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Animal Welfare during Transport: Technical requirements for long-distance transport of unweaned calves

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Technical requirements for long-distance transport of unweaned calves

Calves that still need to be fed with milk or are accustomed to milk replacer (unweaned calves) place special demands on the technical equipment of transport vehicles during long-distance transport. This animal welfare assessment provides an overview of the technical requirements for transport vehicles from an animal welfare perspective. In particular, the technical requirements for watering devices specified in Chapter VI No. 2.2 of Council Regulation (EC) No. 1/2005 (Council Regulation on Animal Welfare during Transport) are dealt with. The assessment aims at assisting the authorities of the Federal States responsible for granting permission of long-distance transport of calves in approving the means of transport.

Legal situation

The legal basis for monitoring the transport of animals in Germany are the German Regulation on Animal Welfare during Transport and on the Implementation of Council Regulation (EC) No 1/2005 (Regulation on Animal Welfare during Transport) of 11 February 2009 and Council Regulation (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport and related operations. In the latter, the following undetermined and specific rules have been laid down for animal welfare during long-distance transport of unweaned calves:

Article 3 lays down general conditions for the transport of animals, according to which no person shall transport animals or cause animals to be transported in a way likely to cause injury or undue suffering to them. In particular, **point (a)** demands that inter alia „all necessary arrangements have been made in advance to minimise the length of the journey and meet animals‘ needs during the journey“. In other parts of the regulation, quantified information has been provided, e.g. on feed and water supplies to be carried to meet the animals’ needs.

Point (h) demands that „water, feed, and rest are offered to the animals at suitable intervals and are appropriate in quality and quantity to their species and size“.

The maximum time intervals considered necessary for watering and feeding are specified in **Chapter V of Annex I** of the regulation. Unweaned calves, lambs, kids and foals which are still on a milk diet and unweaned piglets must, after nine hours of travel, be given a rest period of at least one hour sufficient in particular for them to be given liquid and if necessary fed. After this rest period, they may be transported for a further nine hours **(Point 1.4 (a)).** After the maximum journey time of 19 hours (according to current ECJ jurisdiction), the unweaned animals must be unloaded, fed and watered, and given a rest period of at least 24 hours.

Needs of unweaned calves

Suckling calves (calves accustomed to a milk diet, unweaned calves) as well as weaned calves that are able to sustain themselves and grow by taking up solid food and water, are so-called suction drinkers. For the physiological act of sucking, suckling calves need a teat which they can take into their mouth. In a two-phase sucking act they first create a vaccuum which makes the teat fill with milk (approx. 30 % vaccuum phase). Subsequently, the milk is emptied into the oral cavity under pressure (tongue against palate, base of the teat occluded against the upper jaw) (approx. 70 % pressure phase, Wehowsky u. Troeger, 1994). This cycle is repeated at a frequency of about 80 to 150/min when the calf sucks the cow’s udder or

the flexible rubber teat of the bucket or automatic milk feeder. With natural ad libitum feeding, the calf visits the cow's udder up to 11 times a day during the first two weeks of life (Kunz 2014) and takes up 16 to 24 % of its own body weight in drinking volume (Jensen u. Vestergaard, 2018). With a body weight of about 45 kg, the suckling calf, when fed nine times on average with an automatic milk feeder, has a daily dry matter intake of about 1 to 1.5 kg (Steinhöfel u. Diener, 2015).

For the daily energy and crude protein supply (in the sense of feed for maintenance and growth), the minimum daily need of unweaned calves at the age of 3 to 6 weeks (50 to 75 kg live weight, Mansfeld u. Hoedemaker, 1998) at a moderate rearing intensity with daily weight gains of approx. up to 600 g must be assumed to be 17 (50 kg live weight) to 21 (75 kg live weight) MJ metabolizable energy (ME), with a daily need of crude protein of 200 to 250 g in the specified age range (Meyer, 2005; Kamphues et al., 2014, LfL 2019). The indicated energy and crude protein contents are to be administered with approx. 8 l of milk replacer (160 g powder/l, no vegetable proteins, high skim milk powder content) per day, with free access to water and good hay (LfL 2019). However, Maccari et al. (2015) assume that for high performance (milk or meat) in later phases of life, a kind of „metabolic programming" must take place during the first weeks of life, which makes the daily need in this phase appear much higher. This change in feeding and rearing strategy is based on intensive feeding in the drinking phase (drinking quantity: 20 % of body weight or ad libitum) with a daily body weight increase in the milk diet phase between 900 and 1000 g (Bazely, 2015; Cockroft, 2015; Nooerdhuizen, 2012).

