The Type of Bedding on the Welfare of Dairy Cattle

A. Suárez-Usbeck

Department of Livestock Sciences. Higher Polytechnic School of Chimborazo (ESPOCH), 060106. Riobamba, Ecuador. Livestock Knowledge Department. Milk and Meat International Consulting. 060103. Riobamba, Ecuador, E-mail: andres.suarez@espoch.edu.ec

S. Villagómez-Estrada

Department of Livestock Sciences. Higher Polytechnic School of Chimborazo (ESPOCH), 060106. Riobamba, Ecuador.

P. Vinueza

Department of Livestock Sciences. Higher Polytechnic School of Chimborazo (ESPOCH), 060106. Riobamba, Ecuador.

A.N. Haro

Department of Life Sciences. University of the Armed Forces, 230101. Santo Domingo, Ecuador. Livestock Knowledge Department. Milk and Meat International Consulting. 060103. Riobamba, Ecuador.

T. Maldonado

Livestock Knowledge Department. Milk and Meat International Consulting. 060103. Riobamba, Ecuador.

Abstract

The usual surfaces for the rest of dairy cattle used by farmers in Ecuador incorporate various types of material such as straw, chaff, compost, sawdust or sand; however, there is controversy when choosing the substrate or bedding material that will be used as a resting surface for this species. Consequently, the objective of this review was to refer to the type of bed indicated for the practice of dairy production on cattle welfare. The primary material of the facilities for dairy cattle, lodging, milking, feeding platforms, corridors and rest surfaces is made of concrete, and this material is not the determining factor on the product yields and determination of the well-being of cattle. It is well known that dairy cattle avoid concrete and wet surfaces and spend less time lying down. Therefore, including substrates such as straw, sand and rubber mats are the solution to improve the welfare of this species. In conclusion, this review showed that litter with clean and dry materials, regardless of origin, improves the welfare of the animals.

Keywords: animal welfare, type of bedding, altitude, dairy cattle.

1. Introduction

Dairy cattle production systems in Ecuador are classified as extensive and rotational grazing; in these cases, the animals are managed outdoors throughout the year. At the same time, intensive systems have increased to improve productive, reproductive and animal welfare yields, so protecting the resting soil is uncertain about the bedding material [1, 2].

Farmers employ incomparable bedding materials for dairy cattle, such as straw, chaff, compost, sawdust or sand [3, 4, 5]. Many of the beddings can provide favorable resting habitat and resting time, reduce injuries and possibly extend the life span of cattle [3]. In contrast, hard-floored or unfavorable bedding materials and dampness have detrimental effects on this species' production, reproduction, behavior and welfare [3, 5, 6].

The aforementioned common surfaces on which dairy cattle are managed in the country fill controversy precisely when choosing the substrate or bedding material destined as a resting floor for dairy cows. Therefore, the objective of this review was to refer to the type of bedding indicated for the practice of dairy production on cattle welfare.

2. Methodology

The collection of information for the elaboration of this review on bedding types and welfare of dairy cattle had an emphasis on material rigorously adapted within the keywords animal welfare, bedding types, bedding types in cattle, animal behavior, parasitic diseases, udder diseases, udder health. The scientific material was reviewed within scientific articles, book sections, journals, magazines, and web pages of different scientific communities, extracted from electronic scientific libraries such as Scopus,

Wiley, Scielo, Latindex, Redalyc and Dspace and scientific journals, especially Journal of Dairy Science, Animal Welfare and Applied Animal Behaviour Science, directly for direct analysis, we used those related to the importance of bedding types for resting dairy cattle and beef cattle, animal welfare and animal behavior during and after their adoption to the associated bedding types.

3. Results and discussion

Cattle ranches have implemented intensive systems that involve housing and resting cattle in warm and cold areas (classified in Ecuador as coastal, highlands, eastern and insular systems peninsula). These have been implemented to increase their production [7, 8]. However, the management of the usual livestock areas throughout the year in Ecuador is poorly controlled and does not provide welfare to dairy cattle, so their health and hygiene are deplorable, which leads to problems in production, reproduction and stress in this species [9].

3.1. Types of bedding

The primary fraction of the facilities of the resting or lying place, milking, feeding platforms, and aisles, among others, are made of concrete, stone and earth, which will be the determinant of the product yields and determination of the welfare of cattle. Well-known and growing information shows that dairy cattle avoid concrete and wet surfaces (poorly drained facilities and grazing on poorly drained soils) and spend less time lying down [3, 6].

The bedding is soft, reusable (pasture fertilizer or bio-composting) and easy to handle materials. Bedding of straw, chaff, compost, sawdust, sand and, more recently, rubber mats on concrete is usually superimposed on the bedding [3, 9]. At present, in the regions of higher cattle production and depending on the type of livestock (meat or milk) and the available substrate, the bedding available for its easy acquisition and handling is made of chaff and sand, followed by bedding with sawdust (Sierra region) and the mixture of sawdust with calcium carbonate, although, in recent years and pushed by greater demands on the management of slurry, manure solids, water bedding and rubber bedding or rubber mats have been introduced in livestock farms of important economic interest [10, 11, 12].

