

Relationship among body condition at parturition, decrease of backfat thickness and weight during the lactation and the interval from weaning to oestrus of sows

Relação entre a condição corporal na época do parto, a diminuição de espessura de toucinho e de peso corporal durante a lactação e o intervalo desmama-cio em fêmeas suínas

CORRESPONDENCE TO:
Roberto Maurício Carvalho Guedes
Departamento de Clínica e Cirurgia
Veterinária
Escola de Veterinária da Universidade
Federal de Minas Gerais
Caixa Postal 567
Av. Antonio Carlos, 6.627
30161-970 - Belo Horizonte - MG
e-mail: giraorh@vet.ufmg.br

1 - Departamento de Clínica e Cirurgia
da Escola de Veterinária da UFMG - MG

Roberto Maurício Carvalho GUEDES¹; Raimundo Hilton Girão NOGUEIRA¹

SUMMARY

The main objectives of this study were to verify the relationship among body condition at parturition, decrease of backfat thickness and weight during the lactation and the interval from weaning to oestrus of sows. It was performed with 10 gilts and 10 fifth, sixth and seventh parity Camborough sows. The average breeding age and weight of the gilts were respectively 231 days and 149.5 kg. During lactation all females were fed a wet diet (3.34 Mcal/kg, 17% CP), *ad libitum*. The average daily food consumption was 5.233 for gilts and 5.721 kg for multiparous sows. Ultrasonic measurements of backfat at the P₃ site were recorded on day 6 before and days 2, 7, 14, 21 and 25 after parturition. Body weight was recorded on the same dates, except the day before parturition. Sows were divided into 2 groups according to their backfat thickness 6 days before parturition. Sows with a backfat thickness of 16 mm or less were assigned to the L-group, while those with a backfat thickness more than 16 mm were assigned to the H-group. After weaning, the interval from weaning to oestrus was recorded. The percentage of total weight loss during lactation was slightly higher (not significant) in the H-group (-4.26%) than in the L-group (-2.64%). The percentage of backfat thickness decreased in both groups from 6 days before parturition until day 25 of lactation, but the decrease was highest in the H-group ($p < 0.03$). The weaning-oestrus interval did not differ significantly between the 2 groups. In conclusion: there was no correlation between percentage of weight loss (total) and weaning to oestrus interval, or percentage of backfat thickness loss (total or by periods) and weaning-oestrus interval, or percentage of weight loss (total or by periods) and percentage of backfat thickness loss (total or by periods). On the other hand, there was a significant positive correlation between weaning-oestrus interval and percentage of weight loss during the third week of lactation.

UNITERMS: Sows; Body weight; Backfat thickness; Body condition; Weaning; Oestrus.

INTRODUCTION

Strategies for sow nutrition imply attention to long term reproductive performance. Consequently, when examining the influences of nutrition at different stages of the reproductive cycle it is important to consider their effect on the whole breeding life-time. In this context, body condition and how it is influenced by the level and pattern of supply of energy and nutrients is generally considered of key importance. Relationships exist between the different phases of the reproductive cycle and their influence needs to be accommodated in developing an appropriate strategy³.

In recent years, it has been suggested that the long-

term reproduction of sows is best served by minimizing weight and fat loss in lactation². Such a strategy would require only a minimal restoration of weight in the following pregnancy; which would be beneficial since the greater the feed intake and weight gain in pregnancy the greater the weight loss in lactation^{7,10}.

The rate at which maternal fat deposits are mobilized in a sow during lactation, reflected by a loss of weight and a decrease in backfat thickness, is influenced by body weight and backfat thickness at parturition^{9,15}, litter size^{12,15}, but the rate of maternal fat mobilization varies considerably between sows^{8,12}. During the past 10 years there has been significant use made of ultrasonic probes to measure the depth of backfat in the live animal, most commonly at the

P₂ position (65 mm from the mid line at the level of the last rib), and this parameter is now frequently recorded in experiments as an indication of the change in fat reserves in sows⁶. It is known that the modern sow has a great dependence on maternal body reserves than previously, because they frequently fail to consume enough food to meet the nutritional requirement of a short lactation⁵. It is also known that excessive fat loss during lactation delays the return to normal cyclic activity after weaning^{8,12}.

The main objectives of this study were to verify the relationship among body condition at parturition, decrease of backfat thickness and weight during the lactation and the interval from weaning to oestrus of sows.

