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Impact on behavioral activities of animals under different rearing substances: A review study

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Abstract
The behavioral pattern of animals under different bedding materials can be used as a standard for assessing the level of animal welfare. It is a physiological process used by the animal to adapt itself to external and internal changes. A faulty flooring system may induce stress conditions among the animals. Animals will try to cope up with these stressful conditions by altering their normal behavioral activities at the expense of extra energy. It is now widely accepted that both behavioral and physiological measures together provide a more comprehensive assessment of animal welfare than either alone so bedding is one of the most important components of animal housing as far as animal health and welfare are concerned. The present investigation is aimed to summarized wide aspect of review on the effect of different bedding on animal behavior and their welfare.

Keywords: Cow comfort, concrete floor, lying time, sand bedding

1. Introduction
Housing management of animals in the form of bedding is of paramount importance for good health, better growth, and animal welfare. The behavior of animals can be used for assessing the effects of stress and it has the advantage of being non-invasive. Behavior can show displacement and abnormal patterns which can be an indicator of stressful conditions to animals thus animals will try to cope up with these stressful conditions at the expense of extra energy hence all of the available energy could not be used for animal growth and results in an overall decrease in production. Behavioral and physiological measures together provide a better comprehensive assessment of animal welfare Ewbank (1985) [6]; Lane (2006) [14] than either alone. Adequate rest is essential for the welfare of animals, therefore, lying times can provide valuable information about the comfort of animals. Lying time is likely important for growing animals and typically spent about 18 h/ day laying down (Wilson *et al*., 1999 and Chua *et al*., 2002) [31, 4]. Inadequate lying time due to uncomfortable bedding reduces the growth rate (Mogensen *et al*., 1997) [18]. Analysis of various other research works (Panivivat *et al*., 2004; Tucker *et al*.,2003, and Vanegas *et al*., 2006) [20, 28, 30] also reveals that to ensure animal comfort which leads to increased production, the environment surrounding of animals must always be considered and provision of comfortable bedding materials is one aspect of the dairy housing system which must be considered so the manifestation of the behavioral pattern of animals on different bedding surfaces can be used as a standard for assessing the level of animal welfare.

2. Headings and Footnotes
The literature related to the present study has been reviewed under the following sub-heads:

2.1 Concrete Floor
The Health and welfare of animals are the key elements to ensure their longevity and long-term productivity. In recent years efforts have been undertaken to improve the health and welfare of animals by providing a high level of comfort regarding the rearing surface of animals. The rearing of animals on concrete floors resulted in the increased lesion and joint swelling (Rushen *et al*., 2007) [23]. Concrete floors resulted in abnormal behavior and posture of animals which can be indicative of reduced comfort of animals (Absmanner *et al*., 2009) [1] on the concrete floor as compared to other alternative bedding sources such as straw bedding, rubber mat bedding, and wooden slat. It was observed that when given free choice to animals,

they prefer straw, rubber mat, and wooden slat bedding over concrete floor although Hanninen *et al*. (2005) [10] did not find any significant difference in the resting behavior of animals between concrete and rubber mat. Study results of Archana (2019) [2] and Pradip (2017) [22] (table 1 & 2 respectively) revealed that the behavioral traits of animals were most favorable on rubber mats and paddy straw floors as compared to the concrete floor. Although Fulwider and Palmer (2005) [8] reported that cows spent similar time lying in stalls but significantly less standing time in stall when concrete alleys were covered with rubber alley mats.

2.2 Rubber mat Bedding

It has been observed that rubber mat is a cost-effective and softer flooring material as compared to concrete floor and provides a good layer of insulation against the cold floor in winter and a comfortable lying surface alternative in the summer. Animals should spend nearly half of their lives lying down, ideally 40-60% a day (12-14 hours/day, Greenough, 2007) [9]. It was observed that a reduction in lying time can lead to physiological changes associated with stress which can ultimately affect the overall health and production of the animals. Animal comfort is vital for health and profitability. Lying is an important behavior for animals as it allows animals to rest. Comfortable stalls encourage animals to maximize lying times (Brouillette and Spanski, 1998) [3]. It is observed that maximizing comfort reduces stress in animals and thus increases production, productive life, and profit potential (House *et al*., 2003) [12]. Bedding surfaces of concrete floors, conventional rubber matting, and comfort mats (soft rubber mats) were compared for the lying down behavior of dairy cows by Herlin (1997) [11]. He concluded that animals preferred the comfort mats in comparison to the rubber mats and concrete floors, they suggest that comfort mats appeared to provide a very attractive surface for the dairy cows. Platz *et al.* (2007) [21] revealed that animals in the rubber and the choice pens showed significantly more lying periods (P<0.01) and had a lesser incidence of skin lesions (P<0.01) as compared to bulls housed on concrete pens. Similarly, Sadharakiya & Sorathiya (2019) [24] investigated the effect of rubber mat flooring on behavior, welfare, and production performance in crossbred cows and revealed that rumination time and sitting time were significantly (P<0.05) higher on rubber mat flooring as compared to the concrete floor but milk yield did not differ significantly among both floors. although Hanninen *et al*. (2005) [10] did not find any significant difference in resting behavior between concrete and rubber mat floors. Study results of Jain *et al.* (2013) [13] revealed that lying downtime of cows on rubber mats was also more as compared to the concrete floor thus they suggested that the rubber mat floor is more comfortable than the concrete floor. Absmanner *et al*. (2009) [1] also revealed that rubber mats over slatted floors have a positive effect on bull behavior but could not reach up to the welfare potential of straw bedding.

