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ASPECTS OF PUBERTY IN THE INDIGENOUS GILT

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OPSOMMING: FAKTORE WAT PUBERTEIT BY DIE INHEEMSE SOGGIE BEÏNVLOED

Twee proewe is met 120 inheemse soggies uitgevoer om maatstawwe waarvolgens die aanvang van puberteit vasgestel kan word te ondersoek. In die eerste proef is soggies vanaf 'n ouderdom van agt weke op drie voedingspeile wat 100 (Hoë peil), 75 (Medium peil) en 50% (Lae peil) van die voedingsbehoeftes vir groei en reproduksie verteenwoordig grootgemaak. Die soggies in die tweede proef is volgens 'n faktoriaal ontwerp een van ses rantsoene met twee proteïen- en drie energiepeile gevoer. In beide proewe is die soggies individueel gevoer. In die eerste proef is die ouderdom ($P < 0,05$) en liggaamsmassa ($P < 0,01$) waarop die soggie puberteit bereik het betekenisvol beïnvloed deur die peil van voeding. In vergelyking met die medium en lae peilgroepe het aanvang van eerste oestrus oor 'n aansienlik korter periode voorgekom by soggies op die hoë voedingspeil. In die tweede proef was daar hoogs betekenisvolle ($P < 0,01$) verskille in beide die liggaamsmassa en ouderdom waarop puberteit bereik is tussen soggies op die twee proteïenpeile, maar geen waarneembare invloed as gevolg van die energiepeil nie. Die ouderdom waarop puberteit begin toon geen verwantskap met die soggie se werpseloorsprong of vaar nie. Die ouderdom waarop puberteit bereik word en daaropvolgende produktiwiteit soos gemeet deur die aantal varkies gebore met die eerste jonging is nie gekorreleer nie.

SUMMARY

Parameters relating to the onset of puberty were recorded in a total of 120 indigenous gilts in two experiments. In the first experiment gilts were reared from eight weeks of age on three planes of nutrition estimated to provide 100 (High plane), 75 (Medium plane) and 50% (Low plane) of the nutrient requirements for growth and reproduction. The second experiment was of a factorial design and gilts were reared on diets containing two levels of protein and three levels of energy in six treatment groups. Gilts were fed individually in both experiments. Plane of nutrition had a significant effect on the livemass ($P < 0,01$) and age ($P < 0,05$) at which puberty was attained in experiment one. The onset of first oestrus occurred over a considerably smaller period of time in the high plane gilts when compared with the medium and low plane. In the second experiment, there was a highly significant difference ($P < 0,01$) in both livemass and age at puberty between gilts on the two intakes of protein, but no apparent effect of the three levels of energy. The age of onset of puberty was not related to the gilt's litter of origin on her sire. No correlation was evident between age at puberty and subsequent productivity in terms of number of piglets born at first parity.

The relationships between age, livemass and the physiological mechanisms responsible for the onset of puberty have not been established. Thus although experiments with exotic pigs have shown that plane of nutrition can have a significant effect on both age and livemass at puberty (*inter alia* Burger, 1952; Lodge & McPherson, 1961), experimental results have been very variable (Lodge, 1969). Other workers have recorded that genetic factors (Squiers, Dickerson & Mayer, 1952) and the presence of the boar (Brooks & Cole, 1969) may also influence the age at which puberty is attained.

In this paper, factors associated with the attainment of puberty are examined in a total of 120 indigenous gilts reared on different planes of nutrition in two experiments.

