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Research Article

Temperament during Milking Process and its Effect on Behavioral, Productive Traits and Biochemical Parameters in Friesian Dairy Cows

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Abstract | The aim of this study was to investigate the effect of temperament on maintenance activities, productive performance and biochemical parameters (cortisol and prolactin) in Friesian dairy cows. These investigations were carried out on one hundred Friesian dairy cows (3 to 6 years old), which were milked with machine with a rate of three times a day and eight hours interval. The cows were classified according to their temperament during milking into calm, nervous (restless) and aggressive**.** Observation was carried out 3 hours per week (6 minute interval for each cow through one hour observation for each group), by using a focal sample technique. The obtained results revealed that there were a non significant differences between different types of temperament of dairy cow on ingestive behavior although the eating, ruminating times were increased with calm temperament. Resting and sleeping were increased with calm temperament and the differences were highly significant**.** Interestingly, grooming increased in calm animals. The daily milk, day in milk and total milk production was increased with calm temperament and decreased with nervous and aggressive temperament and the differences were highly significant. The level of cortisol was significantly increased in aggressive cows than calm and nervous cows. The prolactin level was significantly increased with nervous temperament. **Conclusion:** Temperament of animals especially during milking process is considered vital managemental factor must be kept in order to maintain the productive efficiency, alternatively the whole income.

Keywords | Dairy cow, Temperament, Productive performance, Behavior, Prolactin, Cortisol level.

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INTRODUCTION

Cattle are social animals and live in groups, and behave in a manner associated with this way of life as each member of the groups maintains its relationships and communicates between themselves (Charlton et al., 2011). Milk and milk products constituted about 75% from the total income obtained from animals in Egypt and it play a great role in human supplementation with high amount of daily protein intake (Atallah, 2004).

There was positive relationship between dairy temperament score and milk production traits in cows. Temperament of the animal is very important especially during the production phase, so any changes during lactation in temperament of cows scored directly before milking is associated with stress and so convert the animals from docile animal to aggressive one (Wanger, 2007). Therefore, any stress affects the temperaments of the animals has a significant ecological and evolutionary role and so make functional interactions and disturbances among several important traits (Von Schantz et al., 1999; Costantini et

al., 2008). Stress leads to a number of physiological changes in the body including altered locomotors activity and general exploratory behavior which associated with almost all of the body processes, for example, with reproductive processes (Monaghan et al., 2009). Since under physiological conditions a certain level of free radicals and reactive metabolites is required, complete suppression of this free radical formation which caused by stress would not be beneficial (Halliwell and Gutteridge, 2007).

Release of oxytocin as result of teat stimulation is important for fast and complete milk removal (Bruck maierand Blum, 1998). In addition, release of prolactin and cortisol is induced by machine (Goreweitet al., 1992) or suckling (Williams et al., 1993). If the animal has been interrupted before milking, the release of all hormones can be affected, as,lack of oxytocin release and delayed cortisol and augmented prolactin release (Bruck maier et al., 1992), and may reached to inhibited milk ejection after parturition (Bruck maier et al., 1993), which in turn affects on several productive and milk related traits (Silveria et al., 1993).The objectives of the present study were to reveal the effect of temperament on behavioral, productive traits and biochemical parameters (cortisol and prolactin) in Friesian Dairy Cows.

MATERIALS AND METHODS

This study was reviewed and approved by the Animal Care and Welfare Committee of faculty of veterinary medicine, Zagazig University, Egypt.

Experimental Animals and Management

This study was carried out on one hundred Friesian dairy cows aging 3 to 6 years old belonging to private dairy cow's farm at Hehia city in Sharkeya Governorate during the period between March 2016 to March 2017. The animals were housed free in an open yards, supplied with a cool spraying system during hot climate. Animals had free access to clean water from common water troughs under a shaded area. The animals were fed on total mixed ration according to its production state NRC (2001). The animals were identified by applying an ear tag containing the number of dairy cow and the same number was applied on the side of neck of each animal by using a coloring material.
All cows were machine milked; 3 times a day with eight hours interval. Milking was carried out in a ventilated herringbone-milking parlor, it was connected with electronic digital display to record the milked cow's number. All data were collected through automatic central computer, which is specialized for dairy farm's electronic data management. Thirty dairy cows were selected according to their temperament and allocated in the same yard with stocking density 30 m^2 / cow.

