Farmer's attitude, perception and management of heat stressed cows in selected dairy farms

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Khulshi, Chattogram-4225, Bangladesh

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A Clinical Report submitted as per approved style and conntent

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Abstract

The continuous increase of global mean temperature due to climate change is creating many difficulties in production and welfare of dairy animals all over the world. Being a tropical country Bangladesh is not out of these. Heat stress is the major problem that dairy animal face due to high environmental temperature. Welfare of cows get hampered due to heat stress and as a result production is also decreased. It is vital to know the farmers view about heat stress and their strategy to mitigate heat stress. Therefore, the present study was conducted in 28 dairy farms in 4 different places of Chattogram district to assess the perception, management of heat stress in dairy farms and attitude of farmers towards cows. Farmers behavior and attitude towards cow and their perception about heat stress was observed and recorded. The results showed that farmers had good idea about heat stress and different types of managemental steps had been taken by farmers to mitigate heat stress. Relationship among beating of cow during milking and knowledge of heat stress of farmers was compared and the result was significantly ($p<0.05$) related. Farmers who have idea of heat stress were less concerned about the welfare of animals during heat stress. Based on collected data THI (Temperature Humidity Index) of farms were calculated and relationship with presence of ceiling fan was checked. Result showed that presence of ceiling fan was positively related to low THI of farm. The study findings conclude that there is much room for improvement of welfare of dairy cows and behaviors towards them as far as heat stress is concerned.

Keywords: Heat stress, Welfare, Dairy cow, Temperature, Attitude and perception.

Chapter-I

Introduction

Animals are continually faced with short and long-term changes in their habitats because of a variety of variables, including ambient temperature, photoperiod, nutrition, location, and geography. If animal cannot cope up with any of these changes animal face stress. Stress is a general phrase that refers to the cumulative negative impact of numerous circumstances on animal behavior and productivity. It is the external forces that attempt to shift the body's systems out of their resting condition (Yousef et al.,1986). When stress occurs due to increased temperature and humidity then it is termed as heat stress. In general, it includes of both climatic and non-climatic elements that either limit body heat loss or increase heat gain from surroundings (Lind et al., 1977). When there is an imbalance between heat generation inside the body and its dissipation from the body, animals experience heat stress. A heat stressed animal shows some deviation from its normal behaviors. These deviations from normal behavior can be indicator of physiological and environmental irregularity. Heat Stress is a significant element that can have a severe impact on the performance and production of dairy cattle, particularly in hot climates or during the summer in many parts of the world. In shaded area animal get heat from solar radiation and radiation coming from ground. As global mean temperature is increasing day by day due to global warming, it's becoming hard for animals to cope up with this increased temperature. Heat wave events are being seen more frequently and for longer period of time. Animals are becoming more prone to heat stress due to global warming caused by climate change.

When exposed to heat stress cow may change their behavior to maximize cooling (Polsky et al., 2017). Changes in reproductive behavior, a desire for cooler settings, or the manifestation of thermoregulatory behavior, such as a reduction in activity and feed consumption, may all be vital indicators of animal welfare (Herbut et al., 2021). During heat stress cows spend more time in standing and they reduce their activity so that they can increase surface area for heat dissipation, proper water loss, radiating surface area and air movement through convection (Cook et al., 2007). The effect of heat stress in milk production of cow is so much prominent. Milk production is 15% lower in the summer than it is in the winter due to heat stress in summer (De Vries et al., 2005). Heat stress can affect the milk content of dairy cows. According to certain studies (Hammami et al., 2015; Bouraoui et al., 2002), heat stress is linked to a reduction in total protein and total fat output. As heat stress has direct impact on health and production of animals it cause economic

losses by negatively affecting the health and production of animals. In USA it was estimated that the country faced an economic burden of between $1.69 and $2.36 billion (USD) on the US annual agriculture industries due to heat stress. (St. Pierre et al., 2003). Among these estimation economic losses of $897 to $1500 million (USD) were attributed to the dairy industry. For the whole US dairy industry, the reduction in milk output due to heat stress alone results in a $1.2 billion yearly economic loss (Key et al., 2014). In 2006, Sackett et al. estimated approximately 16.5 million (AUD) economic losses in Australian feedlots due to heat stress. These estimation may not reflect current scenario of economic losses due to heat stress as these estimation were done more than a decade ago. Moreover, in addition with climate changes, it can be predicted that these estimates are underestimating the present impact on economic loss due to heat stress in cattle industry. Bangladesh has a demand of 15.67 million metric ton milk per year whereas the availability is 13.07 million metric ton per year (DLS, 2021-22). So Bangladesh has about 2.6 million metric ton milk deficiency of milk per year. Bangladesh faces a hot, humid summer from March to June. This is the time when animals are very much susceptible to heat stress.

