EVALUATION OF TECHNIQUES FOR ESTIMATING MILK PRODUCTION BY SOWS 4. A COMPARISON OF TWO WEIGH-SUCKLE-WEIGH TECHNIQUES (OFFSPRING AND MATERNAL) FOR ESTIMATING MILK PRODUCTION

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Summary

The maternal weigh-suckle-weigh (WSW) method for estimating milk production of sows was further evaluated by comparing this to the traditional WSW method. Twenty one estimates of hourly milk production were obtained by both methods. Total hourly milk production between the two methods was not significantly different (292.4 vs 303.3 g/h, $p > 0.05$). Hourly milk production determined by the maternal WSW method was highly correlated with hourly milk production estimates using the traditional WSW method ($R^2 = 0.94$, $p < 0.001$). When corrections for metabolic and salivary losses were made, the milk production figures for the maternal WSW method were approximately 27% less than those estimated by the traditional WSW method.
(Key Words: Weigh-Suckle-Weigh, Milk Production, Sow, Maternal, Offspring)

Introduction

The use of the D_2O dilution technique allows an accurate estimate of milk intake by piglets (Prawirodigdo et al., 1990a). Experiments described in previous papers (Prawirodigdo et al., 1990bc), compared estimates of milk intake determined by the traditional and maternal WSW methods with "true" milk production estimated by the D_2O dilution technique. Unfortunately, a valid evaluation of the maternal WSW as a mean to estimate milk production was not achieved in the previous experiment (Prawirodigdo et al., 1990c) because of inaccurate estimates of milk production as determined by the D_2O dilution method during the relatively short WSW periods.

This study evaluated the maternal WSW method of estimating milk production of sows in comparison to the traditional WSW method in which piglets were weighed before and after suckling.

Materials and Methods

Animals

Two lactating sows with their offspring were used in this study and were housed in farrowing crates in an insulated room. Piglets had free access to their dam except during each measurement period when they were only allowed access to the sow every hour to suckle. For the remainder of the measurement period, piglets were separated from their dams by a wire mesh barrier which ensured visual contact between dam and offspring.

Design and management

Two sows were offered a daily intake of 5 kg lactation diet as described in the previous paper (Prawirodigdo et al., 1990c). Milk production of the sows, which were each suckling 10 piglets, was estimated by the traditional and maternal WSW methods simultaneously. Estimates were derived hourly for seven hours from one sow and hourly for seven hours on two consecutive days from the other sow, thereby obtaining 21 estimates of hourly milk production.

After the first suckling at 07:00 piglets were separated from their dams using a wire mesh barrier. During the subsequent seven hours, piglets and sows were weighed simultaneously before and after suckling each hour, to determine the total of individual weight gains of piglets and the

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corresponding weight losses of sows. Furthermore, to obtain an estimate of the weight losses of sows associated with metabolism, the weight changes of sows were also recorded at various times between the suckling intervals.

The procedure used to estimate milk yield of sows by the piglets and sows WSW methods are discribed below.

Piglet weighing

In the morning, piglets were separated from their dam, individually identified and weighed in an individually marked plastic bean. An electronic scale (Sartorius 3902MP8) with a readability of 0.1 g was used and programmed to provide a stable reading which was a mean of 20 readings obtained over a 5-second period. Piglets were weighed before and after suckling. Any piglet which was observed to urinate or defaicate before suckling was reweighed and return to the dam. The interval of nursing was similar to the natural nursing interval (1 hour) as reported by Whittemore and Fraser (1974).

Sow weighing

The WSW by sow weighing was conducted in a similar manner to that discribed above in the piglet weighing method except that the sow was weighed before and after suckling. A weigh scale capable of weighing up to 400 kg with an accuracy of 10 g which was supplied by Electronic Force Measurement Pty. Ltd. was incorporated into a farrowing crate. After the scale had been tared to zero the piglets were allowed access to their dam, hourly during 7 consecutive nursing bouts. Any faeces or urine found on the platform during nursing periods was removed. The average loss of weight (g) of sows after nursing was used to estimate daily milk yield. Between suckling sows were observed to lose significant amounts of bodyweight whilst resting. Consequently, rate of body weight loss was used to correct the estimates of milk yield obtained by the sow weighing method.

Statistical analysis

The milk production estimates by the traditional and maternal WSW methods were compared using the paired t-test and by regression analysis (Steel and Torrie, 1981).