Chaff, straw, sand and sawdust provide light and comfortable bedding for dairy cattle. The amount of this material used in the bedding determines the time of satisfaction or comfort of the cattle [13]. According to different criteria among cattle farms, inclusion is variable and fluctuates between 4 and 8 kg of straw or chaff, between 6 and 10 kg of sawdust and sand between 4 and 5 kg. This type of substrate is expensive, so farmers adopt strategies for its use as mixtures or incorporating other substrates. Using these bedding materials or their combination can favor cattle welfare because of their soft and impermeable texture. For cattle, it takes time to adapt to these types of bedding. However, as time goes by, it becomes one of the favorite bedding options [12, 14].

Manure solids are obtained from the dehydration treatment of manure from livestock farm facilities and corridors [14]. Their composition is varied. They contain moisture content before treatment and mix with other bedding materials at about 70% (favors microbial growth). On the other hand, its dry moisture content averages 55%. The bacterial concentration before and after the application is cfu/mL, Coliforms 10 9.0 cfu/mL Streptococcus spp. and 15 cfu/mL Bacillus spp

[11, 14]. On the other hand, the high costs of substrates or materials traditionally used as cattle bedding have caused manure solids to become a common material on cattle farms. The high availability of recycled manure solids and their aforementioned low cost makes it possible to use them in staggering quantities [14, 15].

Waterbeds and rubber mats provide dairy cattle with optimal welfare during resting. Furthermore, these systems determine the comfort of the animals since they do not establish pressure points on the body at the moment of lying down or during rest due to a layer of water between the animal and the floor or because of the soft and impermeable texture of the rubber mats, which favors the reduction of problems in the legs, udder and better welfare of the cattle [13, 16]. Likewise, as its competitive materials, the high costs in the provision of this type of bedding contribute to the implementation and acquisition of raw materials such as those mentioned above [13, 14].

3.2. Animal welfare

The bedding and type used for resting cattle are implemented in dairy farms to improve this species' productive and reproductive parameters. In addition, it contributes to the welfare of production animals, their health and less exposure of pathogens to the udder [3, 14]. Related studies [3, 6, 12] have shown that animal behavior and resting time are specific indicators of welfare in dairy cattle to distinguish different types of surfaces and the choice of bedding type.

Dairy cattle in Ecuador, when grazing remains between 8 and 10 h per day lying down, the same results provide beds with similar resting material with chaff or sawdust surfaces; sand can also provide similar benefits. However, it takes time for cattle to adapt to these types of surfaces, and with time, it becomes one of the favorite options [12, 14]. A study in New Zealand [17] showed that cows spend no more than 45% less time lying on a wood chip surface than on a concrete or muddy surface. Sawdust, chaff, and sand bedding comfort cows; however, they do not contribute greatly to the welfare of this species.

This type of bedding material is a major source of exposure to udder pathogens, and wet conditions are a factor that can contribute to softer hooves and higher risks of hoof injury and long-term lameness [11, 12, 17].

The inclusion of manure solids in large quantities as bedding for dairy cows can improve the comfort of cattle, and decrease lameness and hock injuries. At the same time, it can increase milk production and the longevity of cows. However, cattle can distinguish the quality of bedding (dirty and wet) by avoiding lying down [3, 12]. In addition, dairy cattle with reduced resting times during their resting period will trade feeding time for more time lying outdoors during grazing [6, 17].

Facilitating the comfort of cattle, contributing to the production and animal welfare, and implementing waterbeds and rubber mats could establish the comfort of livestock animals, thanks to the fact that warm waterbeds do not establish pressure points on the animal's body when lying down or during rest, and stimulate milk production during milking [18, 19, 20]. On the other hand, rubber mats provide comfort for the animals and facilitate cleaning and reduce microbial loads due to the soft and impermeable texture of the mats; in addition, they reduce problems in the legs and udder and improve the welfare of cattle [21, 22, 23]. The comfort and hygiene of dairy cows lying on limestone and manure solids bedding corroborate that the type of bedding does not affect milk production and components, nor somatic cell counts [24, 25]; however, to date, most dairy farms housing cows outside grazing areas have shown that the risk of parasitosis is reduced, due to the use of recycled manure solids bedding [26, 27]. Nevertheless, despite some harmful effects of pathogens in herds, there are disadvantages such as low feed efficiency, reduced milk production, hoof problems and even death of the animal [28, 29, 30].

4. Conclusions

The consequence of dealing with production in systems intensive in Ecuador entails maintaining standards and protocols for their management and developing good facilities that adopt animal welfare methodologies for livestock production and exploitation. On the other hand, this review showed that bedding with clean and dry materials improves rest periods and cow hygiene. The hardness of the bedding according to the type of substrate used can favor the development or appearance of lesions in legs and udders, altering cattle health.

Acknowledgments

Thanks to ESPOCH for their contribution to the writing and revision of the manuscript and to the International Milk and Meat Consultancy for their help in sharing their livestock knowledge.

