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EFFECTS OF ARTIFICIAL HEAT SOURCE ON THE BEHAVIOUR AND THERMORESPIRATORY CHARACTERISTICS OF PIGLETS IN THE HUMID TROPICS.

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Target Audience: Animal scientist, pig producers and breeders, veterinarians

ABSTRACT

The effects of the supply of artificial heat on the behaviour and thermorespiratory characteristics of piglets were studied during the nursing period using eighty - two piglets and ten sows assigned equally to two treatments in special farrowing stalls. The treated group had wooden boxes each with 100 W bulb suspended inside about 40 cm from the floor in the resting areas while the other group had neither boxes nor bulbs. The behaviour of the piglets (classified into seven) was observed as well as the respiratory rates and rectal temperature of four piglets per litter with the dry-and wet-bulb temperatures of the farrowing pens at birth, 12 h postpartum (pp) and 5, 10, 15 and 21 days pp.

Provision of artificial heat only tended to increase the thermal condition of the farrowing pens and resulted in a significantly ($P<0.05$) higher mortality between birth and 21 days pp. While about 40% of treated piglets slept under/around the heat source, over 50% of the non-treated group slept in other parts of the pen thus ruling out any relative comfort around the heat source. Also piglets wandered more in the morning than at other times of the day probably for more heat production. It appears that the provision of artificial heat during the nursing period for piglets in the rainy season in the humid tropics is not economical or necessary. However, we have to wait for a more elaborae study covering the whole year.

Key words: Artificial heat, piglets bahaviour; thermorespiratory function; humid tropics.

DESCRIPTION OF PROBLEM

In swine production, the number of offspring per litter is of economic importance and is a result of the interaction of several variables including the environment. It is known that some breeds outproduce others in various locations according to their degree of adaptation and/ or acclimatization of the prevalent enviromental conditions.

While the adult pig is highly susceptible to heat, piglets are prone to chilling and hypoglycaemia or death due to relative lack of hair together with subcutaneous fat and their high surface area in relation to body weight (1). Thus it is customary to provide piglets with supplemental heat in the first

few days of postnatal life especially as the lower critical temperature of the newly-born piglets is about 34° C (2, 3). Judging from the results of recent experiments in temperate climates using infra-red lamps and 100-175 W lamps (4, 5, 6), heating rubber pads or 500 W heating elements placed 500 mm above the floor (7) and electrically heated rubber floor mats (8), where temperatures ranged from 28.5-31.3° C in the pens during preweaning management (4) better litter weight gains were observed in the warmer pens but not on litter size at weaning, litter feed consumption and mortality (4, 9). This observation was therefore a confirmation of the conclusion of Baey-Ernsten, von der Haar and Clausen (9) that the proportion of ideal lying conditions and piglets growth was highest in warm systems with a plastic covered floor.

Considering that our ambient tropical temperatures can be as high as 35° C during the hottest period of the year, varying little from month to month (10), and that our piggeries are normally dwarfwalled, one may wonder about the necessity of the application of artificial heating in the management of newborn piglets therein especially as McGinnis *et al.* (11) had concluded that no supplemental heating is necessary at ambient temperatures between 21 and 22° C. It is therefore with this in mind that this study was carried out in our piggery.

MATERIALS AND METHODS

Location and climate: Ibadan is located at latitude 07° 20' N and longitude 03° 50' E and has a humid semi-hot equatorial climate (12). This study was carried out in the rainy season between June and September.

Animals: The study involved eighty-two Large White piglets from ten sows (farrowings). The sows were kept in farrowing pens, one week to term, where they were fed with standard breeders' ration and watered *ad libitum* as already described (12). The farrowing pens had concrete floor and consisted of two resting areas and a nursing area separated by metal guard rails to protect the piglets from being crushed by the sows/dams (Fig.1) The outer walls consisted of metal rods and wire netting. A wooden box was placed in the resting area as a source of heat.

