



Question raised by requestor

In the abattoirs, the Regulation (EC) No 1099/2009 requires that feed and bedding be provided if bovines remain in the cattle pen for more than 12 hours. French reports, notably BOUV'ALIM (2015), indicate that, in practice, slaughterhouses use digestible pellets or fodder to meet this requirement. The regulation does not precisely define what "feeding" is, leaving a regulatory gap. While straw can be a dietary supplement capable of promoting rumination and providing volumetric satiety, it is not sufficient to give satiety, given its low content of nutrients, calcium, and feed units. What is your opinion? Has this question already been raised by another Member State, and if so, what response was given?



Answer

In short, the question concerns whether feeding cattle with pellets or straw can be considered to be in accordance with current EU legislative requirements. The Regulation (EC) No 1099/2009 states that "*Animals which have not been slaughtered within 12 hours of their arrival shall be fed, and subsequently given moderate amounts of food at appropriate intervals.*" The legislation does not specify the type of feed to be provided.

According to the BOUV'ALIM report [1], which studied feeding and bedding for cattle kept in holding areas at abattoirs for more than 12 hours in France, feed can consist of pellets or roughage (hay or straw). The document specifies that:

- Pellets can be used alone as a feed source if they are palatable, high in fibre, have a protein level <15 %, and are preferably large in diameter to prevent overconsumption.
- Feeding pellets alone is possible but sometimes questioned because it could induce metabolic disorders in the animal (e.g., acidosis, bloating).
- Roughage can also be used alone if it is of good quality and palatable.

The report does not prescribe a mandatory combination of pellets and roughage.

Eating time and rumination time

A dairy cow with unrestricted access to feed spends approximately 4–5 hours per day feeding and about 7 hours ruminating, resulting in a maximum total chewing time of up to 16 hours per day [2]. Cattle exhibit distinct cycles of feed intake and rumination and tend to consume feed for shorter periods, but more frequently when offered a total mixed ration compared with grazing systems [3]. Rumination generally begins around four hours after feed intake and is commonly associated with lying behaviour, and during the night. Rumination time is strongly influenced by several feed-related factors, including particle size, dry matter content, neutral detergent fibre (NDF) intake, resistance of the feed to mastication, and fibre indigestibility [2]. The shortest total chewing time, defined as the combined duration of eating and rumination, occurs when the mean particle size of the diet is very fine (<5 mm) [2]. During feeding and rumination, ruminal contractions increase, facilitating the movement of smaller particles from the rumen into the omasum.

Dry matter intake in ruminants is largely determined by physical characteristics of the diet, particularly fibre content, fibre digestibility, and the degradation rate in the rumen. Neutral Detergent Fibre (NDF), which comprises lignin, cellulose, and hemicellulose, serves as an indicator of dietary fibre content and significantly influences feed intake, rumen fermentation, and nutrient utilisation [4]. Feeds with high NDF concentrations promote rumen health, and feeds for high-yielding cows should have a NDF concentration of at least 25–30 % of dietary dry matter [5]. While NDF measures the chemical characteristics, the physical characteristics of fibre, such as particle size and density, are not taken into consideration. The physically effective fibre in feeds (peNDF) combines information on dietary particle length and the NDF content of the diet in a manner that predicts the physical effectiveness of the diet and describes the feed's ability to promote chewing activity [6]. An increase in the peNDF typically increases chewing time, mainly because of increased rumination time [7]. Feeds high in fibre are generally less digestible, resulting in prolonged retention time within the rumen to enhance fibre breakdown. This increased retention time, however, is associated with reduced voluntary feed intake in ruminants [8].



Function of the rumen

The physical breakdown of large feed particles through mastication during feed intake and rumination is a crucial component of the digestive process in ruminants. Within the rumen, and to some extent within the reticulum, microbial activity (i.e., bacteria and protozoa) facilitates the degradation and fermentation of complex carbohydrates into volatile fatty acids (VFAs). VFAs are short-chain fatty acids and the main source of energy absorbed by the digestive tract of ruminants. An optimal ruminal pH value for microbial fermentation is maintained through the continuous secretion of saliva containing phosphate and bicarbonate that buffers the pH value in the rumen, as well as through the absorption of VFAs produced in the rumen.

