

DAIRY VEAL CALVES

INFORMATION NOTES



AUGUST 2017

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Information supporting the *RSPCA Approved Farming Scheme Standards – Dairy Veal Calves*

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INDEX

Dairy veal calves lifecycle.....	5
Antimicrobials	6
Bedding.....	6
Behaviour – abnormal	6
Behaviour – competition	6
Behaviour – suckling and cross sucking	7
Biosecurity	7
Bobby calf.....	7
Closed Circuit Television (CCTV).....	8
Colostrum	8
Cow-calf separation	8
Disease	9
Environmental enrichment	9
Euthanasia	9
Feeding – frequency	10
Feeding – method	10
Feeding – milk volume	10
Feeding – roughage	11
Five Freedoms	11
Flooring.....	12
Group housing	12
Group housing – health.....	12
Group housing – mixing	13
Handling.....	13
Health	13
Hormone growth promotants	13
Iron deficiency.....	14
Pasture	14
Rumen development.....	14
Slaughter	15
Stocking density.....	15
Stockpersonship	15
Stress	15
Temperature, ventilation and air quality	16
Transport	16
Veal	16
Weaning	17

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The RSPCA Approved Farming Scheme is part of the RSPCA's efforts to improve the lives of Australia's farm animals. The RSPCA's animal welfare standards for dairy veal calves provide the requirements for housing, handling, transport and slaughter that must be met under the Scheme. The RSPCA encourages producers to exceed these Standards as the opportunity arises and commit to a pathway of continuous improvement in the welfare of their calves. These notes provide information about a range of aspects relating to the Standards, to dairy calf welfare and to the rearing of dairy veal calves generally.

Dairy veal calves lifecycle

Dairy veal calves are dairy or dairy-cross breed calves – usually male – that are selected and raised for veal production. The birth of a male calf at a dairy farm signals the beginning of a dairy veal calf's lifecycle. On the vast majority of dairy farms, the calf is separated from the mother (or 'dam') within 24 hours of birth. The main reasons for this separation are to reduce the risk of transmitting Bovine Johne's Disease (a fatal wasting disease) to the calf, to ensure the calf receives sufficient colostrum, and for ease of management of cows and calves. Whereas the common fate of male dairy calves is to be sent to slaughter from 5 days of age because they are a by-product of dairy farming, male calves selected for rearing are destined for the high-value veal market.

Dairy calves in Australia may be reared under different housing systems, including pasture-based systems, systems where calves have access to an outdoor area, and indoor systems (although these are not common in Australia). In their first days or weeks of life, some farms house calves individually in pens (to ensure adequate colostrum and milk intake, and to avoid disease transfer) while others house calves in groups, or a combination of the two. Milk-feeding systems also differ from farm to farm and may include bucket feeding or teat feeding. Teat-feeding systems include automatic calf feeders which allow individual calves to feed voluntarily while their milk intake is automatically recorded.

Around 5 weeks before giving birth, the calf's mother will have started to form colostrum. This colostrum is the first milk that the calf will drink shortly after birth. Calves are born with little to no immunity and colostrum provides them with antibodies that will initially protect them from infectious diseases. Colostrum has its greatest protective capacity within the first 6 hours of calving and then starts to decline rapidly within 36 hours of birth. After this time, the calf no longer has the ability to absorb the antibodies present in the colostrum, although further colostrum feeding has been shown to have additional benefits.

In Australia, it is a food safety requirement that the milk from the first 8 milkings following calving is excluded from the milk vat and does not enter the milk supply chain. This 'transition milk', which may contain traces of colostrum, is usually fed to calves.

Following initial colostrum feeding in the first 1-2 days of life, the calf in the rearing stage receives transition milk, whole milk, and/or milk replacer (made up from powdered milk) until weaning at 6-8 weeks of age when milk is slowly removed from the diet. Roughage and a grain-based ration or concentrate may be introduced slowly from around 4 days of age. In most calf-rearing systems, a calf would be eating at least 1kg of concentrate per day before being gradually weaned off milk. Some calf-rearing systems provide milk as the main component of the calf's diet throughout its life, with some access to roughage and/or pasture.

The finishing stage commences after weaning when the calf is at least 6 weeks of age. The calf usually receives a gradually increasing grain-based ration (and/or access to pasture) until it reaches slaughter weight at around 6 to 8 months of age. Calves may be slaughtered at a younger or older age depending on the rearing/finishing system and the market for which the veal product is destined.

