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A Long Term Study on the Health Status and Performance of Sows on Different Feed Allowances during Late Pregnancy

I. Clinical observations, with special reference to agalactia post partum

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Persson, A., A. E. Pedersen, L. Göransson and W. Kuhl: A long term study on the health status and performance of sows on different feed allowances during late pregnancy. I. Clinical observations, with special reference to agalactia post partum. Acta vet. scand. 1989, 30, 9–17. – Thirty nine pairs of full sibs were investigated over 6 parities in a long term study on the effects of late pregnancy feed allowance on the occurrence of agalactia post partum and on the performance of sows and piglets. A careful examination of all sows with a rectal temperature exceeding 39.5°C was performed by a veterinarian within the first 48 h after farrowing. Milk-samples were taken from sows with elevated rectal temperatures and showing clinical symptoms of agalactia. During the last 15 days of gestation the sows in the control group were fed 3.4 kg daily and the sows in the experimental group 1.0 kg daily of a commercial type of diet. In 26.6 % of the farrowings in the control group the sows were agalactic whereas the corresponding figure in the experimental group was 14.4 %.

On clinical examination udder changes were observed in a majority of the diseased sows in both groups. However, the agalactic sows in the control group were generally more affected, with lower water and feed consumption than in the experimental group. No effects of age of the sow (parity number) or length of the gestation period on the incidence of agalactia were demonstrated. The rectal temperature of agalactic sows was significantly higher than in the healthy sows already 1 day before farrowing. The agalactic sows farrowed a larger number of stillborn piglets, which indicates an early establishment of the disease. The number of weaned piglets at 6 weeks did not differ between agalactic and healthy animals. The interval from weaning to first oestrus was not influenced by agalactia in the preceding lactation.

Agalactia post partum; late pregnancy feeding; clinical signs; parity number; length of gestation period; litter size; oestrus interval; causes for culling.

Introduction

Agalactia post partum is a disease syndrome frequently diagnosed in the sow at farrowing, or within the first 48 h after parturition (*Hermansson et al.* 1978). The range of incidence in Swedish herds has been reported from 5.5 % in small herds to 10.3 % in large herds (*Bäckström* 1973). More recent figures from Denmark reveal an incidence of 9.5 %, independent of herd size, calculated from a total of 80,000 farrowings (*Jorsal* 1983).

The main clinical symptoms in diseased

sows often originate from the mammary gland resulting in hypogalactia or agalactia. Enlargement and discoloration of one or more mammary glands and reluctance to allow nursing are common findings in agalactic animals. Pathological and microbiological findings at necropsy have indicated that mastitis associated with isolation of *Escherichia coli* is an important component of the disease (*Ringarp* 1960, *Ross et al* 1975, *Middleton-Williams et al.* 1977, *Ross et al.* 1981). Affected sows also often show an elevated rectal temperature and inappetence (*Ringarp* 1960, *Hermansson et al* 1978). Mortality is usually low but considerable losses are seen due to starvation and insufficient colostrum intake in the offspring (*Jorsal* 1983). The treatment of agalactic sows usually includes oxytocin to reestablish the milk flow as quickly as possible, antibiotics and corticosteroids (*Elmore & Martin* 1986).

The etiology of the agalactia syndrome appearing within 48 h after parturition is still unknown although many causes, such as hormonal dysfunctions, stress, mycotoxins and bacterial infections, have been suggested in the literature (*Ross et al.* 1975, *Ross et al.* 1981, *Elmore & Martin* 1986).

In some herds a prolonged gestation period has been reported to precede agalactia (*Ringarp* 1960). In recent investigations however, no differences in length of gestation periods have been shown between healthy and agalactic sows (*Hermansson et al.* 1978, *Jorsal* 1983).

Partus induction using prostaglandins (PG F_2 alpha) in herds with a high incidence of agalactia has been shown to reduce the frequency of clinical agalactia (*Einarsson et al.* 1975, *Bäckström et al* 1976).

The work of *Ringarp* (1960) and field studies by *Sandstedt et al.* (1979) have drawn attention to the influence of feeding intensity during late pregnancy on agalactia in the sow. In one of the field studies carried out by *Sandstedt & Sjögren* (1982), the occurrence of agalactia was significantly reduced after a substantial restriction of the daily feed allowance together with increased access to hay or straw during the last 3 weeks of gestation.

With reference to these results a research programme to study the effects of very restricted late pregnancy feeding on health status and performance was designed. The results from this research programe will be presented in a series of papers. In this paper the clinical observations with special reference to agalactia post partum are presented.

