UNIVERSITI PUTRA MALAYSIA

THE INFLUENCE OF INDUCED AND SUPERVISED PARTURITIONS ON NEONATAL PIGLET SURVIVAL

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ON

NEONATAL PIGLET SURVIVAL

BY

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SERDANG

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To My Wife, YATI and

My Son, JAFNI

in grateful recognition

for the inspiration and

unending encouragement

in my academic pursuits.

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ABSTRACT

Thirty crossbreds and hybrid sows and guilts were injected intramuscularly with 250 ug of cloprostenol on day 113 of gestation. Ten of these sows were given a further intramuscular injection of 50 i.u.of oxytocin following the birth of the first piglet. Farrowings that occurred during the daytime working hours (from 0730 hrs to 1700 hrs) were supervised. Twenty untreated sows that farrowed naturally during the same period served as controls

Of the treated sows, 93.3% farrowed within 36 hours following induction. The majority (76.7%) of these farrowings occurred between 22 and 36 hours following induction, with 73.3% occuring during the daytime working hours. The mean time interval between induction and farrowing was 25 $\pm$ 2 hours. Induction with cloprostenol did not result in any reduction in the duration of farrowing. Injection of oxytocin after the birth of the first piglet resulted in a significant reduction in the duration of farrowing to a mean o 78 minutes. The number of piglets born dead in induced/supervised farrowings and in spontaneous farrowings (control group) was 0.4 piglet and 0.8 piglet per litter respectively. Early preweaning mortality (from bith to day 4 post partum) in the litters of induced/supervised farrowings and spontaneous farrowings was 0.7 and 1.3 piglet per litter respectively.

This study showed that induced and supervised farrowings resulted in an increase in neonatal piglet survival rates and could be adopted as a management tool to increase piglet survival rates.

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INTRODUCTION

Reports from many different countries showed rather unanimiously that preweaning mortality in pigs is about 20 - 25% and this figure did not seem to have changed significantly since the 1960s (31). Most of the preweaning death losses occur during parturition or in the early neonatal period. A study of reports from different parts of the world showed that four to eight percent of all pigs are stillborn while 12 - 30% of all pigs die within the first four days of life (15). This early neonatal mortality accounts for 74% of the total preweaning mortality (19). A substantial proportion of these losses are attributable to non infection causes which include pre- and intra-partum death, starvation, undersized pigs and trauma (15, 19, 31). Thus, attempts to reduce preweaning mortality should be concentrated on the early neonatal period.

It is widely accepted that supervision of farrowing and provision of strategic assistance to vulnerable piglets increases piglets survival rate (15). Supervision-intervention measures consists of helping piglets out of foetal membranes; wiping dry and removing mucus from nostrils and mouth; cardial massage and introducing piglets to suckle. Oxytoxin or posterior pituitary extract can be administered in cases of dystocia due to uterine inertia or in prolonged farrowing.

Most natural farrowings occur at night. Hence, supervision of parturition can only be economical and practical if farrowings occur during the day time working hours. For this reason, control of parturition is essential. This can be achieved by induction of parturition during late gestation with prostaglandin F2-alpha (PGF) or its analogue, cloprostenol (6, 9, 11, 17, 23, 33). By timing the injection, most of the farrowings could be induced to occur during the daylight hours.

The aim of this study is to determine the influence of induced farrowings and supervision-intervention measures on piglet survival and its economic and practical feasibility under Malaysian commercial farming conditions.