MATERIAL AND METHOD

This study was carried out in a 250 sows farrow-to-finish commercial unit located at Pedro Leopoldo county (Minas Gerais, Brazil), using 10 gilts and 10 fifth, sixth and seventh parity Camborough sows. The average breeding age and weight of the gilts were respectively 231 days and 149.5 kg. During pregnancy all females were kept indoors, with 3 or 4 sows in each pen. One week before expected parturition they were moved to individual parturition pens, where they remained during the lactation period, which lasted 23-27 days. After weaning they were moved back to the gestation unit.

During pregnancy the sows were fed 2.4 kg/day (2.96 Mcal/kg, 16% crude protein) and during lactation all sows were fed a wet diet (3.34 Mcal/kg, 17% crude protein), *ad libitum*, three times per day. After weaning the same ration was offered once daily at morning, until mating. The NRC guidelines of energy and crude protein for bred and lactating sows, respectively, are 3.34 Mcal/kg and 12%, and 3.34 Mcal/kg and 13%.

The piglets were cross-fostered within 72 hours after birth to minimize differences in litter size (range 10-11). Ultrasonic measurements of backfat at the P₂ site were recorded on day 6 before, and days 2, 7, 14, 21 and 25 after parturition. Body weight was recorded on the same dates, except the day before parturition. Sows were divided into 2 groups according to their backfat thickness 6 days before parturition. Sows with a backfat thickness of 16 mm or less (9 animals) were assigned to the low (L) backfat thickness group, while those with a backfat thickness more than 16 mm (11 animals) were assigned to the high (H) group. After weaning, oestrus control was performed with a boar once daily, and the interval from weaning to oestrus was recorded.

The statistical analysis was carried out with the SAS GLM and correlation procedures¹¹. Changes in sow

percentage of weight loss and backfat thickness loss and weaning to oestrus interval were analyzed using Student's T-test. Correlation among percentage of weight loss and backfat thickness loss and weaning to oestrus interval were attempted.

RESULTS

Percentile changes in live weight and backfat thickness of sows and length of the interval from weaning to first oestrus are given for the H- and L-groups in Tab. 1.

The average daily food consumption was 5,233 kg for gilts and 5,721 kg for multiparous sows. Sow weight loss was greatest during the second week of lactation. Total weight loss during lactation was slightly higher (not significant) in the H-group (-4.26%) than in the L-group (-2.64%). H-group sows lost weight (-0.43%) while L-group sows gained (1.72%) during the first week of lactation.

Backfat thickness decreased in both groups from 6 days before parturition until day 25 of lactation, but the decrease was highest in the H-group ($p < 0.03$). Sow backfat thickness loss was greatest during the third week of lactation. The weaning to oestrus interval did not differ significantly between the 2 groups.

There was no correlation between percentage of weight loss (total) and weaning to oestrus interval ($r = -0.05$), or percentage of backfat thickness loss (total or by periods) and weaning to oestrus interval ($r = -0.18$), or percentage of weight loss (total or by periods) and percentage of backfat thickness loss (total or by periods, $r = 0.32$). There was a significant positive correlation between weaning to oestrus interval and percentage of weight loss during the third week of lactation ($r = 0.51$).

DISCUSSION

The poor correlation between backfat thickness and weight loss during lactation observed in this study had already been reported by Whitemore *et al.*¹⁴ and Reese *et al.*⁸ According to Cole³, the relationship between liveweight change and fat change is not good, as sows are able to gain weight and lose fat at the same time. This fact could be explained because weight loss is not a consequence of only fat tissue loss but also of lean tissue, as muscle waste. In addition, fat and muscle catabolism is quite different.

It has been suggested by Mullan⁶ that the amount of body reserves at parturition and weaning are the critical factors affecting sow reproductive performance rather than the amount of tissue mobilized during lactation. In this study, in spite of the difference of backfat thickness between the two groups at parturition and the greater fat ($p < 0.03$)

Table 1

Changes in live weight (%) and backfat thickness (%) of sows during lactation and weaning to first oestrus interval in the high and low backfat thickness groups (means with standard deviations). Belo Horizonte, October, 1996.