Results

Total hourly milk production estimate determined by the traditional WSW method was not significantly different from that determined by the maternal WSW method (table 1). Furthermore,

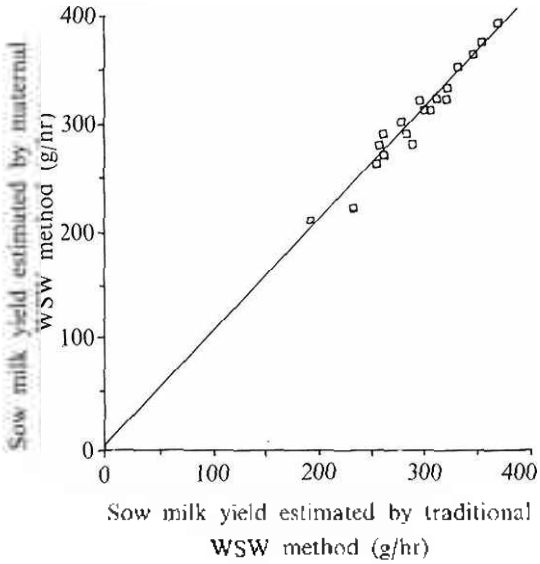

Figure 1. Relationship between milk production estimated by the maternal WSW method and milk production estimated by traditional (piglets) WSW method.

TABLE 1. DIFFERENCE BETWEEN MILK YIELD ESTIMATED BY THE WEIGH SUCKEL WEIGH METHODS OF WEIGHING PIGLETS AND WEIGHING SOWS

Methods of measurement	Number of measurements	Estimated milk yield	
		Mean* (g/h)	Range (g/h)
WSW (piglet)	21	292.4 ± 9.20	192.0 to 370.0
WSW (sows)	21	303.3 ± 9.72	210.0 to 390.0

* No significant difference between means as estimated by the two methods.

hourly milk production estimated by the maternal WSW method was highly correlated with hourly milk production estimated by the traditional WSW method, the respective regression equation being $Y = 2.94 + 1.0274\ X$, $R^2 = 0.94$, $p < 0.001$, where Y was milk production estimated by the maternal WSW method and X was milk production estimated by the traditional WSW method (figure 1). The mean body weight loss of the sow due to metabolism was 4 g/ minute, the mean interval between sow weighing was 5 minutes and the ambient temperature during the experimental period ranged from 22 to 25℃.

Discussion

The alternative WSW methods provided similar estimates of milk production. Furthermore, there was a significant relationship between estimates of milk yield determined by the two WSW methods. However, Saint et al. (1984) reported that higher estimates of milk yield were obtained using the maternal WSW in humans compared with those obtainted from test weighing the infant. This difference was due to sweating and insensible water losses which resulted in the overestimation of milk yield by about 15% when the mother was test-weighed and the underestimation of milk yield by about 10% when the infant was test-weighed (Arthur et al., 1987).

The underestimation of milk yield when the traditional WSW method is used can be calculated from estimates of metabolic and salivary losses in piglets associated with suckling during each WSW measurement period. Mean metabolic and salivary losses were assumed to be 69 g /piglet because estimates range from 4.2 g/piglet (Noblet and Etienne, 1986) to 8.3 g/piglet (Klaver et al., 1981). Thus, in the present experiment the average bodyweight loss of the litters due to metabolic and salivary losses was approximately 60 g per suckle, which would increase mean milk production estimated by the traditional WSW method to about 352 g/hr.

The mean weight loss of the sows associated with metabolism observed in the present experiment was approximately 20 g/suckling. Thus mean milk production estimated by the maternal WSW method would be reduced to about 283 g/hr if metabolic losses during suckling were taken into account. Consequently, if the milk yield estimated by the traditional WSW method, after correction for metabolic and salivary losses, is assumed to provide an accurate estimate of milk yield (Prawirodigdo et al., 1990b), the estimate of milk yield determined by the maternal WSW method in the present experiment underestimates milk yield by nearly 30%. However, the underestimation of milk yield was consistent over the range of milk yield examined in this study. Thus the use of the present maternal WSW method has potential only to provide relative differences in milk yield. The use of maternal WSW method, however, provided accurate estimates of the relative milk yield of sows. The sow weigh scale display was dampened considerably to minimize the effects on the display of small movements of the sow. Thus it is possible that the recorded weight loss of the sow after suckling consistently underestimated actual bodyweight loss of the sow and an accurate absolute value for sow weight loss could not be obtained after each suckle. The accuracy of the weighing scale limits the use of the maternal WSW technique to accurately estimate the milk production of sows. The development of a weighing scale based upon a similar principle as that used in the piglet scale discribed by Prawirodigdo et al. (1990b) should allow accurate estimates of milk production to be obtained by the maternal WSW method.

The results of the present experiment indicate that the maternal WSW technique consistently underestimates sow milk production. Further use of the maternal WSW method to estimate sow milk production is dependent upon the development of a weighing scale capable of accurately recording approximately 500 kg $\pm$ 10 g despite small fluctuations due to animal movement.

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