LITERATURE REVIEW

Numerous comprehensive studies and surveys have been published on neonatal mortalities (7, 10, 19, 28, 30). Glastonbury (19), reported that piglet mortality to weaning was about 20%, of which 75% occurred within the first four days of life, with one third of these pigs being stillborn. Although stillbirth rates as high as 10% - 11% have been reported (7, 25), most reports from different parts of the world appear to agree that the stillbirth rate varies from four to eight per cent of all pigs born (15). Randall (28) showed that in his study, 70% of all stillbirths were due to intrapartum death with approximately 80% of these occurring in the last thi of the litter (28, 32). A higher stillbirth rate was also observed in large litters and litters of older sows (7, 29). The main cause of stillbirth (intrapartum death) is anoxia or hypoxia (29, 30). The degree of anoxia or hypoxia is influenced by a number of factors such as duration of parturiti size of the litter, birth position of piglets and premature rupture of umbilical cord. Anoxia or hypoxia is also the cause of the birth of weak piglets (30). Fahmy et al (16) and Glastonbury (19) reported that over 50% of losses of liveborn piglets occurred within the first two to three days. This high proportion of losses in early life was due to birth of many weak and anoxic piglets which were prone to chilling, starvation and overlaying (15).

Induction of parturition reduced the number of stillborn (17, 18) through effective supervision of farrowing. Various investigators (13, 29) have used PGF or its analogue to induce sows at late gestation (day 111 - 1 to farrow at specific times to facilitate supervision. About 60 - 80% of these induced sows farrowed between 22 and 36 hours after injection with PGF (9, 11, 33) or its analogue, cloprostenol (6, 17, 23). About 60% of the sows, treated with 175 ug of cloprostenol at day 113 of gestation, farrowed within 24 hours after injection, while 80% of the sows treated similarly at day 114 of gestation farrowed within the same time period (18). When sows were injected between 0730 hours and 0800 hours on day 110, 112, 113 of gestation, 64% of these sow farrowed during the daylight hours (0600 - 1800 hours) (23). Chooi (7) however, reported a lower percentage (59.6%) occurring during the daylight hours using a naturally occuring PGF given at day 112 or 113 of gestation.

Unlike Diehl et al (9) who reported a shorter farrowing length in induced sows, most investigators (2, 6, 17, 21, 23) reported that there was no significant difference in the duration of parturition between sows induced with PGF or its analogue and non-induced sows (2, 6, 17. 23). These workers reported a mean range between 3 or 6 hours in the duration of farrowing in both induced and non-induced sows.

There were variable reports on the effects of induction of sow with PGF or its analogue on stillbirth and postpartum mortality. A significant increase in percentage of live born piglets (18) and a decrease in stillbirth rate (17) in sows induced with cloprostenol at day 112, 113 or 114 of gestation have been reported although the majority of workers did not find any significant differences in the performance between treated and control groups. Filho et al (17) recorded a stillbirth rate of 4.5% in sows induced with 250 mg cloprostenol as compared to 12.7% in the control group.

With regard to post partum mortality and piglet viability at birth, Jainudden et al (23) noted that more piglets failed to survive during the first three days of life from farrowings induced at day 110 of gestation while there was no significant difference in piglet mortality and viability between piglets born to sows induced at day 112 or 113 of gestation and the control group. Cerne (6) and Ehnvall et al (11) also reported a similar finding. Gavin et al (18) however, noted that there were an increase in the number of losses during lactation (17.5%) in treated group as compared to that (14.0%) in their controls. Similarly Walker (32) also noted that the number of post natal deaths up to 10 days post partum was higher in litters of sows treated at day 113 with an analogue of PGF. The same author also noted that farrowing one to three days earlier relative to controls resulted in lower birthweights and piglet survival rate. Piglets induced to farrow on day 115 (herd average of gestation length) had better survival rates than the control group (13).

Induction with PGF or its analogue had no apparent effects on subsequent fertility and production of the dams (2, 6, 17, 32). The incidence of mastitis-metritis agalatia (MMA) complexes was greatly reduced among sows nduced to farrow with PGF or its analogue (6, 18).

