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# Feeding behavior in primiparous lactating sows: Impact of a high-fiber diet during pregnancy<sup>1</sup>

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**ABSTRACT:** Voluntary feed intake of hyperprolific sows can be insufficient to cover the requirements for milk production and maintenance of body condition. A bulky diet fed during pregnancy is known to prepare sows for an ad libitum feed supply after parturition as shown by the increased feed intake during lactation. The aim of this study was to investigate the feeding behavior of young sows during their first lactation to evaluate the further impact of the feeding experience acquired during pregnancy, through the addition of dietary fiber in the diet. Analysis of the feeding pattern and the profile of feed intake tested the hypothesis that lactating sows would exhibit different feeding strategies depending on the diet during pregnancy. During pregnancy, 24 primiparous sows (Large White × Landrace) were offered either 2.4 kg of a control diet/d containing 3.16% crude fiber or 2.8 kg of a high-fiber

diet/d containing 12.42% crude fiber. All sows received 33 MJ of DE/d. From the first day postpartum until weaning, all sows were offered the same lactation diet ad libitum. The feeding pattern during lactation was recorded as ADFI, meal frequency, and meal size. In lactation, the ADFI did not differ according to the treatment. Compared with control sows, high-fiber sows consumed their diet in more ( $P < 0.05$ ) but smaller meals ( $P < 0.05$ ). In both treatments, ADFI and the number of daily meals increased over weeks of lactation ( $P < 0.001$ ). All sows presented a strong diurnal and bimodal feeding activity evolving toward 2 distinct feeding periods occurring from 0500 to 0900 and from 1400 to 1800 and accounting for 0.64 of the total daily feed intake during the third week of lactation. The provision of a fibrous diet during pregnancy pointed out the role of an early feeding experience on the development of feeding behavior during the first reproductive cycle.

**Key words:** feeding behavior, fiber, lactation, primiparous, sow

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## INTRODUCTION

Reproductive sows are restrictively fed during pregnancy to avoid overweight, which can lead to farrowing and locomotion problems and be detrimental for piglet survival. Lactating sows are often fed ad libitum to optimize milk production and maintain body condition (Dourmad et al., 1994). However, voluntary feed intake of hyperprolific sows can be insufficient, especially in young sows, to meet their high nutrient requirements due to milk production (Noblet et al., 1990). A low feed

intake during lactation involves mobilization of body tissues (NRC, 1987) and can lead to an excessive loss of BW, reducing sow longevity (Gaughan et al., 1995) and reproductive performance (Quesnel, 2005). Underconsumption is particularly evident in primiparous sows (Eissen et al., 2003). Low appetite can be accentuated by selection strategies for leanness and hyperprolificacy (Cameron et al., 2002) and could reflect a low feeding motivation that limits the spontaneous expression of sows in feeding behavior.

Voluntary feed intake during lactation is modulated by individual, dietary, and environmental factors (Eissen et al., 2000). Among dietary factors, the supply of a fibrous diet in pregnant sows has been tested to prepare animals to ad libitum feed supply. Greater feed intake in lactating sows fed fibrous diet was reported (Matte et al., 1994), but the effect of an early feeding experience on the subsequent feeding pattern over time has not been fully detailed.

The aim of this study was to investigate the feeding behavior of primiparous sows during lactation to ex-

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plain the impact of a fibrous diet supply during pregnancy and to evaluate the role of the experience acquired during the first parity on the development of feeding behavior. We hypothesized that sows fed a fibrous diet during pregnancy would show a greater feed intake and would exhibit a specific feeding strategy characterized by more daily meals of equal or bigger size than in sows fed a standard diet.

## MATERIALS AND METHODS

### *Animals and Housing*

Experimental procedures and animal holding facilities respected French Animal Legislation, including licensing of experimenters; licenses, procedures, and holding facilities were controlled and/or approved by the French Veterinary Services. Twenty-four primiparous sows (Large White × Landrace) were used during their pregnancy and lactation periods. At the beginning of the experiment, sow BW averaged  $143 \pm 1$  kg. Three replicates were conducted during fall and winter. Parturition was not induced, and litters were standardized to  $11 \pm 1$  piglets within 48 h after parturition. The cross-fostering occurred only among sows from the same dietary treatment.

