An HSUS Report: The Welfare of Cows in the Dairy Industry

Abstract

More than 9 million cows compose the U.S. dairy herd. Repeated reimpregnation, short calving intervals, overproduction of milk, restrictive housing systems, poor nutrition, and physical disorders impair the welfare of the animals in industrial dairy operations. Once their productivity wanes, the cows are often weak as a result of high metabolic output. Typically, these "spent" dairy cows are culled and processed as ground beef. In their fragile end-of-production state, handling, transport, and slaughter raise additional welfare concerns.

Introduction

In the United States in 2008, more than 9.3 million cows were used for milk production[1] and approximately 2.6 million dairy cows were slaughtered, composing 7.7% of all federally inspected commercial cattle slaughter.[2] From 1987 to 2007, the number of dairy operations declined by 69% and the number of cows decreased by 11%, while the average number of cows per facility increased by 183%.[3] Milk production per cow has also increased significantly. On average, a U.S. dairy cow produced 9,193 kg (20,267 lb) of milk in 2007,[4] more than double the per-cow milk yield in 1967[5] and 47% more than the per-cow milk yield in 1987.[6] Even though the number of cows in the dairy industry declined from 1987 to 2007, the total production of milk increased by 30%.[7]

In the U.S. industry, cows, overwhelmingly Holsteins,[8] produce an average of 729 days of milk,[9] which corresponds to 2.4 lactations, before they are considered "spent" and sent for slaughter at an average of less than 5 years of age. Cows can naturally live more than 20 years.[10]

Production Cycle

The milk production cycle of a dairy cow typically begins at approximately 25 months of age when, after a 9-month pregnancy, she gives birth to her first calf and commences lactation. Male offspring to dairy cows "are of little or no value to the dairy farmer,"[11] as they are unable to produce milk and are different breeds than those typically raised for beef. As such, a small number of male calves are used for breeding, and other male calves are commonly used for veal production.[12,*] In 2001, the average calving interval was 13 months, i.e., cows were reimpregnated 4 months after giving birth. A similar average was found for 2006.[13] Milk production continues during the subsequent pregnancy, which places a heavy metabolic burden on these animals.

It is a general practice to "dry off," or cease milking, dairy cows approximately 58 days prior to giving birth[14] to enable cows to recover and prepare for birthing.[15] The drying-off period starts with an abrupt cessation of milking, which can cause large quantities of milk to accumulate and lead to udder engorgement. Research has found that cows respond to increased pressure within their udders by reducing the time spent lying down, which is an indicator of discomfort.[16]

In order to quickly cease milk production, it has been recommended by some that producers restrict feed and water intake.[17] However, abruptly restricting feed intake has been associated with an increase in cortisol, an

[*] For more information, see "An HSUS Report: The Welfare of Animals in the Veal Industry" at www.hsus.org/farm/resources/research/welfare/welfare_veal_calves.html.

important physiological indicator of stress,[18] and, as water consumption is important for health and well-being, limiting access can impair welfare.

Reproduction and Breeding

In the 20th century, the selective breeding of dairy cattle has mainly focused on increasing milk production with insufficient attention paid to the improvement of traits important for health and welfare.[19,20]

Fertility and Milk Production

There has been a gradual decline in dairy cow fertility in recent decades, as evidenced by an increase in the calving interval[21,22] and a decline in conception rates.[23] This decline in fertility may be related to the massive increase in milk production. Cows with higher milk production may ovulate later than cows with lower milk yield[24] and be less likely to conceive.[25] This decline of fertility can be considered an indication of the health costs of the extremely high milk production of today's dairy cows. On U.S. dairy operations, 26.3% of cows slaughtered are culled for reproductive issues.[26]

The overwhelming emphasis on artificial selection for milk yield while neglecting health traits has led to an unbalanced allocation of the cow's energy and resources to milk production. When a cow is genetically pre-programmed to put the majority of her metabolic energy into producing milk, she may be more susceptible to stress and disease.[27] A Colorado State University 2005-2006 investigation of 113 U.S. dairy facilities in 5 North Central and Northeastern states reported that some producers felt that "higher milk production had come at a great cost to the cows."[28]