English et al (13) found that despite close supervision at farrowing, there was no improvement in survival rates of piglets of induced sows relative to controls. However, others (15) reported that supervised farrowing, increased monitoring of and manual assistance provided during farrowing leads to reduction in stillbirth rates (15). Some of the practices which are known to be effective in decreasing stillbirth and piglets mortality rates include wiping dry and removing mucus from the mouth and nostril of the piglet; helping semiconscious piglets out of foetal membranes; cardiac massage, placi weaker piglets under the heat source and assisting them to suckle; feeding weak piglets with sow or cow colostrum by stomach tube, crossfostering piglets between simultaneously farrowed litters, and artificial rearing of piglets which are surplus to the rearing capacity of their dam.

Another routine practice at farrowing is the use of oxytocin in case of dystokia due to uterine inerta. However, the routine usage of oxytocin in attempts to reduce the duration of parturition and the incidence of intrapartum death had produced inconsistent results (4, 24, 26). This may be due to the fact that oxytocin appears to be effective in stimulating uterine muscle contractions only for a very short period and its biological half life appears to be no more than five minutes (8).

MATERIALS AND METHODS

The Farm

The study was conducted in a 400-sow commercial breeding and production facility. The sows were crossbred Landrace, Yorkshire, Duroc and hybrid Denmark Landrace.

Study Design

Fifty late pregnant sows projected to farrow during a five-week period were selected for the study. Of these, thirty sows were assigned to group 1 (treatment group) and the rest to group 2 (control group). Each sow in group 1 was given a single intramuscular injection of 250 ug of cloprostenol*, between 0800 hrs and 0900 hrs on day 113 of gestation. The sows were closely observed for signs of impending parturition the following day.

Farrowings that occurred during the daylight working hours in this farm (0730 - 1700 hrs) were supervised and assistance rendered to neonates when considered necessary. The latter include helping piglets out of foetal membrances, wiping dry and removing mucus from nostrils and body, cardiac massage and introducing piglets to the udder, placing weak, anoxic piglets to the heat source and fostering on to other sows if possible. Farrowings that occurred outside the normal farm working hours were not supervised. Ten sows selected from group 1, were injected intramuscularly with 50 international units of oxytocin following the birth of the first piglet. The selection was done such that the different sow parities were more or less evenly represented in all groups (Appendix).

* ICI, Estrumate (R)

All piglets found dead at birth were autopsied. Piglets that had foetal lungs were classified as stillborn while those that had air in the lungs were considered perinatal deaths.

The following data were recorded : induction-to-farrowing interval (interval from injection to expulsion of the first piglet); duration of farrowing (from the birth of the first to last piglet), number of live and stillborn piglets; and number of piglet deaths from 1 - 4 days postpartum. The data were analysed using Student's t-test and Chi-square test.

RESULTS

Induction to farrowing interval

Twenty eight out of 30 sows (93.3%) in group 1 farrowed within 36 hrs following injection with 250 ug of cloprostenol (Fig. 1). Of these five (16.7%) farrowed within 22 hours after injection and 23 (76.7%) farrowed between 22 to 36 hours after injection. The majority of the induced farrowing (66.7%) occurred between 22 and 28 hours after injection (Fig. 1), with only 10% farrowing between 28 and 32 hours after injection. The mean induction-to-farrowing interval was 25 hours $\pm$ 2 hours.

Injecting late pregnant sows (day 113 of gestation) between 0800 hr-0900 hr, caused most of the deliveries (83.3%) to occur during daytime (0600 1800 hr) the following day, with about 73.3% of the induced farrowings taki place within 0730 to 1700 hrs (common working hours in most pig farms). In contrast, only two of the 20 control sows (10%) farrowed during the daylight hours; the rest of the sows farrowed during the night.

The mean gestation length of the treated and control sows were 114 ± 0.5 days and 113 ± 1.7 days respectively.

Duration of Farrowing

There was a significant difference ($P < 0.001$) in the duration of farrowing between sows induced with 250 ug of cloprostenol and sows similarly treated with cloprostenol but received an additional injection of 50 i.u. of oxytocin after the first piglet was born (Table 1). The mean duration of farrowing for the former group was 234 min. while that of the later group was 78 min. The farrowing of the control sows were unsupervised.