As heat stress drastically affects the milk production in dairy cows, it is very important to have proper concept of heat stress among farmers. The management of heat stress in different farms are different from each other. Farmers adapt various strategies such as providing ceiling fan, increased number of showering, supplementation in feed and water, dietary change, supplying water of low temperature to minimize heat stress among dairy cows. In Bangladesh there has never been performed any study to assess the perception of heat stress among farmers and managemental steps taken by farmers to mitigate heat stress in dairy cows. Psychological wellbeing of farm animal mostly depends on the environment and behavior it gets from stockpersons. Stockperson's behavior plays vital role for getting best output from animals (Ceballos et al., 2018). Stockpersons approach and attitude towards milking cow can make differences in production of milk. It is a good indicator of welfare of animals in a farm. A stockperson with rough attitude and behaviors towards milch cow during milking can result into high amount of residual milk in cow thus reduction in milk output (Rushen et al., 1999). In Bangladesh there has not been performed any study about stockpersons attitude towards cows during milking.

With the background mentioned above this study was undertaken with the following specific objectives:

1. To assess the perception of heat stress among dairy farmers.
2. To know management of heat stress in different farms.
3. To study stockperson's attitude towards milking cow on aspect of animal welfare.

Chapter-II

Methodology

2.1 Study area and duration:

The field investigation was conducted in four different area under Chattogram district namely Chattogram metropolitan area, Raozan, Boalkhali and Banskhali. The selection was made on the basis of suggestions made by random selection. Data were collected from 18th March to 8th May, 2022 in the study area.

2.2 Study population:

A total of 162 cows from 28 different dairy farms were studied.

2.3 Selection of farm:

28 dairy farms were selected on the basis of random selection. A total of 162 cows from 28 different dairy farms were studied.

2.4 Farm location and population

In table-1, locations of farms and population in each farm were mentioned. Population varied from farm to farm. Farms were mostly in metropolitan area along with some in rural area.

Figure 1: Geographical location of Chattogram district on Bangladesh map

Table 1: Selected dairy farms and their location in different areas of Chattogram district. (N=28).

Name of the dairy farm	Location	Number of cows
Faiza dairy unit-1	Bahaddarhat	3
Faiza dairy unit-2	Bahaddarhat	2
Green harvest agro unit-1	2 no. gate	6
Green harvest agro unit-2	2 no. gate	2
Nizam dairy unit-1	Wazedia	7
Nizam dairy unit-2	Wazedia	3
Zarif dairy	Neyamot ali Road	18
Iftekhar dairy unit-1	Sagorika	2
Iftekhar dairy unit-2	Sagorika	1
Iftekhar dairy unit-3	Sagorika	1
Iftekhar dairy unit-4	Sagorika	2
Irfan dairy	Bahaddarhat	4
Arshi dairy unit-1	Banskhali	5
Arshi dairy unit-2	Banskhali	3
Molla dairy.unit-3	Patenga	11
Molla dairy.unit-2	Patenga	11
Molla dairy.unit-3	Patenga	8
Molla dairy.unit-3	Patenga	3
Molla dairy.unit-4	Patenga	6
Molla dairy.unit-4	Patenga	6
Sajid dairy farm	Boalkhali	7
Anzuman ara dairy.unit-1	Patenga	13
Anzuman ara dairy.unit-2	Patenga	6
Homeland dairy	Wazedia	11
Enam dairy.unit-1	Patenga	2
Enam dairy.unit-1	Patenga	2
Chabila krishi farm	Raozan	10
Abu Bakar dairy farm	Patenga	5
	Total cows:	162

2.5 Data collection

2.5.1 Questionnaire development

A questionnaire was carefully developed on the basis of objectives to collect worker, farmer, animal management, production and animal welfare linked data related to heat stress of dairy animal. Face-to-face interviews and visual inspection were carried out to collect farmer information and farm management information.

