Replacement heifer rearing on modern dairy farms – part two

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The switch to more 'Holstein' animals in modern dairy farming has resulted in a higher target live weight at calving.

Garnsworthy (2005) suggests that target live weight at calving has increased 13-22% since 1956.

This higher target live weight at calving has necessitated increased growth rate targets throughout the rearing period. It appears that most of this increased growth rate required occurs in the 6-12 month phase.

Growth rates are affected by various factors including:

- Feeding level.
- Feeding system.
- Housing system.
- Group size.
- Group homogeneity.
- Genetic growth potential.
- Animal health.
- Quality of management.

Target growth rates depend on target age at first service, which in turn depends on target age at first calving.

In 1997 Kossaibati and Esslemont calculated that the total cost of rearing a heifer to calve at a particular age was £1,037 for 24 months, £1,340 for 30 months and £1,638 for 36 months.

Although these figures are likely to be different today, for example due to changes in feed costs, they illustrate the cost of delaying first calving. It has been suggested that the increased cost of delayed first calving can be partially offset by increased milk yield in the first lactation, although Garnsworthy (2005) suggests that the economic benefit is unlikely to exceed 20% of the extra costs.

A greater age at first calving not only costs more but also increases the number of heifers being reared at any one time which can put pressure on labour and housing.

As a general guide replacement heifers should be served at 13-15 months old at 55-60% mature weight to calve at 22-24 months old at 85-90% of mature weight.

Recommended target live weights and growth rates throughout the rearing period based on Holstein-Friesian heifers calving at 550kg at 24 months of age can be seen in Table 1.

Sejrsen (2000) suggests that overfeeding energy during the prepubertal period may negatively affect mammary gland development and milk production later in life.

The highest milk yield potential is thought to be best secured at a feeding level resulting in a daily live weight gain of 700-750g/day in the prepubertal period (Sejrsen, 2005).

Housing

The first housing a calf encounters is the calving area, which can be a significant source of infection, for example ingestion of maternal faeces has been associated with transmission of Johne's disease, rotavirus, coronavirus and Cryptosporidium parvum. Therefore it is essential that the calving area is managed to minimise the risk of disease spread.

Ideally cows should be calved in individual pens, which are cleaned and disinfected after each calving, and should only be moved to these pens just prior to calving to minimise contamination. Calving cows in this way has been shown to reduce the risk of both calf pneumonia and diarrhoea (Frank and Kaneene 1993 and Svensson et al. 2003).

If this is not possible, as a second best measure the calving area should be well-bedded, have good drainage, be cleaned out and disinfected regularly and not overstocked. The calving area should also be well ventilated, free of draughts and have low humidity.

Numerous studies have reported an increased risk of infection when calves are left in the calving area for more than a few hours so it is advisable to move calves out of it soon after birth.

Various types of calf housing are present on modern dairy farms. Calves can be housed individually or in groups. It may be better to house calves individually initially as this reduces the spread of disease, as long as the housing is cleaned and disinfected between calves, although group housing allows increased social interactions and more exercise.

If calves are housed individually, regulations state that they must be allowed visual and tactile contact with neighbouring animals and that they must be group housed from eight weeks of age. If calves are housed in groups, Breen et al. (2012) suggest that the group size should be no greater than 4-6 calves and there should be no more than 30 calves sharing a single air space.

In addition to this there should be no mixing of different age groups or of calves from different sources and younger calves should not share air spaces with older animals.

Floor space requirements are important. As a general rule, for individually housed calves the width of the pen should be at least equal to the withers height of the calf and the length should be at least 1.1 times the body length of the calf from nose to pin bone.

Minimum floor space requirements for group housed calves can be seen in Table 2. Air space requirements are just as important as floor space requirements.

DairyCo (2012) suggest that minimum air space requirements are 6m³/calf at birth increasing to 10m³/calf at two months old and 15m³/calf at six months old.

Whatever the type of housing, it is

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Table 1. Target live weights and growth rates for Holstein-Friesian heifers calving at 550kg at 24 months of age (from Dawson and Carson 2005).

Age	Target live weight (kg)	Target growth rate (kg/day)
Birth	41	
6 weeks	65	0.60
12 weeks	95	0.70
6 months	160	0.70
10 months	230	0.60
14 months	330	0.80
23 months	530	0.75
24 months	550	0.66

Weight of calf (kg)	Approx. age (months)	Min. floor space requirement (m²/calf)
45	0	1.5
46-99	0-2	1.5
100-149	3-5	1.5
150-199	5-7	2.0
>200	7+	3.0

Table 2. Minimum floor space requirements for group housed calves (from DairyCo 2012).