Inbreeding

The widespread use of breeding technologies has resulted in a relatively small pool of select bulls, resulting in a reduction of biodiversity and an increase in inbreeding. The percentage of inbreeding has increased from 0% in 1960 to 5.31% in 2007.[29] Inbred cows may suffer from an increased risk of mastitis,[30,31] a potentially painful inflammation of the mammary gland (detailed below),[32] and may have further diminished fertility.[33]

Reproductive Techniques

The development of reproductive technology has evolved rapidly, and techniques such as artificial insemination, multiple ovulation embryo transfer, and *in vitro* fertilization (IVF) have become widespread. These techniques may be painful and cause distress in cows.[34]

The British government's Code of Recommendations for the Welfare of Livestock states that embryo collection and transfer can only be performed if the cows receive appropriate anesthesia.[35] The Farm Animal Welfare Council, an independent advisory body established by the U.K. government, has expressed concern about these technologies and identified the use of fertility drugs and the repeated use of anesthetics as a welfare issue in itself.[36]

IVF can result in "large offspring syndrome," which can cause suffering to both cow and calf. Because embryos produced by IVF develop faster than naturally conceived embryos,[37] the use of IVF may lead to calves with an increased birth weight and subsequently more difficulties during birth,[38,39] as well as increased calf mortality and morbidity.[40,41,42,43]

Electroejaculation of Bulls

In general, there are four techniques for collecting semen samples from breeder bulls: aspiration from the vagina of a recently bred cow, collection from an artificial vagina, collection by transrectal glandular massage, and electroejaculation.[44] Semen collection by electroejaculation, which has been found to be painful in humans,[45] involves the insertion of a device into the bull's rectum that delivers an electric shock. Though more efficacious than transrectal massage or the use an artificial vagina,[46] electroejaculation is associated with an increase in the stress hormone cortisol,[47,48] and the strength of the muscular contractions induced by electroejaculation suggests that the bull experiences pain and distress.[49] Compared to controls, bulls subjected to this procedure vocalize more frequently,[50] which is considered an indicator of stress and pain.[51]

Housing Systems

In 2007, the U.S. Department of Agriculture (USDA) released a report with findings from 17 of the country's major dairy states, representing 79.5% of U.S. dairy operations and 82.5% of the country's dairy cows.[52] According to "Dairy 2007," housing systems for lactating and dry cows are "somewhat determined by local climate" and are broken down as follows:

Housing Type	% Operations (by type of housing used for any length of time during 2006)		% Operations (by primary housing facility / outside area used during 2006)	
	Lactating Cows	Dry Cows	Lactating Cows	Dry Cows
Tie stall / stanchion	62.6	32.7	49.2	23.3
Freestall	41.1	30.9	32.6	22.8
Individual pen / hutch	3.2	4.4	0.1	1.0
Multiple animal inside area (also known as strawyards)	14.7	27.3	3.4	12.9
Drylot / multiple animal outside area	26.8	40.0	4.6	18.7
Pasture	49.4	60.1	9.9	20.5
Other	0.4	1.1	0.2	0.6

Data from: U.S. Department of Agriculture. 2007. Dairy 2007. Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007. USDA-APHIS-VS, CEAH. Fort Collins, CO #N480.1007. http://nahms.aphis.usda.gov/dairy/dairy07/Dairy2007_PtI.pdf. Accessed March 17, 2008.

As detailed above, the overwhelming majority of U.S. dairy operations confine lactating and dry cows in primarily indoor systems, with only 9.9% of operations primarily raising lactating cows on pasture.

Cows kept in tie-stalls, or stanchions, are individually tethered by the neck. Those reared in freestalls, or cubicles, are not restrained and are permitted to move within the barn. Individual lying places are available and separated from each other by metal bars. Most lying places measure between 2-2.4 m (2.2-2.6 yd) in length and 1-1.2 m (1.1-1.3 yd) in width,[53] and may or may not have bedding. Strawyards can be located indoors or outdoors and are usually slightly larger than a cubicle system. The yards typically provide bedding materials such as straw, but there are no individual lying places. Cows are not tethered or constrained and are free to walk within the yard.[54] Drylots are outdoors and consist of an unpaved area confining the animals.