Antimicrobials

An antimicrobial is an agent that kills or stops the growth of microorganisms such as bacteria, viruses, fungi, and parasites. The World Organisation for Animal Health does not include anthelmintics, disinfectants or antiseptics in their definition of antimicrobial agents. Ionophores (antimicrobials not used in humans) and non-ionophores are classed as antibacterial agents. In other words, they are a category of antimicrobial. Calves may develop diseases that can be treated with specific antimicrobial medication. For example, several species of the *Eimeria* protozoa may cause coccidiosis in growing calves, affecting the mucosal lining of the intestines. Calves may become unthrifty and have watery feces and reduced feed efficiency for several days but the infection is not usually severe. Once diagnosed, spread of coccidiosis may be treated or prevented with a coccidiostat – an antimicrobial that kills the *Eimeria* parasite – but prevention is better than cure. The key risk factor for coccidiosis (and most other diseases) is stress, with other factors including overcrowding, wet bedding, dirty feeders and drinkers, poor hygiene, insufficient or inadequate feed (including colostrum), changes in diet, mixing of unfamiliar calves, and transport. Optimising the calves' environment and ensuring appropriate handling and management practices will go a long way towards preventing disease and reducing the need to use antimicrobials. Prophylactic use of antimicrobials (including coccidiostats) is not permitted under the RSPCA Approved Farming Scheme standards for dairy veal calves. Antimicrobial resistance occurs where microorganisms continue to grow in the presence of levels of antimicrobial agents that would normally stop their growth or kill them.

Bedding

Adding bedding such as straw, wood shavings or rice hulls to calf pens and shelters is a means of providing a soft floor surface. Calves may lie down for up to 18 hours a day and appear to prefer dry sawdust as a lying surface. Deep bedding has the benefit of allowing calves to nest and better regulate body temperature, unlike soft floor surfaces such as sand and rubber. Young calves are not able to thermoregulate as efficiently as older cattle and thick, dry bedding provides them with an insulating barrier. Bedding should be removed and/or topped up as necessary to ensure it remains clean and dry in order to avoid the build-up of ammonia and pathogens and to make sure that calves can always lie down on dry bedding. Wet and/or soiled bedding can increase the risk of diarrhoea and other infections.

Behaviour — abnormal

An understanding of animal behaviour (both normal and abnormal) is an important skill for all people working with animals. Abnormal behaviour in calves includes repeated rubbing, tongue rolling, bar biting or chewing, licking or chewing solid objects, eating soil, navel or ear sucking, sham chewing (i.e. chewing without food in the mouth) and urine drinking. Tongue rolling and tongue playing are most apparent around feeding time as well as at times when calves would normally ruminate. It is therefore thought to be associated with chewing behaviour and rumination. Manipulating pen fixtures or buckets, on the other hand, occurs before and after feeding time and is thought to be an indication of anticipatory feeding behaviour followed by dissatisfaction at the short feeding time. Where calves exhibit repeated abnormal behaviours, the cause should be investigated and resolved, for example through modification of the environment, provision of enrichment, more space, additional bedding, and enabling appropriate sucking behaviour. Abnormal behaviours are indicative of poor animal welfare.

Behaviour — competition

Competition for feed (or other resources) is a potential concern with group-housed calves, particularly during mixing when unfamiliar calves are grouped together or join an existing group. Displacement

of calves at the milk feeder increases as group size increases and teat availability decreases. With fewer teats available and increased competition for limited teats, calves tend to increase milk uptake to compensate for reduced meal frequency. Systems that provide barriers that make it more difficult for calves to displace each other at feeding will help calves increase milk uptake and feeding duration when feeding frequency is reduced. Because feeding is a social activity, providing group-housed calves with multiple feeding stations will allow for more synchronised feeding and encourage feed intake while reducing displacement at the feeder. Also, the greater the age difference among group-housed calves, the greater the risk of increased competition.

Behaviour — suckling and cross suckling

Cross suckling is an abnormal behaviour indicative of poor welfare. Cross suckling is exhibited when the calf sucks on the body of another calf or on pen fixtures, including empty teats. Calves are strongly motivated to suckle. Suckling stimulates the closure of the oesophageal groove allowing milk to flow directly into the abomasum thereby avoiding the as yet underdeveloped rumen. Milk that ends up in the rumen can cause a number of health issues, including acidosis, bloat and abnormal feces. Suckling motivation can be satisfied by using teat feeders and by providing calves with a larger ration of milk. Natural suckling bouts would last about 10 minutes and calves in their first week of life will suckle about 10 times a day – with suckling bouts gradually decreasing before weaning. Milk feeding systems that don't allow suckling behaviour and where the milk ration is consumed quickly – such as bucket feeding – result in an inability to express normal suckling behaviour. Calves fed by bucket rather than by teat may display more bar suckling behaviour. Suckling from a teat reduces the speed at which milk is ingested and virtually eliminates any flow of milk into the rumen. Teat-fed calves tend to rest and show signs of satiety sooner after a meal than bucket fed calves. Teat feeding also reduces cross suckling. Cross suckling can be reduced by feeding calves *ad libitum* from an artificial teat, reducing the diameter of the teat in order to increase the feed duration, using automatic feeders which allow for several smaller feeds (or, preferably, *ad libitum* feeding), introducing individual feeding barriers, providing enrichment (for example dry artificial teats (although calves prefer nutritive sucking to dry sucking), netted hay, additional space for exercise), and generally by increasing feed allowance and reducing milk flow allowing for longer suckling bouts.

Biosecurity

Biosecurity is the prevention of disease incurrence and transmission as well as the management of endemic diseases. The key objective of biosecurity and quarantine measures are to prevent or control the introduction and spread of disease regardless of whether calves are housed indoors or have access to an outdoor area or pasture. Appropriate and effective biosecurity measures include hygiene and sanitation/disinfection procedures relating to the movement of staff, visitors, equipment, supplies, and vehicles onto and between different sites and work areas. Further information on biosecurity practices in the dairy industry can be found at www.farmbiosecurity.com.au.