Temperament Score

The cows were classified according to their temperament during milking and the milkier questionnaire into calm (in which the cow indicated docile reaction during teat preparation and during milking process), nervous (restless) (in which cows show frequent movement, foot lifting and tail movement with flicked tail and shift her weight) and aggressive (in which the cows show intensive restlessness during teat preparation, butting and kicking the milker) (Najafi et al., 2009).

Data Measurments

Maintenance Activities:

Observation was carried out 3 hours per week (6 minute interval for each cow through one hour observation for each group), by using a focal sample technique (Youssef, 1995). A stopwatch, field notice and photo-graphing camera were used during the observation time. All maintenance activities were recorded as time and frequency by each animal per 12 h observation period.

-Ingestive behavior (Eating- Drinking- Rumination) (Phillips, 2002).
-Standing, walking and lying behavior (Fraser and Broom, 1990).
-Eliminative behavior (Defecation and Urination).
- Body care and agonistic behavior (Grooming &Aggression) (Philips,1993).

Productive Traits:

- Total milk production: is the actual amount of milk produced by the cow in one lactation.
- Day in milk: is the period from calving to the first breeding.
- Daily milk production: is theactual amount of milk produced by cowper day.
- Morning time: is the time consuming for milking in the morning.
- Evening time: is the time consuming for milking in the evening.

Biochemical Parameters:

Cortisol: Stock solutions of cortisol and sample preparation were done according to Kushnir et al. (2004) and Kao et al. (2001).
Prolactin: By Sequential Method Test System Product Code: 4475-300 (Maddox et al., 1991).

STATISTICAL ANALYSIS

Preliminary test was applied to the percentage data before comparison and analysis and found that data was homogeneous and did not need a transformation to the corresponding arcsine angle. Data were statistically analyzed by

SPSS (2013) using General Linear Model (GLM) procedure according to the following model: Yijk = μ + Ti+ eij, where, μ is the overall mean, Ti is the fixed effect of different ages groups and eij is random error. All data are expressed as the Least Square Mean (LSM) ± S.E. Also, the resultants pvalues were also expressed pvalue of < 0.05 was considered to be statistically significant.

Table 1: Effect oftemperamenton ingestive and kinetic behaviour of dairy cow.

Temperament	Calm	Nervous	Aggressive
Behavior			
Eating time	85.66± 7.44[a]	78.00± 3.46[a]	73.00± 6.55[a]
Eating frequency	23.33± 3.52[a]	22.66± 0.88[a]	30.33± 4.17[a]
Drinking time (min)	1.33± 0.33[a]	0.66± 0.16[a]	0.83± 0.16[a]
Drinking frequency	5.00± 0.57[a]	5.00± 1.15[a]	2.66± 0.88[a]
Rumination time (min)	96.66± 12.01[a]	80.66± 5.20[a]	62.00± 6.42[a]
Rumination frequency	21.33± 2.02[a]	18.66± 3.38[a]	13.33± 0.88[a]
Walking time(min)	22.33± 1.45[c]	77.00± 11.93[b]	112.00± 9.45[a]
Walking frequency	48.33± 4.40[c]	102.67± 3.71[b]	111.67± 4.40[a]
Standing time (min)	115.00± 2.88[a]	140.00± 15.27[a]	142.33± 16.69[a]
Standing frequency	23.66± 4.70[a]	12.66± 1.20[b]	8.33± 0.88[c]

Means with different superscripts in each row are significant at (P ≤0.05).

RESULTS

Table 1 showed the effect of temperament on ingestive and kinetic behavior of dairy cow, results showed that there were non significant differences between different types of temperament of dairy cow on ingestive behavior although the eating, ruminating times were increased with docile temperament. Table 2 showed the effect of temperament on comfort and resting behavior of dairy cow, as the urination, defecation frequency were increased with aggressive temperament then nervous one and at lowest level with calm temperament. While, resting and sleeping were increased with calm temperament than nervous and aggressive temperament, Grooming increased with calm animal while aggressive increased with nervous ones. Table 3 showed the effect of temperament of dairy cow on some productive traits, results showed that the daily milk, day in milk and total milk production was increased with calm temperament and decreased with nervous and aggressive temperament and the differences were highly significant. On the other hand the milking time either morning or evening milking was prolonged with aggressive temperament which may be affected the time, effort of the employer of the dairy farm.

