of 240 m above sea level at the Teaching and Research Farm at Obafemi Awolowo University. The area is located at 7°28' N and 4°23' E, within the hot humid tropical rainforest. The management was intensive; animals were grouped into pens according to sex, age and physiological condition. Feeding was done twice daily with piglet and adult rations depending on their ages. Laboratory feed analysis was not available, although periodic feeding with cassava peels and pawpaw parts was reported. The piglets were creep-fed in addition to access to milk from their dams. Normal daily routine management included cleaning of the pens and removal of left-over feed and water. The control of ectoparasites was done by dipping adult animals in asuntol® solution and endoparasites were controlled by deworming the animals using piperazine® soluble powder at three month-intervals. The boars were introduced to the gilts at 7 to 9 months of age and sows that showed signs of heat 8 weeks post-partum. Gilts and sows were monitored throughout gestation.

The data were subjected to analysis of variance while Duncan Multiple Range Test was employed to separate significant means. Pearson correlation was used to examine correlation between the litter traits. The statistical model used is as follows:

$$Y_{ijkl} = \mu + P_i + S_j + A_k + \varepsilon_{ijkl}$$

Where Y_{ijkl} is observations on the traits

μ is the universal mean

P_i is effect of parity (1-3)

S_j is effect of season (1-4)

A_k is effect of year (1-3)

ε_{ijkl} is experimental error

RESULTS

Table 1 shows the descriptive statistics of litter traits considered. The litter size at birth (lsb), litter size at weaning (lsw), litter weight at birth (lwb) and litter weight at weaning (lww) were 5.78±0.31, 5.51±0.31, 6.15±0.24 kg and 25.14±1.11 kg respectively. The figures, 0.95±0.02, 4.17±0.20, 0.48±0.03, 0.48±0.04 and 4.58±1.45 were estimates of pig weight at birth (pwb), pig weight at weaning (pww), sex ratio at birth (srb), sex ratio at weaning (srw) and mortality respectively. The coefficient of variation varied among the traits with the highest value (211.89%) found in mortality and the smallest (12.96%) in pwb.

Table 2 reveals the effects of parity and non-genetic factors on the litter traits. Parity had no significant effect ($p>0.05$) on most of the traits considered except on the pig weight at weaning. The pig weight at weaning in parity 1 was significantly ($p<0.05$) higher than the weight in parity 3 while no significant effect ($p>0.05$) was observed between parity 1 and 2. Significant effect of season was noticed in lsw, pww and mortality. Lsw (6.88±0.48) in late dry season was significantly higher than 4.46±0.53 observed in late rain while no significant effect was observed between early rain, late rain and early dry season. The pig weight at weaning in early rainy season (4.63±0.47) was significantly higher than the 3.60±0.35 observed in late dry season while no significant effect was observed between early rain, late rain and early dry seasons. The mortality rate of 9.66% during the late rainy season was significantly higher than the values observed in early and late dry season. No significant effect was observed between early and late rainy seasons in other traits considered. Year effect was significant ($p<0.05$) on litter weight at birth, litter weight at weaning and pig weight at weaning.

Table 1: Summary statistics of litter traits of Nigerian indigenous sows

Variables	means	Std.dev.	N	Min.	Max.	CV
Lsb	5.78	2.07	45	2	11	35.94
Lsw	5.51	2.02	45	2	10	36.62
Lwb(kg)	6.15	2.36	100	1.4	10.8	38.31
Lww(kg)	25.14	11.13	100	3	66.5	44.26
Pwb(kg)	0.95	0.12	46	0.58	1.19	12.96
Pww(kg)	4.17	1.33	46	1.95	8.4	31.95
Srb(%)	0.48	0.23	45	0	1	46.78
Srw(%)	0.48	0.25	45	0	1	51.84
Mort.	4.58	1.7	45	0	33	211.89

Lsb-litter size at birth, Lsw-litter size at weaning, Lww- litter weight at weaning, Lwb-litter weight at birth, Pwb-pig weight at birth, Pww-pig weight at weaning, Srb-sex ratio at birth, Srw-sex ratio at weaning, Mort.-mortality.