A well-functioning ruminal microbial population and a stable ruminal pH value are essential for animal health and welfare. Research indicates that following 12 hours of fasting, measurable changes in microbial activity occur, including a reduction in cellulose-degrading bacteria, due to a decline in ruminal pH value [9]. Salivary secretion per minute of chewing and at rest remains relatively constant; thus, differences in the final saliva content of the swallowed bolus are mainly due to differences in feeding rate and particle size of the feed. One study reported that concentrate feeds were consumed approximately 3 to 12 times faster than roughage, likely because they required less time for particle size reduction and lower salivary secretion before swallowing [10]. Feeds containing a high proportion of concentrates can cause a rapid decrease in ruminal pH value, thereby disrupting the ruminal microflora and increasing the risk of acidosis. For instance, one study found that diets consisting of 40 % concentrates or more reduced the ruminal pH value enough to induce subacute ruminal acidosis [11]. These findings underscore the importance of providing ruminants with feeds that promote adequate chewing activity to support rumen function and overall digestive health. Feeding forages that are consumed more slowly may help prevent ruminal acidosis by increasing the total daily salivary secretion [10].

Importance of particle size

Cattle feeds are commonly classified into two categories: roughage and concentrates.

Roughage contains a high level of crude fibres and comprises pastures and other grazed forages, hay and dehydrated forages, silage and straw.

Concentrates are feeds with a high-energy content and consist primarily of cereals (e.g. corn, wheat, rye, oats, and barley), and by-products from the processing of cereals and seeds [12].

Feed particles with a length >6 mm are classified as roughage, whereas particles measuring 6 mm or less are considered concentrates [13]. Studies have demonstrated that the particle size of the bolus from cows fed grass silage chopped to 19 mm did not differ in mean particle size from that of boluses produced by cows fed unchopped grass silage [14]. Consequently, roughage chopped to particle lengths greater than approximately 20 mm is considered to have similar rumination time as unchopped roughage, and therefore contributes to satiety, nutrition, and activity. It is important to note that particle size in this context refers to the length of the hay and silage fibres rather than the overall size of feed forms such as pellets, hay briquettes, and cubes.

The main function of rumination is to break down large particles into smaller ones. Further research has shown that chewing time increases with increasing roughage particle length, with extended rumination accounting for approximately 62 % of the observed increase in total chewing time [15]. In contrast, reducing the mean particle size of hay to 9 mm resulted in a decrease in total chewing time, primarily due to a 74 % reduction in feeding time compared with unchopped hay. Overall, mechanical processing of roughage, such as chopping, grinding, or pelleting, leads to reductions in both feeding and rumination times, with the magnitude of the reduction increasing as mean particle size decreases [16].

As discussed previously, feed characteristics such as physical structure, dry matter content, NDF intake and peNDF also influence chewing time and rumination. Consequently, both the type of roughage and its particle size affect chewing behaviour, and these factors are often difficult to separate under practical feeding conditions. Hay and silage are generally considered to meet the criteria for classification as roughage, even when chopped to a particle length of approximately 20 mm.



Pellets are produced from finely ground or pulverised roughage that is compressed into pellet form and therefore consist predominantly of very small particles. Fortified pellets are enriched with vitamins, minerals, and trace elements. In one study, cows were fed high-quality hay that was either chopped (mean particle size ~15 cm) or ground (mean particle size 470 µm in pellets with a diameter of 10 mm) [17]. Feeding pelleted hay resulted in a reduction in both the rate and extent of ruminal fermentation. In addition, the total retention time of particles within the digestive tract was shortened, leading to an overall decrease in digestibility due to reduced fermentation and limited time available for microbial activity. No rumination was observed when cows consumed pelleted hay, a finding consistent with previous research indicating that feed particles must exceed approximately 700 µm to effectively stimulate rumination [15]. Because pelleted feeds are easy to chew and swallow, they are associated with short eating times and insufficient stimulation of rumination. Consequently, pelleted feeds cannot be considered to meet the functional requirements of roughage, even if they are derived from roughage sources.

