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A Preliminary Trial on the Use of Barium Chloride for Pregnancy Diagnosis in Sows.

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Summary

Urine was collected twice daily (once in the morning and once in the afternoon) for 5 days from 80 Yorkshire x Landrace crossbred gilts/sows made up of 40 non-pregnant and 40 pregnant pigs in an investigation to determine the possibility of using 1% barium chloride solution for pregnancy diagnosis in pigs based on a previous report that addition of a few drops of 1% barium chloride solution to bovine urine caused a white precipitate with non-pregnant but not with pregnant cows. The pregnant pigs were in various stages of gestation.

Urine reaction to 1% barium chloride was highly ($P < 0.01$) dependent on the pregnancy status of the sows, the test being 100% and 81% effective in identifying non-pregnant and pregnant sows respectively.

The sensitivity of the test in the gravid sows was significantly ($P < 0.05$) influenced by and tended to increase with the stage of gestation, with 59% of the sows in their first stage of gestation (≤ 38 days post-coitum) being correctly diagnosed as pregnant, and 95-100% of those in their latter stages of gestation being so correctly diagnosed. Parity and time of day of performance of the test had no effect on urine reaction.

It was concluded that the test was at least 95% accurate when used as from about 39 days after breeding for pregnancy diagnosis in sows.

Résumé

Test préliminaire sur l'utilisation du chlorure de baryum pour le diagnostic de la gestation chez les truies.

Cette étude vise à évaluer la possibilité d'utiliser une solution de 1% de chlorure de baryum pour le diagnostic de la gestation des truies. Elle est basée sur un précédent rapport indiquant que l'addition de quelques gouttes d'une solution de 1% de chlorure de baryum à de l'urine de bovins causait une précipitation blanche chez les vaches non gestantes alors que l'urine des vaches gestantes restait limpide. Ce procédé a été étudié sur un groupe de 80 truies issues du croisement Yorkshire x Landrace, dont 40 étaient non gestantes et 40 l'étaient à différents stades de gestation. L'urine a été collectée deux fois par jour (matin et après-midi) pendant 5 jours.

Le degré de réaction de l'urine à la solution de 1% de chlorure de baryum dépend fortement ($P< 0,01$) de l'état d'avancement de la gestation des truies. Le degré d'efficacité du test est respectivement de 100% pour les truies gestantes et de 81% pour les non-gestantes. L'avancement de la gestation influence positivement et significativement ($P < 0,05$) la sensibilité du test pour les truies gestantes. En effet, le test a diagnostiqué comme gestantes 59% des truies au premier stade de gestation (≤ 38 jours post-coitum) et de 95 à 100% de truies dans un stade plus tardif de leur gestation. Le test n'est pas influencé par la parité et sur le moment de la journée où le test est effectué.

En conclusion, ce test pour le diagnostic de la gestation des truies a une précision de plus de 95% quand il est utilisé 39 jours après la fécondation.

Introduction

The ability to promptly identify sows that may or may not have conceived after service or artificial insemination in commercial pig enterprises is vital to the pig producer as its permits a timely rebreeding of non-pregnant sows with minimal loss of oestrual cycles. Since profitability in such establishments is closely related to the reproductive performance of the breeding stock, any delay in rebreeding sows that return to oestrues can be quite costly (2).

Methods such as the use of ultrasound which are in common use in the developed world for pregnancy diagnosis in pigs are yet to gain wide acceptance and use in the tropics probably because they are either too expensive to acquire and maintain or too complicated for

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the small-holder, often illiterate, tropical swine producer. For a test to be of use in the tropics therefore, it should be cheap, readily available or accessible, uncomplicated and accurate.

Maslor and Smirnov (4) reported a simple and cheap procedure which was 95 to 100% accurate 15 to 210 days after insemination for pregnancy diagnosis in cows. The addition of a few drops of 1% barium chloride solution to urine from non-pregnant cows produced a white precipitate which was absent with urine from pregnant cows. Similar urine reactions have also been reported for sheep and goats with 2% barium chloride solution (5).