During the first 5 wk of pregnancy, sows were individually housed in stalls measuring  $1.90 \times 0.60$  m<sup>2</sup>, with concrete floors and wood shavings. Thereafter, sows were maintained in groups of 4 in pens measuring  $4.20 \times 2.30$  m<sup>2</sup>, with concrete floors and wood shavings, until wk 17 of pregnancy. The pen was divided into a resting and a feeding area, the latter equipped with individual stalls and troughs. Twelve days before expected parturition, sows were moved into farrowing crates, where they stayed until their piglets were weaned at  $26.5 \pm 0.4$  d after parturition. Farrowing crates were equipped with a slatted floor and measured  $2.60 \times 1.60$  m<sup>2</sup>, of which  $1.90 \times 0.60$  m<sup>2</sup> was available for the sow.

During the whole experimental period, artificial lighting (103 lx) was provided from 0800 to 1800, with lighting of lower intensity (10 lx) from 1800 to 0800 to allow video recordings. The ambient temperature was kept at  $20 \pm 1^\circ\text{C}$  (mean  $\pm$  SD) during pregnancy and  $22 \pm 1^\circ\text{C}$  during lactation. Two heaters were available in each farrowing crate, delivering a local temperature of  $30 \pm 1^\circ\text{C}$ .

### *Diets*

From mating until wk 4 of pregnancy, each sow was fed 2.50 kg daily of a standard pregnancy diet. Sows were then allocated to 1 of the 2 experimental diets containing a low (C) or a high (HF) level of crude fiber (CF). The C diet was based on wheat, barley, and soybean meal. In the HF diet, the wheat and soybean meal were replaced by a mixture of fiber-rich feedstuffs of different types. Ingredient composition and chemical

**Table 1.** Composition and chemical characteristics of the experimental diets

Item	Pregnancy diet <sup>1</sup>		Lactation diet
	C	HF	
Ingredient, % as-fed			
Barley	16.70	16.70	25.50
Corn	—	—	12.00
Wheat	65.70	16.42	22.70
Soybean meal	11.25	2.81	21.00
Sunflower meal	—	9.75	—
Wheat bran	—	9.75	10.00
Sugar-beet pulp	—	19.50	—
Soybean hulls	—	9.75	—
Corn gluten feed	—	9.75	—
Sugar-beet molasses	3.00	3.00	3.00
Sunflower oil	—	—	2.00
Calcium carbonate	1.30	0.81	0.95
Dicalcium phosphate	1.10	0.80	1.90
Vitamin and mineral premix <sup>2</sup>	0.50	0.50	0.50
Salt	0.45	0.45	0.45
Chemical analysis, % of DM			
Mineral matter	5.87	7.27	6.94
Starch	57.74	34.48	44.48
Crude protein	16.49	15.72	19.86
Crude fiber	3.16	12.42	4.28
NDF	17.21	30.67	17.15
ADF	3.25	11.00	3.79
ADL	0.58	1.36	0.51
GE, MJ/kg of DM	17.82	17.86	18.50
DE, <sup>3</sup> MJ/kg of DM	15.39	13.37	15.31
Daily allowance, kg	2.40	2.80	ad libitum

<sup>1</sup>C and HF: control diet and high-fiber diet, respectively.

<sup>2</sup>Contributed per kilogram: 10,000 IU of vitamin A; 1,500 IU of vitamin D<sub>3</sub>; 30 mg of vitamin E; 2 mg of vitamin K<sub>3</sub>; 2 mg of thiamine; 4 mg of riboflavin; 20 mg of niacin; 10 mg of pantothenic acid; 3 mg of pyridoxin; 0.02 mg of biotin; 3 mg of folic acid; 0.02 mg of vitamin B<sub>12</sub>; 500 mg of choline; 80 mg of Fe; 10 mg of Cu; 40 mg of Mn; 100 mg of Zn; 0.1 mg of Co; 0.6 mg of I; and 0.15 mg of Se.

<sup>3</sup>Calculated from INRA-AFZ (2004) tables.

characteristics of the diets are described in Table 1. The 2 diets were presented in pellet form and provided once a day at 0900. For both experimental diets, the daily supply of DE was 33 MJ. Diet C and diet HF contained 3.16 and 12.42% CF, respectively.

Within each pen of 4 pregnant sows, half of the animals were individually fed the C diet or the HF diet (C and HF sows, respectively). The diets were supplied after all sows in a group were locked in the stalls, where they remained for 75 min. They were then released into the resting area with no more possibility to enter the stalls. From the first day postpartum until weaning, sows in both treatments were fed ad libitum the same standard lactation diet (Table 1). Water was provided ad libitum in bowls during pregnancy and lactation. During lactation, daily water consumption was recorded using a water meter. The piglets received no creep feed.