Procedure

Experiment 1

Sixty gilts, the progeny of two boars derived from 18 litters reared in a uniform environment, were weaned at eight weeks of age and allocated to three treatment groups of 20. The groups were fed a balanced diet at rates estimated to provide 100 (High plane), 75 (Medium plane) and 50% (Low plane) of the nutrient requirements for immature breeding gilts. The ration (Table 1) and rates of feeding were calculated from data presented by the Agricultural Research Council (1967). As considerable differences in size exist between indigenous and exotic pigs, the given stan-

Table 1

Percentage composition of experimental ration

Ingredient	Experiment 1	% Composition				Experiment 2	
		Low energy		Medium energy		High energy	
	Basic ration	Low protein	High protein	Low protein	High protein	Low protein	High protein
Sugar (Canex)	–	–	–	32,3	27,0	48,8	42,5
Maize meal	71,0	73,5	57,0	49,8	41,5	37,5	32,8
Pollards	8,5	8,7	6,5	5,5	5,0	4,5	3,5
Fishmeal	10,0	10,3	30,5	7,0	22,0	5,2	17,5
Bloodmeal	2,0	2,0	1,5	1,4	1,1	1,0	0,9
Meat and bone meal	5,0	5,0	4,0	3,5	2,9	2,5	2,3
Mineral/vitamin* supplement	3,5	0,5	0,5	0,5	0,5	0,5	0,5
	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Calculated crude protein %		18,7	29,0	12,7	21,0	9,5	16,9
Calculated D.E. content Mcal/kg		3,4	3,2	3,7	3,4	3,8	3,6

*Commercial mineral/vitamin supplement plus filler.

dards were scaled down in proportion to the metabolic body size (Livemass $kg^{0,75}$) of the experimental gilts when compared with exotics.

Gilts were housed in deep litter courts in pens of 10. They were removed twice a day to individual pens for feeding, and allowed approximately 30 minutes to finish their feed. Any feed remaining after this time was weighed and recorded. Gilts were weighed weekly before the morning feed on the day of weighing. Their daily ration for the subsequent seven days was then adjusted, if necessary, according to livemass. Two weeks after allocation to treatments, gilts were introduced to a boar daily and the onset of the first and subsequent heats were recorded. Four boars were used for the detection of heat. All the gilts were served twice, at 12 h intervals, during their third heat period by one of four boars.

Experiment 2

Sixty gilts, the progeny of two boars derived from 16 litters reared in a uniform environment, were weaned at eight weeks of age and allocated to six treatment groups of 10. Treatments consisted of feeding two levels of protein and three levels of energy in a factorial design. The high, medium and low planes of energy intake, and the high and low planes of protein intake were similar to those fed in experiment one. Combinations of high energy; low protein and low energy; high protein levels in the ration were obtained by the respective addition of sugar (canex) or fishmeal to the basal ration (Table 1). Equal daily intakes of protein and energy were achieved by feeding the six rations of different energy and protein content at six rates. Thus, for example, a gilt in the livemass range of 40–45 kg on the low protein intake would receive 110 g. protein per day and on the high protein intake 220 g. protein per day at each of the three levels of energy intake. Intakes of energy on the high, medium and low treatment were similarly blanced. The management of the gilts was identical to that described in experiment one.

In both experiments, the number of piglets subsequently produced by the gilts at first parity was recorded. Correlation coefficients were calculated between this parameter and age at puberty. Data from both experiments were subjected to analysis of variance.

Results

Age at puberty

Gilts on the high plane treatment exhibited first oestrus at a significantly younger age ($P < 0,05$) than

