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Effects of Increasing Heat Loss on Some Physiological Parameters Of Farrowing Sows Under Tropical Climate

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ABSTRACT

Sixteen Large White sows were allocated randomly into 4 treatments in a Completely Randomised Designed (CRD) experiment with 4 replicates. The treatment were Treatment 1: Control - normal farrowing pens, Treatment 2: normal farrowing pens with electric fan, Treatment 3: normal farrowing pens with dripper and Treatment 4: normal farrowing pens with electric fan and dripper.

The result revealed that respiration rate of the sows in Treatment 1 (128.76 breaths/min.) was significantly higher ($P<0.05$) than that of the sows in other treatments. The respiration rate of the sows in Treatment 4 (70.97 breaths/min) was significantly lower ($P<0.05$) than that of the other treatments except those in Treatment 3 (86.64 breaths/min.). The heart rate of the sows in Treatment 3 (82.90 beats/min.) was significantly lower than those found in Treatment 1 (89.04 beats/min.) and Treatment 2 (88.59 beats/min.). Both skin and rectal temperatures of the sows in Treatment 1 (39.23 and 40.25 °C, respectively) were significantly higher ($P<0.05$) than that of the sows in all other treatments.

Furthermore, the results revealed that both respiration rate and skin temperature of all the sows during the period of 1 week prior to parturition were significantly higher ($P<0.05$) than that of the other periods post parturition. There was no significant difference in heart rate among the observed periods. The rectal temperature of the sows during the 1 week period prior to parturition (39.02 °C) was significantly lower ($P<0.05$) than that of the other periods post parturition. The rectal temperature of the sows during the 1st week post parturition (39.69 °C) was significantly lower ($P<0.05$) than that of the 3rd week post parturition (39.94 °C). There was no significant difference ($P>0.05$) among rectal temperature of all the sows in 2nd, 3rd and 4th weeks post parturition.

It was concluded that heat stress in a farrowing sow may be alleviated by using dripper with or without fan. The elevated metabolic rate may be associated with milk production activities of the sow.

Key words: pig, heat stress, parturition

INTRODUCTION

It is typical for a farrowing pen to house two types of animals within a breed at the same time, that is the sow and its offspring. Each of these animals requires different optimum temperatures for their survival and performances. On the other hand, to provide two types of microenvironments within a pen at the same time seems to be impossible. However, since the pig is a non-sweating animal, therefore, evaporative heat loss applied specifically to the sow may be utilised and at the same time the

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required optimum temperature for the piglets can still be maintained.

In order to test the hypothesis, an experiment is designed to investigate into the effect of using dripper with and without fan to enhance evaporative heat loss from the sows on the sows' physiological responses.

MATERIALS AND METHODS

Sixteen Large White sows were allocated randomly into 4 treatments in a Completely Randomised Designed (CRD) experiment with 4 replicates.

Treatment 1: control - normal farrowing pens.

Treatment 2: normal farrowing pens + electric fan.

Treatment 3: normal farrowing pens dripper.

Treatment 4: normal farrowing pens electric fan dripper.

Each electric fan has vane diameter of 36 centimetres and capable of driving the air at the speed of 3.2 metres/sec. Each fan was mounted at 30 centimetres above the floor and directly in front of individual sow that received fan treatment.

Both electric fans and dripper system were activated when the ambient temperature were 30 °C during 08:00 a.m. to 17:00 p.m.

The dripper system consisted of PVC pipe, 1.2 centimetres in diameter, fitting at 70 centimetres above the floor level and running above the sows' body. Each of these pipe was fitted with 3 drippers (Figure 1) which were adjusted to make each sow received water via the 3 drippers at the rate of 750 ml./h. The water was dripped onto the sows' neck, mid-back and rump.

All the sows of similar performance were in their 3rd parity and have passed 100 days advances in their gestation. They were expected to farrow during the summer months (March - April).

All the sows were fed with the same diet (Table 1) throughout the experimental period. Respiration rate and heart rate were recorded during 13:00 - 14:00 p.m. while skin temperature and rectal temperature were recorded at 14:00 - 16:00 p.m. daily.

Analysis of variance (Steel and Torrie, 1980) was then carried out on each parameter measured and the New Duncan's Multiple Ranges Test and simple linear regression were applied when appropriate. All statistical analyses were carried out using SAS (SAS, 1985).

Table 1 Diet composition of the feed used in the study (air dry basis).

Ingredient	Composition (%)
Broken rice	49.70
Rice pollard	35.50
Soybean meal	7.00
Fish meal	5.00
Dicalcium phosphate	2.00
NaCl	0.35
Vitamins and minerals	1.00
Total	100.00

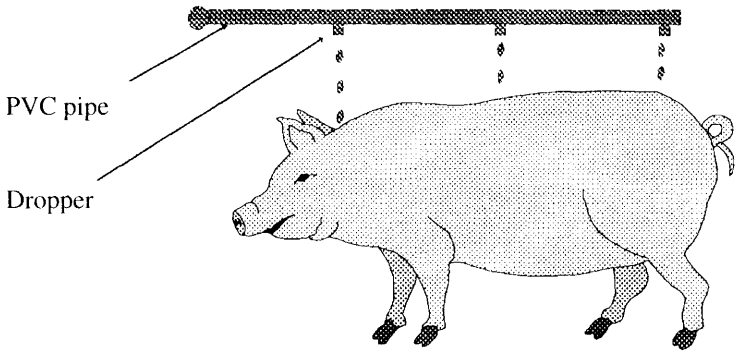

Figure 1 The installed dripper system in the experiment.