### *Feeding Behavior*

During pregnancy, individual feeding behavior was recorded using several criteria. Daily feed refusals were

**Table 2.** Effect of the pregnancy diet, the week of lactation, and their interaction on ADFI, mean number of meals per day, mean feed intake per meal, feeding rate, and daily water intake during lactation

Week of lactation: <sup>2</sup>	Diet <sup>1</sup>								P-value <sup>3</sup>		
	C				HF				Diet	Week	Diet × week
	1	2	3	SE	1	2	3	SE			
ADFI, kg	5.24 <sup>a</sup>	6.39 <sup>b</sup>	6.78 <sup>b</sup>	1.10	5.66 <sup>a</sup>	6.30 <sup>b</sup>	6.87 <sup>c</sup>	0.90	0.82	0.001	0.05
No. of meals per day <sup>4</sup>	5.7 <sup>a</sup>	6.6 <sup>b</sup>	7.1 <sup>b</sup>	1.7	7.2 <sup>a</sup>	9.1 <sup>b</sup>	10.0 <sup>c</sup>	2.3	0.05	0.001	0.02
Feed intake/meal, <sup>4</sup> g	1,055	1,074	1,045	351	917	784	785	287	0.03	0.21	0.12
Feeding rate, g/min	156 <sup>ab</sup>	158 <sup>a</sup>	151 <sup>b</sup>	16	161 <sup>a</sup>	154 <sup>ab</sup>	150 <sup>b</sup>	18	0.75	0.001	0.20
Daily water intake, L	16.8 <sup>a</sup>	24.2 <sup>b</sup>	26.6 <sup>c</sup>	6.1	17.2 <sup>a</sup>	22.6 <sup>b</sup>	25 <sup>c</sup>	4.1	0.62	0.001	0.11

<sup>a-c</sup>Effect of the week of lactation within a dietary treatment: within a row, means without a common superscript letter differ ( $P < 0.05$ ).

<sup>1</sup>C and HF: control diet and high-fiber diet, respectively, fed during pregnancy.

<sup>2</sup>Wk 1: d 1 to 7; wk 2: d 8 to 14; wk 3: d 15 to 23.

<sup>3</sup>Significance of the effect of the dietary treatment, the week of lactation, and their interaction ( $n = 12/\text{group}$ ).

<sup>4</sup>Significant effect of pregnancy diet for the duration of lactation ( $P < 0.05$ ).

measured every morning after feeding. Meal duration and number of breaks within the meal period were also determined by video recordings at 5, 7, 9, 11, 13, and 15 wk of pregnancy while sows were in the feeding stalls. Feeding rate was determined at 6, 10, 12, and 14 wk of pregnancy in a feeding test, during which the amount of feed consumed over a 5-min period was measured.

During lactation, individual feeding behavior was recorded using a computerized system connected to a load cell located under the trough. Every time the trough was detected as unsteady by the load cell, it was considered a visit to the trough by the sow. Each visit was characterized by its beginning and ending time, its duration, and the amount of feed eaten. Intervals between visits were classified as between-meal intervals and within-meal intervals. To cluster successive visits to a same meal, a meal criterion was defined as the maximum length of the within-meal interval between visits. Thus, when 2 successive visits were separated by an interval longer than the meal criterion, they were not considered to belong to the same meal. In all studies that have analyzed feeding behavior, the meal criterion has been calculated using the log survivor technique as described by Bigelow and Houpt (1988). The value usually adopted for the meal criterion in lactating sows reared under temperate climates is 2 min (Quiniou et al., 2000; Renaudeau et al., 2002), and this value was checked in data of our study. Data given by the computerized design were analyzed using a 2-min meal criterion and by combining visits into meals. The following parameters were measured for each sow: ADFI, number of meals per day, feed intake per meal, feeding rate (g/min) calculated on the basis of the total daily values of feed intake, and ingestion time.

### Weight and Body Condition of the Sow

Sows were weighed and backfat thickness was measured at mating, at entrance into the farrowing crates, on the first day postpartum, and at weaning.

### Statistical Analysis

All data were analyzed using a repeated measures model with individual sows as experimental units via the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC). The model for data collected during pregnancy included the main effects of pregnancy diet, replicate, and sampling time, and the interaction between pregnancy diet and the 2 other factors. The within sow diet was considered as residual error for testing the effect of dietary treatment. During lactation, the model included the main effects of pregnancy diet, replicate, day or week of lactation, and the interaction between pregnancy diet and the 2 other factors. The sow within diet was considered as residual error for testing the effect of dietary treatment. The feeding behavior during lactation was only studied during 23 d. During this period, data were available for all experimental sows because parturitions were not synchronized but weaning occurred on the same day. When the week × diet interaction was significant, differences among weekly means were tested within treatment using the PDIF option. Pearson correlation coefficients were calculated between ADFI, the number of daily meals, meal size, and the feeding rate.