Litter Information

Table 2 shows the comparison between the litters of treated and non-treated control sows. The mean litter size for treated (1a + 1b) and non-treated control sows was 10.5 + 2.5 and 10.2 ± 2.0 respectively. The mean born alive per litter in the treated group was 10.1 while that in the contro group was 9.4. The mean born dead per litter in the treated and control groups was 0.4 ± 0.6 and 0.8 ± 1.2 respectively. There were no significant differences in any of the above mentioned parameters between these two groups. However, the number born dead per litter was significantly lower in the litters of group Ib (cloprostenol plus oxytocin) when compared to that in the control group (P 0.05), (Table 3).

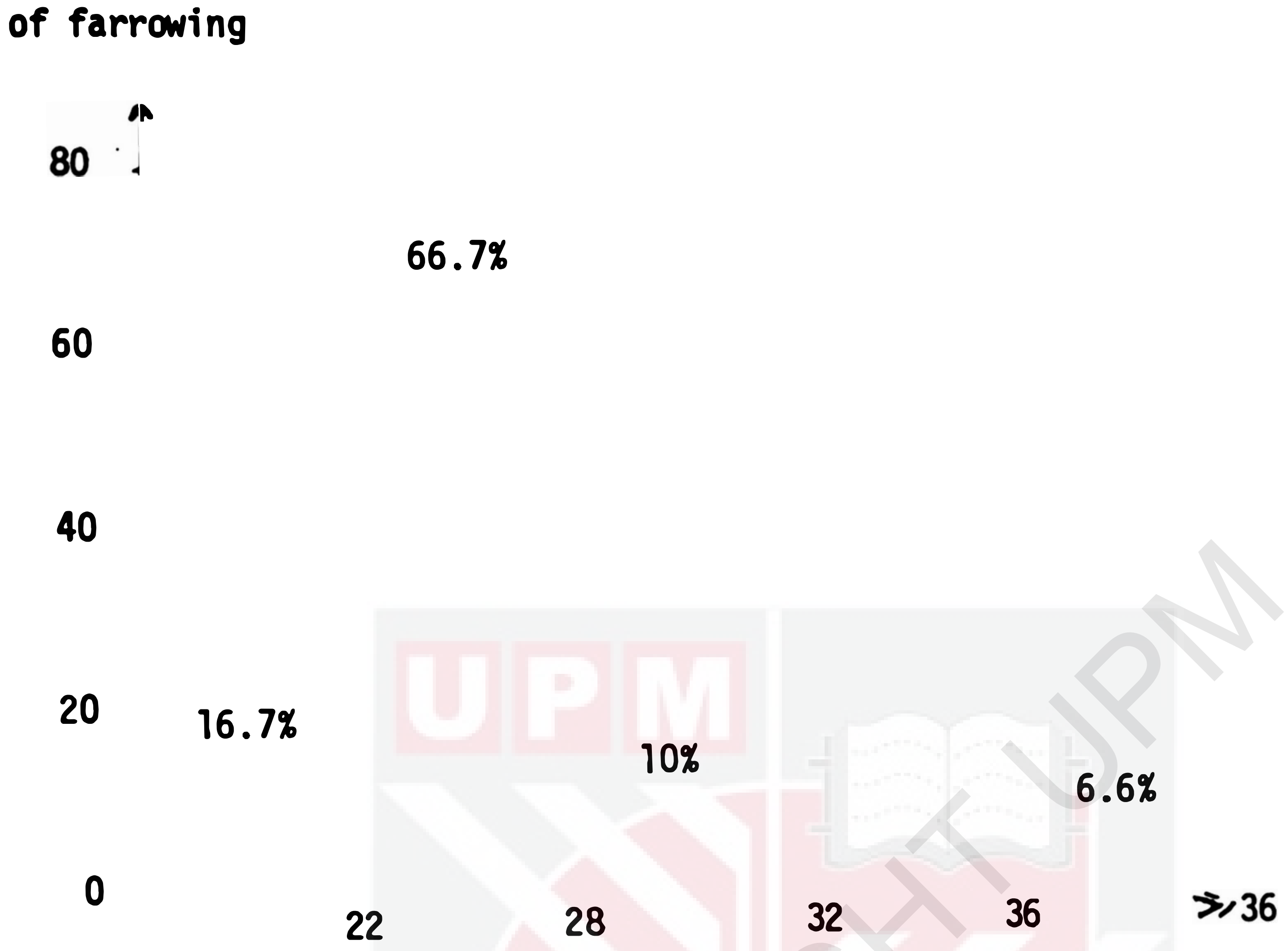

FIGURE 1

DISTRIBUTION OF FARROWING AFTER INJECTION WITH CLOPROSTENOL

(Cloprostenol injection = 0 hr.)

TABLE 1

DURATION OF FARROWING INDUCED WITH CLOPROSTENOL WITH AND WITHOUT OXYTOCIN

Treatment Group	No. of Sow	Duration of Farrowing					
		Range				Mean	
		From		To			
		Hr.	Min.	Hr.	Min.	Hr.	Min.
1a	15	2	05	8	40	3	05**
1b	10	0	41	1	55	1	18**

1a - Induced with 250 ug cloprostenol

1b - Induced with 250 ug cloprostenol and injection with oxytocin after first piglet farrowed.

** Very significant difference between the two valves ($P < 0.001$, Student's t-test).

TABLE 2

THE EFFECTS OF INDUCED FARROWINGS AND SUPERVISION-INTERVENTION MEASURES ON PIGLET SURVIVAL

	1 (Treated)	2(Control)
No. of litters	25	20
Litter size ($\pm$SD)	10.5 $\pm$ 2.5	10.2 $\pm$ 2.0
Mean No. born alive ($\pm$SD)	10.1 $\pm$ 2.4	9.4 $\pm$ 2.1
Mean No. born dead ($\pm$SD)	0.4 $\pm$ 0.6	0.8 $\pm$ 1.2