Operation Types

According to the 2007 USDA report, the majority of operations (63.9%) were "conventional," where the animals were fed harvested forage and may not have been allowed to graze, and the majority of cows (82.2%) were raised in these systems.[55] The larger the size of the operation, the less likely they were to incorporate grazing:

Operation Type	% Operations	% Cows	% Operations by Herd Size (# of Cows)		
			< 100	100-499	500+
Conventional	63.9	82.2	57.1	79.9	91.5
Grazing	3.1	1.7	3.5	2.0	1.0
Combination conventional and grazing	31.1	14.9	37.2	17.0	7.3
Organic	1.7	1.2	2.0	1.1	0.2
Other	0.2	0.0	0.2	0.0	0.0
Data from: U.S. Department of Agriculture. 2007. Dairy 2007. Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007. USDA-APHIS-VS, CEAH. Fort Collins, CO #N480.1007. http://nahms.aphis.usda.gov/dairy/dairy07/Dairy2007_PtI.pdf. Accessed March 17, 2008.					

Flooring and Bedding

In indoor systems, flooring is customarily concrete, as it is inexpensive and considered easy to clean.[56] However, it can cause problems for cows as it is hard, abrasive, and slippery when slicked with urine.[57,58,59,60] Soft rubber flooring material has been shown to reduce slipping and improve ambulation compared to concrete floors.[61]

Provision of bedding materials improves the comfort, cleanliness, and welfare of dairy cows. The type of flooring and bedding should provide sufficient thermal insulation, a low risk of abrasion, and an appropriate degree of softness and friction.[62] Because organic bedding material such as straw or wood shavings may act as a substrate for bacterial growth and increase the risk of mastitis,[63] the best bedding material is most likely a soft synthetic that provides comfort without increasing the risk of infection.

It has been shown that poor flooring and bedding can compromise the lying and resting behavior of cows. Reduced lying or resting has been associated with increased stress;[64,65] reduced levels of growth hormones;[66] and changes in the frequency of behaviors such as eating, grooming, and idling,[67] and the development of hoof lesions that cause lameness.[68] A study in which cows' priorities were quantified found that lying is very important to cows and has a higher priority than eating or social contact.[69]

Cows prefer to lie on soft surfaces rather than on hard ones,[70] favoring, for example, to lie on a wood chip pad rather than concrete or gravel.[71] The total lying time may also improve when bedding materials such as sawdust are added to the mattresses in freestalls.[72] In general, cows kept in cubicle housing systems may spend significantly less time lying than cows housed in strawyards, even if straw is provided in the cubicles.[73,74]

Locomotion and Activity

Cows kept in tie-stalls are confined except when they are milked, severely limiting natural activities such as walking, exploratory behavior, and grooming and licking their hindquarters.[75,76] Research has shown that tethered cows behave abnormally to compensate for their barren environment through oral manipulation of stall components, increased sniffing and licking of the equipment or the ground, increased sniffing of neighboring cows, and more leaning against equipment.[77] Allowing these cows just one hour of exercise daily improved the frequency of normal social, grooming, sniffing, and licking behavior.[78]

A number of studies have also shown that cows are highly motivated to exercise. Compared to cows allowed regular exercise, cows who have been restricted from exercising exhibit increased play behavior when released into a paddock,[79] walk and trot more,[80] and show increased exploratory and self-grooming behavior.[81] This indicates insufficient opportunities for exercise are provided in conventional intensive dairy cattle production systems.

Social Impacts

When provided more natural living conditions, cows form stable social relationships and seldom enter a different herd willingly.[82] In production systems, however, young heifers are typically introduced into unfamiliar lactation groups, which may then be frequently reorganized according to lactation status or other factors.[83] This repeated regrouping has been associated with an increase in cortisol and may induce aggressive reactions. It is often assumed that cows adapt to repeated regroupings, but one research team found that even after cows had been regrouped 16 times, the frequency of aggressive behavior continued to increase and it took even longer to establish dominance relationships within the herd.[84]

In freestalls, dry lots, and strawyards, the space allotted per cow is typically so restrictive that cows must crowd around lying places and feed bunks, which can cause problems for subordinate animals who face aggression from dominant individuals.[85] The lack of opportunity to avoid aggression can cause stress and frustration.[86,87] Increasing the available space at the feed bunk and placing barriers to physically separate cows has been shown to reduce the number of aggressive interactions between cows and allow better access to feed.[88,89]