Straw, a by-product of cereal crops following harvest, is commonly used as bedding material and may also be classified as a form of roughage. However, the use of cereal straw in diets for dairy cows is constrained by its low concentrations of crude protein, vitamins, minerals, and readily fermentable carbohydrates, as well as by its poor palatability. In addition, straw contains high levels of lignin and silica, which contribute to its low nutrient digestibility. Consequently, some researchers have suggested that the inclusion of straw in the diets of lactating dairy cows should not exceed 15 % of total dry matter [18]. Although straw lacks the nutritional content to serve as a sole feed source, it can nevertheless provide beneficial chewing activity when offered in combination with other feeds. This characteristic makes straw valuable in environments such as abattoirs, where opportunities for natural feeding behaviour may otherwise be limited.

Animal welfare aspects

Due to their inherent survival instincts, animals may respond adversely to unfamiliar situations. For example, exposure to novel environments during transport and lairage at abattoirs can be stressful and may negatively affect animal welfare. Following transport that often lasts several hours, animals may arrive at the abattoir already experiencing hunger and/or thirst. In addition, during lairage, the animals can experience social stress, pain and fear, restricted movement, resting problems, fatigue, and heat or cold stress [19]. Feed deprivation adversely affects animal welfare in multiple ways. Sensations of hunger and thirst are powerful motivators closely linked to survival, and prolonged deprivation inevitably results in stress, discomfort, and frustration, and may lead to oral stereotypies such as head nodding, tongue rolling, or bar-biting/licking [20]. In addition, insufficient feed intake may cause physical discomfort, weakness, and a general decline in health status.

Providing feed during lairage serves an important behavioural function by keeping the animals occupied. Feeding and ruminating are integral components of natural cattle behaviour and may contribute to stress reduction in the unfamiliar and potentially challenging environment of the abattoir. According to a Swedish study, dairy cows were motivated to consume feed even when their rumens were filled artificially, indicating that cattle may have a behavioural need to perform foraging behaviour even when metabolically satiated [20]. Other studies have shown that when given a choice, heifers fed a limited high concentrate total mixed ration were willing to pay a price to obtain supplementary roughage [21]. In addition, the heifers preferred to feed long rather than short particle straw, to maximise their foraging needs and to increase satiety through sufficient rumen fill. Thus, a supplementary feed to animals fed a limited total mixed ration is recommended to engage in feeding patterns resembling their natural behaviour and to diminish frustration and hunger due to insufficient foraging or rumen fill [22]. For animals required to remain in lairage for extended periods (e.g. overnight), it is therefore important, also from a welfare perspective, to provide adequate roughage as feeding them only pellets will not provide chewing activity, stimulate rumination or give a feeling of satiety.



Conclusion

It should be noted that the provision of pelleted feed to ruminants during lairage is not prohibited; however, such feed should be offered only as a supplement to roughage, with careful consideration of the balance between fibre-rich feeds and more readily digestible components. Although straw does not provide sufficient nutritional value to serve as a sole feed source, it may be effectively combined with other feeds to extend feeding time and promote natural feeding activity, thereby contributing positively to animal welfare during lairage.

Examples from EU Member States

Sweden: The Swedish Board of Agriculture stipulates in national legislation (SJVFS 2020:22) that *"If the total time for transport to and stabling at the slaughterhouse exceeds twelve hours, the animals shall be fed with feed that is suitable for the species and in sufficient quantity. Ruminants shall be provided roughage."* It should be noted that the total time of 12 hours includes both transport and lairage at the abattoir. According to a statement from the Swedish Centre for Animal Welfare [23], for a feed to function as roughage for ruminants, it must possess adequate physical structure, contain sufficient fibre, stimulate chewing activity, keep the animals occupied, and maintain the rumen microflora in a satisfactory condition. Pelleted feeds do not fulfil these criteria and therefore cannot be considered roughage.