Table 2: Mean (\pm SE) for effects of parity and non- genetic factors on litter traits

factors	variables								
	Lsb	lsw	Srb(%)	Srw(%)	Lwb(kg)	Lww(kg)	Pwb(kg)	Pww(kg)	Mort.
Parity1	5.95 \pm 0.43	5.70 \pm 0.42	0.44 \pm 0.05	0.43 \pm 0.06	6.21 \pm 0.42	26.94 \pm 1.88	0.98 \pm 0.03	4.42 \pm 0.27 ^a	3.77 \pm 1.85
2	5.39 \pm 0.49	5.22 \pm 0.53	0.54 \pm 0.05	0.54 \pm 0.05	6.34 \pm 0.38	24.54 \pm 1.99	0.93 \pm 0.03	4.13 \pm 0.36 ^{ab}	4.35 \pm 2.42
3	6.29 \pm 0.97	5.71 \pm 0.75	0.43 \pm 0.11	0.43 \pm 0.11	5.70 \pm 0.38	23.03 \pm 1.39	0.93 \pm 0.02	3.51 \pm 0.28 ^b	7.47 \pm 4.83
Season	5.81 \pm 0.59	5.5 \pm 0.58 ^{ab}	0.46 \pm 0.06	0.42 \pm 0.07	6.17 \pm 0.42	25.32 \pm 1.61	0.95 \pm 0.04	4.63 \pm 0.47 ^a	5.03 \pm 2.41 ^{ab}
Er	5.0 \pm 0.64	4.46 \pm 0.53 ^b	0.44 \pm 0.05	0.44 \pm 0.06	6.42 \pm 0.53	25.97 \pm 2.38	0.95 \pm 0.04	3.98 \pm 0.23 ^{ab}	9.66 \pm 3.64 ^a
Lr	5.88 \pm 0.48	5.88 \pm 0.48 ^{ab}	0.55 \pm 0.08	0.55 \pm 0.08	5.92 \pm 0.52	27.29 \pm 2.83	0.98 \pm 0.02	4.12 \pm 0.30 ^{ab}	0.00 \pm 0.00 ^b
Ed	6.88 \pm 0.48	6.88 \pm 0.48 ^a	0.55 \pm 0.09	0.57 \pm 0.09	6.09 \pm 0.45	21.92 \pm 2.43	0.95 \pm 0.03	3.60 \pm 0.35 ^b	0.00 \pm 0.00 ^b
Ld	5.94 \pm 0.50	5.71 \pm 0.52	0.56 \pm 0.05	0.53 \pm 0.06	5.33 \pm 0.37 ^b	22.89 \pm 1.58 ^b	0.95 \pm 0.03	4.44 \pm 0.40 ^a	5.01 \pm 2.48
Year 1	5.60 \pm 0.59	5.33 \pm 0.50	0.43 \pm 0.07	0.42 \pm 0.07	6.02 \pm 0.41 ^b	23.99 \pm 1.65 ^{ab}	0.96 \pm 0.04	4.33 \pm 0.30 ^{ab}	3.49 \pm 2.38
2	5.77 \pm 0.56	5.46 \pm 0.57	0.45 \pm 0.06	0.47 \pm 0.06	7.21 \pm 0.38 ^a	29.05 \pm 2.47 ^a	0.95 \pm 0.03	3.60 \pm 0.22 ^b	5.28 \pm 2.84
3	5.78 \pm 0.31	5.51 \pm 0.30	0.48 \pm 0.03	0.48 \pm 0.04	6.15 \pm 0.24	25.14 \pm 1.11	0.95 \pm 0.02	4.17 \pm 0.20	4.58 \pm 1.45
overall	5.78 \pm 0.31	5.51 \pm 0.30	0.48 \pm 0.03	0.48 \pm 0.04	6.15 \pm 0.24	25.14 \pm 1.11	0.95 \pm 0.02	4.17 \pm 0.20	4.58 \pm 1.45

Lsb-litter size at birth, Lsw-litter size at weaning, Lww- litter weight at weaning, Lwb-litter weight at birth, Pwb-pig weight at birth, Pww-pig weight at weaning, Srb-sex ratio at birth, Srw-sex ratio at weaning, Mort.-mortality; Er-Early rainy season; Ed-Early dry season; Ld-late dry season; Lr- Late rainy season

A progressive increase was observed in the litter weight at birth and litter weight at weaning as the animals advanced in age. The pig weight at weaning decreased with increase in year of the pig and significant effect was observed between years 1 and 2. The correlations between most of the traits were weak (Table 3). The correlation coefficient between litter size at birth and other litter traits ranged between -0.07 and 0.96. No significant effect was observed in virtually all the relationship except between lsb and lsw which was high and very highly significant.