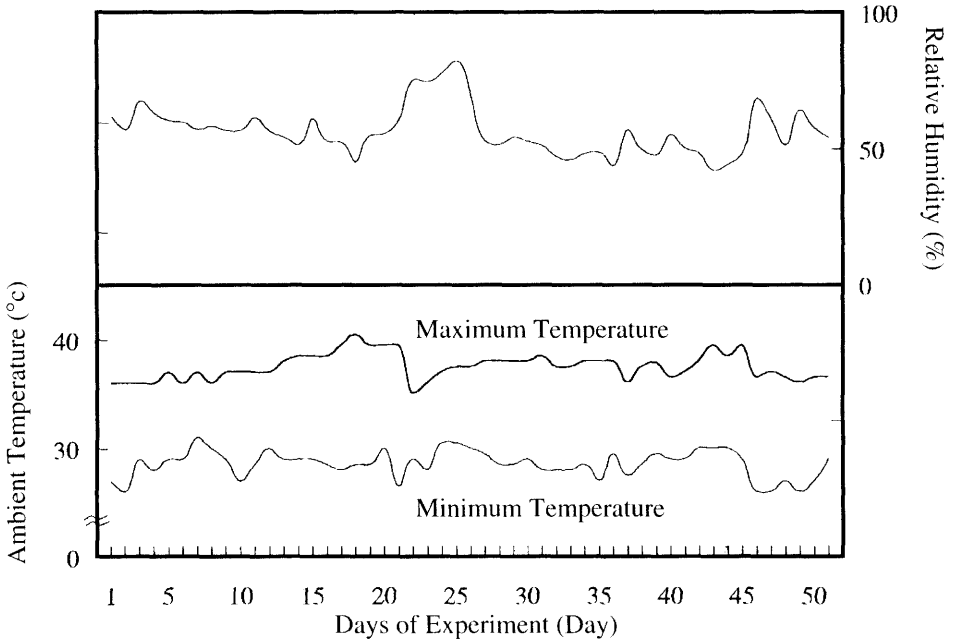

Figure 2 Meteorological data of the farrowing shed during the experimentalperiod.

Table 2 Mean values of physiological parameters measured from the sows received various treatments.

Parameter	Normal	Dripper	Fan	Dripper Fan
Respiration rate (breaths/min.)	128.76^{a}	86.64^{bc}	106.61^{b}	70.97^{c}
Heart rate (beats/min.)	89.07^{a}	82.90^{b}	88.59^{a}	84.37^{ab}
Skin temp. (°C)	39.23^{a}	38.56^{b}	38.51^{b}	38.38^{b}
Rectal temp. (C)	40.25^{a}	39.60^{b}	39.53^{b}	9.34^{b}

Means with different superscript within the same row are significantly different (P 0.05).

The experiment was carried out at Tubkwang Research Station, Kasetsart University, Saraburi (latitude 14O 5' North, longitude 99O 9' East).

RESULTS

The meteorological data of the farrowing shed were shown in Figure 2 while Table 2 indicated feed composition of the diet used in the study.

The mean values of physiological parameters measured from the sows received various treatments were shown in Table 2 and from which it could be seen that respiration rate of the sows that did not receive cooling treatment (Control; 128.76 breaths/min.) was significantly higher ($P<0.05$) than that of the sows in other treatments. The respiration rate of the sows that received fan + dripper treatment (70.97 breaths/min) was significantly lower ($P<0.05$) than that of the other treatments except those in treatment that received dripper only (86.64 breaths/min.). There was no significant difference ($P>0.05$) in respiration rate of the sows that received dripper or fan only treatments (86.64 and 106.61 breaths/min., respectively).

Furthermore, the results (Table 2) revealed that the heart rate of the sows received dripper only (82.90 beats/min.) was significantly lower than that of the sows in the control treatment (89.04 beats/min.) and the sows that received fan only (88.59 beats/min.). Nevertheless, the mean values of heart rate of the sows that received dripper only was not significantly different ($P>0.05$) from that of the sows that received both dripper and fan (84.37 beats/min.).

Both skin and rectal temperatures of the sows in the control (39.23 and 40.25 °C, respectively) were significantly higher ($P<0.05$) than that of the sows in all the other treatments.

When the results were analysed for the variation in physiological parameters of all sows during the period of 1 week prior to parturition and 1, 2, 3 and 4 weeks post parturition (Table 3 and Figure 3), the results revealed that both respiration rate and skin temperature of all the sows during the period of 1 week prior to parturition were significantly lower ($P<0.05$) than that of the other periods post parturition. There was no significant difference in heat rate between between the observed periods.