Finland: Under the Finnish Animal Welfare Act (2023), the physiological needs of animals must be taken into account when feeding. The Finnish Food Authority [24] states that pellets are primarily intended as a supplementary feed rather than a replacement for roughage. When used as the sole feed, pellets do not satisfy the chewing needs of ruminants and may increase the risk of digestive disorders. Consequently, when pellets are provided, the feeding instructions and recommendations issued by the feed manufacturer must be followed, and as a practical principle, pellets alone should only be used as a stand-by feed, i.e., for animals that are lairaged for such a short period that they only need to be fed once at the most.



References

- [1] Lefebvre T. BOUV'ALIM : Alimentation et mise à disposition de litières aux Gros Bovins séjournant plus de 12 heures en bouvieries : faisabilité au niveau Français [Internet]. Institut de l'Élevage; 2015 Dec p. 1–56. (RESULTATS). Report No. 00 15 401 013. Available from: https://bibliothequerd.interbev.fr/wp-content/uploads/2017/12/CR_Bouv_Alimentation_decembre_2015_version_diffusable.pdf
- [2] Beauchemin KA. Invited review: Current perspectives on eating and rumination activity in dairy cows. *J Dairy Sci.* 2018; 101(6):4762–4784. <https://doi.org/10.3168/jds.2017-13706>.
- [3] Roche JR, Blache D, Kay JK, Miller DR, Sheahan AJ, Miller DW. Neuroendocrine and physiological regulation of intake with particular reference to domesticated ruminant animals. *Nutrition Research Reviews* 2008; 21:207–234. <https://doi.org/10.1017/S0954422408138744>.
- [4] Shi R, Dong S, Mao J, Wang J, Cao Z, Wang Y, Li S, Zhao G. Dietary Neutral Detergent Fiber Levels Impacting Dairy Cows' Feeding Behavior, Rumen Fermentation, and Production Performance during the Period of Peak-Lactation. *Animals (Basel)*. 2023; 13(18):2876. <https://doi.org/10.3390/ani13182876>.
- [5] National Academies of Science, Engineering, and Medicine (NASEM). *Nutrient Requirements of Dairy Cattle*, 2021. 8th rev ed. National Academies Press.
- [6] Mertens DR. Creating a system for meeting the fiber requirements of dairy cows. *J. Dairy Sci.* 1997; 80:1463. [https://doi.org/10.3168/jds.S0022-0302\(97\)76075-2](https://doi.org/10.3168/jds.S0022-0302(97)76075-2).
- [7] Yang WZ, Beauchemin KA, Physically Effective Fiber: Method of Determination and Effects on Chewing, Ruminant Acidosis, and Digestion by Dairy Cows. *J. Dairy Sci.* 2006; 89(7):2618–2633. [https://doi.org/10.3168/jds.S0022-0302\(06\)72339-6](https://doi.org/10.3168/jds.S0022-0302(06)72339-6).
- [8] Huhtanen P, Ahvenjärvi S, Weisbjerg MR, Nørgaard P. Digestion and passage of fibre in ruminants. *De Gruyter Brill* 2023. Eds. Sejrson K, T. Hvelplund T, Nielsen MO. https://doi.org/10.3920/9789086865666_004.
- [9] Rabaza A, Bancharo G, Cajarville C, Zunino P, Britos A, Repetto JL, Fraga M. Effects of feed withdrawal duration on animal behaviour, rumen microbiota and blood chemistry in feedlot cattle: implications for rumen acidosis. *Animal* 2020; 14(1): 66-77. <https://doi.org/10.1017/S1751731119001538>.
- [10] Beauchemin KA, Eriksen L, Nørgaard P, Rode LM. Short Communication: Salivary Secretion During Meals in Lactating Dairy Cattle, *J Dairy Sci.* 2008; 91(5):2077–2081. <https://doi.org/10.3168/jds.2007-0726>.