This need must be covered with milk or milk replacer offered by a flexible rubber teat from a temperature-controlled feeding device in accordance with the natural feeding behaviour (sucking) (u. a. DePassille, 2001; DePassille u. Rushen, 2012, 2016; Kahn et al., 2011; Kamphues, 2014; Dennis et al., 2018). At cold temperatures, the need of energy supply for maintenance increases strongly (Davis u. Drackley, 1998; Elmer u. Reinhold, 2002; LfL, 2019). The physiological act of sucking (including „correct" position of the head), but not the act of swallowing, triggers the so-called abobamasal groove reflex of suckling calves, which prevents the milk from being misdirected into the maturing „pre-ruminant" stomachs (rumen, reticulum and omasum) and transports it directly into the fourth stomach, the abomasum (de Pasillé u. Rushen, 2008; Brammertz, 2014; Jones u. Heinrich, 2017). Misdirection into the forestomachs causes malfermentation and decay processes leading to severe diarrhea (Drochner et al, 2008; Kamphues et al., 2014).

An essential prerequisite for avoiding digestive disorders in suckling calves is the observance of a rest period after milk intake. Within a period of approx. 3 hours, an enzymatic casein precipitation occurs in the abomasum under resting conditions (de Pasillé and Rushen, 2008; Brammertz, 2014; Kamphues et al., 2014; Schäff et al., 2016). For this purpose, calves also need suitable resting areas with respect to space and bedding material (Drochner, 2008, Khan et al., 2011; Ellingsen et al., 2016). In addition, suckling calves also require, among other things, constant access to drinking water for early development of the rumen (Jensen and Vestergaard, 2018), which is required anyway for calves aged 14 days and older pursuant to the German Regulation on Animal Welfare in Farm Animal Husbandry (Tierschutz-Nutztierhaltungsverordnung).

The effects of underfeeding on morphological changes in the mucous membranes of the gastrointestinal tract already were investigated in an early study in mice (Brown et al., 1963). According to this study, cell changes in the epithelium of intestinal villi and crypts of the small intestine occurred after only 6 hours of „emptiness“, accompanied by a strongly reduced mitosis rate and increased percentage of immature cells. Other consequences of underfeeding in pigs were increased cortisol and TNFα concentrations in the digestive tract with negative effects on the physiology of the digestive system and intestinal immunity (Lee et al., 2016).

Phases of underfeeding lead to reduced pH values in the abomasum, which can only be kept above the level of 3 permanently by frequent feeding with milk or milk replacer (Ahmed et al., 2002). This prevents damage (ulcers) of the gastric mucosa (Steinhöfel u Diener, 2015). This problem is increased when feeding only twice a day, and in particular also by feeding acidified milk or milk replacer (Steinhöfel u. Diener, 2015). Acidification is done to reduce the number of microbes in whole milk or pre-mixed milk replacer and only is effective when the pH value is reduced to below 5 (Steinhöfel u. Diener, 2015) or 5.5 (LfL, 2019). If the calves are not accustomed to acidified feed from the beginning, i.e. after the colostrum phase, a later change is associated with acceptance problems and the animals do not take up feed at all or only to a limited extent (LfL, 2019).

Not feeding calves at all or only to a significantly limited extent has considerable effects on the immune system of the animals, which are heavily stressed by the transport anyway and also are in the „immunological gap“ due to their age (Marcato et al., 2018, among others): maternal antibody uptake occurs exclusively during the completed colostrum phase, the calves‘ own, „pen-specific“ immune system has not yet developed. When moved to new environments during this sensitive phase, in combination with stress during transport, both, morbidity, especially for diarrhea and pneumonia, and mortality are increased, sometimes considerably, for up to 3 weeks after arrival in the new holding (u. a. Fiore et al., 2010; Panciera u. Confer, 2010; Marcato et al., 2018; Van Engen et al., 2018; Meylan, 2019).

Covering the need of unweaned calves during long-distance transport

The relevant provisions of Regulation (EC) No 1/2005 distinguish a water (or liquid) supply from feeding, even in the case of calves not (yet) weaned (fully). Pursuant to this regulation, unweaned animals are always assumed to have a need for water or liquid after a maximum transport period of 9 hours, whereas feeding is only required when there is an actual need („if necessary“). Feeding is not only characterized by satisfying the energy requirements, but also and above all by covering the protein requirements. Depending on the numerous feeding types in animal husbandry systems, suckling calves in the phase of life in question are accustomed to a daily administration of 6 to 12 litres of milk or (depending on the concentration) milk replacer by a flexible rubber teat, which enables sucking with a negative and positive pressure phase, thus triggering the abomasal groove reflex. The supply with and therefore the habituation to acidified milk or milk replacer is available in only a part of the rearing farms and holdings. To ensure the thermoregulatory fluid balance and to induce rumen development, calves for rearing are provided with water ad libitum.