Cows tethered in tie-stalls have few opportunities for social contact. The stress of physical restraint and social isolation can be measured by an increase in plasma cortisol[90] and may lead to a phenomenon called hypoalgesia,[91,92] which is an increase in the pain threshold that has been observed in many species after exposure to stressful and painful experiences. It is thought to be a coping mechanism by which decreased sensitivity to pain may make animals better able to withstand aversive environments.[93]

Physical Problems

Lameness

Lameness is one of the most serious welfare issues in the U.S. dairy industry. In 2006, producers self-reported that 14% of dairy cows suffered from clinical lameness,[94] though this is likely an underestimation.[95] Based on locomotion scoring studies of more than 9,000 dairy cows in Wisconsin[96] and Minnesota,[97] two of the top U.S. dairy-producing states,[98] the prevalence may be as high as 24.6%.[99] In a survey of the primary causes of cow deaths, lameness or injury ranked highest at 20%, followed by 16.5% due to mastitis and 15.2% as a result of calving problems; lameness was reported to be the third most common reason dairy cows are selected for removal and slaughter, after mastitis and calving problems.[100]

Lameness causes pain and discomfort. Cows suffering from lameness develop hypoalgesia[101] and alter their behavior in an attempt to relieve the pain by changes in body posture,[102] reduced walking activity,[103] and more frequent shifts of their weight from one leg to the other.[104]

Hoof lesions are a main cause of lameness[105] and have been associated with concrete flooring.[106] There are additional indications that rates of lameness increase with increasing milk yield.[107] Lameness has also been tied to insufficient physical activity. Studies have shown that increased exercise and access to pasture can improve cow gait and may have a positive effect on hoof health.[108,109,110,111] Despite this, many dairy operations do not allow cows access to pasture or provide opportunities for daily exercise[112,113]

Mastitis

Clinical mastitis is the most commonly reported health problem in the U.S. dairy industry, responsible for 16.5% of recorded deaths.[114] The trauma caused by milking machines to teat tissues[115] and genetic selection for extremely high milk yields[116,117] have been identified as predisposing factors for this painful swelling of the cows' mammary glands.[118]

Most cases of mastitis are caused by infections by pathogenic bacteria[119,120,121] introduced through the teat opening.[122] Poor cubicle and cow cleanliness may therefore increase mastitis rates,[123,124] whereas frequent bedding changes and milking parlor sanitation may reduce the risk. Reducing the stocking density of cows in loose housing systems could also reduce the risk to mastitis by increasing hygiene and reducing the incidence of teat injuries.[125]

Tail-Docking†

Tail-docking of dairy cows—the partial amputation of up to two-thirds of the tail—is a procedure typically performed without anesthetic and is accomplished by the application of a tight, rubber ring that restricts blood flow to the distal portion of the tail, which atrophies and detaches[126] or is removed with a sharp instrument.[127] Without a tail, the cow may suffer disproportionately from fly bites,[128,129] and the pain from the remaining stump may become chronic, comparable to phantom pain in humans after limb amputation.[130]

A USDA survey in 2001 found that 50.5% of U.S. dairy operations practiced tail-docking. Some dairy farmers tail-docked only a small percentage of their herd, but approximately 1 in 6 dairy producers docked the tails of 100% of the herd.[131] The Colorado State University 2005-2006 survey of 113 dairy facilities reported that 82.3% of dairies surveyed practiced tail-docking.[132] Arguments used in favor of tail-docking include improved udder and milk hygiene and cleaner milking parlors and holding areas,[133] but there is no scientific evidence supporting these claims.[134] The opinion of the American Veterinary Medical Association on tail-docking is that "routine tail docking provides no benefit to the animal, and that tail docking can lead to distress during fly seasons."[135] Indeed, researchers from Colorado State University stated that "[t]he discomfort suffered by cows at the time of docking and throughout life as a result of not being able to swish flies is not reasonable, because the only benefit is to milkers in the milking parlor" and noted that some producers "had quit tail-docking due to difficulty defending the practice."[136]

Diet-Related Problems

On pasture, dairy cows graze throughout the day,[137] but in modern dairy production, cows may only be briefly fed once or twice daily.[138] There are indications that the duration of feeding time and the feeding behavior itself are important for the well-being of cows, as is the composition of feedstuffs.