DISCUSSION

The estimates of litter traits in this present study are similar to the values reported for Nigerian indigenous pigs by earlier researchers (Adeoye *et al.*, 2003; Nwakpu, 2013; Ajayi and Akinokun, 2013 and Oluwole *et al.*, 2014). However higher values were reported for exotic pig breeds (Nwakpu and Onu, 2011) compared the results of indigenous pigs in this study. The lower performance of the indigenous compared to the exotic pigs is in line with the reports of Umesiobi (2000) that Nigerian indigenous pigs have poor performance in litter traits.

Table 3: Correlations between litter traits

	lsb	lsw	lwb	lww	pwb	pww	srb	srw
Lsw	0.96***							
Lwb	0.06ns	0.12ns						
Lww	0.04ns	0.09ns	0.60***					
Pwb	0.09ns	0.12ns	-0.19ns	-0.07ns				
Pww	-0.00ns	0.06ns	-0.02ns	0.25ns	0.03ns			
Srb	-0.04ns	0.12ns	0.21ns	0.07ns	0.09ns	-0.12ns		
Srw	-0.07ns	0.09ns	0.26ns	0.08ns	0.05ns	-0.05ns	0.96***	
Mort.	0.01ns	-0.26ns	-0.27ns	-0.28ns	-0.02ns	-0.19ns	-0.43**	-0.43**

p<0.01 *p<0.001, ns- not significant Lsb-litter size at birth, Lsw-litter size at weaning, Lww- litter weight at weaning, Lwb-litter weight at birth, Pwb-pig weight at birth, Pww-pig weight at weaning, Srb-sex ratio at birth, Srw-sex ratio at weaning, Mort.-mortality

The pre-weaning mortality rate of 4.58% observed in this study indicates that the indigenous pigs have high survival rate, which is in agreement with the observation survival rate was high, this is in line with the observation of Fetuga *et al.* (1976) who reported that Nigerian indigenous pig had fewer death of piglet to weaning. The observed sex ratios showed that more females were produced at birth and weaning than males, which is supported by the findings of Ajayi and Akinokun (2013). The non-significant effect of parity on most of the traits is in agreement with the findings of Deo *et al.* (1979), but contrary to the report of Pokhara *et al.* (2013). The significant effect observed in pig weight at weaning could be attributed to progressive increase in the number of piglets farrowed and weaned, and probably not commensurate with the available nutrition as the weights decreased with increase in parity. Season had no significant effect on most of the litter traits, which is in consonant with the findings of Oseni (2005). Igboeli and Orji (1980) opined that Nigerian indigenous pig possess greater heat tolerance and is thus able to display some stability in performance across different seasons when compared to exotic breed which explains the results of this study. The significant effect of season observed in litter size at weaning, pig weight at weaning and mortality rate which can be attributed to environmental factors, is contrary to the findings of Oseni (2005). The significant effect of year on litter weight at birth and weaning as well as pig weight at weaning is similar to the findings of Gunawan and Jakaria (2011) on Bali cattle. The progressive increase observed in all the traits as the year advanced could be attributed to increase in the structure and physiology of different systems of the body of the female pig. The high significant correlation observed between litter size at birth and weaning is expected because the litter size at weaning

is a function of litter size at birth. Similar trends were also observed between litter weight at birth and weaning and sex ratio at birth and weaning. These results corroborate the findings of Adeoye *et al.* (2003) as well as that of Oluwole *et al.* (2014). The effect of parity and the non-genetic factors considered in Nigerian indigenous pig was more on pig weight at weaning compared with other variables tested in this study.