2.5.2 Environmental data collection

Date, starting time, name of farm, farmers name, interviewee name, mobile number of interviewees were collected at first. Temperature, humidity of Chattogram and outside of the farm were recorded. Temperature and humidity of Chattogram were taken from AccuWeather website and outside temperature and humidity were taken via thermometer and digital hygrometer. Dry and wet bulb hygrometer was also used for accuracy.

2.5.3 Managemental data collection

Some managemental data such as changes of ration during summer, percentage of ration changed, feeding frequency in a day and times of feeding were collected. Data of supplementation in ration was collected such as type and percentage of supplementation in ration and how these are served to animals. Source of drinking water, frequency of water supply, frequency of pump supply, temperature of drinking water were recorded. Frequency of showering and showering water temperature were recorded.

2.5.4 Behavioral data collection

Stockpersons behavior and concept about heat stress was taken. Milking frequency, time and milkers behavior during milking was observed. Beating of cow, shouting, removing sweat during milking was observed and mean was calculated per cow.

2.5.5 Constructional data collection

Data regarding shed, floor and stocking density were collected by using different measuring aid and direct observation. Inside the farm, temperature and humidity at backbone height of cow during standing position in each floor was recorded by using digital measuring device. Some structural data of farm such as shed direction, shed surroundings (side and open/closed), floor type (paved/non paved), floor type (concrete/only brick/concrete with smooth finish) shed style (stanchion barn/non stanchion barn), roof (tin/asbestos/cement sheet/plastic sheet/others), roof insulation material (none/bamboo/aluminium-foam sheet/others), type of wall (bamboo/brick/tin/others), presence of exhaust fan (yes/no), fan number and type(ceiling/wall mount/standing) were taken for each floor by direct observation. Some numerical data like shed length and width, shed height, height of wall, ceiling fan height from roof were measured by using measuring tape. These data were measured in feet. Number of cows lying and standing at a time were observed and recorded. Presence of space of lying for number of cows at that time was also recorded.

2.6 Data processing and analysis:

Collected data were analyzed with mainly in tabular method. The collected data were calculated and analyzed in MS excel software. The frequency, percentages were calculated to explain data scientifically. Association in different factors were done by t-test in STATA-11(stata corps, Texas, USA). The probability level of significance was considered as $p<0.05$.

Chapter-III

Result

The study was conducted on 162 cows in 28 farms at four different areas of Chattogram district.

Table 2: Demographic information of dairy fam related to management (N=28)

Traits	Category	Frequency (%)	Confidence Interval
Source of drinking water	Tubewell	22 (78.57)	59.15-91.7
	Pond	4 (14.29)	4.03-32.66
	WASA	2 (7.14)	0.88 - 23.5
Fresh drinking water supply	Two times/day	12 (42.86)	24.46-62.82
	Three times/day	2 (7.14)	0.87-23.5
	Four times/day	4 (14.29)	4.03-32.66
	Available whole day	10 (35.71)	18.64-55.93
Water supply	With feed	5 (17.86)	6.06-36.89
	Water supplied separately	1 (3.57)	0.09-18.34
	Both separately and with feed	22 (78.57)	59.05-91.7
Shower	Once/day	2 (7.14)	0.87-23.5
	Two times/day	12 (42.86)	24.46-62.82
	Three times/day	8 (28.57)	13.22-48.66
	Four times/day	6 (21.43)	8.29-40.95
Roof Insulation material	Aluminum Foam Sheet	10 (35.71)	18.64-55.93
	Bamboo	14 (50)	30.64-69.35
	No material	4 (14.29)	4.03-32.66
Presence of ceiling fan	Present	22 (78.57)	59.05-91.7
	Absent	6 (21.43)	8.29-40.95
Exhaust fan	No exhaust fan	23 (82.14)	63.11-93.93
	Two fans	3 (10.71)	2.27-28.22
	Four fans	2 (7.14)	0.88-23.5
Shed surroundings	All open	12 (42.86)	24.46-62.82
	At least one side is closed	16 (57.14)	37.17-75.53
Shed height	≤ 10 feet	9 (32.14)	15.87-52.35
	> 10 feet	19 (67.86)	47.64-84.12