- [11] Gozho GN, Plaizier JC, Krause DO, Kennedy AD, Wittenberg KM. Subacute Ruminant Acidosis Induces Ruminant Lipopolysaccharide Endotoxin Release and Triggers an Inflammatory Response. *J Dairy Sci.* 2005; 88(4):1399–1403. [https://doi.org/10.3168/jds.S0022-0302\(05\)72807-1](https://doi.org/10.3168/jds.S0022-0302(05)72807-1).
- [12] Senchuri R. (2025) *Animal Nutrition and Feeding Practices*, 2025. Pedigogy.com.
- [13] Nørgaard P, Nadeau E, Randby Å, Volden H. Chewing index system for predicting physical structure of the diet. *NorFor – the Nordic Feed Evaluation System*. EAAP Publication No 130, Wageningen Academic Publishers 2011, Ed. Volden H. https://doi.org/10.3920/978-90-8686-718-9_11.
- [14] Nørgaard P, Sehic A. Particle size distribution in silage, boluses, rumen content and faeces from cows fed grass silage with different theoretical chopping length. *Proceedings from the 6th International Symposium on the Nutrition of Herbivores*, 2003.
- [15] Woodford JA, Jorgensen NA, Barrington GP. Impact of Dietary Fiber and Physical Form on Performance of Lactating Dairy Cows 1, *J Dairy Sci.* 1986; 69(4):1035–1047. [https://doi.org/10.3168/jds.S0022-0302\(86\)80499-4](https://doi.org/10.3168/jds.S0022-0302(86)80499-4).
- [16] Nørgaard P, Nadeau E, Randby ÅT. A new Nordic structure evaluation system for diets fed to dairy cows: a meta analysis. *Modelling nutrient digestion and utilisation in farm animals*. Wageningen Academic Publishers, Wageningen 2011. Eds. Sauvant D, Van Milgen J, Faverdin P, Friggens N. https://doi.org/10.3920/978-90-8686-712-7_12.
- [17] Udén P. The effect of grinding and pelleting hay on digestibility, fermentation rate, digesta passage and rumen and faecal particle size in cows. *Anim. Feed Sci. Technol.* 1988; 19(1-2):145–157. [https://doi.org/10.1016/0377-8401\(88\)90063-6](https://doi.org/10.1016/0377-8401(88)90063-6).
- [18] Wang B, Sun H, Wang D, Liu H, Liu J. Constraints on the utilization of cereal straw in lactating dairy cows: A review from the perspective of systems biology. *Animal Nutrition*. 2022; 9:240–248. <https://doi.org/10.1016/j.aninu.2022.01.002>.
- [19] EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare). Scientific Opinion on the welfare of cattle at slaughter. *EFSA Journal*, 2020; 18(11): 6275. <https://doi.org/10.2903/j.efsa.2020.6275>.
- [20] Lindström T, Redbo I. Effect of feeding duration and rumen fill on behaviour in dairy cows. *Appl. Anim. Behav. Sci.* 2000; 70:83–97. [https://doi.org/10.1016/S0168-1591\(00\)00148-9](https://doi.org/10.1016/S0168-1591(00)00148-9).
- [21] Greter AM, Miller-Cushon EK, McBride BW, Widowski TM, Duffield TF, DeVries TJ. Short communication: Limit feeding affects behavior patterns and feeding motivation of dairy heifers. *J. Dairy Sci.*, 2015; 98:1248–1254. <https://doi.org/10.3168/jds.2014-8879>.
- [22] Greter AM, Prinsen M, Duffield TF, McBride BW, Widowski TM, DeVries TJ. Growing dairy heifers prefer supplementary long straw when fed a nutrient-dense ration in a limited amount. *J. Dairy Sci.* 2013; 96:3950–3958. <https://doi.org/10.3168/jds.2013-6625>.
- [23] Swedish Centre for Animal Welfare, ID no. SLU.thv.2024.2.6-110.
- [24] Finnish Food Authority, personal communication, 05/02/2026.



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References, continued

Legislation:

Council Regulation (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing.

Finnish Welfare Act (693/2023).

The Swedish Board of Agriculture's regulations and general guidelines on the slaughter and other killing of animals (SJVFS 2020:22).



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