2.3 Straw Bedding

Straw is one of the most popular and versatile bedding, suitable for most livestock. It has good absorbency, better insulating power, is light to handle, and is easy to compost. Lowe *et al.* (2001) [15] compared the preferences of different floor types by using finishing beef cattle and they reported that straw bedding was the most preferred floor type, followed by sawdust, then mats, and finally slats. Tucker *et al*. (2003) [28] concluded that the quality and quantity of bedding materials influence the behavior and comfort of animals. They compared the effect of deep-bedded sawdust, deep-bedded sand, and a geotextile mattress covered with 2 to 3 cm of sawdust among Holstein cows. Animals were found to spend more time lying on softer substrates when given the choice. Sawdust and sand were chosen in preference to a rubber-filled geotextile mattress. Norring *et al.* (2010) [19] concluded that the total daily duration of lying was longer for cows on straw bedding than on sand bedding (straw 749±16 vs. sand 678±19 min). Madke *et al.* (2010) [16] concluded that time spent on feeding and rumination was significantly higher in straw bedding as compared to rubber matters. Tucker *et al*. (2009) [29] revealed that an additional increase in the amount of bedding above a scant improves cow comfort as, cows increased lying time by 12 min for every additional kilogram of straw. Drissler *et al.* (2005) [5] also investigated the effects of depth of bedding on the lying behavior of dairy cattle they concluded that with every 1 cm decrease in bedding, cows spent 11 min less time lying down during each 24-h period thus lying times reduced with decreasing bedding. Similarly, Schulze *et al.* (2007) [26] investigated the effect of different floor systems and revealed that the straw floor remains more comfortable for animals as compared to the concrete, slatted, and grooved floor.

2.4 Sand Bedding

Sand being an inert and inorganic bedding material helps in the lesser transmission of bacterial infection but has less absorbent capacity than other bedding materials and disposing of soiled sand is also a challenging task. Total daily lying time was significantly (P<0.01) high on sand bedding as compared to the concrete floor (Sinha *et al*., 2017) [27] and revealed that sand bedding remains beneficial in terms of behavior and comforts of animals. although Norring (2010) [19] reported that cows preferred abundant straw bedding and soft rubber mats & showed an aversion to sand bedding. Sahu *et al.* (2018) [25] revealed that sand beds had moisture in it which could be the reason for higher R.H and lower floor surface temperature of it and Fregonesi *et al*. (2007) [7] concluded that animals spent more time at outside the stall when bedding remain wet. Similarly, Manninen *et al.* (2002) [17] revealed that cows prefer straw bedding over sand.

Table 1: Effect of different floor types on the behavior of Sahiwal calves. (Archana, K., 2019) [2]

Behavior/floor type	Concrete floor	Rubber mat bedding	Kachha floor
Standing time	829.41^{a}±6.12	734.87^{c}±5.36	777.18^{b}±8.28
Sitting time	610.59^{c}±6.12	705.13^{a}±5.36	662.82^{b}±8.28
Rumination time	492.13±5.74	510.56±18.18	498.56±18.18

Table 2: Behavior Activities of Gir cows on different flooring materials (Pradip, 2017) [22]

Behaviors	Rubber Mat	Concrete Floor
Standing time	196.48±4.61	150.05±5.75
Sitting time	431.76±4.96	150.14±5.45
Rumintion time	306.46±4.15	215.63±1.89

Table 3: Effect of rubber mat flooring on the behavior of cross breed cows when given free choice of surface (Sadharakiya & Sorathiya, 2019) [24]

Behavior/floor type	Concrete floor	Straw bedding	Rubber mat bedding
Sitting & idling time	657.09^{a}±30.92	670.59^{a}±20.11 20.11	761.31^{b}±28.13
Standing time	831.70^{b}±13.34	788.62^{b}±22.40 22.40	723.27^{a}±23.68
Rumination time	484.89±5.90	488.52±24.00 24.00	495.39±23.65
Sleeping time	321.01a±11.29	329.13^{a}±8.77	375.41^{b}±16.56

Conclusion

The provision of an ideal bedding surface for animal rearing has paramount importance as far as animal behavior and welfare are considered. It was observed that animals feel more comfortable on a soft surface so straw and rubber mat bedding was more preferred as compared to sand and concrete floors but results may vary according to the season and age of animals so a broad study including the different age group of animals and under different season is required for further better understanding of animals welfare and their relationship with rearing surface.

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