Bobby calf

A bobby calf is a male or female dairy or dairy cross-breed calf, which is less than 30 days old and is not accompanied by its dam (mother). Male bobby calves are unwanted by the dairy industry as they are not able to join the milking herd. Some bobby calves may be raised to an older age for veal while the majority are transported to the abattoir for slaughter from 5 days old. Raising excess dairy calves for veal is one way in which the value of these animals can be increased. By increasing their value, enhancing their environment, and providing an alternative market, there is real potential to improve the welfare of bobby calves and provide them with a life worth living.

Closed Circuit Television (CCTV)

The RSPCA Approved Farming Scheme standards for dairy veal calves require that CCTV be used to monitor those areas of the slaughtering facility where the risk to animal welfare is greatest. CCTV should not replace the need to employ people with the right attitude towards animals, comprehensive staff training and good stockpersonship. It is, however, an excellent means by which facility management and auditors can monitor compliance with standards and regulations relating to animal welfare. CCTV allows problem areas to be identified and promptly addressed. It is important that a protocol is in place to determine the use of CCTV. Such protocols should include information about the positioning of the camera to allow a clear view of calf handling, stunning and slaughtering processes; a decision about the period for which the footage should be retained (3 months is considered good practice); the review of the footage and who should be responsible; and how the footage should be kept safe and secure. These protocols are well described in the UK Farm Animal Welfare Council's *opinion on CCTV in slaughterhouses*.

Colostrum

Colostrum is a fluid produced by the pregnant cow in readiness for the calf at first suckling. Calves are born with little to no immunity and colostrum provides the calf with antibodies that protect it from infectious diseases. In addition to antibodies, colostrum also contains white blood cells, anti-microbial factors, growth factors and nutrients. The strongest concentration of these constituents is present at birth. A refractometer can be used to measure the level of antibodies in colostrum indirectly. Readings of 22% or greater on the refractometer's Brix scale indicate good quality colostrum. The more antibodies (mainly immunoglobulin IgG) in the colostrum, the higher the quality (good quality colostrum contains >50mg IgG per ml). The calf's intestine is best able to absorb these large antibody molecules immediately after birth. From then on, absorption ability decreases rapidly within 6 hours and stops completely within 36 hours of birth. To achieve successful transfer of immunity, calves should receive high quality colostrum within 6 hours of birth. Calves should be provided with a sufficient quantity of colostrum over the first 24 hours to ensure IgG concentration in calf serum is at least 10mg/ml when sampled between 24 to 48 hours of age or at least 55mg/ml when sampled between 3 and 7 days of age. Testing of IgG levels in blood serum can be done on farm using a refractometer or alternatively at commercial laboratories.

Cow-calf separation

For cows to produce milk, they must give birth to a calf. In the dairy industry, most calves are separated from their mother within 24 hours of birth to reduce the risk of transmitting Bovine Johne's Disease (a fatal wasting disease) to the calf, to ensure adequate colostrum intake in order to achieve successful transfer of passive immunity, and for ease of management of cows and calves. Separation within 24 hours of birth interferes with the development of the cow-calf bond and reduces separation distress. Cows will show a strong response (calling) if their calf is separated at an older age, for example 4 days after birth, compared to separation at 1 day or 6 hours after birth. The longer calves are allowed to stay with their dam, the stronger the cow-calf bond and the greater the response (including a negative affective state) at separation. On the other hand, calves reared by their mothers may display less abnormal oral behaviours and improved social behaviour, they may also gain more weight and have better health. Health benefits for the dam resulting from suckling may include a reduction in the incidence of mastitis and in the incidence of fetal membrane retention. Housing calves in groups appears to alleviate the stress of separation from the dam. Further research is required to determine optimal management strategies for the welfare of both cows and calves in dairy production systems.

Disease

Ongoing adherence to established biosecurity protocols can help reduce the incidence of disease. Enteric and respiratory diseases are the most common health disorders in calves. In early calf rearing, calf scours (diarrhoea) is the main priority in terms of prevention, diagnosis and treatment of disease. In young calves, respiratory disease can be a significant cause of morbidity and mortality, with the risk steadily increasing and then plateauing after 4 weeks of age. Calf scours is common in young calves and not necessarily related to housing system, with the same pathogens detectable in individual versus group-housing systems. Cleaning of the calving area after each calving so as to avoid a build-up of mud, manure and other potential disease-causing agents reduces the risk of calf scours in the rearing facility. Incidence of respiratory disease may be higher in calves prior to weaning housed in larger groups compared to those housed individually or in smaller groups. Calves that are well fed and managed, and not stressed are likely to have a stronger immune system and thus are more resistant to disease than unthrifty animals. Preventative treatment such as vaccination should be implemented where available in addition to ongoing monitoring by farm workers who should be able to recognise early signs of disease.