This study was therefore carried out to ascertain the possibility of using barium chloride for pregnancy diagnosis in sows, and what effects stage of gestation, parity and time of day of performance of the test might have on the test results.

Material and Methods

Eighty Yorkshire x Landrace crossbred gilts and sows made up of 40 non-pregnant and 40 pregnant pigs were selected from the breeding stock of Mitchell Farms (Piggery Operations), Ovwor, near Ughelli in Delta State of Nigeria based on the breeding records at the farm. The farm, located approximately 5.33° N and 6.00° E in the tropical rainforest zone southwest of Nigeria had, at the time of the study, an average daily temperature of about 28°C and a mean relative humidity of about 75%. The pigs were fed on a commercial diet (approximately 16% crude proteins and 3322 kcal/kg) and were provided clean, cool drinking water *ad libitum*.

Fourteen of the pregnant pigs were in their first stage of gestation (≤ 38 days post-coitum, with the day of mating as day O), 12 in their second stage of gestation (39 - 76 days post-coitum) and 14 in their third stage of gestation (≥ 77 days post-coitum). The pregnant pigs were also at different levels of parity (Table 1).

Each pig was housed individually in a wooden metabolic cage with a slatted floor fitted beneath with a corrugated metal roofing sheet appropriately tilted to direct urine into a plastic bowl covered with a fine wire mesh to ensure separation of urine from faeces.

Urine collected twice daily, once in the morning between 07.00 a.m. and 10.00 a.m. and once in the afternoon between 14.00 p.m. and 16.00 p.m. Nigerian time for 5 days from each of the pigs was used for the trial. Five drops of 1% barium chloride ($BaCl_2$) solution were then added with a dropper to about 2 ml of each urine sample, shaken and left to stand for about 5 minutes. Urine samples which showed any degree of cloudiness or turbidity after 5 minutes were regarded as having shown precipitate with the reagent.
The mean number of urine samples (± standard error) which showed or failed to show precipitate with $BaCl_2$ were organized into contingency tables (Table 1) and analyzed by the chi square procedure. Yate's correction for continuity was applied whenever degree of freedom for the test was 1. Proportions showing significance were separated using the Bonferroni confidence intervals procedure (1).

Results and Discussion

The effects of pregnancy, stage of gestation and parity of the dam on the reaction of porcine urine with 1% barium chloride solution when the test was carried out in the mornings are presented in Table 1. All urine samples from the non-pregnant sows showed precipitate with barium chloride thus implying that the absence of pregnancy was correctly diagnozed in 100% of the pigs. However, only an average of 32.40 ± 0.24 urine samples per day from the 40 gravid sows (or 81%) failed to show precipitate with the reagent as expected. This implies that pregnancy was correctly diagnozed in about 81% of the pregnant sows with $BaCl_2$. The chi square test performed on the data (Table 1) showed that urine reaction with $BaCl_2$ was highly ($P < 0.05$) dependent on, and tended to vary with, stage of gestation. While only about 59% of the pregnant sows in their first stage of gestation were correctly diagnozed as such, 95% of those in their second stage were correctly diagnozed, the difference being significant ($P < 0.05$).

Furthermore, all (100%) of the pregnant sows in their stage of gestation were correctly diagnozed. The difference between the second and the third stage percentages (95% and 100% respectively) was not, however, significant ($P > 0.05$). The sensitivity with which pregnant sows were correctly diagnozed therefore in-

Table 1
The effects of pregnancy, stage of gestation and parity on urine reaction with 1% barium chloride solution in pigs ♦