Stereotypies

Research has found that the short duration of feeding in industrial production may lead to the development of oral stereotypies. Stereotypies are abnormal, repetitive behavior patterns with no obvious goal or function.[139] In cattle, these are characterized as repeated rolling of the tongue, bar biting, and licking of the stable equipment, which may be manifestations of the frustration associated with the deprivation of grazing behavior.[140] Even if the feed ration contains all required nutrients, the cow may still have a behavioral need to perform oral manipulation of the feed, as would be normal under natural conditions.[141]

Rumen Acidosis and Laminitis

As a result of genetic selection for high milk yields, cows used in today's dairy industry are unable to acquire all of the necessary energy from forage alone to sustain their abnormally high milk production. As such, feed for industrially reared dairy cows has become very concentrated with energy-dense nutrients such as grains or slaughter waste. The diet of lactating cows consists of 30-60% feed concentrates.[142] Daily, conventional dairy cows in the United States may eat 0.5 kg (1 lb) of meat and bone meal, which is composed of "trimmings that originate on the killing floor, inedible parts and organs, cleaned entrails, fetuses...."[143] However, cattle are naturally herbivores.

Abnormally concentrated diets result in the formation of organic acids,[144] which can lead to rumen acidosis in cows. A serious medical condition, rumen acidosis is the result of the inability of the cow to adapt to an

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† For further information on tail docking in dairy cows, see "An HSUS Report: Welfare Issues with Tail Docking of Dairy Cows," at http://www.humanesociety.org/farm/resources/research/practices/tail_docking_dairy_cows.html.

unnatural, high energy and low fiber diet and may result in a loss of body condition, reduced feed intake, and reduced rumen motility.[145] In severe cases, this abrupt dietary change can lead to such high acid levels that the natural rumen flora may be disrupted, which can lead to a spilling of toxins and excess acid into a cow's bloodstream causing shock or even death.[146,147]

Another problem closely linked to the feeding of concentrates is laminitis,[148] a painful inflammation of the dermal layers inside the hoof which can lead to lameness.[149]

Ketosis

According to John Webster, Emeritus Professor of Animal Husbandry at Bristol University, "[t]he amount of work done by the [dairy] cow in peak lactation is immense. To achieve a comparable high work rate a human would have to jog for about 6 hours a day, every day."[150] This huge metabolic drain may leave cows in negative energy balance, unable to eat enough to keep up with calorie loss.[151] Excessive mobilization of fat stores may lead to ketosis,[152] which in serious cases can lead to signs of neurological dysfunction such as circling, excessive grooming, wandering, and excessive salivation.[153]

Milk Fever

Another disease commonly afflicting high-producing cows is milk fever.[154] The sudden loss of calcium into the milk with the onset of lactation may not be able to be adequately compensated by dietary intake or from skeletal calcium reserves.[155] If this happens, there may not be enough calcium left in the cows' blood for proper nerve and muscle function, resulting in clinical milk fever.[156] Cows with this condition may be unable to stand and, when not treated in time, may lose consciousness to the point of coma.[157]

Bovine Growth Hormone

Recombinant bovine somatotropin, rBST (also referred to as bovine growth hormone), is a genetically engineered hormone injected into dairy cows to increase milk yield.[158] In the 2005-2006 survey of 113 dairies in 5 U.S. states, 71.7% used rBST,[159] and of U.S. dairy operations with 500 or more cows, 42% use rBST. Overall, approximately one in six U.S. dairy cows are repeatedly injected with this growth hormone.[160] The use of rBST may have significant welfare repercussions, since unnaturally high milk yields are associated with poorer body condition and increased rates of mastitis, lameness, and reproductive problems.[161]

Diminished Body Condition

Colorado State University Professor of Animal Science Temple Grandin blames the "indiscriminant [*sic*] use of recombinant bovine somatotropin" and "genetic selection for increased milk production" as the two reasons body condition scores of dairy cows have declined.[162] She reported that transport drivers with whom she spoke in California "pick up more cows in poor body condition from dairies that inject cattle with bovine somatotropin to increase milk production."[163]

Body condition is a term used to describe a cow's energy reserves, which, when excessively depleted, can have welfare implications.[164] For example, emaciated cows may be more likely to be injured during transport.[165] An expert panel formed by the Canadian Veterinary Medical Association (CVMA) to review the use of rBST "concluded that using the nutritional management programs that are common on the majority of commercial dairy herds, it would be a challenge to maintain body condition in cows treated with rBST," despite the fact that the studies they reviewed had "very good nutritional management."[166]