The within-day distribution of feed intake was analyzed using the MIXED procedure of SAS. Effects of replicate, pregnancy diet, week of lactation, hour of day, and their interactions were tested. For each week, the feeding periods were determined on the basis of the hourly feed intake compared with the average value recorded between 0000 and 0400, which was considered the reference value.

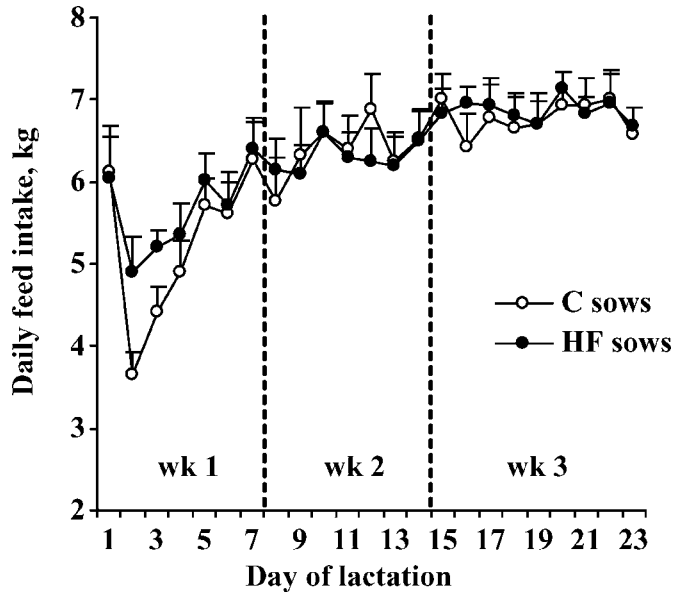
Data on sow BW and backfat thickness were analyzed using the GLM procedure of SAS, testing effects of replicate, treatment, and their interaction.

Significance was declared at  $P < 0.05$ , with a tendency at  $P < 0.10$ .

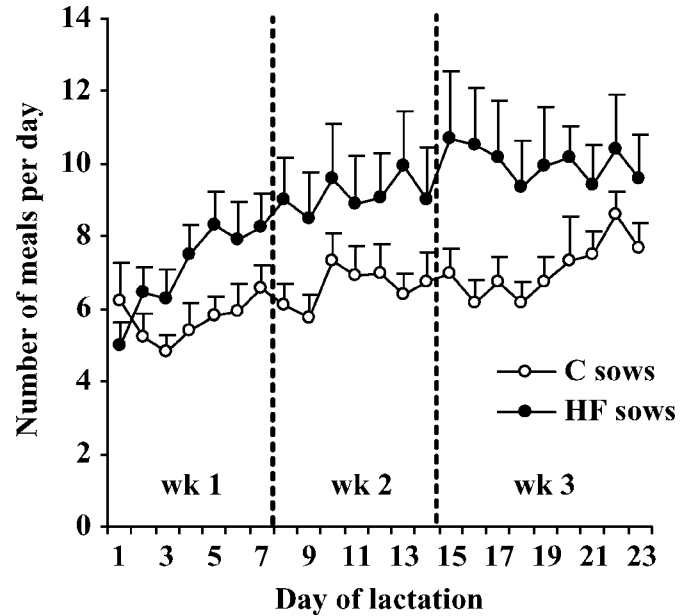
## RESULTS

### Feeding Behavior During Pregnancy

Whatever the parameter, feeding behavior was similar in the 3 replicates. The meal lasted for a longer time



**Figure 1.** The ADFI during lactation in sows receiving control (C) and high-fiber (HF) diets; diets C and HF contained 3.16 and 12.42% crude fiber, respectively.



**Figure 2.** Number of meals per day during lactation in sows receiving control (C) and high-fiber (HF) diets; diets C and HF contained 3.16 and 12.42% crude fiber, respectively.

in HF sows than in C sows ( $35.7 \pm 1.5$  vs.  $14 \pm 0.3$  min, respectively;  $P < 0.001$ ) and was more frequently interrupted as shown by a greater number of breaks during the meal period ( $0.93 \pm 0.19$  vs.  $0.01 \pm 0.01$ , respectively;  $P < 0.001$ ).

During the feeding tests, HF sows had a lower average feeding rate compared with C sows ( $130 \pm 6$  vs.  $235 \pm 7$  g/min, respectively;  $P < 0.001$ ).