REFERENCES

- Adebambo O A and Dettmers A E (1979). Comparative performance of the indigenous and exoticsows in Nigeria.1. Milk yield, persistency of production and utilization by litter. *Nigerian Journal of Animal Production*, 6 (1 & 2): 26 - 32.
- Adeoye, A.A. and Adebambo, O. A. (2010). Evaluation of litter traits of pigs in an African Swine Fever (ASF) prone environment. *Proceedings of 1st Nigerian international pig summit*. 22-25 November 2010. Pp114-118
- Adeoye, A.A., Adeogun, I.O and Akinokun, J.O (2003). Repeatability of litter traits of indigenous sows of Nigeria. *Livestock Research for Rural Development* vol.15 No. 22. Retrieved February 4, 2016, from <http://www.lrrd.org/lrrd15/2/adeo152.htm>
- Ajayi, B.A. and Akinokun, J.O. (2013). Evaluation of Some Litter Traits and her estimates of Nigerian indigenous pigs. *International Journal of Applied Agricultural and Apicultural Research*, 9 (1&2): 113-119.
- Chiboka, O.O. (1981). The effect of age at first mating on litter characteristics in native

- pigs. *Livestock Production Science*, 8 (2): 155-159.
- Das, D., Deka, D. Nath, D.R. and Goswami, R.N. (2005). Heritability and effect of some non-genetic factors on traits of reproduction in Hampshire pigs. *Indian Veterinary Journal*, 82: 847-850.
- Deo, S., Raina, B. L. and Bhat, P. N. (1979). Studies on some reproductive traits in Landrace, Large White and their crossbreds. *Indian Journal of Animal Sciences*, 49: 807-811.
- Fetuga, B.L., Babatunde, G.M. and Oyenuga, V.A. (1976). Performance of the indigenous pigs of Nigeria under intensive management condition. *Nigerian Journal of Animal Production*, 3: 148-161.
- Gunawan, A. and Jakaria, T. (2011). Genetic and non-genetic effect on birth, weaning and yearling weight of Bali cattle. *Media Peternakan*, 34(2): 34-40.
- Igboeli, G. and Orji, B. I. (1980). Female reproduction of tolerant breed and possibility of artificial Insemination in West Africa. FAO/SIDA Workshop on the breeding of trypano tolerant livestock, Lome, Togo.
- Ilori, J.O. (1974). Assessing the productive potentials of local breeds of pigs: I. Effect of protein levels on performance. *Nigerian Journal of Animal Production*, 1: 27-34.
- Nwakpu, P.E (2013). Prewaning litter growth and weaning characteristics among inbred and cross bred native by exotic piglet genotypes. *Agriculture and Biology Journal of North America*, 4(4): 393-397.
- Nwakpu, P.E. and Onu, P.N. (2011). Heterosis for litter size traits in native by two exotic inbred pig crosses. *Agriculture and Biology Journal of North America*, 2(10): 1340-1346.
- Orheruata, A.M. (2000). Influence of sow age and gestation length on litter size, birth weight and weaning weight of pigs in Southern Nigeria. Proceedings of 25th Annual NSAP conference 19-30 March, Umudike. P. 272-273.
- Oseni, S. (2005). Evaluation of the F1 and backcrosses of Nigerian local pigs and the Large White for litter characteristics in Southwest Nigeria. *Livestock Research for Rural Development*. Volume 17, Article #44. Retrieved April 24, 2013, from <http://www.lrrd.org/lrrd17/4/oseni17044.htm>.
- Oluwole, O.O., Tihamiyu, A.K., Olorunbounmi, T.A., Oladele-Bukola, M.O., and Akintoye, N.A (2014). Prewaning growth traits in Nigerian Indigenous pig crossbreds. *Agricultural Sciences*, 5, 891-896.
- Pokhara, B.B., Bhattarai, N., Sapkota, M and Kafle, P. (2013). Effect of non-genetic factors on litter traits of Hurrah pigs in Nawalparasi, Nepal. *International Journal of Agriculture and Forestry*, 3(4):141-144.
- Singh, G. and Khanna, A.S. (2000). Genetic and Phenotypic trends for economic traits in Large White Yorkshire pigs. *Indian Journal of Animal Sciences*, 70(7):728-731.
- Umesiobi, D.O. (2000). Animal Production 2: Ruminant and Non Ruminant Practicum. Bean Blaise Publication, Owerri, Nigeria.
