Chapter 4
Characteristics of female breeding stock

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This chapter will provide:

- A ranking of focus points with regard to feeding of replacement gilts
- A brief description of inherent as well as nutritional and management factors important for sow longevity and performance

1. Introduction and terminology

Female breeding stock includes gilts and sows. A gilt is a young female pig that eventually becomes a sow. The term “gilt” is used very broadly and not only for breeding stock; in some areas the term is also used for female pigs destined for slaughter and consumption. In Danish, a young non-pregnant gilt destined for breeding is called “polt” and a pregnant gilt is called “gylt”. The term gilt is also frequently used until the first litter is weaned. After the first farrowing, the terms primiparous sow, 1st litter sow or 1st parity sow are also used. For sows having their second or later litter, the generic term “multiparous sow” is commonly used. To be more specific, the terms 1st litter sow or 1st parity sow, 2nd litter sow or 2nd parity sow etc. are used.

2. Replacement gilts

The future sow is recruited among the population of replacement gilts. Thus, decisions along this recruitment are decisive for the quality and performance of the future sow. These decisions include choice of genotype and choice of feeding strategy for the gilt. Most female breeding stock in Denmark at present are Landrace x Yorkshire hybrids. Many farmers buy replacement gilts from farms or companies specialized in raising breeding stock. This will usually ensure animals that are genetically superior with regard to the traits included in the breeding programme such as growth rate, feed efficiency and litter size. Some traits are, however, sensitive to feeding and other ma-

nagement factors, and rearing conditions therefire contribute to the final outcome of gilt rearing, i.e. the sow.

2.1. Feeding and subsequent leg strength

The purpose of rearing gilts is to produce future sows that have the capacity to produce many big and uniform litters and at the same time remain healthy. This purpose is quite different from that of rearing pigs for slaughter and consumption. In the latter case, focus is on producing animals with optimum amounts of edible meat. These animals have a relatively short lifespan, and since they never mature there is no need to focus on the long-term effects of rearing such as for example effects on leg problems at maturity. Leg strength is indeed a prominent example of a trait affected by feeding. It has been shown convincingly that relatively high feeding levels during the rearing period will lead to an increase in leg problems in the future sow (Figure 4.1). This is probably due to bone and joint development not keeping pace with the increase in weight of muscle and fat tissues. Thus, feeding levels should be within a range that does not compromise leg development relative to the increase in body weight.

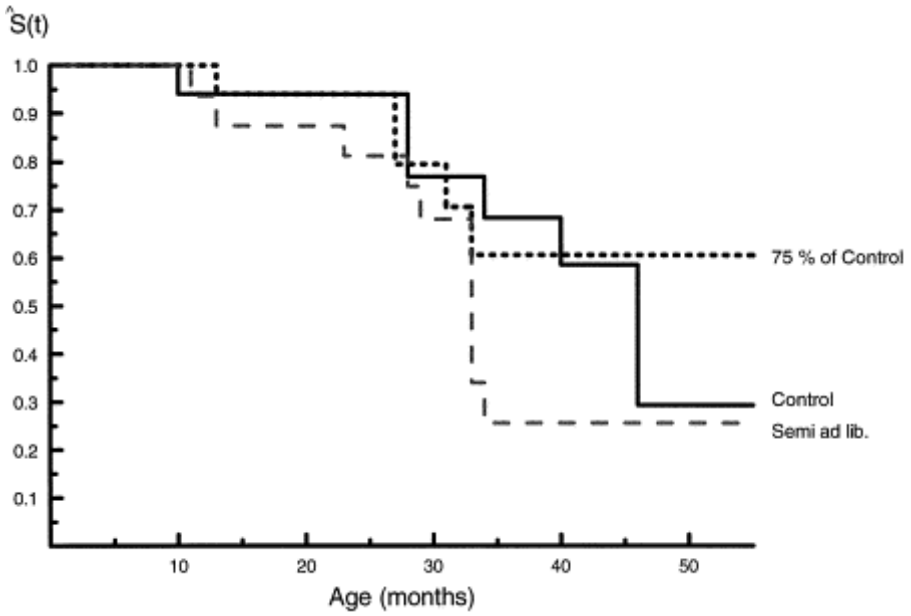

Figure 4.1.The probability (S(t)) of a pig not being culled due to leg disorders as a function of different feeding levels from 6 weeks of age to mating. It is clear that the risk of being culled at a relatively early age is increasing with increasing feeding level (from [3]).