Materials and methods

Animals

A total of 39 pairs of full sibs (Swedish Landrace x Swedish Yorkshire) were used in the experiment, approximately 2/3 of them entering as gilts. Each sow was if possible kept for 6 parities. One sib was allocated to the control group, the other to the experimental group.

The gilts were mated at their second oestrus using a Swedish Yorkshire boar and the same boar was in most cases used for each sib pair. Three weeks before expected farrowing the sows were transferred to the farrowing pens. Weaning was carried out when the piglets were 6 weeks old. At weaning the sows were moved to stalls next to the boar for mating and the piglets were kept in the farrowing pens for another 3 weeks. After mating sows were kept in pens in groups of 4 but were individually fed. Data concerning performance and reproduction were collected.

Feeding

All sows were fed a commercial type of diet (Table 1) and had free access to straw and

Table 1. Composition of the feed mixture used in the experiment.

Composition:	%
Barley	59.1
Oats	20.0
Wheat bran	5.0
Lucerne meal	5.0
Soy bean meal	4.0
Fishmeal	2.0
Meat meal	2.0
Minerals ans vitamins	1.9
Chemical composition:	
ME, MJ/kg	11.5
Crude protein %	14.9
Digestible crude protein, g/kg	115
Crude fibre, %	5.8
Ca, %	0.82
P, %	0.60

water. The total amount of feed given during the gestation period was the same for both groups. The animals in the control group (C) were fed 2.4 kg per day the first 100 days of pregnancy and then 3.4 kg day until farrowing. The experimental group (E) was offered extra feed between 30–100 days of gestation and then fed 1.0 kg daily (minerals and vitamins supplemented) during the last 15 days of gestation. During lactation the daily feed allowance was increased to a maximum of 4.0 kg + 0.2 kg per piglet within 14 days after farrowing.

Experimental design

The rectal temperature was monitored twice a day, morning and evening, starting 2 days before expected farrowing and continuing until 2 days after farrowing to detect diseased sows as early as possible. When a sow had a temperature exceeding 39.5°C within the first 48 h after farrowing an examination was performed immediately by a veterinarian.

The general condition and temperament of the sow, appetite and thirst were recorded and the external genital organs were inspected. Milk samples were collected from at least 4 different glands of each sow after careful disinfection. Preferably glands with signs of inflammation were sampled together with normal glands opposite to the affected ones. After sampling the sows were treated parenterally with oxytocin and broad-spectrum antibiotics. Severely affected animals were also treated with corticosteroids. The treatment with antibiotics was continued for another 2 days. A follow-up clinical examination including collection of milk from the same glands was done 2 days later. Milk sampling was then repeated 7 and 21 days after the sow was first diagnosed as being ill. Sows not showing symptoms of agalactia were milk sampled as healthy controls but in these cases no clinical examinations were performed. Milk samples were collected during altogether 78 lactations of agalactic sows and 96 lactations of healthy sows. The sampling technique and results from milk analysis will be presented in a separate paper (*Pedersen et al.* in prep.).

Statistical methods

Statistical evaluation was performed using procedures available from the Statistical Analysis System (*SAS* 1982:. Frequency distribution was established using PROC FREQ, where significance was determined by the chi-square test. The analysis includes: agalactia incidence, recurrence rate of agalactia, some clinical observations, agalactia occurrence in subsequent parities. Analysis of variance was carried out according to the GLM procedure. The following model was used for rectal temperature measurements, length of gestation, litter size at birth and weaning, and interval to the first oestrus:

$$y_{ijk} = \mu + a_i + b_j + (ab)_{ij} + e_{ijk}$$

where y_{ijk} = the i . . . th observation
μ = general mean
a_i = effect of group (E, C)
b_j = effect of agalactia
$(ab)_{ij}$ = interaction effect
e_{ijk} = error term

Results

The investigation comprised 376 lactations. In the experimental group, the sows developed agalactia in 26 out of 181 lactations and in the control group, in 52 out of 195 lactations ($0.01 > p > 0.001$). The age distribution (parity number) of agalactic and healthy sows, milk sampled or not respectively, is presented in Fig. 1.