Environmental enrichment

Providing animals with environmental enrichment may be an effective strategy to improve animal welfare by enabling positive affective states, particularly where animals are confined indoors. Poor animal welfare occurs where there is a mismatch between the animal's needs and aspects of animal management and/or the animal's environment. However, environmental enrichment alone will not address this mismatch. Good animal welfare relies on meeting an animal's physiological needs (for example good health, good nutrition, comfortable housing), good stockpersonship (for example low-stress animal handling), providing for innate behavioural needs (for example, in veal calves, the ability to suckle, chew, ruminate, the company of other calves), and providing the opportunity to have positive experiences (for example through play and locomotor behaviours, through active engagement with their surroundings). Good welfare can be achieved where calves are provided with sufficient space to play in the company of other calves, sufficient quantity of milk to prevent hunger and competition at the feeder, teat feeders to satisfy the need to suckle, and roughage to promote chewing and rumination and express foraging behaviour, and bedding to allow for thermal comfort as well as nesting. An outdoor area and access to pasture will provide additional stimulation and the opportunity to further improve animal welfare. Environmental enrichment objects, such as balls, cow brushes, or dry teats are only effective if they are used by the animals. Such objects should be replaced, rotated and reviewed if calves lose interest.

Euthanasia

Humane killing (euthanasia) should result in rapid brain death. This is achieved by destroying the brain stem, which is located midway between the two ear canals at the base of the ears. Blunt force trauma is not acceptable for euthanasing calves due to the calf's skull being too hard to reliably and consistently achieve immediate unconsciousness through destruction of brain tissue. Blunt force trauma relies on correct and effective application each and every time for it to be humane. Persons carrying out blunt force trauma can find it unpleasant, and operator fatigue and unreliability are potentially serious welfare risks for the animal concerned. Use of a firearm or penetrative captive bolt in the frontal position is the recommended method for on-farm euthanasia of calves. Use of the penetrative captive bolt in the poll position is more prone to operator error and can result in misdirection of the bolt into the spinal cord instead of the brain. Following firearm or captive bolt use, the calf must always be checked immediately to ensure it is dead. Persons carrying out euthanasia should be aware of the dairy industry's fact sheet on *Humane killing and disposal of sick or injured cattle* and attend accredited training to ensure competency.

Feeding — frequency

Feeding calves more frequently than once or twice a day has a behavioural benefit to the calf — it more closely reflects natural suckling frequency and reduces abnormal oral behaviours. Feeding more frequently also reduces the risk of overfilling the abomasum and/or milk spilling into the rumen as compared to larger quantities of milk fed once or twice a day. Utilisation of glucose and nutrients is improved when meal frequency is increased. Automatic calf feeders allow group-housed calves to feed more frequently during the day. They also permit the calf to consume larger volumes of milk at each drinking bout and across multiple drinking bouts throughout the day. Automatic feeders have the ability to more closely mimic the natural nursing behaviour of the calf. Manual feeding typically involves more labour.

Feeding — method

Sufficient feeding stations should be available so that all calves are able to feed at the same time. Feeding systems incorporating teat feeders are the preferred method for milk feeding as they satisfy the calf's behavioural need to suckle and reduce the risk that calves will 'cross suck' (suckle one another or pen fixtures, including empty teats). Buckets and open troughs are often used for milk feeding because they are easier to pour milk into and also easier to clean. However, from a behavioural needs perspective, they do not address the calf's motivation to suckle despite the calf feeling full relatively quickly. Sucking milk from a teat or even sucking on a dry teat will increase the level of digestive hormones (insulin and cholecystokinin) in the calf's blood, showing that suckling may be important from a metabolic as well as a behavioural perspective. Increasing the time that the calf is able to suckle by using teat feeders and by slowing the flow of milk through the teat, better satisfies innate suckling behaviour and significantly reduces the amount of time that the calf may spend cross suckling. Suckling also increases satiety and the length of time that calves will sleep. Milk temperature is also an important factor. When feeding calves, milk temperature should be consistent — i.e. warm or cool — at every feeding until weaning. The temperature of the mother's milk for naturally suckling calves is 38°C. Calf body temperature is around 38.6°C. Milk is best fed at a temperature that will maintain, rather than decrease calf body temperature.

Feeding — milk volume

Common dairy industry practice is to feed unweaned calves around 10% of calf body weight in milk daily. This amount of milk is about half of what calves would typically drink (around 10 litres of milk over 8-12 feeds per day) in the first weeks of life if they were able to suckle from their dam. Reducing milk intake is intended to encourage the calf to consume solid feed (which is usually cheaper than milk replacer) which leads to more rapid rumen development and allows the calf to be weaned off milk more quickly. However, it appears that calves are not able to compensate low milk intake with a higher solid feed intake in their first few weeks of life. Feeding calves more than the traditional quantity — for example feeding up to 20% of calf body weight — has been shown to result in greater feed consumption, body weight gain and hip growth. Higher milk allowances may also result in less unrewarded visits to the milk feeder. A high number of such unrewarded visits is indicative of hunger. Calves that are hungry will vocalise more and play less than well-fed calves. Frequent visits to feeders will cause frustration if the calf is often not allocated sufficient milk. Increased mortalities may result if calves are fed a limited ration in winter and therefore have limited energy reserves to keep warm. There is no strong evidence that feeding calves large amounts of milk will increase the incidence of clinical diarrhoea, although their feces may be more liquid. Offering calves an amount of milk that they would choose to consume *ad libitum* will ensure calves are satiated. Potential for poor welfare exists where calves are fed limited milk rations, particularly if the diet is not supplemented with concentrate and/or roughage.