Born dead %	3.44	7.39
Early neonatal mortality		
No. dead at day 0	0	5
No. dead at day 1	6	2
No. dead at day 2	6	12
No. dead at day 3	2	4
No. dead at day 4	3	2
Total dead (mean/litter)	17 (0.7)	25 (1.3)
Early neonatal death %	6.72[a]	13.30

a - Differs significantly from the control group,(P 0.05 χ^2-test).

TABLE 3

COMPARISONS OF LITTER INFORMATION OF SOWS TREATED WITH OXYTOCIN VS CONTROL

	1b (Treated with cloprostenol plus oxytocin)	2 (Control)
No. of litters	10	20
Litter size (±SD)	10 ± 2.0	10.2 ± 2.0
Mean No. born alive ± (SD)	10 ± 2.8	9.4 ± 2.1
Mean No. born dead ± (SD)	0.1 ± 0.3[a]	0.8 ± 1.2
Born dead %	0.94	7.39
Mean early neonatal mortality (1 - 4 days old)	0.6 ± 0.5	1.3 ± 1.1

a - Differs significantly from the control group,(P 0.05 χ^2-test)

Piglet Mortality

The total piglet mortality from birth (including stillborns) until day 4 postpartum was 66 (14.2%) of 465 piglets born. The stillborn piglets represented 36.6% of the total mortality while the rest of the piglet deaths occurred between day 0 and day 4 post partum. Of 29 piglets "found dead" at birth, 24 were identified as stillborn while the remaining five piglets (born to control sows) were classified as perinatal deaths i.e they were born alive but died shortly after birth. The later were detected as post mortem to have had air in their lungs. Of the stillborn piglets from both groups, four were prepartal and 20 were intrapartal deaths. The early neonatal mortality (from day 0 to day 4 postpartum) was significantly lower (P 0.05) in the litters of treated group as compared to that of the control group (Table 2).