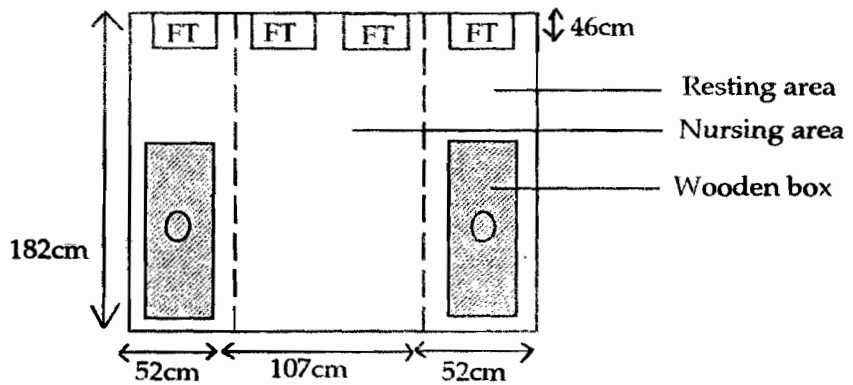

Fig.1. Design of the farrowing pen. FT = Feed trough; WT = Water trough

Experimental design and Data collection: The sows randomly and equally assigned to two groups, heated and not heated, such that there were forty-one piglets and five sows in each of the two treatments. Thus there were between eight and nine piglets per sow in the groups. In the heated group, a 100 W bulb was suspended into each of the wooden boxes in the resting areas about 40 cm from the floor while the non heated group had neither bulb nor boxes.

During the study, the dry-and wet-bulb temperatures of the farrowing pens as well as the respiratory rate and rectal temperatures (13) of four piglets randomly taken per litter were recorded at birth, 12 h post partum (pp), and 5, 10, 15 and 21 days pp as these have already been shown (13, 14) to contribute 65 and 35% respectively to the thermal comfort of pigs. Also the mortality of the piglets was recorded between birth and when the piglets were 21 days old.

Before all these were done, the piglets, which were boldly numbered such that they could be seen from a distance, were observed and classified as per their behavioural activities coded as follows:

1. Wandering about the pen.
2. Suckling
3. Sleeping under heat source
4. Sleeping near heat source
5. Sleeping near or by the sow
6. Sleeping in any other part of the pen
7. Any other activity (which includes fighting, snorting, scratching the floor. etc)

The sequence of data collection was observation of piglets behaviour and taking of respiratory rate, rectal temperature and the dry- and wet-bulb temperatures.

Statistical Analysis: After obtaining the frequency distribution of the behavioural activities of the piglets, the data were subjected to analysis of variance and Duncan's multiple range test (15) to assess the significant differences. Also data were subjected to correlation anaylses while mortality was compared using the Chi- square test (15).

RESULTS

The provision of artificial heat in the farrowing pens in our partially open sided piggery only tended to increase the ambient temperature and the physiologically - effective temperature of the piglets (Table 1). The artificial heat also resulted in a higher ($P<0.05$) mortality among the piglets between birth and 21 days postpartum although the respiratory rate and rectal temperature were unchanged by treatment. It is also worthy to note that the heat treatment significantly ($P<0.05$) influenced the behavioural activities of

Table 1. The effects of artificial heat source on ambient temperature and some production indices in piglets in the farrowing pen.

Parameters	Treatment	
	Heat	No Heat
Dry-bulb temperature (^{0}C)	27.79 ± 0.48	26.62 ± 0.42
Wet-bulb temperature (^{0}C)	24.85 ± 0.31	24.59 ± 0.22
Physiologically-effective temperature (^{0}C)*	26.76 ± 0.3	25.91 ± 0.19
Respiratory rate (Counts/min)	5.93 ± 0.26	56.02 ± 0.30
Rectal temperature (^{0}C)	38.31 ± 0.28	38.49 ± 0.22
Mortality (%, day 0.21)	10.46[a]	6.55[b]

*Calculated from the weighting factors of Steinbach (13).
ab: Values differently superscripted differ significantly (P<0.05).

the piglets. 27.19 and 12.76 % of these piglets were observed to the sleeping under or near the heat source respectively while 55.98 % of the piglets without heat were observed to be sleeping in other parts of the pen as against 11.33 % of those provided with heat (Fig. 2). All other activities, like wandering, suckling, sleeping near or by the dam, fighting, snorting, urinating, defecating and so on, were similarly distributed between the treatments.