Feeding — roughage

Calves have an inherent need to chew and to ruminate and will begin to chew on solid food at around 2 weeks of age, although they prefer to consume a largely milk-based diet up to 1 month of age. Providing calves with roughage allows them to carry out normal chewing behaviour and decreases any abnormal oral behaviours such as manipulating pen fixtures and pen mates or tongue playing that may occur around feeding time. Short chewing bouts will not satisfy this behavioural need; nor will feeding only liquid diets. By providing hay in racks *ad libitum* the calves' natural foraging behaviour is continuously stimulated as they pull the hay out of the rack similar to the way they would pull grass from the ground. Calves prefer to chew on long hay rather than chopped hay, possibly because it stimulates chewing more. Where long hay is provided in addition to their ration, overall roughage intake, rumen development and rumination are promoted. Long stalk straw, on the other hand, is generally of poor nutrient value and may limit growth and rumen development due to reduced feed intake. To reduce abnormal oral behaviours, calves should be provided with at least 50g, 500g and ≥ 1 kg of dry matter/calf/day of long hay at 1, 3 and 6 months of age respectively. Providing coarse fibrous feed to calves that consume large amounts of milk replacer can increase the risk of damage to the abomasum because of the potential abrasive effect and should be managed carefully for example through the provision of long hay rather than other coarser forms of roughage. The cause of abomasal damage is multi-factorial. Consumption of large volumes of milk replacer can cause damage and ulceration of the abomasum, which is painful to the calf. Trough and bucket milk-feeding systems increase the risk compared to automatic calf feeders from which calves can drink more frequent smaller meals. It is as yet unclear whether the risk of abomasal damage is related to an underdeveloped rumen in milk-fed calves. However, the provision of concentrate to calves from a young age will stimulate early rumen development, which may help alleviate and heal abomasal damage. Textured feed (concentrate) is preferred by calves over ground meals or pellets that crumble into a fine dust.

Five Freedoms

The Five Freedoms were first mentioned in 1965 in a UK report on the Welfare of Animals kept under Intensive Livestock Husbandry Systems which stated that “farm animals should have freedom to stand up, lie down, turn around, groom themselves and stretch their limbs”. Following the establishment of the UK Farm Animal Welfare Council shortly after, the concept was further refined into the Five Freedoms we know today: freedom from hunger and thirst; freedom from discomfort; freedom from pain, injury or disease; freedom to express normal behaviour; and freedom from fear and distress. The RSPCA considers that the welfare of an animal includes its physical and mental state. Good animal welfare implies both fitness and a sense of wellbeing. Criteria for assessing the welfare of dairy veal calves against the Five Freedoms include:

- Freedom from hunger and thirst – by ready access to fresh water and a diet to maintain full health and vigour
- Freedom from discomfort – by providing an appropriate environment including shelter and a comfortable resting area
- Freedom from pain, injury or disease – by prevention or rapid diagnosis and treatment
- Freedom to express normal behaviour – by providing sufficient space, proper facilities and company of the animal's own kind
- Freedom from fear and distress – by ensuring conditions and care which avoid mental suffering.

An overall welfare assessment can be made by looking at the calf's physical environment, its biological functioning and by observing calf behaviour in response to challenges in their environment. The latter, in particular, requires an understanding of normal behaviour and being able to identify behaviour indicative of poor welfare.

Flooring

For a floor surface to be comfortable for calves it must be soft underfoot, prevent slipping and falling, and avoid foot or leg issues. Hard floors include concrete floors (solid or slatted) and hardwood slats whereas softer floors include concrete covered with rubber, rubber matting, sand, and floors bedded with straw or wood shavings. Calves prefer softer floors over hard floors. Sawdust is preferred over rubber floors which, in turn, are preferred over sand. Heavier animals may experience discomfort when getting up and down on hard floors. Calves on hard floors generally experience more joint injury and swelling.