In table 2, result shows the demographic data of farms and idea of farmers about heat stress. The source of drinking water was mostly from tube well (78.57%), whereas pond (14.29%) and WASA water (7.14%) was used in lesser number of floors. Fresh drinking water supplied two times a day in 42.86% of floors. In 35.71% of floors fresh drinking water was supplied throughout the whole day ad-libitum whereas three and four times water was supplied in 7.14% and 14.29% of floors respectively. In 78.57% of floors water was supplied both separately and with water. In 17.86% floors water was supplied with feed and in 3.57% floors water was served separately. Shower of animal was done twice a day in 42.86% floors. Three times of shower was done in 28.57% of floors whereas once in a day and four times in day was practiced in 7.14% and 21.43% of floors respectively. Bamboo was used in 50% of floor as roof insulation material. Aluminium foam sheet was used in 35.71% floor and no material was used as roof insulator in 14.29% floors. Ceiling fan was present in 78.57% floors and in rest 21.43% floor there were no ceiling fan. In 82.14% floors there were no exhaust fan whereas there was two fans in 10.71% floor and four fans 7.14%% in floors. All sides of shade were open in 42.86% floors whereas all least one side was closed in 57.14% floors. Shed height was more than 10 feet in 67.86% floors and less than 10 feet or 10 feet in 32.14% floors. 7.14% floors were in non-heat stress zone where 92.86% floors were in heat stress zone. 92.86% farmers had the idea of heat stress and 7.14% farmers didn't have idea about heat stress. The knowledge of heat stress was satisfactory in 60.71% farmers where it was not optimum in 32.14% farmers and among 7.14% farmers there was no knowledge about heat stress. Only 14.29% farmers used supplements with water to reduce heat stress and 85.71% farmers didn't used any supplements in water. 67.86% farmers used supplements with feed to reduce heat stress and 32.14% farmers used nothing as supplement with feed.

Table 3: Relation among the perception of heat stress with supplied drinking water temperature and beating of cow during milking.

Traits	**Idea of heat stress**		
	Yes (Mean ± SE)	No (Mean ± SE)	P value
Drinking water temperature [at °C]	26.81 ± 0.43	25 ± 0.00	0.0003
Beating cow during milking	0.28 ± 0.075	0 ± 0.00	0.0009

In table 3 the relation between farmers having idea of heat stress and their behavior (supplied drinking water temperature and beating during milking) is shown. In the table it is observed that the farmers who have idea about heat stress, they supplied drinking water that was higher in temperature (26.81±0.43). On the other hand temperature of drinking water supplied by farmers who don't have idea about heat stress are lower (25 ± 0.00). Beating of cow during milking was noticed in the farms where the farmers have idea about heat stress. Beating of cow during milking was not noticed in the farm where the farmers do not have any idea about heat stress.

Table: 4 Relation between recognition of heat stress signs and beating of cow.

Traits	Knowledge of heat stress			
	Yes (Mean ± SE)	Not optimum (Mean ± SE)	No (Mean ± SE)	P value
Beating of cow during milking [no/cow]	0.43 ± 0.39	0 ± 0.00	0 ± 0.00	0.007

In table: 4 there have been shown the relation between recognition of heat stress signs and beating of cow by milkers during milking. In the table it is observed that in the farms where the farmers have proper idea about heat stress, beating of cow during milking was noticed there. Whereas it was not noticed in the farm where farmers do not have proper idea about heat stress.

Table: 5 Relation between presence of ceiling fan and THI.

Traits	**Presence of ceiling fan**		**P value**
	Yes (Mean ± SE)	No (Mean ± SE)	
THI	83.73 ± 0.43	85.05 ± 0.44	0.049

In table: 5 it is seen that THI was higher in the floors where there was no ceiling fan. THI was lower in the floors where there is presence of ceiling fan.