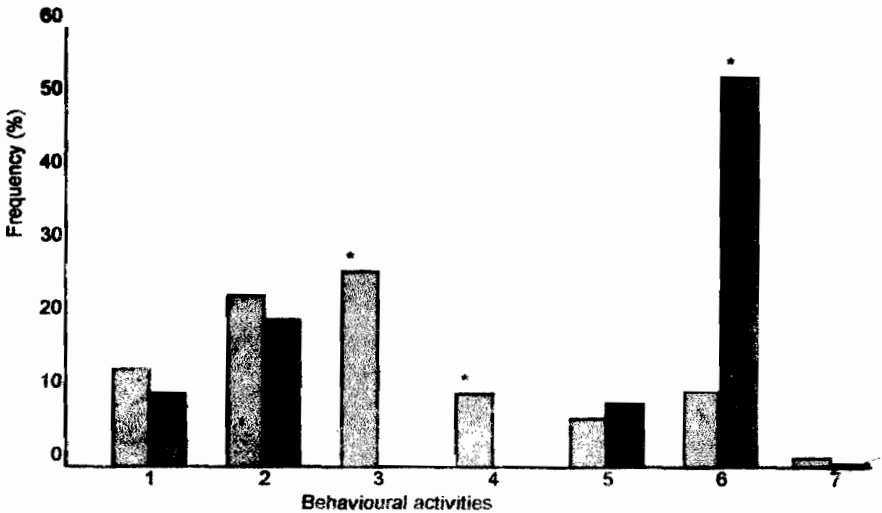

Fig. 2. Effects of artificial heat source on the frequency of behavioural activities in piglets Behaviour 1 = Wandering in pen; 2 = Suckling; 3 = Sleeping under heat source; 4 = Sleeping near heat source; 5 = Sleeping near or with the sow; 6 = Sleeping at other part of the pen and 7 = any other activity. Shaded blocks represent piglets with heat while dark blocks are piglets without heat. Asterisks indicate activities that are significantly influenced by heat source (P<0.05).

Table 2. Diurnal variations in the frequency distribution of behavioural activities of piglets with or without artificial heat source (%)

Time	Heat/ No Heat	Behavioural activities 1	2	3	4	5	6	7
Morning	Heat	49.80^{b}	27.89^{b}	41.89^{b}	21.47^{a}	19.91^{b}	22.51^{b}	41.33^{a}
	No Heat	75.28^{a}	51.63^{a}	0^{b}	0b	31.51^{a}	39.62^{a}	0^{b}
	Mean	62.54^{c*}	39.76^{d}	20.95^{e*}	10.74f*	25.71^{de}	31.07^{de}	20.67^{a}
Afternoom	Heat	31.58^{a}	36.98	14.42^{a}	41.46^{a}	48.63	45.10	58.67^{a}
	No Heat	22.47^{b}	30.48	0^{b}	0^{b}	30.82	35.62	0.44^{b}
	Mean	27.03^{d}	33.73^{cd}	7.21^{e}	20.73^{d}	39.73^{c}	40.36^{c}	29.56^{d}
Evening	Heat	18.62^{a}	35.13^{a}	43.69^{a}	37.07^{a}	31.46	32.39	0^{b}
	No Heat	2.25^{b}	17.89^{b}	0^{b}	0^{b}	37.67	24.76	100.00^{a}
	Mean	10.44^{f}	26.51^{d}	21.85^{ef}	18.54^{ef}	34.57^{d}	28.58^{d}	50.00^{c}

Behaviour 1= Wandering in pen; 2 = Suckling; 3= Sleeping under heat source; 4 = Sleeping near heat source; 5 = Sleeping near or with the sow; 6 = Sleeping at any other part of the pen and 7 = any other activity.

ab:Values within the same behaviour / time differently superscripted differ significantly (P<0.05).

cdef = Mean values / time differently superscripted differ significantly (P<0.05).

*: Mean diurnal variations are significantly different (P<0.05).

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