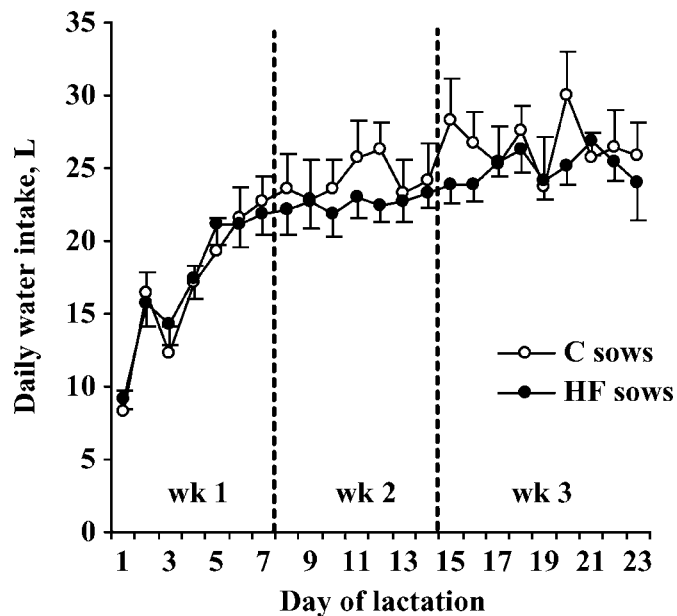
### Feeding Behavior During Lactation

None of the items of feeding behavior differed between replicates. There was no treatment effect on ADFI, but number of daily meals and feed intake per meal differed between C and HF sows (Table 2). During the whole lactation period, ADFI was 2.3% greater in HF sows (6.33 kg/d) than in C sows (6.19 kg/d), which represented 140 g more food per day, but this difference was not significant. The ADFI was not affected by treatment on wk 1, although the level was 8.1% greater in HF sows that ate 420 g more food per day than C sows (Table 2). Differences between treatments were lower during wk 2 and 3 (<2%). The HF and C sows showed a different feeding pattern; HF sows exhibited on average 2.4 more meals per day (8.9 and 6.5 meals/d, respectively;  $P < 0.05$ ) and ate on average 235 g less feed per meal (822 and 1,057 g/meal, respectively;  $P < 0.05$ ) than C sows. Feeding rate was not affected by treatment and averaged 155 g/min. In both treatments, significant correlations were found between daily feed intake and the number of daily meals ( $r = 0.48$  in HF sows and  $r = 0.54$  in C sows;  $P < 0.001$ ), and between the daily number and size of meals ( $r = -0.69$  in HF sows and  $r = -0.68$  in C sows;  $P < 0.001$ ). Correlations between the

other parameters were either significant but lower than 0.30 or nonsignificant.

The evolution of feeding behavior through the 3 wk showed an increase in ADFI ( $P < 0.001$ ) and number of daily meals ( $P < 0.001$ ), which differed according to the treatment ( $P < 0.05$ ). In C sows, ADFI and number of daily meals did not differ between wk 2 and 3 ( $400 \pm 160$  g and  $0.5 \pm 0.3$  meals/d, respectively), whereas in HF sows the values were greater during wk 3 compared with wk 2 ( $600 \pm 147$  g,  $P < 0.001$  and  $0.9 \pm 0.4$  meals/d, respectively,  $P < 0.05$ ). Meal size was not affected by week of lactation and averaged  $1,057 \pm 26$  and  $822 \pm 20$  g in C and HF sows, respectively. Feeding rate decreased from  $159 \pm 19$  to  $151 \pm 11$  g/min over the 3 wk of lactation, whatever the treatment ( $P < 0.01$ ).

The profile of the feeding behavior described a variation of ADFI ( $P < 0.001$ , Figure 1) and of the number of daily meals ( $P < 0.001$ , Figure 2) over successive days. The ADFI decreased strongly on the second day postpartum, then increased gradually until the end of wk 1 ( $P < 0.001$ ) and reached the intake level obtained on the first day. The ADFI during wk 2 and 3 did not differ according to day. The sows performed a continuous increase of the number of daily meals between d 1 and 23 of lactation:  $4.30 \pm 1.50$  meals/d in HF sows and  $1.40 \pm 0.8$  meals/d in C sows. Whatever the day, HF sows performed more meals than C sows ( $P < 0.05$ ). Meal size appeared greater on the first day postpartum in both treatments ( $1,254 \pm 225$  and  $1,509 \pm 271$  g/meal in HF and C sows, respectively) compared with the values obtained thereafter and where no change was observed ( $798 \pm 17$  and  $1,050 \pm 25$  g/meal in HF and C



**Figure 3.** Daily water intake during lactation in sows receiving control (C) and high-fiber (HF) diets; diets C and HF contained 3.16 and 12.42% crude fiber, respectively.

sows, respectively). In all cases, HF sows showed smaller meal size than C sows ( $P < 0.05$ ). Feeding rate decreased gradually over days ( $P < 0.05$ ) in both treatments.