2.2. Feeding and subsequent reproduction

Future reproductive performance of the sow is another trait that may be affected by the feeding level of the gilt. Consequently, recommendations for gilt rearing usually include a recommendation with regard to weight and fatness at breeding. Under normal conditions, sexual maturity is mainly determined by age, and a relatively high feeding level will therefore result in heavy and fairly fat gilts at sexual maturity and breeding and vice versa. From the scientific literature it is, however, evident that there is a wide range of weight and fatness within which the effect on subsequent reproduction performance is marginal. Because reproductive performance seems rather unaffected by growth rate and fatness of the gilt, feeding within the ranges normally practised will not affect subsequent reproductive performance significantly.

2.3. Feeding and subsequent milk production

A third trait worthwhile considering in gilt feeding is the future milk production of the sow. The normal mammary development of growing gilts as well as gestating gilts is illustrated in Figure 4.2 by the mammary tissue DNA content. Since the DNA content is the same in all cells, the figure illustrates the development in the total number of cells in mammary tissue. From the figure, it appears that mammary development accelerates at approx. 3 months of age in growing gilts and in the third trimester of gestation in gestating gilts. In cattle, mammary development in heifers and subsequent milk production of the cow is compromised if the pre-pubertal heifer is raised at a feeding level that is too high. A similar relationship has not been documented in pigs. On the contrary, there are indications that high feeding levels from three months of age to puberty is beneficial to mammary gland development in the gilt [8]. However these pre-pubertal feeding effects are probably of minor significance. This is mainly because the mammary development after parturition can compensate for a sub-development before parturition [2]. Furthermore, the amount of mammary DNA increases by 100 % from day 5 to day 21 of lactation demonstrating that an important part of mammary development occurs from parturition until peak lactation [4]. This latter mammary development is entirely dependent on the piglets, i.e. their ability to remove the milk (suckle) efficiently.

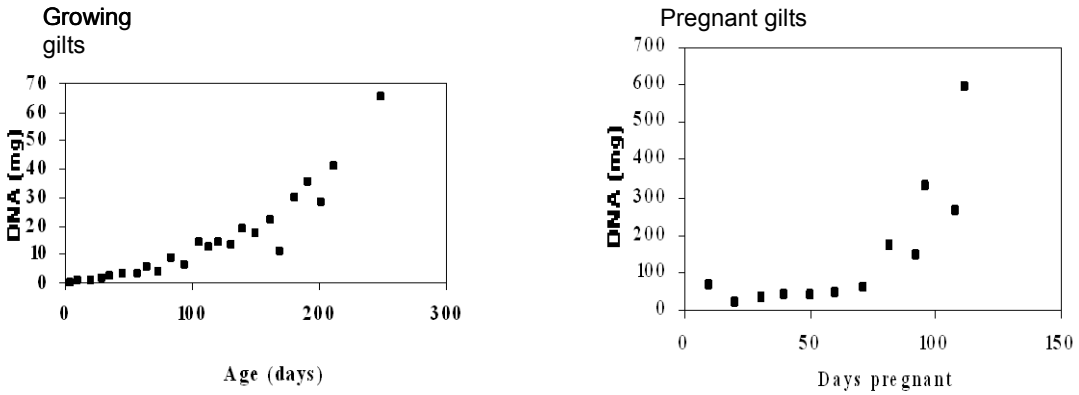

Figure 4.2. Development of mammary gland tissue DNA in growing (left figure) and gestating (right figure) gilts (from [7]).

2.4. Feeding replacement gilts

With marginal effects of feeding on future reproduction and milk production, the main focus in gilt feeding therefore should be on ensuring a good locomotion apparatus of the future sow. With the genotypes commonly used under Danish conditions, the current recommendation is to feed for a weight of approx. 130 kg and a backfat thickness of 12-18 mm at a recommended breeding age of 230-240 days. There are several ways to attain this condition as outlined in a publication from Pig Research Centre [5] all of which are most likely to ensure a good locomotion apparatus.

3. The sow

The ideal sow is one that is able to produce several big and uniform litters and remain healthy. The sow should have a long productive lifetime (also often described as longevity), and preferably the sow should be culled due to age. What are the characteristics of such a sow?

