Effect of High-Energy Diets on the Performance of Lactating Sows in Tropical Climate

Juan J. Morales¹, Rubén Loeza¹,², Álvaro A. Ángeles², Felipe Montiel¹*

¹Facultad de Medicina Veterinaria y Zootecnia
Universidad Veracruzana
Circunvalación S/N Esquina Yañez, C.P. 91710, Veracruz, Ver., México

²Campo Experimental “La Posta”
Instituto Nacional de Investigación Forestal, Agrícola y Pecuaria
Carretera Federal Veracruz-Córdoba, Paso del Toro, Ver., México

(Received October 08, 2008; accepted September 07, 2009)

Abstract


To study the effect of high-energy diets on performance of lactating sows in a tropical climate, 78 multiparous PIC sows on d 100 of gestation were divided into 4 groups (20x3, 18x1). From d 7 before parturition (d-7) until d 21 of lactation (weaning), sows were fed ad libitum diets containing 3.2, 3.3, 3.4 or 3.5 Mcal ME/kg. At farrowing, BW was not different among diets (P>0.05), but at weaning it was lower for the control diet (P<0.05). BFT and BCS at farrowing and weaning and overall feed, energy and protein intake were lower for control group (P<0.05). Litter weight at birth was higher for the 3.5 Mcal ME/kg diet (P<0.05), and at weaning it was lower for the control diet (P<0.05). Weaning-first service interval was longer in control group (P<0.05). In conclusion, increasing the dietary energy content by adding fat improved the overall performance of lactating sows in a tropical climate and prevented them from decreasing their voluntary feed intake.

Keywords: Dietary energy, dietary fat, feed intake, lactation, sows.

Introduction

Greater prolificacy of sows has increased nutrient requirements during pregnancy and lactation (Dourmad and Étienne, 2002). During lactation, the greater litter size and milk production increase voluntary feed intake (VFI) (Dourmad and Étienne, 2002), but this is not sufficient to meet the higher energy requirements and sows must catabolize body fat and protein, which affects the weaning-estrus interval and overall productivity (Quesnel and Prunier, 1995).

VFI is reduced when ambient temperature exceeds the thermoneutral zone (15 to 20C). This decreases heat production due to thermic effect of feed (Renaudeau et al., 2001). Diets with low crude protein level and/or added fat result in lower heat production (Le Bellego et al., 2001). Thus, fat can be added to lactation diets to increase energy intake with reduced heat production (van den Brand et al., 2000).
Little information is available on the overall performance of lactating sows raised in tropical climates (Gourdine et al., 2004). Therefore, the aim of this study was to determine the effect of feeding diets with high levels of metabolic energy on the productive and reproductive performance of lactating sows in a tropical climate.

**Materials and Methods**

This study was conducted in Veracruz, Mexico, in a humid tropical climate. Seventy-eight multiparous PIC sows on d 100 of gestation were selected from one commercial herd. Seven days before expected parturition, sows were moved from the gestation area to a semi-open farrowing area equipped with standard facilities. A pre-starting diet (19% CP) was offered *ad libitum* to the piglets from d 15 to weaning (d 21). Throughout the study, average ambient temperature and relative humidity were 26°C and 70%.

During pregnancy, sows were fed a sorghum-soybean meal based gestation diet containing about 18% CP and 3.2 Mcal of ME/kg, until 7 d before expected parturition (d 7). From d 7 until d 21 sows were fed either the gestation diet (control diet) or diets having 3.3, 3.4 or 3.5 Mcal ME/kg (NRC, 1998) for lactating sows. High energy diets were formulated by addition of dry tallow.

Body weight (BW), backfat thickness (BFT) and body condition score (BCS) of sows were determined 24 h after farrowing and at weaning. The BFT was ultrasonically measured at the last-rib level at 65 mm from the midline. The BCS was assessed using a five-points scale (1 = thin to 5 = obese, Vargas *et al.*, 1991).

Feed, energy and protein intakes were evaluated during the lactation period (days 1 to 21). The number and weight of piglets born alive and at weaning were recorded.

From d 22 to d 43, sows were checked twice daily for signs of estrus behavior using a mature boar. Sows were artificially inseminated 24 h after detected estrus and the weaning-first service interval was recorded.

Data were analyzed through analysis of variance (SAS Inst. Inc.).

**Results and Discussion**

At farrowing, BW was not different among diets (P>0.05), but at weaning it was lower for the control group (P<0.05; Table 1). The sows fed the high-energy diets had a greater BW, BFT and BCS at weaning (Table 1) and a higher intake of feed, energy and protein (Table 2) throughout the study, compared to the sows fed the control diet. Averette *et al.* (2002) reported that sows fed supplemental fat during lactation had a lower overall decrease in BCS and a greater BFT gain. This BFT gain was contrary to our results, as BFT decreased from farrowing to weaning in all the diets, although BFT was greater for the sows fed the high-energy diets. One explanation for this loss of BFT might be that because of high ambient temperatures the VFI of the sows either decreased or did not increase and was not sufficient to meet the higher energy demands for milk production, leading to a loss of BCS, BW and BFT even in the sows fed high energy diets. Renaudeau *et al.* (2001) found a decreased VFI of lactating sows exposed to 29°C vs 20°C.