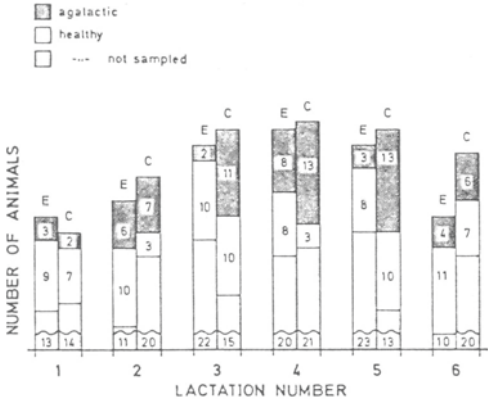

Figure 1. Number of animals included in the trial. One bar for the experimental (E) and one bar for the control (C) group respectively represent each lactation number. Each bar is divided into three separate parts, which denote agalactic, healthy and healthy but not sampled sows.

The recurrence rates of agalactia among the two groups of sows (E and C respectively: are presented in Table 2. After exclusion of all lactations of sows diseased at 3 or more lactations the incidence of agalactia decreased from 26.6 % to 19.4 % in the control group and from 14.4 % to 9.7 % in the experimental group. The rectal temperatures of

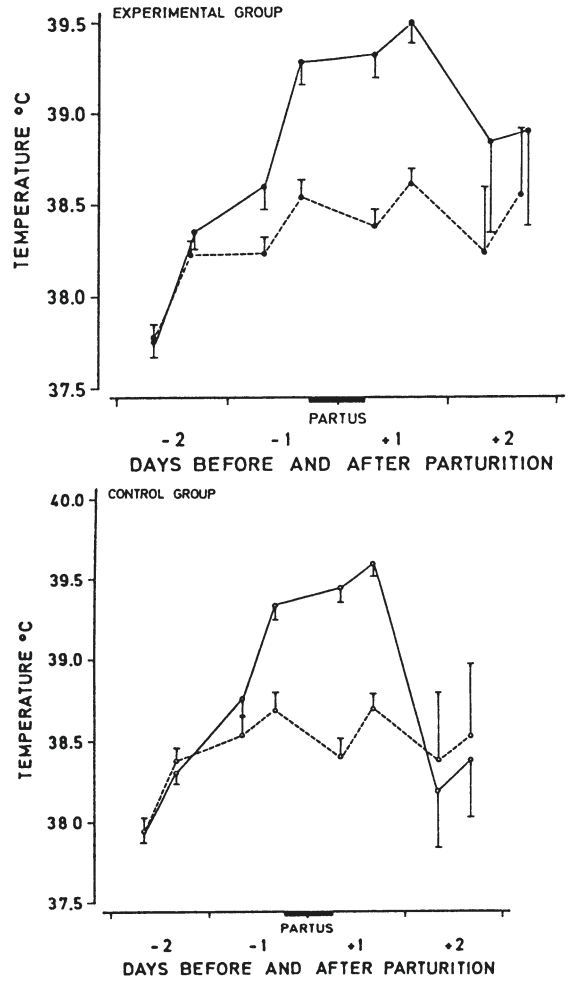

Figure 2 a and 2 b. Rectal temperatures of periparturient sows belonging to experimental (●———●) and control group (○———○) respectively. The upper lines in both figures illustrate the elevated rectal temperature in sows which developed agalactia post partum, while the lower lines illustrate the rectal temperature of apparently healthy sows. Horizontal black bar denotes time of parturition.

the affected and healthy sows are presented in Figs. 2a and b. The mean temperature was significantly higher in the affected sows from 1 day before farrowing until 1 day after

Table 2. Occurrence of agalactia.

Group	Number of animals never diseased during the experimental period	Number of animals diseased at 1 lactation	Number of animals diseased at 2 lactations	Number of animals diseased at more than 2 lactations
Experimental	24	9	3	3
Control	11	13	9	6

farrowing. No differences were found between control and experimental animals within the diseased and healthy groups, respectively.

Results concerning the general condition and feed and water consumption in the diseased sows are given in Table 3. A majority of the sows in the control group were clinically affected at first examination whereas on the same occasion the majority of experimental animals were registered as unaffected. At the second examination most of the animals were normal in both groups. In 46.2 % of agalactic sows in the control

Table 3. Clinical observations in agalactic sows.