Elevated Risk of Mastitis, Lameness, and Other Problems

In their reviews of rBST, both the CVMA and the European Commission's Scientific Committee on Animal Health and Animal Welfare (SCAHAW) found that rBST use increases the risk of both mastitis and lameness.[167,168] rBST use may increase the frequency of clinical mastitis by approximately 25%[169] and prolong recovery. SCAHAW concludes that "BST causes a substantial increase in the risk of mastitis etc. on most farms and this risk, with associated poor welfare, would not occur if BST were not used."[170]

rBST use also increases lameness rates. One study found the risk of lameness approximately 50% higher for rBST-injected cows,[171] while another found a 220% increase in foot problems with injected cows suffering twice as long. Given the pain associated with foot and leg problems, SCAHAW concluded that "welfare will be seriously and adversely affected as a consequence of the BST treatment"[172] and the CVMA "did not feel that current dairy cattle management techniques would be able to control or eliminate the increased risk of lameness."[173]

rBST use may also introduce reproductive problems. Rates of pregnancy drop in rBST-injected cows, which may be a sign of how "severely affected by metabolic demands" cows are, and the frequency of multiple births increases substantially, which can lead to further welfare problems.[174] For the cow, these can include decreased reproductive capabilities and retained placenta, which may lead to metritis and even death.[175,176] Calves born as twins can have reduced vitality and suffer higher mortalities than single born calves.[177] SCAHAW concludes its chapter on the effects of rBST on reproductive problems: "Failure to conceive is an indicator of poor welfare and multiple births lead to poor welfare."[178]

rBST may also lower the ability of cows to cope with heat, increasing the risk of heat stress, and cause severe swelling and chronic infections at the injection sites. In general, rBST-treated cows are culled at a higher rate than nontreated cows, which likely demonstrates poorer welfare overall.[179]

Both the CVMA[180] and SCAHAW recommend against using rBST for welfare reasons. The SCAHAW concludes: "BST is causing poor welfare which would not occur if it were not used. The conclusion which should be drawn is that avoidable actions which result in poor welfare, such as BST usage, should not be permitted."[181]

Nonambulatory Cows‡

Nonambulatory cattle—referred to as "downers" by the industry—are animals who collapse for a variety of metabolic, infectious, toxic, and/or musculoskeletal reasons and are too sick or injured to rise. Data from federally inspected slaughter facilities estimate 1.1-1.5% of U.S. dairy cows go down every year, but this does not include those who collapse on-farm. A 2007 review of nonambulatory cattle suggests that the number of downed cattle in the United States each year may approach 500,000.[182] It has been reported that dairy cows account for approximately 75% of downed cattle.[183]

Prevention and Treatment

Since "[h]andling a downer dairy cow in a humane manner is almost impossible,"[184] writes Grandin, "[t]he best way to improve the welfare of nonambulatory (downer) cattle is to prevent them."[185] As many as 90% of downed cattle cases may be preventable.[186]

Grandin calls for dairy producers to cull cattle before they become physically unfit to survive transport and handling en route to slaughter[187,188] and for the industry to breed cows for better foot and limb strength since "[t]here are disturbing signs that some dairy cattle breeders are selecting for milk production at the expense of their cows."[189]

Poor management and maintenance of dairy facilities also places cattle at increased risk for becoming nonambulatory.[190] Providing proper bedding, for example, is considered critical for downer prevention. As

‡ For additional information, see "An HSUS Report: Food Safety Concerns with the Slaughter of Downed Cattle" at http://www.humanesociety.org/web-files/PDF/farm/hsus-food-safety-concerns-with-the-slaughter-of-downed-cattle.pdf.

discussed above, smooth surfaces such as concrete can become slippery; however, according to Victor S. Cox and Ralph J. Farmsworth, both with the University of Minnesota's College of Veterinary Medicine, "the best surfaces for cows are not easy to clean, and concrete, the easiest surface to clean, is hardest on cows."[191] Unyielding surfaces like concrete also minimize chances of recovery by contributing to the pressure damage associated with immobility in such heavy animals; as a bedding material, concrete is considered "extremely dangerous."[192]