Daily water consumption during lactation was similar in both treatments and increased over successive days and weeks ( $P < 0.001$ , Table 2, Figure 3).

### Nycthemeral Distribution of Feed Intake

All sows presented a strong diurnal and bimodal feeding pattern ( $P < 0.001$ ) with 2 distinct feeding periods, a major one in the morning and another one in the afternoon of lower amplitude and longer duration, whatever the replicate, the week of lactation, and the treatment. The feeding profile differed according to the week ( $P < 0.001$ , Figure 4). During wk 1, the morning period of feeding activity occurred from 0900 to 1100 and the afternoon period from 1400 to 1800. These 2 periods accounted for 6 h and 0.41 of the total daily feed intake. Similarly, the 2 feeding periods during wk 2 lasted 6 h and accounted for 0.41 of the total daily feed intake. The morning feeding period was initiated earlier at 0800, whereas in the afternoon the feeding period appeared more clearly defined. During wk 3, these 2 periods were of a longer duration, lasting from 0500 to 1000 in the morning and from 1400 to 1900 in the afternoon. Both periods accounted for 0.64 of the total daily feed intake.

### Weight and Backfat Thickness

Weight gain during pregnancy did not differ between treatments, whereas BW losses during lactation were

greater in HF sows ( $P < 0.05$ , Table 3). The HF sows showed a lower gain in backfat thickness during pregnancy ( $P < 0.05$ ) but lost the same amount of backfat during lactation, leading to leaner HF sows at weaning ( $P < 0.05$ ).

## DISCUSSION

The supply of a HF diet during pregnancy modulated the feeding behavior of sows during lactation. Initially, we hypothesized that sows fed a fibrous diet during pregnancy would show a greater feed intake and would exhibit a specific feeding strategy characterized by structure and sequence of meals within daytime and over lactation period. Results obtained in this study partly confirm our hypothesis.

The supply of a HF diet during pregnancy modulated the feeding behavior of sows during lactation, but effects were limited on the feed intake over time. The HF sows consumed more feed daily during the first week than C sows but with weak and nonsignificant differences. Greater feed consumption has been reported in sows fed a HF diet during pregnancy compared with sows fed a standard diet, with differences ranging from 4.4 to 10.4% over a 28-d lactation period (Matte et al., 1994; Farmer et al., 1996; Courboulay and Gaudré, 2002). In these studies, experimental diets had similar differences in CF content, but sows were given ad libitum access to the lactation diet from the second day or fifth day after parturition. In our study, ad libitum feed supply began 12 to 24 h after parturition and induced a high feed intake level on the first day of lactation, on average 6 kg, reflecting the maximum feed intake capacity of the sows recorded over the whole lactation. Such an increase was followed by a drop in feed intake as shown by Neil (1996) in sows fed ad libitum 4 d before parturition, on the day of parturition, or 3 d after parturition. This highlights a high feeding motivation of the sows on the first day after a feed restriction period, whatever the pregnancy diet. Bergeron et al. (2000) described a lower operant response to a feeding motivation test only in pregnant sows fed ad libitum compared with feed-restricted sows with a standard or a HF diet. Similarly, Arey (1992) demonstrated a high feeding motivation around farrowing. The drop of feed intake on the second day postpartum should be associated with a transiently filled digestive tract. The drop was less marked in HF sows, suggesting that sows fed a bulky diet during gestation have adapted to eat a larger amount of feed and to a greater gastric distension through the properties of the fibrous components such as their water-holding capacity, physical bulk, and chemical composition (Lepionka et al., 1997; Guérin et al., 2001). The HF sows also appeared more adapted to a high level of feed intake compared with C sows, as shown by the slight slope in the increase of the feed intake until the end of the first week of lactation, where similar levels were recorded in both treatments. Although the adaptation hypothesis cannot be ruled out,