Group housing

Calves born in a natural environment will begin interacting with each other at around 1 week of age. Before then, the calf is either alone or with its dam. It is common in the dairy industry to house new-born calves individually in their first days or weeks of life. This reduces the risk of disease transmission because there is generally no nose-to-nose contact between calves, it enables close management of colostrum feeding and facilitates the initial care of the calf. However, calves are gregarious animals, which means they are highly social and motivated to interact with each other and mimic each other's behaviours. From an animal welfare perspective, group housing is desirable because it improves cognitive performance (allowing them to better respond to changes in their environment), it provides animals with more space to move around, and gives calves the opportunity to express social behaviours, including play behaviours (running, jumping, and bucking). Individual housing requires more space and more infrastructure than group housing and it allows customised feeding and care of the calf. However, stronger bonds are formed between calves paired at birth rather than later in life and these social bonds influence calf fearfulness. Tactile contact is important for calf welfare in that it enables the expression of sniffing and licking behaviours and is further improved in pair or group housing where calves can have full body contact with each other. In individually housed calves, the level of licking fixtures and their own bodies is higher than in pair-housed calves. This suggests that this licking may be redirected social grooming or redirected exploratory behaviour. The greater space allowance in group housing allows calves to lie with their legs outstretched and their head on the ground, postures which are important for ensuring proper rest and sleep. In colder climates, group housing or pair housing of calves helps calves to keep warm as they can lie next to each other. Calves housed in pairs are less reactive to novel situations (environmental or social). Although group housing may increase competition for feed and other resources, it is thought that competition and socially transmitted behaviours (for example feeding and degree of competition at feeding) improve rumen development and increase starter feed intake. Calves housed in pairs prior to weaning consume more starter feed, gain more weight and vocalise less than individually housed calves.

Group housing — health

Group housing should not be seen as a trade-off between health and behavioural freedom. The incidence of mortality, respiratory disease and diarrhoea in group-housed calves depends on a range of factors including management, environment and feeding routine. Disease transmission may occur through contact with infected calves, for example through feces or nose-to-nose contact. The common pathogens causing respiratory disease are transmitted by air. Calves housed in small groups (less than 10 calves) prior to weaning may have fewer incidences of respiratory diseases than those housed in large groups (up to 30 calves) or individually, suggesting that group size rather than grouping itself may be associated with disease risk. Keeping calves in small groups can make it easier to identify a calf that may be sick. Overall, the animal welfare benefits of housing calves in pairs and in groups outweigh the risk of transmission of disease.

Group housing — mixing

Weaning, mixing with other calves and a change in housing and diet are all acute stressors. When new calves are introduced into a group, competitive interactions usually go up, resulting in increased social stress as well as reduced feed intake. Where calves prior to weaning are kept in dynamic groups, there may be considerable age variation within the group as new calves are introduced soon after birth and older calves are removed at weaning. Post weaning, it may also be difficult to maintain stable groups as calves may need to be regrouped according to age or size. However, fewer aggressive encounters and more positive social interactions result if regrouping is limited to mixing two previously stable groups of calves. Aggression is rare in homogenous age groups, with calves displaying mainly non-agonistic social behaviours. The greater the age difference among group-housed calves, the greater the risk of increased competition for feed and other resources, presenting a welfare issue for low-ranking/younger/smaller calves. Individually housed calves tend to display a high level of activity and aggressive behaviours at grouping. Previously group-housed calves transition more smoothly when mixed with a novel group of calves. It is recommended that calves are transitioned into small groups (less than 10 calves) before being moved to larger groups (up to 30 calves). Age and weight composition must also be considered.

Handling

Calves must be handled humanely at all times – whether on farm, during transport or at the abattoir. Calves must not be subjected to rough handling, prodding, and use of dogs or electric goads. Very young calves have underdeveloped ‘following’ behaviour, which means that they do not stay together as a group. This may make moving and loading/unloading for transport difficult. When moving calves, the principles of low-stress animal handling should be applied. An understanding of animal behaviour and the animal’s flight zone should be used to encourage rather than force an animal in the required direction. Cattle (including calves) are gregarious animals so they are highly motivated to remain with their herd and don’t like being isolated. Cattle also have poor perception of distance, depth and detail which means they are unlikely to want to walk into shadows or on irregular floors, move between contrasting light and dark areas, or respond well to sudden movement. Calves also do not respond well to sudden loud noise.

Health

Calves must be protected from pain, injury and disease through good management and husbandry practice, and through rapid detection and treatment of disease. It is a requirement of the Approved Farming Scheme standards that producers develop a veterinary health plan in consultation with a designated veterinarian. Disease is a major cause of poor welfare and mortality in calves. Therefore, it is essential to take all reasonable steps to minimise the likelihood of disease outbreaks.

Hormone growth promotants

The use of hormone growth promotants (HGPs) to increase growth rates is a widespread practice in the Australian beef cattle industry. Cattle naturally produce steroid sex hormones to regulate reproduction and growth. In cattle, natural and synthetic hormones may be implanted under the skin of the animal’s ear to improve daily weight gain, feed conversion and carcass quality. Hormones increase the rate at which muscle grows by about 10-30% thereby reducing the time to reach slaughter weight. Hormone implant sites may become infected if the implant is not injected properly or the site is not disinfected. Hormones may also cause cattle to become more sensitive to hot climatic conditions. Hormonal implants interact with the animal’s natural hormones and side effects of their use may include aggressiveness (particularly in the first few weeks after implantation), difficulty in handling, nervousness, rectal prolapse, ventral oedema (swelling) and the base of the animal’s tail being elevated. There is also some evidence of chronic stress conditions as a result of hormone implant use. Although uncommon, these side effects of hormone use are all signs of poor welfare.