Conflict of interest

The authors declare that they have no conflict of interest.

Reference

1. Salazar M, Cedeño P. 2015. Cambio del sistema de manejo y alimentación

extensivo porsemi intensivo en ganado bovino de carne en el Ecuador. Investigación, Tecnología e177Innovación. 7: 106-118.

- 2. Fregonesi JA, Leaver JD. 2001. Behaviour, performance and health indicators of welfare for dairy cows housed in strawyard or cubicle systems. Livestock production science. 68: 205-216.
- 3. Haro A, Diaz F. 2019. Types of bedding and its effects on dairy cattle welfare. Dairy Knowledge Center, LLC. All Rights Reserved. Disponible en: https://dellait.com/es/tipos-de-encamadoy-sus-efectos-sobre-el-bienestar-delganado-lechero/
- 4. Schütz KE, Clark KV, Cox NR, Matthews LR, Tucker CB. 2010. Responses to short-term exposure to simulated rain and wind by dairy cattle: time budgets, shelter use, body temperature and feed intake. Animal Welfare. 19: 375.
- 5. Tucker CB, Weary DM, Fraser D. 2003. Effects of three types of free-stall surfaces on preferences and stall usage by dairy cows. Journal of Dairy Science 86: 521-529.
- Schütz KE, Cave VM, Cox NR, Huddart FJ, Tucker CB. 2019. Effects of 3 surface types on dairy cattle behavior, preference, and hygiene. Journal of Dairy Science. 102: 1530-1541.
- Mora EA. 2002. Centralismo y descentralización en la historia del Ecuador: del pasado a la situación actual. Procesos. Revista Ecuatoriana de Historia. 203-221.
- Williams LA, Rowlands GJ, Russell AM. 1986. Effect of wet weather on lameness in dairy cattle. The Veterinary Record. 118: 259-261.

- Castro-Calderón MV, Elizondo-Salazar JA. 2021. Establecimiento de tres indicadores de eficiencia en el uso de agua para lavado en instalaciones lecheras en Zarcero, Costa Rica. Agronomía Costarricense. 45: 153-163.
- Pesántez MT, Hernández A. 2014. Producción lechera de cabras Criollas y Anglo-Nubian en Loja, Ecuador. Revista Cubana de Ciencia Agrícola. 48: 105-108.
- Schütz KE, Huddart FJ, Sutherland MA, Stewart M, Cox NR. 2015. Effects of space allowance on the behavior and physiology of cattle temporarily managed on rubber mats. Journal of Dairy Science. 98: 6226-6235.
- 12. Tucker CB, Weary DM. 2004. Bedding on geotextile mattresses: How much is needed to improve cow comfort?. Journal of Dairy Science. 87: 2889-2895.
- 13. Richard MM. 2008. Confort de los cubículos desde el punto de vista de las vacas. Frisona Española. 28: 92-94.
- 14. Patel K, Godden SM, Royster E, Crooker BA, Timmerman J, Fox L. 2019. Relationships among bedding materials, bedding bacteria counts, udder hygiene, milk quality, and udder health in US dairy herds. Journal of Dairy Science. 102: 10213-10234.
- Husfeldt AW, Endres MI, Salfer JA, Janni KA. 2012. Management and characteristics of recycled manure solids used for bedding in Midwest freestall dairy herds. Journal of dairy science. 95: 2195-2203.
- 16. Cook NB, Bennett TB, Nordlund KV. 2004. Effect of free stall surface on daily activity patterns in dairy cows with relevance to lameness prevalence. Journal of Dairy Science. 87: 2912-2922.

- 17. Fisher AD, Stewart M, Verkerk GA, Morrow CJ, Matthews LR. 2003. The effects of surface type on lying behaviour and stress responses of dairy cows during periodic weather-induced removal from pasture. Applied Animal Behaviour Science. 81: 1-11.
- 18. Andreasen SN, Forkman B. 2012. The welfare of dairy cows is improved in relation to cleanliness and integument alterations on the hocks and lameness when sand is used as stall surface. Journal of dairy science. 95: 4961-4967.
- Némethová M, Lendelová J, Šranková V, Žitňák M, Botto Ľ. 2020. Verification of thermo-technical characteristics of selected floor constructions for dairy cows (pilot study). Acta Technologica Agriculturae. 23: 87-91.
- 20. Jacobs JA, Siegford JM. 2012. Invited review: The impact of automatic milking systems on dairy cow management, behavior, health, and welfare. Journal of dairy Science. 95: 2227-2247.
- 21. Lendelova J, Mihina S, Žitnák M, Nemethova M, Botto L. Thermo-technical parameters of the different bedding surfaces in cubicles for dairy cows as a factor of their well-being in winter and summer. In 2019 ASABE Annual International Meeting (p. 1). American Society of Agricultural and Biological Engineers. 2019.
- 22. Allen JD, Anderson SD, Collier RJ, Smith JF. Managing heat stress and its impact on cow behavior. In 28th Annual Southwest Nutrition and Management Conference 2013. 68: 150-159.