3.1. Sows with long productive lifetime

A way to identify long productive lifetime sows is to describe the characteristics of their contrasts, i.e. the sows that are being culled. The ideal sows are those not possessing the characteristics of culled sows. So what are the most common reasons for culling? Surveying the scientific literature

clearly indicates that reproductive failure, which can cover a variety of problems such as failure to cycle or inability to conceive, is the single biggest reason why sows are removed from the breeding herd. The literature also reveals that the reasons for culling vary somewhat with parity. For example, reproductive failures together with leg problems are the predominant reasons why parity 3 sows and sows younger than this are culled. Consequently, getting younger females to reproduce seems to be the largest challenge in order to improve sow longevity. Once sows reach the fourth parity, culling for reproductive failure becomes less of an issue, and leg problems together with poor performance, for example small litter size and low litter growth rate, become more dominant reasons. Health, disease, and milking and farrowing problems are also reasons for culling although less frequent. Furthermore, in the oldest sows age is a reason for culling. Thus an ideal sow is one that is prolific, has strong legs and feet, weans large, uniform and fast growing litters and remains healthy, and therefore can be culled due to age.

3.2. Performance and parity

Performance as related to parity is illustrated in Figure 4.3. From this figure, it is evident that peak performance is attained at around parity 3-4, and culling before this age will therefore not allow the sow to show its full potential and it does not leave the farmer with the possibility to cull the sow due to poor performance. The optimal time for replacement depends on a number of factors such as the expected future performance of the sow and the cost and expected future performance of the replacement gilt. From Figure 4.3 it can be inferred that a sow in 2008 staying in the herd for eight parities will produce a total of around 115 live piglets.

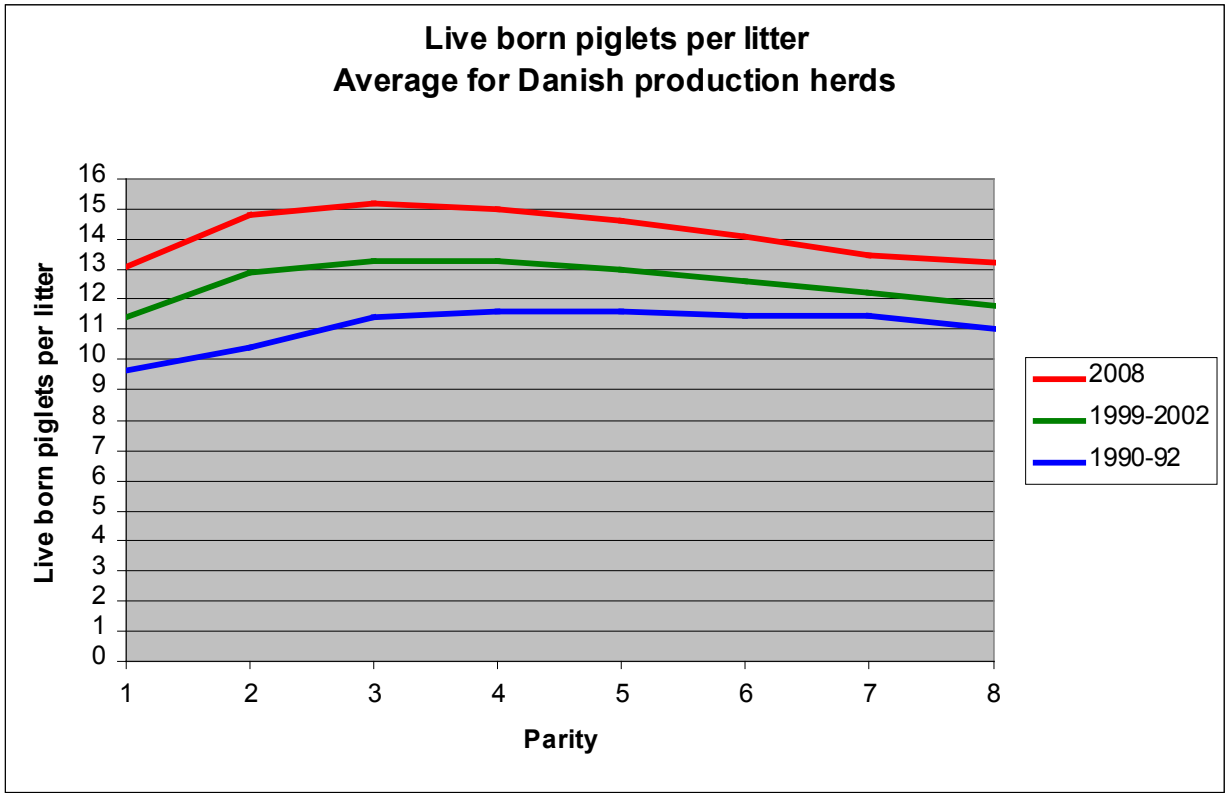

Figure 4.3. Litter size of sows as a function of parity. Selection for increased litter size was introduced in 1992 (Thorup, unpublished data from Pig Research Centre).