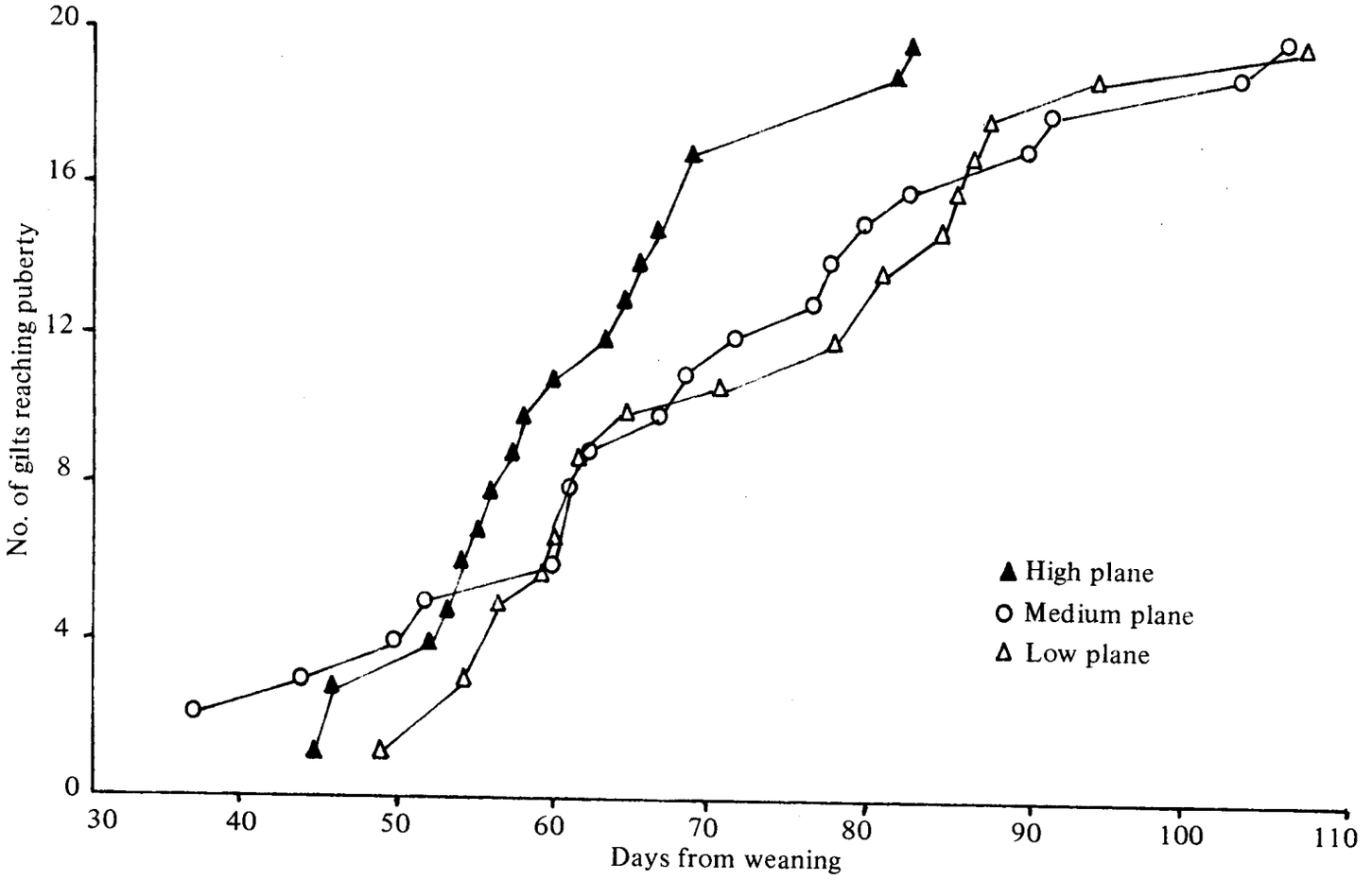

Fig. 1. – *Cumulative occurrence of puberty in gilts fed on one of three planes of nutrition*