Until now, vehicles for long-distance transport of cattle have been approved pursuant to Article 18 in conjunction with Annex I Chapters II and VI and Annex II Chapter IV of Regulation (EC) No 1/2005. However, as the long-distance transport of unweaned calves places special demands on animal care, the Commission (Directorate F) and the working group of the National Contact Points (NCP) in Grange, Ireland, request that for approval of these vehicles a distinction have to be made as to whether they are also suitable for long-distance transport of the cattle category „unweaned calves“. Accordingly, the certificate of approval, limited to 5 years, must be issued by the competent authority. Corresponding information has also been included in the Manual for Animal Transport („Handbuch Tiertransporte“) of the Working Group on Animal Welfare (AGT) of the Federal States‘ Working Group on Consumer Protection (LAV). Since calves that have not been weaned are not accustomed to covering their fluid balance (drinking liquids in the sense of the Regulation) via an open water surface offered to adult cattle, in the period of their lives (2 to about 6 weeks) that has hitherto been considered for long transport, they must be offered the drinking technology they are accustomed to (deformable rubber teat enabling the suckling act) after a maximum transport time of 9 hours (Herzog and Franzky, 2019).

In order to decide whether, if necessary, unweaned calves must also be fed during this rest period in order to ensure an adequate energy and protein supply to avoid undue suffering pursuant to Article 3 of the regulation, the previous and upcoming transport periods at this time point must also be taken into account – in particular with regard to the times of the last and the expected next needs-based feeding. Since the long-distance transports in question usually are processed in collection centres, where unweaned calves can stay unfed for up to 6 hours after a previous transport period (watering in the sense of liquid supply must be ensured, to which however calves are not accustomed. This also applies to watering with electrolyte solutions gentle on the abomasum, which are not considered as feed), the competent authority will normally consider feeding during the at least 1 hour rest period during transport as necessary. This is in particular the case, as the authority cannot determine the time of feeding after completion of the second part of the journey and unloading of the calves (usually again at a collection centre). The long-distance transport of unweaned calves must therefore be carried out in vehicles specifically approved for this category of animals.

Technical requirements for feeding of unweaned calves during transport

The food supply equipment required for feeding unweaned calves during long-distance transport in accordance with their needs and behaviour is comparable to (automatic) feeding equipment in calve rearing facilities, as the same requirements must be met. This applies in principle to a temperature-controlled feed supply (milk or milk replacer in the appropriate concentration) by a rubber teat which enables a behaviour-appropriate, i.e. neither insufficient nor too hasty, two-phase sucking act by appropriate design of the opening. With automatic feeding systems, watering on demand is provided, which means that liquids must not be stored, thus preventing or limiting the danger of microbial colonisation and spoilage. With manual feeding (feeding bucket) the individual animal is given its respective ration and the intake can be monitored. The automatic feeder is controlled and monitored by a transponder for each individual animal, which can be used to monitor the frequency and extent of food intake. As there is only a limited time frame available for feeding the calves, the latter two

techniques are not suitable for transport, as at least group feeding must be possible in order to avoid competition between calves.

For this reason, one teat must be available per calf in a group (loading pen or tier) during feeding, which must be accessible to the calf. To prevent the calves from sucking an empty teat or sucking in air and turning away from the teat (Zerbe, 2020; Kaske, 2020), the teat should already be filled with liquid like in a feeding bucket or automatic feeder. Since technically rationed feeding is not feasible here and it must be ensured that each calf is fed, it must be ensured that each calf can satisfy its hunger. Experiences from collection centres show that the majority of calves do not find the teat. It must therefore be ensured that the animal keeper has access to each calf on the loading tier of the vehicle to guide it to the teat.

If it is not possible to mix the milk replacers in a temperature-controlled way „on demand“ and they must therefore be carried as a ready-to-use mixture, separation of the mixture must be avoided and storage stability according to hygienic aspects must be ensured. As a rule, this is done by acidification with organic acids. At pH values below 5.5 however, acceptance of the milk replacer by the calves decreases, in particular if they are not accustomed to this procedure. In principle, this also applies to feeding with cold liquid; in addition, both aspects also increase the risk of digestive or health problems. A further risk, which however cannot be regulated in the approval procedure is failure to observe the at least 3-hour rest period for digestion, during which casein precipitation occurs in the calf’s abomasum.

In summary, from an animal welfare point of view, the following essential requirements must be fulfilled by the technical equipment of transport vehicles for the feeding of unweaned calves in accordance with their needs and behaviour:

- Feed liquid (milk replacer, milk) is administered by a flexible rubber teat which the calf takes into its mouth for the two-phase sucking act (no overpressure in the system).
- The animals must obtain feed already with the first sucking act (no sucking of empty teat).
- In order to avoid acceptance or digestive problems, milk or milk replacer must be administered at a controlled temperature of > 30 °C.
- In order to avoid acceptance and digestive problems, acidification of liquid feed should be avoided.
- All calves of a group within the vehicle must be able to feed at the same time.
- To avoid underfeeding, each calf must have access to the full energy and protein content necessary per meal and the corresponding volume of liquid feed (> 3 litres, in winter > 4 litres) from the beginning (no „refilling“). This also prevents overfeeding.
- It must be ensured that each calf can be guided to the feeding system by the animal keeper, so that it has sufficient time for appropriate feeding as needed.
- The feed supply to be carried (capacity of storage tank for milk replacer or in case of mixing „on demand“ of water and milk replacer powder) must comply with the total number of transported calves. The filling volume of the feeding system must be added.

Literature available from FLI on request

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