Table 2: Effect oftemperamenton comfort and resting behaviour of dairy cow.

Temperament	Calm	Nervous	Aggressive
Behavior			
Urination frequency	11.00± 0.57[c]	22.66± 1.20[b]	32.66± 3.71[a]
Defecation frequency	12.33± 1.45[c]	26.33± 4.33[b]	35.00± 2.88[a]
Recumbancy time (min)	80.00± 2.88[a]	50.00± 5.77[b]	34.33± 2.96[c]
Recumbancy frequency	15.66± 0.88[a]	12.00± 1.52[a]	13.33± 0.88[a]
Sleeping time(min)	63.33± 6.00[a]	25.00± 2.88[ab]	24.33± 3.48[b]
Sleeping frequency	17.66± 1.45[a]	12.00± 0.57[b]	8.66± 0.88[c]
Grooming frequency	36.00± 2.08[a]	27.33± 0.88[b]	22.66± 0.88[c]
Aggression frequency	8.33± 0.88[b]	15.00± 2.88[ab]	24.00± 5.03[a]

Means with different superscripts in each row are significant at (P ≤0.05)

Table 3: Effect of temperament of dairy cow on some productive performance.

Temperament	Calm	Nervous	Aggressive	P value
Traits				
Daily milk (kg)	39.64± 0.60[a]	28.81± 0.76[b]	21.07± 0.80[c]	**
Day in milk (days)	335.78± 39.76[a]	187.33± 7.93[b]	141.33± 39.76[c]	**
Total milk production(kg)	1779.60± 358.69[a]	591.39± 12.79[b]	385.98± 21.44[c]	**
Morning time	4.41± 0.22[a]	6.70± 0.29[b]	9.71± 0.36[c]	**
Evening time	3.95± 0.22[a]	5.84± 0.27[b]	8.98± 0.38[c]	**

Means of different ages within the same row having different superscripts are significantly different (p ≤ 0.05).

Table 4 showed the effect of temperament of dairy cow on biochemical parameters, results showed that significant differences between aggressive, nervous, calm cows in relation to cortisol and prolactin level due to the correlation between cortisol and prolactin release. It was founded that the level of cortisol in first stage of experiment was

significantly increased in aggressive cows than calm and nervous cows, while the level of cortisol in second time of experiment calm cows were significantly increased than aggressive and nervous cows. Our results showed that third time cortisol level significantly increased in aggressive than nervous and calm cows. On other hand the prolactin level in first time was significantly increased with aggressive and nervous cows than calm cows, while in second time calm and nervous cows were significantly increased than aggressive cows, but in third time prolactin was significantly increased in nervous cows than aggressive and calm cows.

Table 4: Effect of temperament of dairy cow on some biochemical parameters.

Temperament	Calm	Nervous	Aggressive	P value
Traits				
First time cortisol	1.32^{c} ±0.58	2.20^{b}±0.05	2.53^{a} ±0.06	
Second time cortisol	3.12^{a} ±0.58	2.24^{c} ±0.01	3.04^{b} ±0.01	
Third time cortisol	1.14^{b} ±0.58	1.11^{c} ±0.05	1.28^{a} ±0. 05	
First stage prolactin	0.55^{b} ±0.15	0.66^{a} ±0.01	0.63^{a} ±0.05	
second stage prolactin	0.62^{a} ±0.08	0.62^{a} ±0.05	0.50^{b} ±0.05	
Third stage prolactin	0.73^{b} ±0.58	0.77^{a} ±0.05	0.65^{c} ±0.05	

Means of different ages within the same row having different superscripts are significantly different ($p \leq 0.05$).