The number of piglets at birth and weaning was not affected by the diet (P>0.05; Table 3), similar to other reports (Renaudeau and Noblet, 2001; Averette *et al.*, 2002). Litter weight at birth was higher for the diet with 3.5 Mcal ME/kg (P<0.05; Table 3) and at weaning it was lower for the control group (P<0.05; Table 3). Feeding supplemental fat to sows in late gestation and (or) lactation increased litter weight (Averette *et al.*, 2002; van den Brand *et al.*, 2000), perhaps via an increase of milk energy output, particularly in a hot environment (Quiniou *et al.*, 2000). In our study, a higher conversion efficiency from dietary fat to milk fat as a result of the fat added to the diets might explain the difference of weight among the litters of the sows fed the
Table 1
Effect of energy content in diet on body measurements of lactating sows raised in a tropical climate

<table>
<thead>
<tr>
<th>Diet (Mcal ME/kg)</th>
<th>3.2 (control)</th>
<th>3.3</th>
<th>3.4</th>
<th>3.5</th>
<th>SEM¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farrowing</td>
<td>249.2a</td>
<td>254.4a</td>
<td>242.8a</td>
<td>249.0a</td>
<td>0.352</td>
</tr>
<tr>
<td>Weaning</td>
<td>209.1a</td>
<td>231.8b</td>
<td>229.4b</td>
<td>223.9b</td>
<td>0.412</td>
</tr>
<tr>
<td>BFT, cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farrowing</td>
<td>2.51a</td>
<td>4.50b</td>
<td>4.41b</td>
<td>4.06b</td>
<td>0.191</td>
</tr>
<tr>
<td>Weaning</td>
<td>1.85a</td>
<td>3.53b</td>
<td>3.35b</td>
<td>3.19b</td>
<td>0.175</td>
</tr>
<tr>
<td>BCS, 1 to 5 scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farrowing</td>
<td>2.3a</td>
<td>2.6b</td>
<td>2.6b</td>
<td>2.6b</td>
<td>0.0408</td>
</tr>
<tr>
<td>Weaning</td>
<td>1.8a</td>
<td>2.2b</td>
<td>2.3b</td>
<td>2.3b</td>
<td>0.0443</td>
</tr>
</tbody>
</table>

¹Different superscripts in a row mean statistically different values (P<0.05).
SEM: Standard Error of Means.

Table 2
Effect of energy content in diet on intake of feed, energy and protein of lactating sows raised in a tropical climate

<table>
<thead>
<tr>
<th>Diet (Mcal ME/kg)</th>
<th>3.2 (control)</th>
<th>3.3</th>
<th>3.4</th>
<th>3.5</th>
<th>SEM¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of sows</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Feed (kg/21 d/sow)</td>
<td>71.4a</td>
<td>92.7b</td>
<td>90.3b</td>
<td>93.3b</td>
<td>0.1108</td>
</tr>
<tr>
<td>Energy (Mcal/day/sow)</td>
<td>10.1a</td>
<td>14.3b</td>
<td>14.4b</td>
<td>15.1b</td>
<td>0.3580</td>
</tr>
<tr>
<td>Protein (g/day/sow)</td>
<td>595a</td>
<td>769b</td>
<td>770b</td>
<td>787b</td>
<td>19.40</td>
</tr>
</tbody>
</table>

¹Different superscripts in a row mean statistically different values (P<0.05).
SEM: Standard Error of Means.

Table 3
Effect of energy content in diet on size and weight of litters of lactating sows raised in a tropical climate

<table>
<thead>
<tr>
<th>Diet (Mcal ME/kg)</th>
<th>3.2 (control)</th>
<th>3.3</th>
<th>3.4</th>
<th>3.5</th>
<th>SEM¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth (born alive)</td>
<td>9.6a</td>
<td>8.6a</td>
<td>8.8a</td>
<td>9.6a</td>
<td>0.2482</td>
</tr>
<tr>
<td>Weaning</td>
<td>8.2a</td>
<td>8.3a</td>
<td>8.5a</td>
<td>9.4a</td>
<td>0.2482</td>
</tr>
<tr>
<td>Litter weight kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth</td>
<td>9.7a</td>
<td>9.5a</td>
<td>9.4a</td>
<td>10.7b</td>
<td>0.2734</td>
</tr>
<tr>
<td>Weaning</td>
<td>48.6a</td>
<td>52.5b</td>
<td>55.0b</td>
<td>60.8b</td>
<td>1.7827</td>
</tr>
</tbody>
</table>

¹Different superscripts in a row mean statistically different values (P<0.05).
SEM: Standard Error of Means.

Feeding high-energy diets to lactating sows in a tropical climate

high-energy diets and those fed the control diet; however, milk fat percentage was not determined. Although the sows were exposed to ambient temperatures higher than 22°C, this did not affect litter growth, perhaps because of the higher energy intake of sows. However, the litters of the sows fed the control diet had a lower BW gain, which could be attributed to a lower milk production or to a direct effect of reduced VFI when lactating sows were exposed to high ambient temperatures (Quiniou and Noblet, 1999).

The sows on all the four diets came into estrus within 10 days after weaning. Averette
et al. (2002) found no effect of supplemental fat on the weaning-to-estrus interval. In our study the interval weaning-first service was 5.2±0.4, 5.3±0.8 and 5.2±0.4 d for the sows on the diets of 3.3, 3.4 and 3.5 Mcal ME/kg, respectively (P>0.05) and 6.2±0.9 d for the sows on the diet of 3.2 Mcal of ME/kg (control group; P<0.05). In reproductive sows, a reduced feed supply during lactation inhibits LH secretion, which delays ovarian activity and oestrus after weaning (Quesnel et al., 1998). The lower energy level of the control diet might be responsible for the longer weaning-to-estrus interval in the sows of this group, but LH concentrations were not measured. Therefore, increasing VFI of lactating sows could help offset the catabolic losses and permit maintenance of body condition and a more rapid return to estrus (Payne et al., 2004).

In conclusion, increasing the energy content of the lactation diet of multiparous sows by adding fat reduced losses in BW, BFT and BCS and shortened the weaning-first service interval.

References


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