Stillbirth	<2%
Mortality <24 hours old	<5%
Mortality 24 hours old to weaning	<2-5%
Incidence rate of diarrhoea in the pre-weaning period	<0.08 cases/calf
Incidence rate of respiratory disease in the pre-weaning period	<0.05 cases/calf
Mortality post-weaning to calving	<2%
Incidence rate of respiratory disease in the post-weaning period	<0.05 cases/calf

Table 3. Targets for mortality and the main calf diseases (from Breen et al. 2012).

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essential that ventilation is good as it prevents build-up of dust and waste gas, for example ammonia, which irritate the respiratory tract and compromise calf respiratory defences, making calves more susceptible to pneumonia. In most cases natural ventilation will be adequate, although in some cases mechanical ventilation may be required due to building design constraints. Natural ventilation relies on air coming in through an inlet, rising due to the stack effect and then flowing out through an outlet.

To optimise natural ventilation, DairyCo (2012) suggest that the inlet area should be ~0.05m^2/calf and the outlet area ~0.04m^2/calf with the outlet being at least 1.5m above the inlet. Although it is important to ensure good ventilation, housing should be free of draughts and temperature should be maintained above a critical temperature of 12°C. Ventilation should never be restricted in an attempt to raise temperature, instead additional bedding should be provided.

Relative humidity is also important and should be maintained below 75% as above this pathogen survival is greater. Good ventilation will help to maintain relative humidity below this level, as will good drainage, which can be achieved by ensuring floors have a minimum slope of 5% or 1 in 20, and provision of a clean dry bed.

Good hygiene is essential and housing should be completely cleaned out and disinfected on a regular basis. An all-in all-out system with cleaning and disinfection in between is the ideal but this is not always possible, especially on farms that have an all-year-round continuous calving pattern.

Calf diseases

The pre-weaning period is the high risk period for disease. A survey by USDA in 2010 showed an overall pre-weaned calf mortality rate of 7.8%. The two main diseases responsible for calf morbidity and mortality in this period are diarrhoea and pneumonia. The USDA survey reported that 12.4% of pre-weaned calves were affected with pneumonia and 23.9% with digestive problems, and that mortality rates were 56.5% for diarrhoea and 22.5% for pneumonia. Targets for mortality and the main calf diseases can be seen in Table 3.

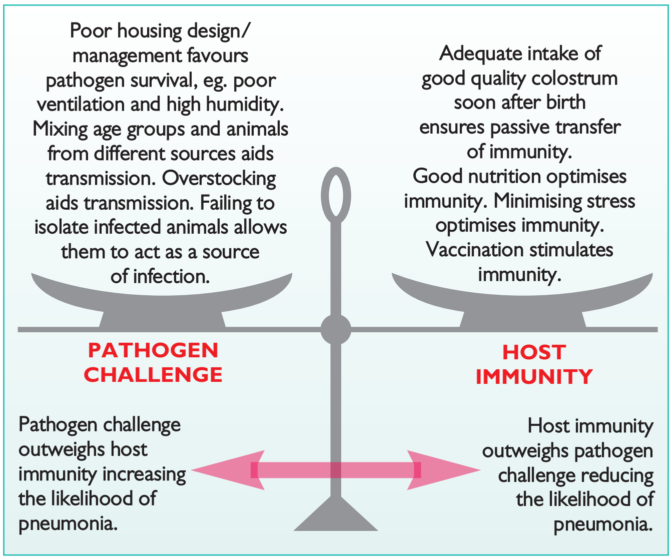


Fig. 1. Diagram illustrating the factors which influence the balance between pathogen challenge and host immunity, which in turn influences the likelihood of pneumonia occurring.

Pneumonia

Calf pneumonia has a huge economic impact on modern dairy farms. Andrews (2000) estimated the average cost of a case of pneumonia in dairy calves to be £43.26, with the highest components of this cost being reduced weight gains followed by medicine costs.

In addition to this, pneumonia may have long term effects on performance, including decreased future milk production, decreased fertility and increased probability of mortality. Therefore prevention of pneumonia is essential on modern dairy farms.