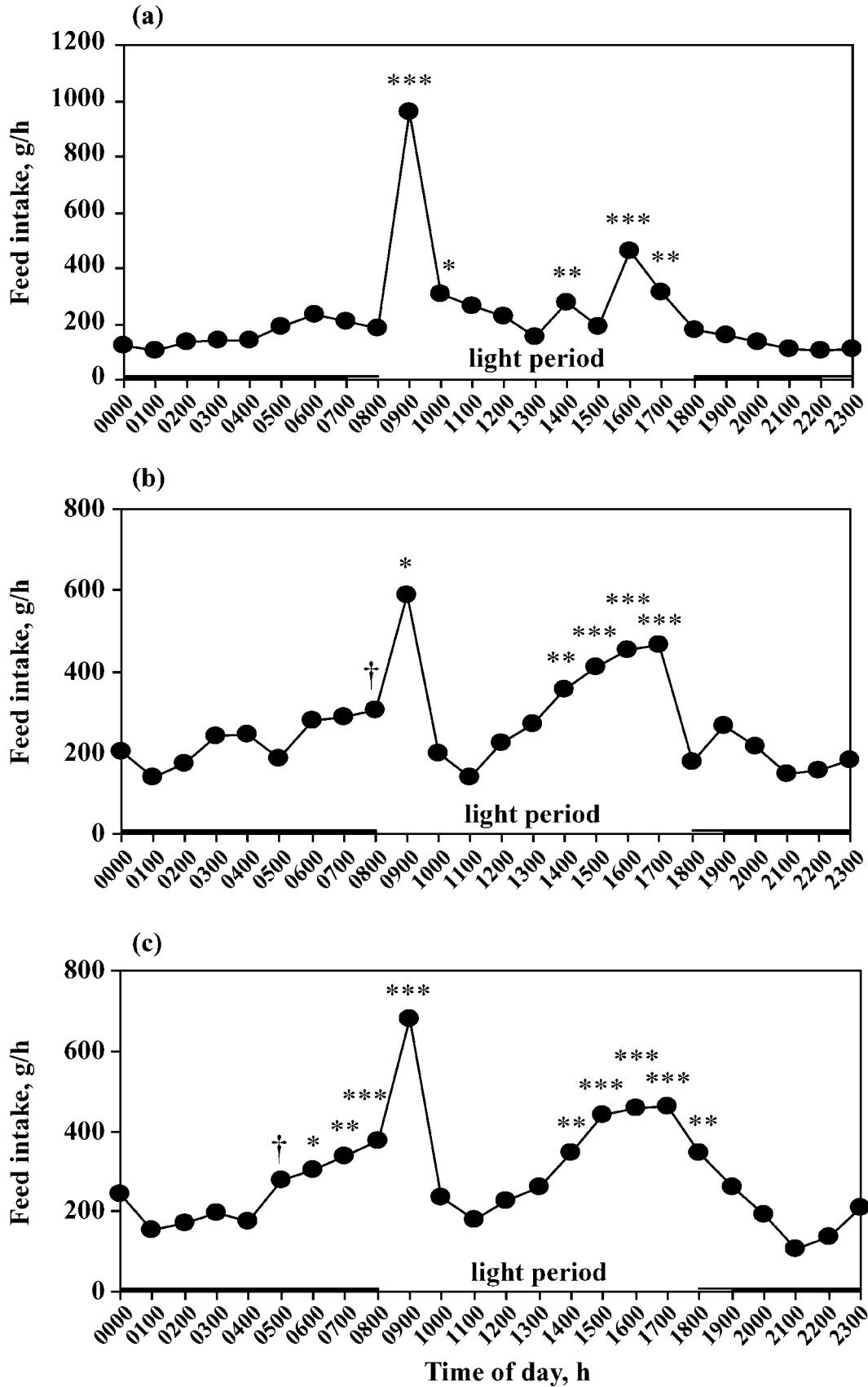


Figure 4. Feed intake per hour during the 3 successive weeks of lactation (mean values for both dietary treatments). (a) wk 1: d 1 to 7; (b) wk 2: d 8 to 14; (c) wk 3: d 15 to 23. † $P < 0.10$ , \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ , hourly feed intake was significantly different compared with the mean intake between 0000 and 0400 (reference intake).

**Table 3.** Effect of the pregnancy diet on sow BW and backfat thickness during gestation and lactation

Item	Diet <sup>1</sup>		SE	P-value <sup>2</sup>
	C	HF		
Body weight, kg				
Mating	143	143	6	0.96
d 105 of gestation	208	207	7	0.71
Gain during gestation	65	64	7	0.73
Parturition	204	200	9	0.60
Weaning	194	182	11	0.06
Loss during lactation	-10	-18	7	0.02
Backfat thickness, mm				
Mating	14.5	14.8	1.7	0.94
d 105 of gestation	19.0	17.6	2.9	0.19
Gain during gestation	4.5	2.8	1.8	0.03
Parturition	18.0	16.1	2.8	0.16
Weaning	15.6	13.6	2.3	0.05
Loss during lactation	-2.4	-2.5	2.2	0.72

<sup>1</sup>C and HF: control diet and high-fiber diet, respectively, fed during pregnancy.

