EFFECTS OF SEASON AND LITTER SIZE ON GESTATION LENGTH IN SWINE

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SUMMARY

488 gestations (309 Large White and 179 Landrace) and the size of all litters resulting from services which occurred between January 1967 and March 1970 were analysed.

The mean gestation length was 113.96 days for the Large White and 113.74 days for the Landrace while the mean values for the litter size were 9.14 and 9.58 respectively. There was a significant negative correlation between these two traits in both breeds (P 0.01).

A slight and non-significant seasonal effect (P 0.10) was shown with the highest and lowest gestation lengths being recorded in July (114.38 days) and in January and February (113.40 days). Breed effect and interaction between breed and season were also not significant.

INTRODUCTION

Litter size exhibits considerable variability among individuals as well as

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between subsequent farrowings by the same sow. Gestation length, on the other hand, tends to be constant within species or strains. However, litter size and gestation length have been shown to be highly negatively correlated (Manresa, 1933; Biggers, Curnow, Fin and McLaren, 1963 and Cox, 1964). Thus, the smaller the litter size, the higher the incidence of longer gestation.

Environmental factors, especially day length changes, have been shown to exert a strong influence on many reproductive phenomena (Ulberg, 1958; Dutt, Ellington and Carlton, 1959; Hafez, 1968 and Waites, 1968). In a comparative study, Cohen (1970) has shown that the monthly variations in gestation length were similar in women, cattle, buffaloes and horses and were influenced by daylight changes. High temperatures have also been suspected to prolong gestation in rodents (Hafez, 1968). MacFarlane, Pennycuik, Yeates and Thrift (1959) have shown that high temperatures, with or without vitamin supplements, increase gestation length in rats. It has been claimed also that thyroid deficiency initiated before pregnancy prolongs gestation (Bruce and Sloviter, 1957 and Lucas, Brunstad and Fowler 1958) while Biggers et. al. (1963) demonstrated that some humoral factor from the placenta and/or foetuses was involved in the regulation of gestation length by litter size.

This investigation was undertaken to obtain more information about the effects of season and litter size on gestation length in the sow.

Season and Litter Size on Gestation.

MATERIALS AND METHODS

The breeding records of 137 Large White and 78 Landrace sows in the University of Ibadan Breeding Stock, during a period of 39 months (January 1967 to March 1970) were studied and analysed.

The sows, which ranged from 10 to 36 months in age, were hand-fed twice daily, bred on their second estrus and farrowed two to four times during this period. The gestation length includes both the first day of service and the day of farrowing and was related to the month, and therefore season, of service since the exact time of mating was known. The litter size was represented by the total number of piglets farrowed.

All the climatic data were obtained from the Geography Department, University of Ibadan, Ibadan and the Physiologically-effective temperature was calculated by weighing the dry bulb and wet bulb temperatures by 0.6 and 0.4 respectively according to Ingram (1965) and Steinbach (1971). Each year was divided into four three-monthly seasons (Egbunike and Steinbach, 1970). All statistical analyses were made according to Steel and Torrie (1960).

RESULTS

The mean gestation lengths in days for both breeds were 113.96 (Large White) and 113.74 (Landrace) while their mean litter sizes were 9.14 and 9.58. The

differences between the two breeds were not significant. Table 1 shows the seasonal means of gestation length and litter size from the combined data of both breeds

Table 1. Seasonal means and standard errors of gestation length, litter size and physiologically-effective temperature.

Season of Service	n*	Gestation Length(days)	Litter size (numbers)	Physiologically effective temperature(^{o}C)
January - March	162	113.59 ± 0.13	9.50 ± 0.22	26.33 ± 0.11
April - June	100	114.02 ± 0.15	9.24 ± 0.29	25.98 ± 0.55
July - September	106	114.00 ± 0.71	9.39 ± 0.30	23.61 ± 0.07
October - December	120	113.96 ± 0.18	9.00 ± 0.29	25.22 ± 0.65

* Number of parturitions.

with the respective physiologically-effective temperatures. Throughout the period under investigation, a slight non-significant seasonal effect on gestation length was demonstrated (0.05 P 0.10). Season and breed interaction was also not significant. The longest and shortest gestations were recorded in July (late rainy season) and in January and February (late dry season) as 114.38 and 113.40 days respectively. Generally there was a greater incidence of prolonged gestation when sows were bred in the rainy season.

There was a significant negative correlation between litter size and gestation

Season and Litter Size on Gestation.

length (P 0.01) in both breeds (Table 2) and the regression equations obtained are

$$Y = 114.94 - 0.125x$$

$$Y = 114.81 - 0.093x$$

$$Y = 114.87 - 0.106x$$

for Landrace, Large White and both breeds, where Y and X are respectively gestation length and litter size. A multiple regression analysis, in which the physiologically-effective temperature (X_1)(^{o}C) was kept constant, showed gestation length (Y) and litter size (X_2) to be less negatively correlated (-0.096) than was the case in the simple analysis (-0.20) (Table 2). The multiple regression equation is:

$$Y = 113.35 \pm 0.039X_1 - 0.046X_2$$

Table 2. Regression analysis of gestation length and litter size in pigs.

BREEDS	VARIABLES					REGRESSION EQUATIONS
	Y	X	n*	r	P/	
LANDRACE	GL	LS	179	- 0.22	0.01	Y = 114.94 - 0.125x
LARGE WHITE	GL	LS	309	- 0.18	0.01	Y = 114.81 - 0.039x
COMBINED	GL	LS	488	- 0.20	0.01	Y = 114.87 - 0.106x

*n represents number of parturitions.

GL = Gestation length LS = Litter size.

DISCUSSION

The significant negative correlation between litter size and gestation length has shown, contrary to the reports of Biggers et. al., (1963) and Cox (1964), that the sow like other species, strives to rid herself of the burden of pregnancy - the larger the litter size, the more the burden and the greater the urge to terminate pregnancy. However, the real correlation between these two variables is small and not significant ($r = 0.096$) as shown by the multiple correlation analysis. This indicates a confounding effect of the physiologically-effective temperature at the time of service as well as a negative correlation between this and litter size. Although reduction in litter size has been implicated in the increase in gestation length (Bruce and Sloviter, 1957), Krizenecky (1953) failed to show significant changes in gestation length with litter size. Incidentally, the seasonal changes in litter size are slight (Table 1) and insignificant (Steinbach, 1968).

Although the seasonal variations in the gestation length were not significant, the results confirm the findings of Joubert (1958) and Bhattacharya, Gupta and Moulick (1967) on pigs. In addition, results from Bruce and Sloviter (1957) and Lucas et. al. (1958) suggest that the seasonal effect on gestation length is probably via the seasonal fluctuations of the thyroid activity, which declines with increasing temperature (Brooks and Rose, 1962) and that thyroid deficiency prior to pregnanc

usually results in prolonged gestations. Thus, gestations resulting from services in the hottest months, when thyroid activity will supposedly be at a minimum (February to July), should be longer than the mean. This in fact is the case and Steinbach (1973) had observed minimal and maximal thyroid activities in gilts slaughtered in April and September respectively.

The biological reason for the effects of the environmental conditions at service on the gestation length may involve the time of implantation. There is possibly a delayed implantation of embryos resulting from services in the hottest months. In any case, that there is some seasonal influence, though insignificant, on gestation length is of little, if any, economic importance and will not affect reproductive efficiency. It will be more valuable, for instance, to breed the sows in seasons when conception rate is high than when gestation resulting from such services will be shorter by a few days. However, it is interesting, from the comparative biological point of view, to know the relationship between gestation length and both litter size and season.

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Season and Litter Size on Gestation.

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