Pneumonia pathogens include Bovine Respiratory Syncytial virus, Parainfluenza 3 virus, Infectious Bovine Rhinotracheitis virus, Bovine Viral Diarrhoea virus, Mannheimia haemolytica, Pasteurella multocida, Haemophilus somnus, Mycoplasma dispar and Ureaplasma spp.

The occurrence of pneumonia depends on the balance between pathogen challenge and host immunity as illustrated in Fig. 1.

Controlling pneumonia involves reducing factors that aid pathogen challenge, for example ensuring housing is well ventilated, and increasing factors that aid host immunity, for example ensuring adequate intake of good quality colostrum. Vaccination can be useful in the control of pneumonia, but it should never be used as an alternative to good housing design and management, and before it can be used the pathogens present on the farm must be identified.

Metaphylactic therapy can be used in the face of an outbreak to aid control of pneumonia, but routine use is not advisable due to the risk of development of antibiotic resistance.

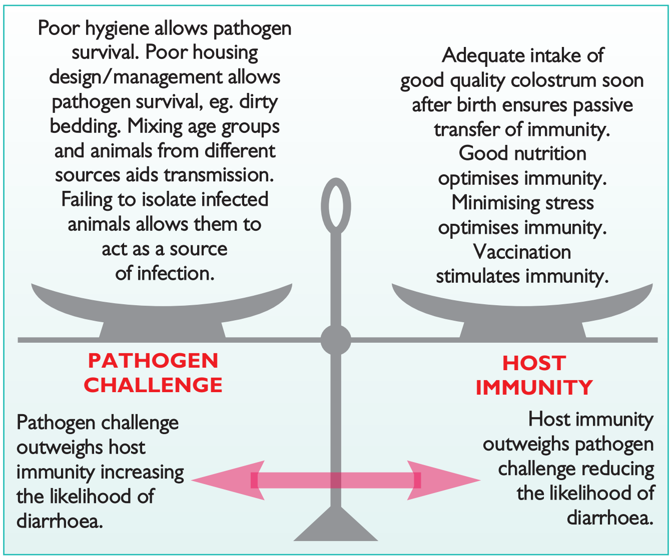
Flöck (2004) suggests that ultrasonography can be a useful tool in the diagnosis of calf pneumonia as it can be used to assess the amount of lung tissue affected, and therefore provide prognostic information. Although normal lung tissue is difficult to visualise using ultrasonography, as ultrasound waves are unable to penetrate through gas-filled structures, areas of consolidation, frequently present in cases of calf pneumonia, can be visualised as hypoechoic areas containing hyperechoic dot and line-shaped structures.

Diarrhoea

Calf diarrhoea also has a huge economic impact on modern dairy farms, with the greatest losses being due to mortality, treatment costs and poor growth rates.

Calf diarrhoea can be nutritional or infectious. Nutritional diarrhoea can result from failure of abomasal clot formation, for example due to milk replacer not being made up according to the manufacturer's recommendations or feeding skim-milk powder replacer that has been highly heat treated, or from overfeeding. Infectious diarrhoea can be caused by a number of pathogens including rotavirus, coronavirus, E. coli, salmonella, clostridia and cryptosporidia. As for pneumonia, the occurrence of infectious diarrhoea depends on the balance between pathogen challenge and host immunity as illustrated in Fig. 2.

Fig. 2. Diagram illustrating the factors which influence the balance between pathogen challenge and host immunity, which in turn influences the likelihood of infectious diarrhoea occurring.



Controlling infectious diarrhoea involves reducing the factors that aid pathogen challenge, for example ensuring good hygiene, and increasing the factors that aid host immunity, for example ensuring adequate intake of good quality colostrum.

Vaccination can be useful in the control of infectious diarrhoea, but it is not a replacement for good hygiene and management and will fail to prevent disease if pathogen challenge is too great. Vaccination against infectious diarrhoea involves vaccinating cows in the last trimester of pregnancy and then feeding calves colostrum from them for 2-3 weeks after birth, which provides a local protective effect within the gut.

Conclusion

In conclusion, rearing replacement heifers is just as important as looking after milking and dry cows as, after all, they are the future of the herd.

Replacement heifer rearing can be challenging for modern dairy farms, but these challenges can be overcome and when it is carried out well, a good supply of healthy replacements will be available enabling selective culling, which in turn promotes good dairy herd health and performance. ■

References are available from the author on request