DISCUSSION

Non significant differences were found between different types of temperament of dairy cow on ingestive behavior although the eating, ruminating times were increased with docile temperament. These results were similar to (Langbein and Raasch, 2000) who stated that calm high yield dairy cow required more time for feeding and rumination while walking and standing time were increased with nervous and aggressiveness. Phillips, (2002), Ceballos and Weary, (2002); and Fukasawa and Tsukad, (2010), stated that walking, exploring and licking object were increased with aggressive animal in order to evaluate stressful conditions. In contrast (Cavallina et al., 2008; Tripaldi et al., 2004; Stafford and Gregory, 2008) stated that when agonistic behavior increased with stress caused by mechanical milking the time of locomtion decreased. Regarding urination, defecation frequency, it was increased with aggressive temperament then nervous one and at lowest level with calm temperament. Similar results with (Horning and Kramer, 2003) mentioned that nervous cattle defecate more and produce more liquid faces as an indication of more stress. While, resting and sleeping were increased with calm temperament than nervous and aggressive temperament (Munksgaard et al.,1999; Cavallina et al., 2008). Grooming increased with calm animal while aggressive increased with nervous ones (Von keyserligk et al., 2008)

Concerning the productive performance of dairy cows in relation to their temperament during preparation for milking and actual milking process, results showed that the daily milk, day in milk and total milk production were increased with calm temperament and decreased with nervous and aggressive temperament and the differences were highly significant. The obtained results were in agreement with (Devyatkina, 1986) who revealed linear relationship stands between temperament score and daily and total milk yields, but the relationship with lactation length was not clear. Furthermore (Roy and Nagpoul, 1986), found that in Bos indicus cows with unfavorable temperament produced less milk and their ability of releasing milk was the worst compared to cows having better temperament and suggested that milk yield significantly decreased with nervousness and aggressiveness. As well as, docile temperament had more milk producer than nervous and aggressive temperament even with the same breed and the same management (Youssef and Fouda, 1995). In contrast (Munkgaard et al., 2001) found that temperament of cow had no effect on milk yield. Furthermore, (Szentleleki, 2008) did not reveal any correlation between milk production and temperament and suggested No correlation was found between daily milk yield and temperament score.

Regarding to the effect of temperament of dairy cow on biochemical parameters, results showed that there were significant differences between aggressive, nervous, calm cows in relation to cortisol level and prolactin due to the correlation between cortisol and prolactin release.

These results were in agreement with (Silveria et al., 1993) who reported that the first suckling of dairy cows after four weeks of only machine milking caused a lack of oxytocin release. The effect is more variable according to the temperament of cows. The possible relationship of dairy temperament induced lack of oxytocin release to maternal bond. Also prolactin release was inhibited during suckling by alien calves (Perez et al., 1985). In suckling management system, oxytocin and prolactin release in ewes are not under the similar central regulation (Marnet and Negreo, 2000). Stress can be defined as a process of altered biochemical homeostasis produced by psychological, physiological, or environmental stressors (Dimitrios et al., 2003). There is evidence that under physiological conditions the endogenous opoids have atonic effect on oxytocin release which suppress cortisol and stimulate prolactin (Schams et al., 1998). The milking temperament can be considered as a kind of emotional response resulting in increase of

beta-endorphine (Bishop et al., 1999). Probably the endogenous opoid system could play some role in the release of measured hormones in first suckling of the cows conditioned to machine milking (Bruckmaier and Blum, 1998).

SUMMARY

Based upon these results, it is concluded that temperament test application is positive benefits for dairy cattle breeders, e.g. calm animals can produce more productive and behavioral performance. As the maintenance behavior and productive performance of female dairy cows were changed according to their temperament during milking and so we should keep the temperament of the animal. So it was recommended that, the cows which are nervous and aggressive with frequent tail movement and kicking during milking process should be milked separately from normal calm cows to not altered their behavior and affect their milking process then its production and consequently the income.

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CONFLICT OF INTEREST

The authors have declared that no competing interest exists.

AUTHORS CONTRIBUTION

SE. Abdel-Hamid conceived and designed the experiments; HM Ghanem and EA. Manaa performed the productive part of experiments, wrote the manuscript and analyzed the data, DM. Abdel Fattah analysed the biochemical parameters.

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