<sup>2</sup>Significance of the effect of the dietary treatment (n = 12/group).

the greater feed intake level measured in HF sows during the first week of lactation might also be a consequence of their lower gain in backfat thickness compared with C sows, resulting in leaner HF sows at parturition. This difference might be partly explained by the method used to determine the daily feed allowance in each treatment, based on the DE and expecting a supply of 33 MJ of DE·d<sup>-1</sup>·sow<sup>-1</sup> during pregnancy. The lower NE/DE ratio in fibrous diet, because of the digestion of fibrous components inducing methane production, suggests that HF sows received less NE than C sows during pregnancy. According to INRA-AFZ tables (2004), daily NE values of the C and the HF diets are 23.5 and 21.1 MJ/d, respectively. Besides, the adaptation period to the experimental diet was longer in HF sows, resulting in slightly lower ADFI during gestation than expected (2.75 instead of 2.80 kg/d). A negative relationship between sow body composition at parturition and spontaneous feed intake during lactation has been shown by Dourmad (1991), with a daily decrease in feed consumption of 95 g/mm of backfat during the first week of lactation. Our results showed a difference in backfat thickness averaging 1.9 mm at parturition between the 2 treatments which could thus explain a 180 g greater daily feed intake in HF sows. The greater difference of 420 g/d obtained in the current study could then result from the feeding experience acquired by the HF sows through the consumption of a HF diet during pregnancy. However, additional studies are needed to confirm this hypothesis.

The feeding experience acquired during pregnancy by primiparous sows induced the development of feeding strategies, which were maintained over the whole lactation period: HF sows ate more and smaller meals whereas C sows ate fewer and larger meals. In return, both sows showed similar daily feed intakes and feeding rate over lactation. Spreading feed intake over a num-

ber of small meals could have been acquired by HF sows during pregnancy when sows were accustomed to taking more time to eat their daily feed ration and to take more breaks compared with C sows. Eddison and Roberts (1995) observed a wide variability in feeding strategies in dry sows and reported that some of this variability was explained by the experience acquired by the sows through consecutive reproductive cycles. Different feeding strategies have also been reported by Labroue et al. (1996) in growing pigs of 2 breeds, defined as big eaters and nibblers, respectively. These authors suggested that feeding behavior in each breed was acquired very early and did not evolve afterwards. Similarly, sows of the current study maintained their feeding strategy throughout lactation: C sows appeared as big eaters and HF sows as nibblers. Additional studies are needed to determine if these strategies are maintained over successive reproductive cycles to evaluate the role of the experience acquired during the first parity on the development of the feeding behavior.

Our results on the daily feeding pattern agree with the minimal available data reported for primiparous lactating sows in the literature. The number of daily meals obtained in our study ranged from 5 to 10 meals/d and coincided with literature values ranging from 8 to 10 (Dourmad, 1993) or 5 to 10 (Weldon et al., 1994), whereas our values on meal size tended to be greater: 800 to 1,100 vs. 560 to 649 (Dourmad, 1993) and 596 to 848 g/meal (Weldon et al., 1994).

The nycthemeral profile of feeding activity in lactating sows was found to occur mainly during the daytime with 2 distinct feeding periods, in the morning and in the afternoon. Observations conducted on domestic pigs under seminatural conditions showed that their activity was concentrated to some hours in the morning and in the late afternoon—early evening, with resting periods in the middle of the day and during the night (Wood-Gush et al., 1990). In the case of pigs raised in farm buildings, our results are in agreement with literature data in ad-libitum-fed pigs, in sows (Dourmad, 1993; Burke et al., 2000; Renaudeau et al., 2003), and in growing pigs (De Haer and Merks, 1992; Nielsen, 1995). In our experiment, the amount of feed eaten during the 2 feeding periods accounted for 0.64 of the total daily feed intake during the third week of lactation. This proportion is lower than the 0.77 and 0.86 values reported by Burke et al. (2000) and Renaudeau et al. (2003), respectively. This discrepancy could be explained by differences in the lactation period and the parity of the sows considered in those studies. Other environmental factors could be involved, such as the light variations, which have been shown to modulate the feeding activity in pigs (Feddes et al., 1989; Renaudeau et al., 2003). In the current study, the additional light provided in the farrowing room during the dark period could have induced a greater level of feeding activity compared with levels reported in literature. This could explain the lower contribution of the diurnal feeding periods to the total daily feed intake.

The current study demonstrated the impact of the feeding experience acquired during pregnancy on the feeding behavior of lactating sows. Different feeding strategies were developed in sows according to the pregnancy diet, without major differences in daily feed intakes. Results show the role of the dietary factors on the development of the feeding behavior during the first reproductive cycle. Evaluation of the persistence over successive parities of the feeding strategies induced by dietary experience could be important to the management of sow reproduction.

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