General condition	Experimental group n = 26		Control group = 52	
	1st examinat	2nd examinat	1st examinat	2nd examinat
Unaffected	16	19	15	33
Irritated	2	3	9	5
Depressed	6	2	23	4
Apathetic	1	0	2	0
Information not available	1	2	3	10
Feed consumption				
Normal	20	24	24	39
Low	3	0	11	3
None	2	0	13	0
Information not available	1	2	4	10
Water consumption				
Normal	21	24	24	40
Low	2	0	11	2
None	2	0	13	0
Information not available	1	2	4	10
Clinical udder changes				
Number of lactations with udder changes observed as reddening and/or swelling and or soreness	23	15	38	16

group, the consumption of water and feed was reduced or completely ceased at the first examination. The corresponding figure in the experimental group was 15.4 %. The results from the clinical examinations of the udders of the agalactic sows are given in Table 3. Udder changes were recorded in 88 % of the lactations in the experimental group and in 73 % in the control group on the first examination and in 58 and 31 % respectively on the second examination. One of the agalactic sows in the control group showing udder changes had developed severe symptoms of circulation failure at the first examination.

In 10 of 26 farrowings in the experimental group and in 19 of 52 farrowings in the control group vaginal discharge was observed at one or both of the clinical examinations. In only 2 agalactic lactations were symptoms of clinical metritis observed.

No differences were seen in incidence of agalactia for the different parities (Table 4).

Table 4. Distribution of agalactia according to parity (number of animals). Only animals entering the experiment as gilts are included.

	Parity					
Sows	1	2	3	4	5	6
Healthy	44	36	39	32	31	29
Agalactic	5	10	7	13	13	7

Data of length of gestation periods and oestrus are given in Table 5. No effect of the length of the gestation period on agalactia was registered. Neither were differences found in the interval from weaning to first oestrus for healthy and agalactic animals respectively. No differences in litter size at birth or at weaning were found between agalactic and non-agalactic sows (Table 6). However, agalactic sows farrowed a significantly higher number of stillborn piglets compared to non-agalactic sows (Table 6).

Twenty-six of 39 sows in the experimental group and 32 of 39 sows in the control group remained in the trial throughout the designated 6 lactations. Due to reproductive disturbances, e. g. abortion or failure to hold to service, 5 sows in the experimental group and 2 sows in control group were slaughtered during the experiment. Five animals in the experimental group and 2 animals in the

Table 5. Length of gestation and interval from weaning to first oestrus (days). Mean ± s.e.m.

Sows	Gestation length	Weaning to first oestrus
Agalactic	115.1 ± 0.2[a] (n = 77)	6.9 ± 0.7[b] (n = 74)
Non agalactic	115.0 ± 0.2[a] (n = 92)	6.4 ± 0.6[b] (n = 85)

[a, b] Means within columns with the same superscript are not significantly different ($p > 0.05$).

Table 6. Litter size at birth and at weaning. Mean ± s.e.m.

	Litter size		
	at birth		at weaning
Sows	born alive	stillborn	
Agalactic	11.4 ± 0.3[a] (n = 71)	1.0 ± 0.1[a] (n = 76)	9.1 ± 0.3[a] (n = 76)
Non agalactic	12.2 ± 0.3[a] (n = 93)	0.6 ± 0.1[b] (n = 93)	9.6 ± 0.3[a] (n = 93)

[a, b] Means within columns with different superscripts are significantly different ($p < 0.001$). All other within column means are not significantly different ($p > 0.05$).

control group were slaughtered due to acute disease, such as sudden paralysis or bone fractures. One animal in the experimental group and 2 animals in the control group were culled due to chronic lameness caused by arthritis and abscesses. The cause of culling was not recorded for 3 animals. Most of the remaining sows could be used for other experimental purposes.

Discussion

When comparing the results from the present experimental study with results obtained from earlier field studies it must be emphasized that this was a long-term study at an experimental station where a number of sows were followed through 6 lactations.

The incidence rates of agalactia in the present study were high, 14.4 % and 26.6 % in the experimental and control groups, respectively which might be due to the very careful observation of the sows allowing detection also of mild cases of agalactia post partum (see Introduction). The early diagnosis of agalactia in the present study is also demonstrated when comparing general condition as well as water and feed consumption of agalactic sows with the results of *Hermansson* (1978) and *Ringarp* (1960), as the sows in our study were found to be less clinically affected.

Recurrence rates of agalactia in this study are in agreement with earlier observations (*Hermansson et al.* 1978, *Jorsal* 1983). No significant effect of parity number on agalactia could be observed in contrast to the results of *Jorsal* (1983), who found that first parity sows were significantly more often agalactic and that incidence rates decreased with an increasing farrowing number. These conflicting results might be due to the different designs of the trials. In the present study the same sows were followed during 6 consecutive lactations.