When cows become nonambulatory, in conjunction with proper diagnosis and specific treatment, general management should include making the cow as comfortable as possible on a solid, non-slip surface, keeping the cow thermally protected, allowing constant access to food and water, turning the cow at least four times every 24 hours, and carefully attempting daily to raise the cow with a hip sling.[193] Nonambulatory cattle should be treated as medical emergencies, as prolonged recumbency itself can lead to muscle and nerve damage that may reduce the chance of recovery. Recovery may be unlikely for cows who have been nonambulatory for six or more hours.[194]

If indeed their prognosis is poor or they appear to be in extreme discomfort, downed cattle should be immediately and humanely euthanized.[195] Methods deemed acceptable by dairy cattle experts—when performed properly by veterinarian or trained personnel—include captive bolt, gunshot, and euthanasia solution.[196]

Diagnosis

Diagnosing nonambulatory cattle can be difficult because of the wide range of primary conditions and the secondary damage. However, it is noted that having a medical history and carefully examining the cow will help immensely and that one should look for signs of the previously mentioned conditions. Nonetheless, it is difficult to examine cows in recumbency.[197] A 2003 review echoes these thoughts, stating: "In the case of cows that have become recumbent through illness rather than accident, enquiries as to their stage of lactation, recent performance and appetite prior to falling ill are essential." The review further asserts that clinical examinations "should always be thorough" and that "a precise 'cow-side' diagnosis can, on occasions, be very difficult." The review concludes: "It should always be considered that two or more conditions may present simultaneously in a downer cow…."[198] Bovine veterinarian Jim Reynolds of the University of California's School of Veterinary Medicine reportedly agrees: "It is very, very difficult for a veterinarian to differentiate the many reasons a cow may be non-ambulatory."[199]

Humane Handling Violations

In 1995, Grandin cautioned that "[o]ne emaciated, downed, suffering cow shown on television can cause more losses to the industry" than all other costs associated with carcass condemnation.[200] Investigative efforts by the Humane Society of the United States[201] and others[202,203,204] have found that nonambulatory cattle may be routinely beaten, dragged with chains, shocked with electric prods, and pushed by forklifts in efforts to move them at slaughter facilities, compounding the pain they may already suffer as a result of the injury or illness causing their immobility.

Citing "egregious violations of humane handling regulations" the USDA suspended inspection and federal food program eligibility for a major slaughter plant in 2008 as a result of one such investigation,[205] which resulted in the largest beef recall in U.S. history.[206] The investigative findings of downed dairy cow mistreatment and allegations of nonambulatory animals being slaughtered for human consumption also prompted congressional reaction,[207] led to school districts temporarily pulling all beef from their menus,[208] and placed the reliability of the U.S. meat inspection process in question.[209]

Handling and Transport

Rough handling is a major cause of stress, bruising, and injuries. Improving the training[210] and attitude of handlers towards cattle would improve welfare[211] and make future handling easier, as cattle remember and respond to bad experiences.[212] Sticks and electric prods should never be used to handle or move cattle.[213]

Cattle may find transport to be threatening and unfamiliar, involving a series of stressful handling and confinement experiences. The animals face stressors from noise, motion, and potentially extreme temperatures and humidity. Unless transport is cautiously planned and executed, it may cause injury and even death.[214]

During transport, unfamiliar groups of animals may be mixed, which can increase the risk of fighting and threatening behaviors,[215] cause stress, and lead to exhaustion.[216] Attempts should be made to keep familiar groups of cows together.[217]

Food and water are typically withheld during transport, which can lead to weight loss and dehydration,[218] compounded by stress-provoked defecation and urination on the trucks.[219] Reviews of welfare during transport suggest that cattle may reach exhaustion after 15 hours[220] and become significantly dehydrated after 24 hours.[221] Dairy cow mortality during transport has been associated with longer journeys and colder weather.[222]

In 2005, the 167 member countries of the World Organisation for Animal Health (OIE) adopted animal transport standards,[223] the first article of which reads: "The amount of time animals spend on a journey should be kept to the minimum."[224] This echoes the conclusions of the SCAHAW and the European Food Safety Authority that "journeys should be as short as possible."[225,226]

Potentially even more important than reducing transport duration may be the road quality and driver's skill.[227,228] Drivers can have an enormous impact on the welfare of the animals being transported.[229] Cattle subjected to sudden braking and cornering cannot effectively brace themselves and may be thrown to the floor or into each other.[230,231]