Iron deficiency

The system of veal production where calves spend their entire lives in small, individual crates is not used in Australia. This system of housing calves for veal production is designed to produce the 'classic' white-coloured veal by restricting movement and denying the calf access to iron. Veal crates have been illegal in the UK and Europe since 2007 but are still used in some countries. Calves that are exclusively fed on milk or milk replacer without iron supplements are likely to be anaemic, i.e. have iron deficiency. Iron is essential in haemoglobin formation in red blood cells ensuring that oxygen is carried around the body. Iron is also important for the concentration of myoglobin in muscle. Myoglobin is responsible for the red colour of muscle, which is why iron-deficient calves produce white or pale meat. Calves fed on a grain ration and/or provided with roughage and/or access to pasture are unlikely to suffer from iron deficiency.

Pasture

Cattle spend 90-95% of the day grazing, ruminating and resting, with grazing being the most common of these behaviours. Grazing occurs mostly during the day, rumination occurs while cattle are resting, and ruminating and resting occur mostly at night. When given a choice, dairy cows prefer to be on pasture at night and in the shed during the day (particularly after milking) where they can access feed (mixed ration). The shed may also be preferred on warmer days when dairy cows seek shade, on rainy days when they seek shelter, and as the days get progressively colder in winter when they seek warmth. In experiments where animals are given a choice, beef cattle in feedlots have also shown a preference for pasture, not necessarily influenced by temperature or rainfall, with time spent in the feedlot coinciding with feeding at the feed bunk. Providing fresh cut grass to calves prior to weaning may reduce abnormal behaviours and increase positive behaviours such as tail swishing, self-grooming and rubbing. Where calves do not have access to pasture, attention needs to be given to providing appropriate and palatable forage feeds (fibrous feeds including silage, hay and straw) to allow calves to express some foraging behaviour.

Rumen development

Cattle are ruminants and have a stomach that consists of four compartments: reticulum, rumen, omasum, and abomasum. The reticulum and the rumen together are a large fermentation vat. The omasum absorbs water and minerals, and the abomasum is the 'true stomach'. In cattle, only the abomasum is fully developed at birth. Suckling stimulates the closure of the oesophageal groove by allowing milk to flow directly into the abomasum, thereby avoiding the as yet underdeveloped reticulum and rumen. Because these two compartments are bypassed, reticulum and rumen development are slow if the calf is only milk fed. In the abomasum, the milk forms a curd-like clot and is steadily released throughout the gut. Complete digestion of this milk can take 12-18 hours. Once the calf begins to consume dry feed, concentrate or forage feeds, this ends up in the rumen and starts off rumen development and digestion. Calves must always have access to plenty of clean fresh water as, without it, bacterial fermentation in the rumen is not possible. When the calf is born, the rumen capacity is approximately 1-2l, whereas when fully developed by 3 months of age it can reach 25-30l. An obvious sign that the rumen is developing is the calf beginning to chew the cud (ruminating) at about 2 weeks of age. Digestive bacteria gradually multiply in the rumen and it takes about 3 weeks from the point where calves are consuming sufficient amounts of concentrate (around 1kg per day) for the rumen to be fully developed and able to absorb nutrients to support the calf post weaning. The longer and the more frequently a calf drinks, the slower rumen development will be. On the other hand, calves fed less milk and more concentrate can have a functioning rumen by 3 weeks of age and can be weaned by 6 weeks of age.

Slaughter

The RSPCA definition of humane killing is: 'an animal must be either killed instantly or rendered insensible until death ensues, without pain, suffering or distress'. When killing animals for food (termed slaughter), this means they must be stunned so they immediately become unconscious prior to bleeding out. All methods of humane killing, including slaughter and on-farm euthanasia, must meet the same criteria: death of an animal without panic, pain or distress; instant unconsciousness followed by rapid death without regaining consciousness; reliability; simple; and with equipment that is easy to maintain. A high level of operator skill is essential for the humane killing of animals. Operators must be trained in: animal handling; selection of the best killing method; correct application of the killing method; and proper maintenance of equipment. At the very least, abattoirs should meet the Australian meat industry's *National Animal Welfare Standards for Livestock Processing Establishments*.

Stocking density

Animals need enough space to ensure they remain physically healthy and can carry out normal behaviours. Space allowance should enable animals to exercise, explore and express social behaviours. When determining the appropriate stocking density for animals, consideration needs to be given to a range of factors, including: ventilation, temperature, humidity; age, size and sex of the animal; the group size and composition; weather conditions; bedding management; and quality and management of the outdoor area and/or paddock. In other words, it is not only the quantity of space provided to each animal, but also the quality of the space provided that influences animal welfare. Veal calves given sufficient space exhibit fewer abnormal behaviours, have room to exercise, play (run, buck and jump), can lie with their legs outstretched and head on the ground, and have full body contact with each other. Stocking density should be reviewed regularly and where animals are diseased, injured, aggressive or behaving abnormally, space allowance should be increased to ensure the welfare of the animals.

Stockpersonship

The attitudes and competence of staff are a vital factor in determining whether high standards of animal welfare can be achieved. It is the responsibility of management to ensure there is a welfare ethos among staff. It is essential that stockpersons are suitably trained and experienced (or directly supervised by experienced staff), and are able to recognise indicators of poor welfare. They must have a good working knowledge of the husbandry system used and the animals under their care. High standards of husbandry must be maintained at all times with the welfare of animals considered a priority. The stockperson is responsible for optimising the environment that calves rely on for survival and must maintain the highest environmental quality at all times. It is widely acknowledged that good stockpersonship and reduced stress levels in animals are key factors in meat quality.