However the rectal temperature of the sows during the 1 week period prior to parturition (39.02 °C) was significantly lower ($P<0.05$) than that of the other periods post parturition. The rectal temperature of the sows during the 1st week post parturition (39.69 °C) was significantly lower ($P<0.05$) than that of the 3rd week post parturition (39.94 °C). There was no significant difference

Table 3 Mean values of physiological parameters measured from the sows prior and post parturitions.

Parameter	Before	1	2	3	4
			(weeks after parturition)		
Respiration rate (breaths/min.)	81.86^{b}	96.18^{a}	104.91^{a}	104.73^{a}	96.05^{a}
Heart rate (beats/min.)	87.99	85.96	84.10	86.32	83.95
Skin temp. (°C)	38.04^{b}	38.67^{a}	38.90^{a}	38.95^{a}	38.92^{a}
Rectal temp. (°C)	39.02^{c}	39.69^{b}	39.86^{ab}	39.94^{a}	39.82^{ab}

Means with different superscript within the same row are significantly different (P 0.05).

(P>0.05) for the rectal temperature of all the sows in 2nd, 3rd and 4th weeks post parturition.

DISCUSSION

The results from the study (Table 2) revealed that the level of stress as indicated by respiration and heart rates, and skin and rectal temperatures, were reduced significantly (P<0.05) by using dripper with and without fan or fan only. Furthermore, the sows that received dripper with fan had less significant (P<0.05) climatic stress than those received either dripper or fan only. This may be due to the rate of cutaneous evaporation which was further increased by the movement of air surrounding the sows by the fan, hence the rate of evaporative heat loss.

Furthermore, the results (Table 3) revealed that during the period of one week prior to parturition, most of the physiological parameters measured were significantly lower (P<0.05) than those of the period up to 4 weeks post parturition. Although the general findings of other workers (Jones, 1966; Frazer, 1970; Kelly, Curtis and Norton, 1978) found that farrowing sows would have their rectal temperature elevated during the period 24 hours prior to and at post parturition. However, the period between 168 to 24 hours to parturition the pregnant sow's rectal temperature usually was not elevated (Hendrix, Kelly, Gaskin and Bendel, 1978).

The elevation of physiological parameters measured at post parturition may be due to the increasing in metabolic activities associated with the milk production.

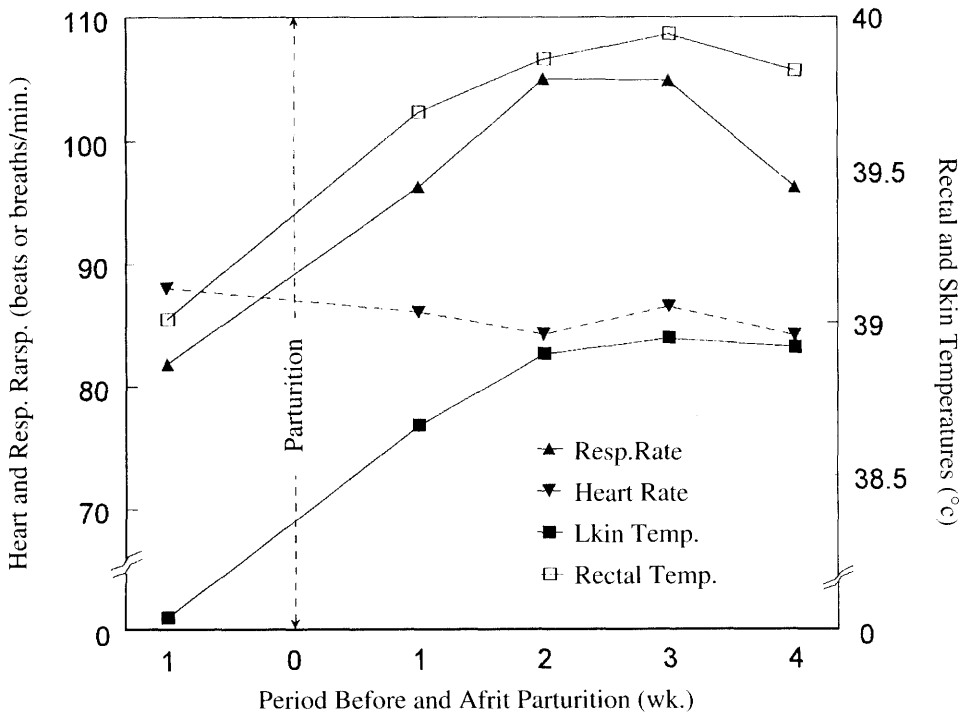

Figure 3 Values of physiological parameters measured from the sows prior and post parturitions.

CONCLUSION

It is thus concluded that heat stress in a farrowing sow may be alleviated by using dripper with or without fan. The elevated metabolic rate may be associated with milk production activities of the sow.

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