N° of sows	Backfat thickness		P-value, effect of backfat thickness (H or L)
	High (H) 11	Low (L) 9	
Percentage of weight loss per period:			
First week after parturition	-0.43 (± 2.97)	1.72 (± 2.85)	0.12
Second week after parturition	-2.74 (± 1.24)	-2.97 (± 1.96)	0.75
Third week after parturition	-0.91 (± 1.64)	-1.15 (± 3.56)	0.85
From third week to weaning	-0.17 (± 1.65)	-0.21 (± 1.68)	0.96
Total weigh loss during lactation	-4.26 (± 3.32)	-2.64 (± 5.01)	0.40
Percentage of backfat thickness loss per period:			
Last week of gestation	1.75 (± 5.95)	-2.03 (± 5.54)	0.92
First week after parturition	-5.61 (± 7.18)	-1.58 (± 6.46)	0.21
Second week after parturition	-3.69 (± 7.53)	-2.87 (± 5.70)	0.79
Third week after parturition	-7.29 (± 4.73)	-3.71 (± 5.88)	0.29
From third week to weaning	-2.02 (± 4.01)	0.81 (± 5.12)	0.18
Total backfat thickness loss	-19.87 (± 10.01)	-8.76 (± 10.91)	0.029*
Length of weaning to oestrus interval			
Interval	5.00 (± 0.77)	4.89 (± 1.69)	0.85

* p < 0.05 (significant).

and weight losses of the H-group during lactation, there was no significant difference in weaning to oestrus interval between the two groups. It seems that, even losing a great amount of fat, well-conditioned sows could keep a normal reproductive performance. In addition, there was no correlation among weight and backfat thickness loss and weaning to oestrus interval (by periods or total), except for weight loss at the third week of lactation. However, Hulten *et al.*⁴ found that sows with higher backfat thickness at parturition mobilize maternal deposits at a higher rate during the first week of lactation than sows with lower backfat thickness. This fact indicates that sows can change body condition but, on the other hand, are able to keep their normal metabolic state, leading to no differences in reproductive function. Recently, several researchers have suggested that changes in reproductive hormones released in response to dietary manipulation are mediated through blood metabolic hormones, or a combination of metabolites and hormones rather than through direct effects of body fat or protein reserves. Accumulating evidence is consistent with the contention that numerous metabolites and hormones are mediators of dietary influences on reproduction. Some that have been cited include the

metabolites glucose, nonesterified fatty acids, and individual amino acids and the hormones insulin, growth hormone, insulin-like growth factor I, glucagon, the thyroid hormones, the brain-gut hormones, and the adrenal glucocorticoid hormones¹. According to Tokach; Dial¹³ and based on the results of this study, body tissue stores may be involved secondarily by acting as a buffer for these circulating metabolites.

In summary, the results of this study suggest that 1) H-group sows lose more fat tissue during lactation than L-group sows; 2) the higher backfat thickness decrease occurs during the third week of lactation; 3) even greater backfat thickness loss does not imply percentile weight loss, showing the difference in fat and muscle catabolism; and 4) the length of weaning to oestrus interval does not correlate to the body condition losses, suggesting the greater importance of the metabolic imbalance on reproductive performance.

ACKNOWLEDGMENTS

This study was supported by the Fundação de Amparo à Pesquisa do Estado de Minas Gerais, FAPEMIG (grant # 2141).

RESUMO

Este trabalho teve como objetivo verificar a relação entre a condição corporal na época do parto, a diminuição da espessura de toucinho e de peso corporal durante a lactação e o intervalo desmama-cio em fêmeas suínas. Vinte porcas Camborough, sendo 10 marrãs e 10 porcas adultas com a ordem de parto variando entre o 5º, 6º e 7º partos, foram divididas em dois grupos experimentais seis dias antes do parto previsto. A média de idade e de peso das marrãs por ocasião da cobertura foi de 231 dias e 149,5 kg, respectivamente. Durante a lactação, os animais foram alimentados com ração lactação molhada, à vontade (3,34 Mcal/kg e 17% PB). O consumo médio de ração foi de 5,233 kg para as marrãs e de 5,721 kg para as porcas. O grupo-H constituído de 11 fêmeas com espessura de toucinho sobre o ponto P₂ superior a 16 mm, e o grupo-L de 9 fêmeas com espessura de toucinho igual ou inferior a 16 mm. As mensurações de espessura do toucinho sobre o ponto P₂ foram feitas 6 dias antes do parto e 2, 7, 14, 21 e 25 dias após o parto. O peso corporal foi mensurado nas mesmas datas, com exceção da data antes do parto. Foi observado o intervalo desmama-cio de cada animal. A percentagem de perda de peso durante a lactação foi ligeiramente maior (não-significativa) no grupo-H (-4,26%) do que no grupo-L (-2,64%). A percentagem total de espessura de toucinho diminuiu nos dois grupos, entretanto foi maior no grupo-H (p < 0,03). O intervalo desmama-cio não diferiu entre os dois grupos. Não se observou correlação entre a percentagem total de diminuição de peso e o intervalo desmama-cio, ou entre a percentagem de diminuição de espessura de toucinho (total e por períodos) e o intervalo desmama-cio, ou entre a percentagem de diminuição de peso (total e por períodos) e a percentagem de diminuição de espessura de toucinho (total e por períodos). Entretanto, existiu correlação positiva entre o intervalo desmama-cio e a percentagem de diminuição de peso na terceira semana de lactação.