Lower stocking densities are preferable, as high stocking densities have been associated with reduced welfare. On overcrowded trucks, cows not only have an increased risk of falling, but may have more difficulty regaining a standing posture.[232]

Transport can also reduce welfare by affecting immune function[233,234] and increasing the likelihood of disease. By the end of their journey to slaughter, cattle may be weakened, hurt, or diseased. Animals who have become injured, sick, or nonambulatory during transport should be given prompt medical attention or be immediately and humanely euthanized.[235]

Stunning and Slaughter

Virtually all dairy cows are ultimately slaughtered for human consumption in the United States.[236] Millions of dairy cows enter the food chain as ground beef every year,[237] accounting for at least 17% of the ground beef produced in the United States.[238] Since the muscles of dairy cows have a lower fat content, they are commonly used in producing the more expensive "lean" hamburger.[239]

Grandin indicates that the five main causes of welfare problems during the time preceding slaughter are: poor condition of arriving animals, stressful handling methods, distractions that hinder movement, improperly trained employees, and poor maintenance of equipment.[240]

Pre-Slaughter Handling

Handling in the slaughter plant should be performed gently and carefully so that cows move as calmly as possible through holding pens, races, and into the kill box.[241,242] In audits of slaughter facilities, Grandin found that 98.2% of vocalizations were associated with four different adverse events: excessive electric prodding, slipping on the floor, too much pressure in restraining devices, and missed captive bolt stuns.[243] Stress hormone levels can double or triple in cattle because of slipping on slick floors or being over-prodded.[244] Cattle also find yelling by workers to be stressful and aversive.[245]

Slaughter plant workers need to be properly trained in humane handling techniques.[246,247] Since the attitude of workers can become negative, Grandin recommends lowering slaughter line speeds and rotating employees through different jobs every few hours to so they "maintain a humane attitude."[248] Management must also maintain a culture of accountability. Over a period of 20 years, Grandin "observed that the single most important thing that determines how well animals will be treated is the attitude of management."[249] Slaughter plants with poor managers reportedly often have problems with animal abuse.[250]

Stunning

Stunning is performed before slaughter to render the animal insensible to pain.[251] Once unconscious, the cow should be slaughtered immediately to minimize the chance of her regaining consciousness.[252] Cattle are typically stunned with a captive bolt pistol or gun shot to the head.[253]

After a cow is stunned, she should immediately drop to the floor and, after 5-10 seconds, exhibit a flaccid head and neck, a lack of reflexes in and around the eye, and drooped ears.[254,255,256] If the stunner is not positioned correctly, it may fail to render her unconscious. If she is not effectively stunned the first time, she may be more difficult to re-stun, so it is critical the stunner be positioned correctly, which may not be an easy task since the cow is likely to be moving.[257] If the stun is not effective, the cow may vocalize, indicating that she may be in pain, or she may blink, indicating that she is still conscious.[258]

Improper maintenance of the equipment is a major problem that can lead to multiple shots and decrease welfare.[259] For this reason, Grandin recommends that a second stunner be close at hand.[260] Where line speeds are high, stunner operators can become overloaded and their stunning error rate may increase.[261]

Slaughter

Exsanguination follows stunning. Cows should be stuck no longer than 15 seconds after stunning and bled to death quickly.[262] A thoracic stick (through her chest) is the recommended method since it avoids problems associated with severing arteries in her neck and causes blood loss that is "rapid and profuse."[263]

Conclusion

There is a tremendous potential for increasing the welfare of cows in the dairy industry. Many of the housing problems can be prevented by increasing the available space, using appropriate bedding materials, and providing opportunities for exercise. Providing regular access to pasture and suitable high-fiber diets could help alleviate the health, stress, and behavioral problems associated with confinement and feed concentration. Genetic selection for health traits could also be used to reduce the incidence of production related diseases such as lameness and mastitis. On the way to their deaths, dairy cows should be transported and handled in a manner which minimizes stressors and proper stunning and rapid exsanguination should be ensured at slaughter.

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The Humane Society of the United States is the nation's largest animal protection organization—backed by 11 million Americans, or one of every 28. For more than a half-century, The HSUS has been fighting for the protection of all animals through advocacy, education, and hands-on programs. Celebrating animals and confronting cruelty. On the Web at humanesociety.org.