Figure 4.3 also shows that the number of live born piglets has increased significantly from the early 1990es to 2008. This is mainly attributed to the implementation in 1992 of a breeding programme that included total litter size at birth as a selection criterion. In 2004, the selection criterion was adjusted to litter size at 5 days of age to decrease the number of weak piglets unable to survive the first days of life. Despite this adjustment, litter size is still increasing.

3.3. Performance and body condition

Nutrition may be a contributing factor for culling due to reproduction failure. For example, Figure 4.4 shows that a loss of more than 16% of the protein mass during lactation corresponding to approximately 5 kg will lead to a substantial increase in the wean-to-oestrus interval. A loss of this magnitude will normally not be found under commercial conditions; however with an average loss of approximately 1.5 kg body protein several sows will experience a greater loss. At a loss of 9-12% of the protein mass corresponding to 2.8-3.8 kg body protein, piglet growth rates and ovarian function start to decline [1]. Due to variation among sows, this magnitude of protein loss will probably be found under commercial conditions.

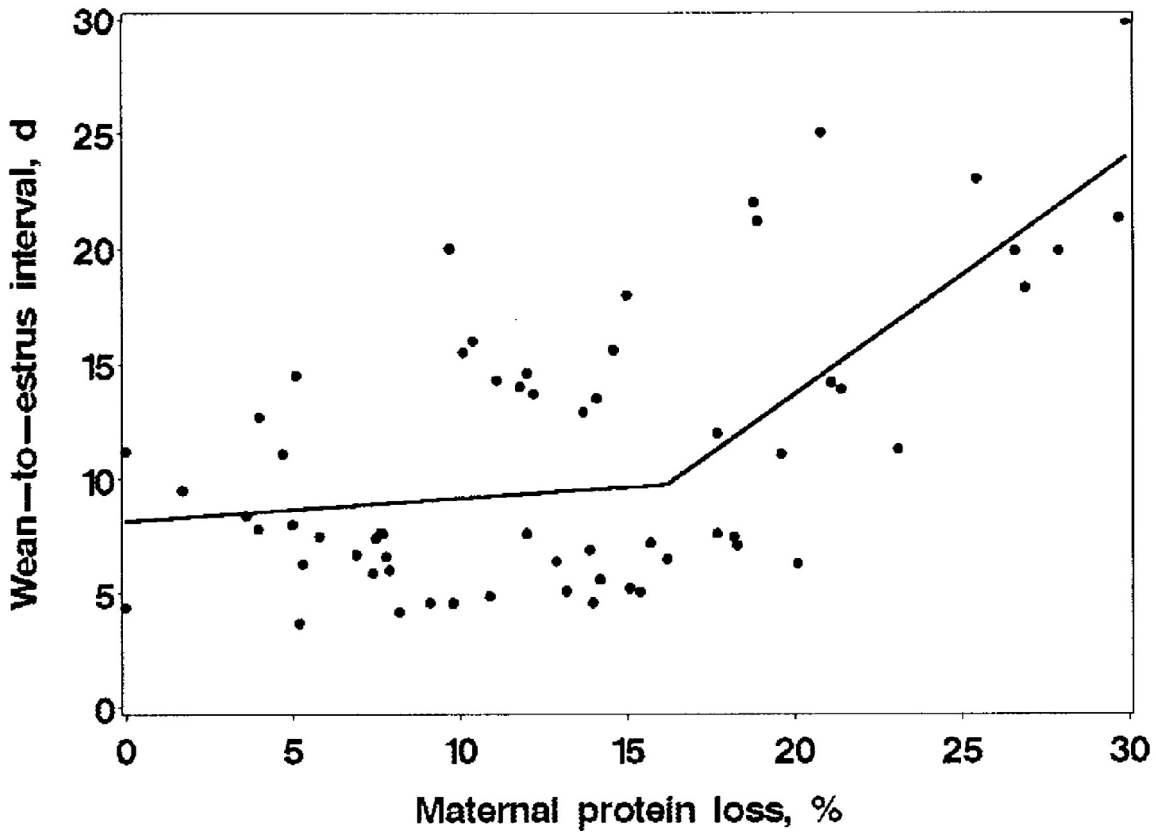

Figure 4.4. Break-point analysis of wean-to-oestrus interval vs. maternal protein loss. Wean-to-oestrus interval increased once sows had mobilized more than 16% of their protein mass (data from 16 experiments collected by [1]).