Stress

The mechanism that allows animals to cope with challenges in their environment is called a stress response and it allows the animal to overcome or avoid such challenges (referred to as 'stressors'). However, where the animal is not able to escape the stressor or where stressors persist beyond the short term, chronic stress can result. Chronic stress compromises animal welfare and can usually be observed through physical and behavioural changes in the animal (for example loss of appetite and weight, compromised immune and reproductive system, impaired mental function and coping ability).

Temperature, ventilation and air quality

Shed temperature should ideally provide a comfortable environment for calves at all stages of production and at all times of the year. Temperature extremes (heat or cold) require additional monitoring of the calves (for example for signs of panting or huddling) and ventilation may need to be adjusted to minimise any impact on the animals. Adequate air exchange is essential for managing heat, moisture, dust and harmful gases, including ammonia. If ammonia can be smelled/detected by humans (10-15ppm) or dust levels are noticeably unpleasant, corrective action such as increasing ventilation must be taken.

Transport

The length of transport, the motion of the truck, the weather and the time off feed and water are all factors to consider when transporting calves, particularly young calves. Climatic conditions influence calf comfort during transport. During hot weather, calves should be transported during the cooler parts of the day for the shortest possible time, avoiding any unnecessary stops of the vehicle. Loading and unloading facilities should ideally provide a loading bay that allows calves, particularly young calves, to walk straight into or out of the vehicle without the need for a ramp. Young calves, especially smaller calves, show a preference for lying down during transport. If provided with straw bedding during transport, they will lie down for longer. Providing straw bedding also reduces fatigue in calves compared to mesh flooring, which they are reluctant to lie on. Calves should be given sufficient space on the transport vehicle to move unhindered from a lying position to a standing position and vice versa. Calves are able to be transported legally from as young as 5 days old (or younger if they are transported directly to a rearing facility). However, calves are best transported at an older age – for example 10 days of age – so that they are better able to withstand the stressors of transport, which include loading and unloading, and mixing with unfamiliar animals in unfamiliar environments. Very young calves (up to approximately 3 weeks of age) have underdeveloped ‘following’ behaviour, which means that they do not stay together as a group and move to where they are directed. This may make moving and loading/unloading young calves for transport difficult. Group-reared calves appear to have less difficulty walking up a loading ramp than individually-reared calves. At the very least, preparation for transport should meet the recommendations set out in the *Is it fit to load guide to the selection of animals fit to transport* published by Meat & Livestock Australia.

Veal

Veal is the meat product from a young bovine of either a dairy or beef breed or a cross between the two. In Australia, Aus-Meat is responsible for establishing national industry-agreed standards for meat production and processing. Aus-Meat standards help ensure a consistent meat product that satisfies certain requirements and is described using a consistent language. The Aus-Meat veal category defines veal as a “female or castrate or entire male bovine that has no evidence of eruption of permanent incisor teeth; weighs no more than 150kg HSCW; shows no evidence of secondary sexual characteristics; and shows youthfulness and veal colour”. HSCW, or hot standard carcass weight, is the weight once the dead animal’s head, feet, hide and internal organs have been removed. HSCW is, very roughly, around half of the animal’s live weight. Aus-Meat also have meat colour standards which are assessed on the rib eye muscle area of the chilled carcass. For veal, the colours range from a light pink (V1) to a light red (V5). Within the Aus-Meat veal category, there are three veal classes: ‘light veal (bobby)’ which must weigh no more than 40kg (HSCW); ‘light veal’ which must weigh no more than 70kg (HSCW); and ‘veal’ which weighs between 70.1kg to 150kg (HSCW). A recent addition to the Aus-Meat veal category is ‘rosé veal’ which must weigh between 100kg-200kg (HSCW), have a fat score between 0-2, and a meat colour between V1-V3. Rosé veal is from calves aged between 150-200 days.

Weaning

Calves would be naturally weaned by their dam at around 8 months of age, with the amount of milk produced by the dam gradually reducing as the calf eats more solid feed. In most calf-rearing systems, calves are weaned from 6-8 weeks of age and introduced to solid feed (grain ration or concentrate) within their first week of life. At weaning, calves can show signs of stress including increased vocalisations, cross sucking and signs of hunger, increased locomotion and less play. Reduced growth, weight loss and immunosuppression may also result. Weaning stress is usually a result of the change in the calf's diet and the mixing with unfamiliar calves. These behavioural and physiological signs of stress can be reduced by weaning calves off milk gradually rather than abruptly and by weaning calves at an older age. For example, weaning 8-week old calves over a 7-day period results in fewer behavioural signs of stress and increased weight gain compared to weaning at 6 weeks old over the same period. Weaning stress can also be reduced by gradually reducing the milk allowance as the calf eats more solid feed. Ensuring group composition is based on age and size (i.e. grouping of calves of similar age and size) will reduce displacement of lower ranking calves at the feeder.

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