Chapter- IV

Discussion

The source of drinking water is important in terms of purity and safety. In this study most (78.57%) of the farmers supplied water from tube well which is a good source of water as it has less chance of contamination. Access of enough amount of water throughout the day is important to reduce the chances of heat stress. In this study result shows water was mostly (78.57%) supplied with both separately and feed which is good for cows. Ceiling fan is an easy and important strategy to mitigate heat stress in dairy farms. The study found presence of ceiling fan in 78.57% farms which is a good sign. Increased shed height helps in proper ventilation and proper dissipation of heat from body of cows. The results shows that in the studied farm the shed height was more than 10 feet in 67.86% farms. Temperature Humidity Index (THI) is an important indicator of heat stress. Among studied farms 92.86% farms were in heat stress zone (THI>80). Knowledge about heat stress among farmers is very crucial for heat stress management in proper way. Most (92.86%) of the farmers of the study had the idea of heat stress and knowledge of heat stress was optimum in 60.71% farmers. Different types of supplements like glucose solution, saline solution, molasses etc. can be used with water and feed to reduce the effect of heat stress. Most of the farmers did not use any supplements with feed or water to reduce heat stress. The temperature of water that is supplied to dairy cows is important in terms of mitigating heat stress. Drinking water of low temperature can be a tool of temporary relief from heat stress (Stermer et al.,1986). In this study it is found that the farmers who possess the idea of heat stress are less concerned about supplying water with low temperature to dairy cows. So the relation between drinking water temperature and having idea of heat stress was negatively co-related in this study. The temperature of supplied drinking water was higher than that of farms where farmers had no idea about heat stress. It was an interesting finding that farmers having the knowledge of heat stress are avoiding the fact that cows need water of low temperature to tackle heat stress.

Stockpersons behavior towards cows is very crucial for getting proper milk yield, comfort and fearless movement of cows (Breuer et al., 2000). Negative tactile interactions such as slaps, pushes, tail twists or hits to cows by stockpersons can negatively affect cow's physiology and production. According to Rushen et al. 1999 research, an unpleasant handler enhance residual milk in cow while also tending to reduce milk output. Further controlled experimental studies should be done to ensure if these production loss is happening due to stress response. Stressed animal should be handled with positive tactile approach to get best out of them (Breuer et al. 2000). In this study it

was found that stockpersons of the farms where farmers are well informed about heat stress showed negative approach towards cows during milking. It was an interesting finding because being known to effect of heat stress these farmers should have been more humane to cows.

Using ceiling fan for the comfort of cows is one of the strategies for mitigating heat stress. By speeding up the rate at which heat is convectively transported from a cow into the air flowing around the animal, an efficient ventilation system can reduce the heat stress experienced by dairy cows (Wang et al.2017). The combined effects of air temperature and humidity related to the degree of thermal stress are represented by a single number known as a temperature-humidity index (THI). To track and minimize losses caused by heat stress, this indicator was created as a weather safety measure. Different animal species react differently to changes in temperature and humidity levels in the environment. High THI value indicates discomfort for animals. High THI is the major reason for heat stress. In this it was found that there was significant relation between THI value and presence of ceiling fan in floor and the relation is positive. Presence of ceiling fan ensures low value of THI which makes cows less prone to heat stress. The finding of this study reflects the result of Wang et al (2017) as THI value was less in the floors where there was presence of ceiling fan.

Chapter-V

Conclusion

The conducted study result shows that farmers are not enough aware about the impact of heat stress and its management in proper way. Proper farm management is an important element for preventing and reducing the effect of heat stress. Some steps like providing more ceiling fan, repeated numbers of showering, dietary changes, supplementation in water, providing proper shade, supply of enough water with low temperature can be helpful to tackle heat stress. Farmers should be made aware of heat stress and its harmful impact on dairy cows. Importance of animal welfare in a farm should be informed to farmers and stockpersons of farm. These can help to get best output from cows combating heat stress.

Chapter VI

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Biography

Sagar Banik, son of Sushil Banik and Pranati Banik passed his Secondary School Certificate (SSC) examination from Bangladesh Railway Government High School, Chattogram in 2014 and Higher Secondary school Certificate (HSC) from North Kattali Alhaz Mostofa Hakim Degree College, Chattogram in 2016. Thereafter he enrolled for Doctor of Veterinary Medicine (DVM) Degree in Chattogram Veterinary and Animal Sciences University (CVASU), Bangladesh and now is an intern student in his university.