Although excessive tissue loss may be suboptimal for reproduction, fluctuations in tissue pools along with cycles of pregnancy and lactation are a natural phenomenon (Figure 4.5). There is a characteristic loss of body protein and fat in the order of 1.5 kg protein (equal to approximately 6.5 kg muscle tissue) and 5 kg fat during lactation followed by a similar gain during pregnancy. Fat and protein losses can be estimated from changes in live weight and backfat thickness by an equation provided by Whittemore and Yang [10].

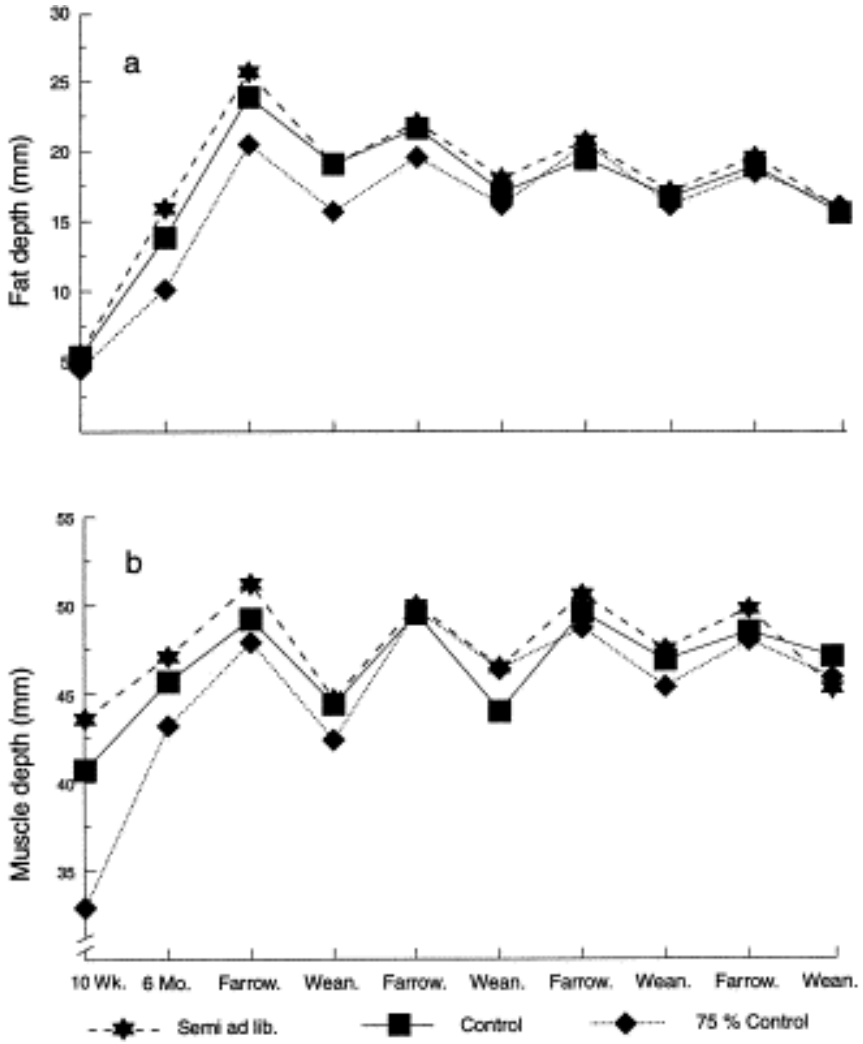

Figure 4.5. Changes in ultrasound (a) subcutaneous fat and (b) muscle (M. longissimus) depth at the last rib in gilts/sows subjected to different feeding levels from 6 weeks of age to first mating (from [6]).

The weight loss during lactation mirrors the fact that high-prolific sows are unable to meet the nutrient output in milk with the nutrient intake in the feed and thus have to mobilize from body tissue pools. In other words, a good milker will inevitably lose weight. A sow that does not lose weight during lactation is therefore likely to produce unsatisfactory amounts of milk to attain a satisfactory litter growth rate. However, there is a limit of approx. 5% in first parity sows and 10% in older sows beyond which the weight loss will compromise not only milk production and litter growth, but also the next reproductive cycle [9]. During weight loss, fat and protein mobilization occur simultaneously, however it is not known whether fat or protein loss affect reproduction the most. Traditionally body fat mass and loss have attracted most attention in this respect; but, as indicated, body protein loss is also important.

4. Concluding remarks

Nutrition of gilts has significant long-term effects on the leg strength of the future sow and probably only minor effects on production traits, and one main focus in gilt nutrition should therefore be ensuring a good locomotion apparatus. Sow longevity and performance are governed by inherent as well as nutritional and management factors. The importance of nutrition on reproduction and lactation will be dealt with in detail in Chapters 16 and 17.

5. References

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