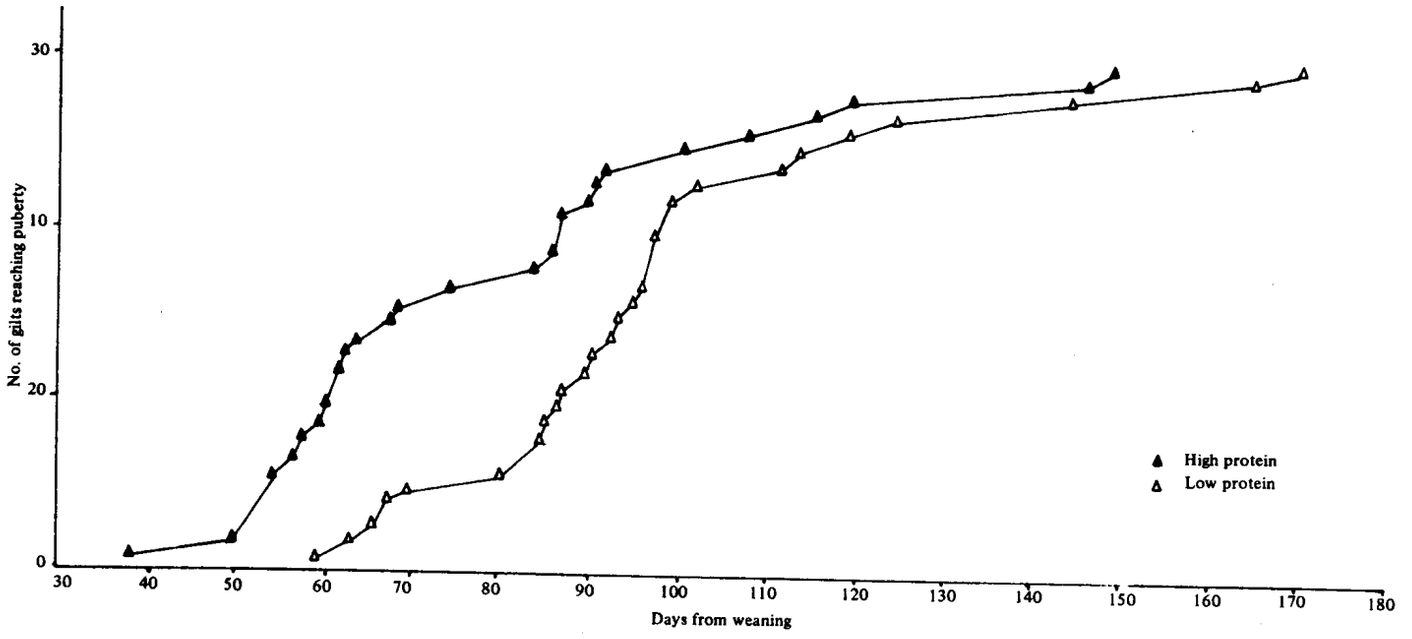

Fig. 2. – *Cumulative occurrence of puberty in gilts fed on two rates of protein intake*

Table 2

Age at puberty of indigenous gilts in two experiments

Experiment 1

	Treatment means			S.E. and significance L.S.D. of greatest difference between treatments		
	High plane	Medium plane	Low plane			
Number of gilts	20	20	20			
Age at first oestrus (days)	116,5	126,1	126,8	3,11*	P < 0,05	8,83

Experiment 2

Age at first oestrus (days)
Treatment means (10 gilts per treatment group)

		Energy intake		
		High	Medium	Low
Protein intake	High	119,4	128,9	153,4
	Low	155,4	155,6	149,2

Analysis of variance

Source of variation	d.f.	m.s.	'F'
Energy	2	1000,5	1,38
Protein	1	5713,8	7,91**
Interaction (Energy x protein)	2	2204,4	3,05
Error	45	722,8	

* Significant P < 0,05
** Significant P< 0,01

those on either the medium or low plane treatments in the first experiment. However, there was no difference in the mean age at onset of puberty between gilts fed on the medium and low plane regimes (Table 2).

In the second experiment there was a highly significant difference (P < 0,01) in age at puberty between gilts on the two intakes of protein, but no apparent effect of the three levels of energy. The interaction between energy and protein approached significance at the five per cent level of probability (Table 2).

Plane of nutrition also affected the pattern of puberty occurrence (Experiment 1, Fig. 1). Whereas in the high plane group, 90% of the gilts attained puberty within 23 days of the first for that treatment, only 25 and 45% achieved puberty in the same space of time in the medium and low plane groups respectively. This effect was not evident in the second experiment, either between treatments or between the high and low protein groups (Fig. 2). There was no indication in either experiment of any relationship between the age at which the gilts attained puberty and the litter from which they originated.

Livemass at puberty

The low plane of feeding severely retarded rate of live mass gain from weaning to first oestrus in the first experiment. Consequently there was a highly significant difference (P < 0,01) in livemass at puberty between the high and low plane gilts, but no significant difference between the high and medium plane treatments (Table 3). In the second experiment, there was a highly significant effect of protein intake (P < 0,01), but no significant effect of energy intake on the livemass of the gilts at

Table 3

Livemass at puberty of indigenous gilts in two experiments

Experiment 1.