DISCUSSION

This study showed that 93% of the sows farrowed within 36 hours following a single intramuscular injection of cloprostenol at day 113 of gestation. This is comparable to the findings by Filho et al (17). The percentage of farrowings that occurred between 22 and 36 hours following chemical induction was similar to those reported by others using PGF (7, 9, 11, 33) or cloprostenol (6, 17, 23). While others reported that 59% (7) to 64% (23) of induced farrowings occurred during the daylight hours, the present study showed that daylight farrowings accounted for 83.3% of the induced farrowings. Of these, the majority (66.7%) occurred in the morning. The findings in the present study confirmed earlier reports (13) that farrowings could be chemically induced to occur at specific times to facilitate supervision. The findings of the present study showed that the majority of induced farrowings could be expected to take place during the daylight working hours if late pregnant sows were treated with cloprostenol at 0800 to 0900 hrs the previous day. Adopted as a routine management practice, most of the farrowings could be more efficiently supervised.

In this study, the mean gestation length of the sows in the control and treated groups was 113 $\pm$ 1.7 and 114 $\pm$ 0.5 days respectively. The relatively short gestation length in the control group was due to the fact that six sows which farrowed earlier than expected (before day 113) during the period of study were included in the control group. If these sows were not included for comparisons, then the mean gestation length of the sows in the control group would be 114 $\pm$ 1.0 days.

The mean duration of induced farrowings recorded in this study (234 min.) were comparable to the findings of other workers (2,6,17,21,23) which showed that chemical induction did not significantly alter the duration of farrowing. However, the parental administration of oxytocin following the birth of the first piglet significantly reduced the duration of farrowing ($P < 0.001$). This was consistent with the findings of Muhrer et al (26) but contrary to those of Breaner et al (4).

Although induced farrowings have been reported to result in a significant decrease in the stillbirth rate (17, 18), the findings in the present study would tend to agree with those of the majority of workers who found that induction had no apparent effect on the number of stillbirths (7,12,23, However, the farrowings in the above mentioned studies were apparently not closely supervised. Nevertheless, the findings in the present study would appear to indicate that even with close supervision and the use of resuscitative measures, intrapartum deaths could not be significantly reduced as previously suggested by Chooi (7). The present study showed that reducing the duration of farrowing through the use of oxytocin would be more useful n significantly reducing the stillbirth rate. Whether the use of oxytocin lone without any intervention measures would have the same effect is unclear. Nevertheless, the reduction in the stillbirth rate through reduction in the duration of farrowing would be consistent with earlier observations (28) that as the duration of farrowing increased from one to eight hours, the percentage of stillbirths also increased from 2.5% to 10.5%.

The number born dead in the litter is obviously not the true reflection of pre or intra-partum deaths. Many of these "born dead" could in fact be perinatal mortalities. Post mortem examinations conducted on those found "born dead" in the morning from litters of the control sows that farrowed in the night, revealed that about 25% of these had air in their lungs although the cartilages on the feet were still intact and there was no milk in the stomach. This would indicate that these piglets were born alive and had breathed although they never walked or suckled and died shortly thereafter. In contrast, none of the piglets dead at birth from the litters of supervised farrowings had air in their lungs, indicating that the deaths were either prepartal (three piglets) or intrapartal (six piglets). Except for those piglets that had obviously died prepatal as indicated by evidence of skin discolouration, these piglets are those that were born apparently dead or with very weak heart beats but did not respond to resuscitative measures. A number of piglets that were born alive but weak responded to simple resuscitative measures such as external cardiac massage. The tempting corollary to this observation is that some of those that were "found dead" in the litters of unsupervised farrowings of the control group could have been saved if the same measures for the treated group were applied. This probably contributed to the significantly lower (P 0.05) early neonatal mortality in the litters of the treated sows that had the benefits of supervised farrowings as compared to those in the control group. In the present study, perinatal deaths in the litters of the control sows accounted for as much as 25% of those that would have ordinarily been classified as "born dead" by the farmers. It is probable that not all piglets that are born anoxic die in the immediate post partum period. Piglets that are weak, undersized and anoxic are unable to compete with their large littermates for teats. These nutritionally and immunologically handicapped piglets are poorly viable and prone to starvation, chilling, overlying and infections. Those that do not die in the immediate post partum period are nevertheless poorly equipped to survive the early neonatal period. The high proportion of piglet deaths in day 2 post partum in the litters of the sows in the control group is probably related to the events in the immediate post partum period. If close attention had been given to these piglets during farrowing and the immediate post partum period, their chances of survival may be improved as suggested by the findings of the present study which showed significant reductions in neonatal piglet mortality in the litters of the supervised group of sows.