A prefarrowing increase in the rectal temperatures was registrered in all sows in this study. Significant differences were seen in body temperatures between agalactic and healthy animals already 1 day before expected farrowing. No differences however were obtained between control and experimental animals. Using radiotelemetry *Elmore & Martin* (1979) continuously monitored rectal temperatures in clinically healthy sows from 1 week before expected farrowing till 3 weeks after farrowing. The mean prefarrowing value was 38.3°C and the temperature began to increase at a mean of 13 h prior to the delivery of the first piglet. During the whole lactation period the temperature varied between 38.9°C and 39.5°C. Within 24 h after weaning the temperature returned to the prefarrowing level. The significantly higher rectal temperatures in agalactic sows in the present study indicate an early establishment of the disease.

The mechanisms behind the influence of reduced feeding on agalactia have been discussed in earlier reports. In our trial the group given a restricted feed allowance had a significantly lower incidence of agalactia. Results from registrations regarding general condition, thirst and appetite in diseased sows also indicate that the control animals were more affected than animals in the experimental group. These results suggest an impact of feeding intensity not only on incidence but also on severity of agalactia. *Ringarp* (1960) proposed that bacterial toxin production in the intestinal tract could be of etiological importance and *Sandstedt & Sjögren* (1982) proposed that reduced feeding could impair the conditions for toxin production in the gut. *Gooneratne et al.* (1982) found an altered composition of colostrum from sows which subsequently developed agalactia and suggested that the premature initiation of lactation resulting in an en-

gorgement of the mammary gland predisposes the sow to agalactia. The intensity of feeding might in the present study have affected the initiation of lactation and/or the udder engorgement in connection with parturition, resulting in an impaired susceptibility to udder infections. These factors however must be further elucidated. Udder changes were registered in 88.4 % of agalactic sows in the experimental group and in 73.1 % of agalactic sows in the control group. These results are in accordance with the work of *Ringarp* (1960), but higher than in the work of *Hermansson* (1978), who reported signs of mastitis in 45–52 % of agalactic sows. The differences in percentages of agalactic sows with udder changes between groups C and E in the present study might indicate an influence of feeding intensity. The results from bacteriological and cytological examinations of milk from affected and nonaffected sows will be presented separately (*Pedersen et al.* in prep.). However, it should be mentioned that in more than 80 % of the agalactic lactations in both groups significant levels of bacteria were found in the milk from one or more mammary glands.

In 29 of 78 farrowings in the present study vaginal discharge was observed at one or both clinical examinations. However, only 2 were diagnosed as cases of metritis. *Hermansson* (1978) after careful inspection found the presence of a vaginal discharge in 97 % of affected sows and 88 % of normal sows. During recent years it has been shown by histopathology and bacteriology that metritis is not a consistent component of the agalactia syndrome (*Ross et al.* 1981, *Middleton-Williams et al.* 1977). However, in some herds metritis occurring within the first days after farrowing could be a problem.

In the current study no effects of the length of the gestation period on the occurrence of agalactia were found. Neither was agalactia shown to influence the interval from weaning to first oestrus. These results agree well with the results of *Hermansson* (1978) and *Jorsal* (1983). In our material no differences were seen between healthy and agalactic sows regarding total number of piglets born. Sows developing agalactia farrowed more stillborn piglets than healthy sows. These results indicate an early effect of the post partum agalactia syndrome during late pregnancy and/or in labour. This is also supported by the previously described rise in rectal temperatures before parturition.

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Sammanfattning

En långtidsstudie rörande hälsotillstånd och produktionsresultat hos suggor på olika fodergivor under sen dräktighet

I. Kliniska iakttagelser med speciell inriktning på agalaktia post partum

Effekterna av fodergivans storlek under de sista 15 dräktighetsdagarna på förekomsten av agalakti post partum hos sugga studerades i ett långtidsförsök där 39 systerpar följdes under 6 laktationer. Frekvensen agalakti var signifikant högre bland de djur som erhållit en högre fodergiva under högdräktigheten jämfört med de djur som fått en kraftigt reducerad fodertilldelning under samma period. Vid den kliniska undersökningen uppvisades majoriteten av agalaktisuggorna förändringar i juvret. Insjuknade suggor visades redan från en dag före grisning ha en signifikant högre rektaltemperatur än de djur som inte drabbades av agalakti post partum. De djur som insjuknade fick dessutom ett signifikant högre antal dödfödda grisar. Dessa observationer indikerar att sjukdomen var etablerad redan före grisningen. Inget samband sågs mellan dräktighetstidens längd eller suggans ålder och förekomsten av agalakti. Reproduktionen observerad som intervallet från avvänjning till första brunst påverkades inte av att suggan haft agalakti under den föregående laktationen.

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