	Treatment means			S.E. and significance of greatest difference	L.S.D. between treatments
	High plane	Medium plane	Low plane		
Number of gilts	20	20	20		
Livemass at first oestrus (kg)	15,06	16,06	11,73	0,65**	P <0,05 1,84

Experiment 2

Livemass at first oestrus (kg)

Treatment means (10 gilts per treatment group)

		Energy intake		
		High	Medium	Low
Protein intake	High	18,4	20,2	17,9
	Low	16,0	14,1	15,4

Analysis of variance

Source of variation	d.f.	m.s.	'F'
Energy	2	3,9	0,128
Protein	1	449,9	14,52**
Interaction (Energy x Protein)	2	50,9	1,64
Error	45	30,9	

** Significant <0,01

puberty (Table 3).

Subsequent reproductive performance

There was no evidence of any correlation between age at puberty and number of piglets produced at first parity (Experiment 1, r = – 0,075; Experiment 2, r = – 0,022).

Discussion

The results recorded in experiment one are in agreement with the findings of many workers that the restriction of feed or energy intake to 50% of *ad lib* will delay the onset of first oestrus in the gilt (A.R.C. 1967). Although there was a significant difference in age at first oestrus between the high and medium plane gilts in experiment one, there was no significant difference (5% level) in livemass. This finding supports the hypothesis (Lodge, 1969) that above a "threshold" level of livemass, below which puberty cannot occur, livemass has little or no effect on the attainment of puberty. From the data collected in both experiments, this threshold livemass is apparently below 10 kg for the indigenous gilt.

Experiments which have investigated the effect of feeding on the onset of first oestrus have been restricted almost entirely to the effects of total energy intake or plane of nutrition (A.R.C., 1967; Lodge, 1969.) The results

obtained in experiment two indicate that further work is required to assess the effect of protein intake on the onset of first oestrus in the gilt.

The expression of first oestrus in the gilt may not only be retarded by a low plane of feeding; it may also be delayed by over-feeding during the pre-puberal phase (Joubert, 1963). However, the high plane gilts in experiment one were significantly younger at puberty than the medium plane, and the period of time over which puberty occurred was considerably smaller in the high compared with the medium plane gilts (Fig. 1). Thus it appears unlikely that plane of nutrition was restricting the expression of puberty in the high plane gilts. The occurrence of the onset of first oestrus over a short period of time in the high plane gilts in experiment one suggests that the high plane of nutrition stimulates the physiological mechanisms responsible for the expression of first oestrus. A comparison with the results of experiment two (Fig. 2) indicates that a high energy intake may be responsible for this effect.

The data presented do not confirm the findings of Burger (1952) of a significant difference ($P < 0,01$) in age at puberty between family lines. Whereas 53,5% of sisters attained sexual maturity on the same day or with five days in Burger's experiment, only 3,5% of sisters attained sexual maturity within the same space of time in this study.

The stimulation of early sexual maturity, and subsequent early breeding, would be of little benefit if it resulted in reduced reproductive performance in terms of number of piglets born. Although only assessed in respect of number of piglets produced at the first parity, there was no evidence of such a relationship in this study.

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References

AGRICULTURAL RESEARCH COUNCIL, 1967. The nutrient requirements of farm livestock – Pigs. No. 3. London: H.M.S.O.

BROOKS, P.H. & COLE, D.J.A., 1969. University of Nottingham. School of Agriculture Report 1968–1969.

BURGER, J.F., 1952. Onderstepoort J. vet. Res. Suppl. 51.

JOUBERT, D.M., 1963. Anim. Breed, Abstr. 31, 295

LODGE, G.A., 1969. Nutrition of animals of agricultural importance. Ed. Cuthbertson, D. London: Pergamon Press.

LODGE, G.A. & McPHERSON, R.M., 1961. Anim. Prod. 3, 19.

SQUIRES, C.D., DICKERSON, G.E. & MAYER, D.T. 1952. Res. Bull. Mo. agric. Exp. Sta. No. 494.