Parameters	N	Precipitate (1) Present	Absent	Chi Square
1. Pregnancy Status				
Non-Pregnant	40	40.00±0.00	0.00±0.00 (0.00)^b	51.51**
Pregnant	40	7.60±0.24	32.40±0.24 (0.81)^a	1df
2. Stage of Gestation				
1st stage	14	5.80±0.20	8.20±0.20 (9.59)^b	
2nd stage	12	0.60±0.24	11.40±0.24 (0.95)^a	10.48*
3rd stage	14	0.00±0.00	14.00±0.00 (1.00)^a	2 df
3. Parity				
0	7	0.00±0.00	7.00±0.00 (1.00)^a	
1	7	2.00±0.00	5.00±0.00 (0.71)^a	
2	6	2.00±0.00	4.00±0.00 (0.67)^a	
3	5	1.80±0.20	3.20±0.20 (0.64)^a	
4	4	0.00±0.00	4.00±0.00 (1.00)^a	
5	1	0.00±0.00	1.00±0.00 (1.00)^a	
6	8	0.60±0.24	7.40±0.24 (0.93)^a	9.18ns
7	2	0.00±0.00	2.00±0.00 (1.00)^a	7 df

(1) Entries are mean number of urine samples (± SE) showing or not showing precipitate.

♦ Data refer to urine samples collected in the mornings.
N = number of pigs.
* $P < 0.05$; ** $P < 0.01$; ns $P > 0.05$
Figures in parentheses are proportions of samples showing no precipitate with barium chloride.
Within each parameter, proportions with different superscripts differ significantly.

creased with stage of gestation. The test was about 59% accurate before 39 days after breeding, and 95% to 100% accurate thereafter. These results compare favourably with an already developed ultrasonic pregnancy tester (6) which was 60% accurate when used at about 21 days of gestation, and almost 100% accurate after the 28th day of pregnancy. However, since modern ultrasonic devices have the disadvantage of being too expensive, not being readily available, and requiring much skill to interprete the acoustic or visual signals produced (3), barium chloride holds a lot of promise among most tropical, small-holder swine producers.

Results obtained with urine samples collected in the afternoons were similar to those of the mornings. Consequently, the data for the former are omitted.

Parity of the dams had no significant ($P > 0.05$) influence on urine reaction with $BaCl_2$ (Table 1).

The physiological basis for the differential reaction of urine from pregnant and non-pregnant sows with 1% $BaCl_2$ is still unclear. Although Maslov and Smirnov (4) attributed the differential reaction in cows to differences of concentrations of oestrogen and progesterone in the urine due to gestation, a more recent study (5) in which urine from non-pregnant sheeps and goats in the follicular and luteal stages of their cycles (when blood concentrations of oestrogen and progesterone respectively were high) always showed a precipitate with $BaCl_2$ suggests that other factors other than differences in the blood concentrations of these steroids may be involved. Further work is therefore required to identify the urinary factor(s) involved, and the nature of their interaction with the reagent.

Conclusion

In conclusion, the results obtained in this trial indicate that the test may be more than 90% effective in identifying pregnant pigs when used as from about 39 days after mating.

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Literature

1. Devore J.L., 1982. Probability and statistics for Engineering and the Sciences. Brooks/Cole Publishing, Monterey, California.

2. Holness D.H., 1991. Pigs. The Tropical Agriculturalist Series. Macmillan Education Ltd., London and CTA, Wageningen.

3. Laing J.A., 1979. Fertility and Infertility in Domestic Animals. ELBS and Bailliere, Tindall.

4. Maslov N. & Smirnov A., 1965. The simplest method for the early diagnosis of pregnancy. Animal Breeding Abstracts **33**, No.2302.

5. Ohazurike E.E., 1990. Pregnancy diagnosis in ewes and goat does using urine and 2% barium chloride solution. B. Agric research Projet, Obafemi Awolowo University, Ile-Ife, Nigeria.

6. Pig International 1989. Pregnancy tester. Pig International, March 1989. Watt Publishing Co., Mount Morris, Illinois. pp. 30.