UNITERMOS: Porcas; Peso corporal; Espessura de toucinho; Condição corporal; Desmama; Estro.

References

- 1- BOOTH, P.J. Metabolic influence on hypothalamic-pituitary-ovarian function in the pig. **Journal of Reproduction and Fertility**, p.89-100, 1990. Supplement 40.
- 2- COLE, D.J.A. Nutrition and reproduction. In: COLE, D.J.A.; FOXCROFT, G.R. **Control of pig reproduction**. London: Butterworths, 1982. p.121-31.
- 3- COLE, D.J.A. Nutrition strategies to optimize reproduction in pigs. **Journal of Reproduction and Fertility**, p.67-82, 1990. Supplement 40.
- 4- HULTEN, F.; NEIL, M.; HAKANSSON, J. Energy metabolism during late gestation and lactation in multiparous sows in relation to backfat thickness and the interval from weaning to first oestrus. **Acta Veterinaria Scandinavica**, v.34, n.1, p.9-20, 1993.
- 5- LYNCH, P.B. Voluntary food intake of sows and gilts. In: FORBES, J.M.; VARLEY, M.A.; LAWRENCE, T.L.J. (Eds.). **The voluntary food intake of pigs**. Edinburg: British Society of Animal Production, 1989. p.13; 71-7.
- 6- MULLAN, B.P. The catabolism of fat and lean by sows during lactation. **Pig News and Information**, v.2, n.2, p.221-5, 1991.
- 7- O'GRADY, J.F. Energy and protein nutrition of the sow. In: HARESIGN, W. **Recent advances in animal nutrition**. London: Butterworths, 1980. p.121-31.
- 8- REESE, D.E.; PEO Jr., E.R.; LEWIS, A.J. Relationship of lactation energy intake and occurrence of post-weaning estrus to body and backfat composition in sows. **Journal of Animal Science**, v.58, n.5, p.1236-44, 1984.
- 9- ROJKITTIKHUN, T.; EINARSSON, S.; EDQVIST, L.E.; UVNAS-MOBERG, K.; LUNDEHEIM, N. Relationship between lactation-associated body weight loss, levels of metabolic and reproductive hormones and weaning-to-oestrous interval in primiparous sows. **Journal of Veterinary Medicine, Serie A**, v.39, n.6, p.426-32, 1992.
- 10- SALMON-LEGAGNEUR, E.; RERAT, A. Nutrition of the sow during pregnancy. In: MORGAN, J.T.; LEWIS, D. **Nutrition of pigs and poultry**. London: Butterworths, 1962. p.333-52.
- 11- SAS Institute. **SAS stat TM User's Guide**. 5.ed. Cary, NC: SAS Institute, 1985.
- 12- STERNING, M.; RYDHMER, L.; ELIASSON, L.; EINARSSON, S.; ANDERSON, K. A study on primiparous sows of the ability to show standing oestrus and to ovulate after weaning. Influences of loss of body weight and backfat during lactation and of litter size, litter weight gain and season. **Acta Veterinaria Scandinavia**, v.31, n.2, p.227-36, 1990.
- 13- TOKACH, M.D.; DIAL, G.D. Managing the lactating sow for optimal weaning and rebreeding performance. **Veterinary Clinics of North America: Food Animal Practice**, v.6, n.3, p.559-74, 1992.
- 14- WHITTEMORE, C.T.; FRANKLIN, M.F.; PEARCE, B.S. Fat changes in breeding in sows. **Animal Production**, v.31, n.2, p.183-90, 1980.
- 15- YANG, H.; EASTHAM, P.R.; PHILLIPS, P.; WHITTEMORE, C.T. Reproductive performance, body weight and body condition of breeding sows with differing body fatness at parturition, differing nutrition during lactation, and differing litter size. **Animal Production**, v.48, n.1, p.181-201, 1989.

Received: 31/03/1998

Accepted: 03/09/1999