A more useful parameter to evaluate the efficacy of supervised farrowing programmes as described in this study would be the weaning index. However, due to the short period of study, this parameter could not be obtained. Nevertheless, it would be reasonable to assume that the number of pigs weaned per litter would be higher in the supervised group as compared to the control group.

CONCLUSION

A single intramuscular injection of 250 ug of cloprostenol on day 113 is an effective method of induction of parturition in sows. The parturitions can be planned to occur at specific times, thereby facilitating supervision. A majority of the farrowings can be expected to occur during the daylight working hours if the injection is given early in the morning of the previous day.

The duration of farrowing is not altered by the induction with cloprostenol. The use of oxytocin is an effective method of reducing the duration of farrowing.

Supervision of farrowing had no significant effect on the stillbirth rate, most of which is intrapartum death. As much as a quarter of the piglets classified as "born dead" were in fact perinatal mortality.

Supervision of farrowings led to a significant reduction in the early neonatal mortality.

Induction and supervision of farrowings are useful management tools that can be adopted by commercial piggeries in order to improve neonatal survival rates.

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APPENDIX I

MAJOR CAUSES OF PREWEANING MORTALITY

Reference: Chooi K.F. (1981)

CAUSES	% OF TOTAL LOOSES
Stillbirth and perinatal mortality	34.9
Crushing	21.0
Undersize	15.2
Starvation	11.8
Weak	6.3
Diarrhoea	5.0
Accident	1.6
Leg problems	0.8
Pneumonia	0.6
Toxicity	0.1
Miscellaneous	2.7

APPENDIX II

BREAKDOWN OF PREWEANING MORTALITY WITH AGE

Reference: Chooi K.F. (1981)

AGE GROUP	% OF DEATH
Less than 4 days	85.1
4 - 7 days	5.3
1 - 3 weeks	8.5
3 weeks to weaning	1.1

APPENDIX III

THE PARITIES OF SOWS IN EACH EXPERIMENTAL GROUPS

	Treated Group		Control Group
	1a	1b	2
First Litter	5	2	4
Second Litter	5	4	4
Third Litter	2	1	2
Fourth Litter	2	1	1
Fifth Litter	-	-	-
Sixth Litter	2	1	3
Seventh Litter	4	1	6
Total Sow	20*	10	20

* 4 sows and 1 gilt which farrowed at night from treated group (1a) were subsequently dropped from the study.

LITERATURE SURVEY ON USE OF PGF2 AND ITS ANALOGUE

Day of Injection	Drug	Route	Dose	Mean time to parturition (hr)	Source
109 - 112	ICI 79939	IM*	750 ug	26	Ash & Heap, 1973
112	PGF2	IM	5 mg	30	Diehl, et al., 1974
110 - 114	PGF2	IM	12.5 mg	32	Einarson et al., 1975
113	ICI 80996	IM	175 ug	24-32	Walker, 1977.,
111 - 112	Cloprostenol	IM	175 ug	24	Cerne, 1978
110, 112, 113	Cloprostenol	IM	175 ug	28	Jainuddin & Brandenburg, 1980
112 - 113	Lutalyse	IM	10 mg	25	Chooi, 1981
112	Cloprostenol	IM	250 ug	29.9	Filho, et al., 1984

* IM - Intramascular